Are Cash Transfers Effective at Empowering Mothers? A Structural Evaluation of Mexico's *Oportunidades*

Andrea Flores[†]

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Abstract

Does placing monetary resources directly in the hands of mothers improve their bargaining position within the household? I develop and estimate a collective household model with home production using a structural approach to identify and estimate the decision-making structure of the household exploiting the exogenous variation induced by Mexico's *Oportunidades* on household behavior. Within this approach, I explore the extent to which gender-targeted benefits can be used as policy levers to increase women's decision-making power, individual welfare and household investments in children. I find that participation in *Oportunidades* increased mothers' bargaining power by almost 24%, associated with a 20% increase in their individual welfare, and with a 25% increase in the domestic production of a child-related public good. The counterfactual exercises implemented yield two policy-relevant takeaways. First, the *Oportunidades* program is as effective as alternative cash transfer programs and significantly more effective than wage subsidies at increasing mothers' bargaining power, individual welfare and domestic output. Second, individual-level poverty rates computed using the money metric welfare index here proposed can help improve the program's targeting strategy by accounting for the unequal sharing of resources within households.

Keywords: Collective model, home production, women's empowerment, individual welfare

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[†]EPGE Brazilian School of Economics and Finance. Praia de Botafogo, 190, 11th Floor, Rio de Janeiro, RJ, 22250-900, Brazil. Email: andrea.flores@fgv.br. I am extremely grateful to George-Levi Gayle for his advice and support at every stage of this project. I also thank Sanghmitra Gautam, Limor Golan, María Hernández-de-Benito, Robert Pollak, Andrew Shephard and Frederic Vermeulen for helpful comments and suggestions. Financial support is gratefully acknowledged from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001. All errors are mine.

1 Introduction

There exists substantial evidence suggesting that improvements in women's control of resources translates into increased household investments in children's human capital (Duflo (2003), Duflo and Udry (2004), Doss (2013), Armand et al. (2020)). This has been the premise under which policies aimed at breaking the intergenerational transmission of poverty by fostering investments in children's education and health increasingly target women as beneficiaries. While it has been well documented that gender-targeted policies have a significant impact on observed household behavior, the extent to which these responses are driven by improvements in women's bargaining power within beneficiary households remains an open question.[1] Since targeting benefits to particular household members may ultimately affect how these resources will be used, evidence in this regard has potentially valuable implications for the optimal design of development policies.

This paper formally explores the link between gender-targeted benefits and women's decision-making power by providing an empirical application of a collective labor supply model with home production based on the framework presented in Blundell, Chiappori and Meghir (2005) to quantify the impact of Mexico's *Oportunidades* cash transfer program on mothers' Pareto weight in urban two-parent households.[2] Despite the central role of the Pareto weight in fully summarizing the household's decision-making process, empirical applications of the model in which this primitive is identified and estimated remain relatively scarce, often relying on survey data containing individual-level time use and consumption information and predominantly focused on developed countries.[3] Importantly, none of these applications have assessed the implications of targeting benefits to specific individuals within the context of a policy experiment in a developing

[1] Participation in *Progresa/Oportunidades* has been found to significantly increase the demand for food in rural and urban households (Attanasio and Lechene (2002), Attanasio and Lechene (2010), Angelucci and Attanasio (2013)), decreased adult women's participation in domestic work (Skoufias (2005)). Attanasio and Lechene (2002) showed that participation in *Progresa* improved mothers' reported bargaining position.

[2] This framework's core assumption is the Pareto efficiency of household behavior. While this can be an unreasonable assumption in the context of developing countries (Udry (1996)), Bobonis (2009) and Attanasio and Lechene (2014) fail to reject the Pareto efficiency assumption for *Progresa/Oportunidades* beneficiary households in Mexico, thereby providing supporting evidence in favor of collective rationality in this paper's relevant context.

[3] Cherchye, De Rock and Vermeulen (2012) provide an empirical application and generalization of this framework using a novel Dutch dataset. Lise and Yamada (2019) extend it to a dynamic setting using unique panel data from Japan. Embedding the model within an equilibrium marriage market framework, Gayle and Shephard (2019) use the variation across marriage markets as the distribution factor that allows them to identify the Pareto weight.

country. I address this gap by exploiting the exogenous variation of *Oportunidades* on household behavior within a structural approach to provide three main contributions.

First, I document a gender-asymmetric effect of *Oportunidades* on the allocation of time within two-parent households. Specifically, I find that participation in the program significantly increased mothers' leisure through a reduction in their home production hours that is not offset by an increase in their labor supply and is compensated with child-related expenditures while leaving fathers' time allocation virtually unaffected. On the other hand, I document an insignificant negative impact of the program on single mothers' leisure hours stemming from an increase in their market work hours that is not offset by the reduction in their home time, which is not substituted with expenditures on children as I find a significant decrease in these expenditures. Such mixed responses to participation in the program indicate that there exist differences in the income and substitution effects triggered by the program's benefits and conditionalities scheme within the two types of households. Specifically, rationalizing this evidence through a collective household framework in which household demand is a function not only of prices and income but also of the decision-making structure of the household, I provide suggestive evidence of a change in the decision-making process within two-parent households in response to the program's gender-based targeting strategy that places the cash transfers directly in the hands of mothers.

Second, I use the observed impact of *Oportunidades* on household behavior to offer identification results that allow us to recover the household's production technology, parental preferences, and the Pareto weight when the intrahousehold allocation of time and consumption is partially observed. Besides assuming that preferences are invariant to marital status, my approach relies on two sources of heterogeneity in the impact of *Oportunidades* on parent's time use. The first source exploits the role of the wife's share of non-labor income as a distribution factor, allowing us to capture shifts in the decision-making process of beneficiary households generated by the program's gender-based targeting strategy. The second source exploits the role of the number of children in the household attending school as a production shifter, allowing us to capture shifts in the household's productivity generated by the program's conditionalities. Throughout my analysis, I find that these two sources of heterogeneity in the effect of *Oportunidades* on mothers' leisure are crucial in ensuring the identification of the Pareto weight. In this way, I show that the complexity of the benefits and requirement schemes of development policies like *Oportunidades* can serve as a valuable source of exogenous variation for identification purposes.

The identification results I propose yield a test of internal and external validity of a collective household model, which consists of defining a set of moment conditions capturing the observed gender-asymmetric effect of *Oportunidades* on time use and partitioning it into two sub-sets with only one of these being included in the estimation procedure. The first one, used in the estimation, captures the program's impact on spouses' leisure to home time ratios through its effect on the wife's non-labor income. The second one, excluded from the estimation, captures the program's impact on these ratios through its impact on the number of children in the household attending school. By ensuring that the predicted moments generated by the estimates obtained from the preferred specification fit the theoretical moments implied by the optimality conditions of the model and both sub-sets of moments related to *Oportunidades*, both the internal and external validity of the model are ensured. Such use of experimental variation as a source of model validation is in line with the work of Lise, Seitz and Smith (2004), Todd and Wolpin (2006) and, in particular, Angelucci and Attanasio (2013) who use the same implementation of the program to reject the validity of a unitary household model.[4] Importantly, my results for the Pareto weight indicate that specifications that fit well the moments associated with *Oportunidades*, thereby consistent with the non-parametric identification and external validity of the model, yield more robust estimates and suggest a stronger response of the Pareto weight to changes in mothers' contribution to total household non-labor income.

Third, through the evaluation of the program's impact on mothers' Pareto weight using the estimation results I present, I show that participation in *Oportunidades* increased mothers' bargaining power by almost 24% within beneficiary households. To the best of my knowledge, this constitutes novel evidence of the Pareto weight's response to the gender-based targeting strategy of development policies within a framework that accounts for the impact of these policies on both time use and consumption. While there exists evidence focusing on the impact of the rural implementation of *Progresa/Oportunidades* on women's resource share, commonly used as a measure of bargaining power within a consumption-based collective framework, this is mixed with

[4] Lise, Seitz and Smith (2004) use the experimental control group of the Canadian Self-Sufficiency Program to predict the outcomes experienced by those in the experimental treatment group. Similarly, Todd and Wolpin (2006) use the control group of the rural implementation of *Progresa* to estimate the model checking the accuracy with which they can predict the actual post-program school attendance of treated households.

no consistent evidence of a link between monetary benefits targeted to women and improvements in their decision-making power. For instance, Tommasi (2019) finds that the program increased women's resource shares by almost 12%, with the results of Sokullu and Valente (2021) indicating a more modest increase in women's resource shares when focusing on the same implementation of the program but using a different methodology that exploits the panel feature of the data. On the other hand, Tommasi and Wolf (2016) found that men benefited more from the program than women in this regard. Thus, by capturing changes in the Pareto weight in response to the program, my results contribute to this strand of the literature by providing evidence of a direct link between women's bargaining power and targeted benefits.

To quantify the extent to which such empowerment effect translated into individual welfare gains, I compute an extension of the money metric welfare index (MMWI) originally proposed in Chiappori and Meghir (2015). This individual welfare measure captures the amount of expenditures an individual household member would need to incur when living in singlehood to reach the same level of utility he or she would enjoy when living in collectivity. Despite assuming marital preference stability, my approach allows single mothers and fathers to have a different production technology. Thus, by using the estimates for single parents to define the economic environment that their married counterparts would face in the case of separation/divorce, the MMWI I implement differs from the related indifference scales used in Cherchye, De Rock and Vermeulen (2012) in the way it captures the loss incurred by married parents in terms of economies of scale in production and consumption when transitioning from marriage into singlehood. I find that *Oportunidades* increased mothers' MMWI by almost 20%. In monetary terms, this change in mothers' MMWI constitutes an annual increase of approximately 3,067 MXN pesos (294 USD) in their individual welfare. Furthermore, I document that this empowerment effect coincides with an increase of approximately 24% in the production of a domestic good that is publicly consumed within two-parent households and which serves as a proxy for children's well-being by taking both parental time and monetary investments in children as inputs. Thus, the results here presented show that the documented increase in mothers' bargaining power within beneficiary two-parent households effectively translated into improvements in both mothers' individual welfare and higher production levels of the child-related public good. Based on my empirical findings, such an increase in domestic output suggests that beneficiary two-parent households effectively substituted monetary for parental time investments in children's human capital in response to the program. Importantly, the link I find between mothers' empowerment and the increased production of a child-related domestic good is in line with the empirical evidence suggesting a positive relationship between mothers' control of resources and investments in children (Duflo (2003), Duflo and Udry (2004), Doss (2013), Armand et al. (2020)).

Taking my program evaluation results as a benchmark, I exploit the structural approach adopted to conduct a set of counterfactual exercises in which I consider alternative designs of cash transfer programs in terms of their revenue neutrality and conditionalities as well as changes in other sources of income, such as wages.[5] I find that *Oportunidades* is as effective as alternative cash transfer programs at empowering mothers, improving their individual welfare and increasing the domestic production of the public good associated with children. Furthermore, I find that cash transfers are significantly more effective than wage subsidies at empowering mothers, improving their welfare and increasing domestic output. As expected, monetary resources targeted to fathers have a contrasting impact on mothers' bargaining power and on the intrahousehold allocation of individual welfare. Importantly, the results from these exercises indicate that targeting cash transfers to mothers generates an increase in the production of the child-related public good, while targeting these transfers to fathers has the opposite effect on domestic output. These results provide further evidence that targeting benefits to mothers can be more beneficial for children than targeting fathers and complements the empirical evidence highlighting this relationship between the identity of benefit recipients and investments in children when randomizing the identity of recipients as in the context examined in Armand et al. (2020).

In the second type of counterfactuals, I implement an individual poverty analysis on the sub-sample of two-parent non-poor households. I find that upon accounting for the unequal sharing of resources within the household by computing individual poverty rates using the MMWI, I can classify almost 44% of mothers living in two-parent non-poor households as individually poor. I further show that targeting a cash transfer to these mothers improves their bargaining position by more than 10%, translating into an improvement of more than 9% in their MMWI and of more than 7% in the households' level of domestic production. In terms of cost-efficiency, these effects are stronger when considering cash transfers that are revenue neutral. Despite working within different

[5] Revenue neutrality is ensured at the household level. This is mainly achieved by triggering a redistribution of non-labor income (in the case of cash transfers) or of wage income (in the case of wage subsidies) from the non-targeted spouse to the beneficiary spouse.

characterizations of a collective household framework, my results are consistent with the findings presented in Tommasi (2019) for the program's rural implementation, as I find that the targeting strategy of *Oportunidades* can be improved by assessing mothers' eligibility on the basis of individual-level poverty rates. More broadly, these results contribute to the growing evidence highlighting the importance of accounting for intrahousehold inequality in poverty calculations as poverty can be unequally shared within households (Cherchye et al. (2018), Tommasi (2019), Calvi (2020)).

The remainder of the paper is organized as follows. Section 2 describes the theoretical framework used to analyze the behavior of two-parent and single-parent households with children. Section 3 describes the institutional context and evaluation data of Mexico's *Oportunidades* program. Section 4 describes the identification and estimation strategy used to recover the household's production technology, parental preferences and decision-making structure. Section 5 describes the analysis of intrahousehold bargaining power and individual welfare used to evaluate the program's effect on beneficiary household's decision-making structure and individual welfare and conducts the counterfactual exercises used to explore alternative policy designs. Section 7 concludes.

2 Model Setup

This paper considers the behavior of two types of households with children. The first type consists of single-parent households whose behavior is described by a standard unitary model of labor supply with home production. The second type consists of two-parent households whose behavior is described by a collective household model of labor supply with home production based on the framework proposed in Blundell, Chiappori and Meghir (2005).

While the paper is focused on the decision-making structure and allocation of welfare within two-parent households, the inclusion of single-parent households in the analysis serves a two-fold purpose. First, as it will be discussed more thoroughly in Section 4, the behavior of these type of households informs the identification of individual parental preferences. Lastly, as argued in this section, these households' economic environment can be used to describe the counterfactual environment that married parents would face in the case of separation/divorce considered by the individual welfare measure proposed in this paper.

2.1 Single-Parent Households

Consider a household comprised by a single parent and his/her children. Let i denote the parent who decides how to allocate his/her time between market work and the production of a domestic good Q. Parents have preferences over their own leisure and private market consumption (l^i, q^i) and the domestic good Q. Moreover, each individual decides how to allocate their total time endowment $\bar{T}$ to leisure l^i, time spent in market work h^i_M, and time spent in home production h^i_D. The model allows for the production technology to differ by gender as the domestic good Q is assumed to be produced using parental time h^i_D $(i = A, B)$ and market purchases q^D using the technology described by $Q = F^{s,i}_Q(h^i_D, q^D; \mathbf{S})$, where $\mathbf{S}$ denotes a vector of production shifters, which includes the number of children in the household attending school. Importantly, given that I model domestic output as a function of parental investments in children's human capital, Q can be interpreted as a proxy for child quality. Furthermore, total household income is derived from the parent's total labor market earnings $(w^i h^i_M)$ and non-labor income. I introduce the exogenous variation of the *Oportunidades* cash transfer by letting non-labor income be a function of the size of the transfer received from the program, $y^i = y^i_C + dy_{CCT}$, where d is an indicator of program participation, y^i_C denotes non-labor income in the case of non-participation and y_{CCT} denotes the cash transfer amount assigned. Thus, the behavior of single-parent households can be described as the solution to the following problem

$$\max_{l^i, h^i_D, q^i, q^D} U^i(l^i, q^i, Q; \mathbf{X}^i)$$

s.t.

$$q^i + q^D = y^i + w^i h^i_M; \quad y^i = y^i_C + dy_{CCT}; \quad Q = F^{s,i}_Q(h^i_D, q^D; \mathbf{S}); \quad l^i + h^i_M + h^i_D = \bar{T}$$

In this case, the optimality conditions governing household behavior within these households are the following

$$\frac{\partial U^i/\partial l^i}{\partial U^i/\partial q^i} = w^i; \quad \frac{\partial F^{s,i}_Q}{\partial h^i_D}\frac{\partial U^i}{\partial Q} = \frac{\partial U^i}{\partial l^i}; \quad \frac{\partial F^{s,i}_Q}{\partial q^D}\frac{\partial U^i}{\partial Q} = \frac{\partial U^i}{\partial q^i}; \quad \frac{\partial F^{s,i}_Q/\partial h^i_D}{\partial F^{s,i}_Q/\partial q^D} = w^i \tag{1}$$

2.2 Two-Parent Households

Consider a household comprised by the wife and husband, denoted by A and B, respectively, and their children. While children are assumed to have no bargaining power of their own, they are accounted for in the production of the public good Q. Spouses have preferences over their own leisure and private market consumption (l^i, q^i) and the domestic good Q. Under a marital stability assumption, these preferences are assumed to be the same as their single counterparts'. Nonetheless, the production technology is assumed to differ across marital status. In this way, the model attempts to capture the economic gains of marriage generated by the economies of scale in production. Within two-parent households, Q is produced in the household using the production technology F_Q^M, taking as inputs both parental time h_D^i, for $i = (A, B)$, and market purchases, q^D. Thus, the full allocation of each spouse's total time endowment $\bar{T}$ is described by the amount of hours they spend in leisure activities (l^i), in home production activities (h_D^i) and in market work (h_M^i). In this way, the household's total income is derived from the parents' total labor market earnings $w^A h_M^A + w^B h_M^B$ and their total non-labor income $y^A + y^B$. I introduce the exogenous variation of the *Oportunidades* cash transfer into the model by assigning the cash transfer amount, y_{CCT}, to the wife's non-labor income if the household is participating in the program. In this case, participation in the program is captured by the indicator variable d, where $d = 1$ if the household has been incorporated into the program and $d = 0$ otherwise. Under the model's assumption that household outcomes are Pareto efficient, household behavior can be described as the solution to the following optimization problem

$$\max_{l^A, l^B, h_D^A, h_D^B, q^A, q^B, q^D} \lambda(w^A, w^B, y, \mathbf{z}) U^A(l^A, q^A, Q; \mathbf{X}^A) + (1 - \lambda(w^A, w^B, y, \mathbf{z})) U^B(l^B, q^B, Q; \mathbf{X}^B) \tag{2}$$

s.t.

$$\begin{aligned} q^A + q^B + q^D &= y^A + y^B + w^A h_M^A + w^B h_M^B \\ Q &= F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S}); \quad \bar{T} = l^i + h_M^i + h_D^i \\ y^A &= y_C^A + d y_{CCT}; \quad y^A = z^A y \end{aligned}$$

Following Browning and Chiappori (1998), some structure is added to the model without imposing any particular functional form by assuming that parental utility functions are strictly concave, twice continuously differentiable and strictly increasing in (l^i, q^i, Q). The model here developed allows for observed preference heterogeneity through the inclusion of a set of taste shifters, $\mathbf{X}^i$, that includes sociodemographic characteristics specific to each spouse and household-level characteristics. As will be discussed throughout the estimation of the model in Section 4, similar to Cherchye, De Rock and Vermeulen (2012) and Lise and Yamada (2019), these variables include parents' age, completed years of education and the number of children in the household.

Similarly, the Pareto weight is assumed to be a differentiable and zero-homogeneous function on $(w^A, w^B, y, \mathbf{z})$. Notice that the collective framework recognizes that the Pareto weight can respond to two sets of variables. The first set includes variables that shift the Pareto frontier such as wages and income while the second set, $\mathbf{z}$, includes variables that trace movements along the Pareto frontier. The role of the former is to define the household's social welfare function described in 2 in terms of wages and income, while the latter allows for exogenous factors to affect household behavior only through their effect on the decision-making process. As discussed in Browning, Chiappori and Weiss (2014), this yields implications derived within the collective framework that are compatible with rejections of income pooling which cannot be rationalized within a unitary setting.

Importantly, as highlighted by Browning and Chiappori (1998) and Chiappori and Ekeland (2009) and more thoroughly discussed in Section 4, the vector of distribution factors, $\mathbf{z}$, plays a significant role in the identification of the model. Intuitively, these exogenous variables serve as an exclusion restriction needed to separately identify individual preferences from the Pareto weight by inducing shifts in intrahousehold behavior only through changes in the Pareto weight while leaving preferences unaltered. This is one of the main channels through which I allow a gender-targeted development program to have an effect on intrahousehold inequality throughout the analysis implemented in Section 5.2.

Furthermore, the production function F_Q^M is assumed to be twice continuously differentiable, strictly increasing and concave in (h_D^A, h_D^B, q^D). The model also allows for the inclusion of production shifters in the vector $\mathbf{S}$. Given the research question at hand, the production shifter used in this paper involves the number of children in the household attending school. In this way, through minimum school attendance requirements attached to the receipt of the cash transfer, I allow for the conditionalities of a program like *Oportunidades* to have an effect on the productivity of the household.

Thus, at an interior solution to 2, I derive three sets of optimality conditions that govern the intrahousehold allocation of time and consumption. The first set relates to the spouses' private consumption of leisure and a market good,

$$\frac{\partial U^A/\partial l^A}{\partial U^A/\partial q^A} = w^A; \quad \frac{\partial U^B/\partial l^B}{\partial U^B/\partial q^B} = w^B; \quad \frac{\partial U^A/\partial l^A}{\partial U^B/\partial l^B} = \frac{w^A}{w^B}\frac{1-\lambda}{\lambda}; \quad \frac{\partial U^A/\partial q^A}{\partial U^B/\partial q^B} = \frac{1-\lambda}{\lambda} \tag{3}$$

The second set relates to the spouses' public consumption.

$$\frac{\partial F_Q^M}{\partial h_D^A}\left[\lambda\frac{\partial U^A}{\partial Q} + (1-\lambda)\frac{\partial U^B}{\partial Q}\right] = \lambda\frac{\partial U^A}{\partial l^A} \tag{4}$$

$$\frac{\partial F_Q^M}{\partial h_D^B}\left[\lambda\frac{\partial U^A}{\partial Q} + (1-\lambda)\frac{\partial U^B}{\partial Q}\right] = (1-\lambda)\frac{\partial U^B}{\partial l^B} \tag{5}$$

$$\frac{\partial F_Q^M}{\partial q^D}\left[\lambda\frac{\partial U^A}{\partial Q} + (1-\lambda)\frac{\partial U^B}{\partial Q}\right] = \lambda\frac{\partial U^A}{\partial q^A} = (1-\lambda)\frac{\partial U^B}{\partial q^B} \tag{6}$$

Lastly, the third set relates to productive efficiency

$$\frac{\partial F_Q^M/\partial h_D^A}{\partial F_Q^M/\partial h_D^B} = \frac{w^A}{w^B}; \quad \frac{\partial F_Q^M/\partial h_D^A}{\partial F_Q^M/\partial q^D} = w^A; \quad \frac{\partial F_Q^M/\partial h_D^B}{\partial F_Q^M/\partial q^D} = w^B \tag{7}$$

The partitioning of these optimality conditions into three groups feeds directly into the identification strategy adopted in Section 4. Since the optimality conditions related to productive efficiency do not involve individual preferences or the Pareto weight, identification of the production function is focused on these conditions alone. On the other hand, most of the identification of the Pareto weight and individual preferences relies on the optimality conditions related to public consumption, namely, the household's marginal rates of substitution for private and public consumption.

2.2.1 The Role of Distribution Factors and *Oportunidades*

One of the main channels through which a cash transfer like *Oportunidades* is expected to have an effect on intrahousehold behavior is through its effect on the wife's share of non-labor income. The wife's share of non-labor income, defined above as z^A, is commonly used in the literature as a distribution factor that plays a central role in the identification of the model further explored in Section 4. As will be discussed in further detail throughout Section 3, due to the program's gender-based targeting, as the *Oportunidades* cash transfer is placed in the hands of mothers in their role of transfer holders, there exists a close relationship between program participation and z^A. Formally, the wife's share of non-labor income can be defined as

$$z_d^A = \frac{y_0^A + dy_{CCT}}{y_0^A + y^B}$$

where $d \in \{0, 1\}$ and y_0^A denotes the wife's non-labor income in the absence of treatment. Then, the difference in z^A between participant and non-participant households can then be defined as

$$z_1^A - z_0^A = \frac{y_{CCT}(Y_0 - y_0^A)}{Y_C(Y_0 + y_{CCT})} \geq 0$$

where $Y_0 = y_0^A + y^B$. Thus, by placing the cash transfer entirely in the hands of mothers, *Oportunidades* can be expected to affect the intrahousehold allocation of resources through its impact on z^A and, subsequently, on $\lambda(w^A, w^B, y, \mathbf{z})$. Throughout the intrahousehold welfare analysis implemented in Section 5, I discuss more thoroughly the role that z^A plays in effectively generating shifts in the Pareto weight, household behavior and parents' individual welfare.

2.3 Measuring Individual Welfare

While measuring individual welfare in single-parent households is relatively straightforward since this involves computing parents' indirect utility ($V^i(w^i, y^i) = U^i(l^{i*}, q^{i*}, Q^*; \mathbf{X}^i)$, where $Q^* = F_Q^{s,i}(h_D^{i*}, q^{D*}; \mathbf{S})$), this is relatively more complex within two-parent households and requires addressing the extent to which welfare gains are shared within the household. The intrahousehold gender inequality analysis implemented in Section 5 focuses on understanding the differences between the two types of money metric utility that can be defined within a collective household framework here described.

2.3.1 The Sharing Rule

The derivation of the sharing rule stems from a two-stage characterization of the model. The Pareto efficiency assumption of household outcomes posited by this model permits decentralizing the social planner's problem in 2 into two stages: a resource allocation stage and an intrahousehold allocation one. The first stage pins down the optimal levels of home production inputs and the optimal transfers of monetary resources (net of production costs) between decision-makers in the form of the *conditional sharing rule*. In the intrahousehold allocation stage, conditional on the first stage's outcomes, each decision-maker optimizes individually to choose his/her leisure and private consumption.

Formally, the household's problem can be broken down into the aforementioned stages with the household solving the following problem in the resource allocation stage

$$\max_{\rho^A,\rho^B,Q} \lambda(w^A,w^B,y,\mathbf{z})V^A(w^A,\rho^A;Q) + (1-\lambda(w^A,w^B,y,\mathbf{z}))V^B(w^B,\rho^B;Q)$$

s.t.

$$\rho^A + \rho^B = y^A_C + CCT\mathbb{1}\{\text{Treat}\} + y^B - C_Q(w^A,w^B,Q,\mathbf{S})$$

where C_Q denotes the expenditures incurred by the household in the production of the public good Q that takes as inputs both parental time and market purchases and is characterized by productive efficiency (i.e. cost minimization) as the solution to the following auxiliary problem

$$C_Q(w^A,w^B,Q;\mathbf{s}) = \min_{h^A_D,h^B_D,q^H}[w^A h^A_D + w^B h^B_D + q^H | Q = F^M_Q(h^A_D,h^B_D,q^H;\mathbf{S})]$$

More importantly, ρ^A and ρ^B characterize the household's sharing rule, which describes the way in which the household's total non-labor income net of production costs is allocated between the decision makers of the household for their private consumption conditional on the optimal level of consumption and production of Q. Thus, the solution to this stage of the household's problem can be generally characterized by

$$\rho^A = \rho^A(w^A,w^B,y,\mathbf{z},\mathbf{S}); \;\; \rho^B = \rho^B(w^A,w^B,y,\mathbf{z},\mathbf{S}); \;\; Q = Q(w^A,w^B,y,\mathbf{z},\mathbf{s}) \tag{8}$$

Furthermore, the *individual* indirect utilities $V^i(w^i,\rho^i;Q)$ for $(i = A,B)$ are defined in the intrahousehold allocation stage as

$$V^i(w^i,\rho^i;Q) = \max_{l^i,q^i} U^i(l^i,q^i,Q)$$

s.t.

$$q^i + w^i l^i = \rho^i + w^i \bar{T}$$

where ρ^i and Q are taken as given at this stage.

Besides yielding a benchmark measure of individual welfare within collective households, the decentralization of the household's problem and its implied sharing rule serve two purposes throughout the analysis presented in this paper. The first one is to provide the theoretical foundation through which I interpret the empirical evidence in Section 3 as a motivation for adopting a structural approach in disentangling the impact of targeted benefits on two-parent households' decision-making process. The second one involves the derivation of a concept capturing the way in which production costs are shared within collective households.

Through the concept of the sharing rule, it is possible to derive the following relationship between each parent's observed demand for leisure l^i for $(i = A, B)$ and its structural counterpart, defined as his/her conditional leisure demand function $\tilde{l}^i$

$$l^A = \tilde{l}^A(w^A, \rho^A(w^A, w^B, y^A, y^B, \mathbf{z}, \mathbf{S})) \tag{9}$$

$$l^B = \tilde{l}^B(w^B, \rho^B(w^A, w^B, y^A, y^B, \mathbf{z}, \mathbf{S})) \tag{10}$$

In this way, the sharing rule allows us to break down the effect of a policy that changes mothers' contribution to non-labor income on the intrahousehold allocation of time and consumption into two components. The first component captures a standard income effect of the policy comparable to the one that can be signed in a unitary setting and a second component that captures the response of the household's sharing rule to the policy. Formally, the response of parents' observed leisure demand to changes in mothers' non-labor income can be characterized as follows

$$\frac{\partial l^A}{\partial y^A} = \frac{\partial \tilde{l}^A}{\partial \rho^A}\frac{\partial \rho^A}{\partial y^A} \tag{11}$$

$$\frac{\partial l^B}{\partial y^A} = \frac{\partial \tilde{l}^B}{\partial \rho^B}\frac{\partial \rho^B}{\partial y^A} \tag{12}$$

The second component of 11 and 12 captures responses of the household's sharing rule to changes in the resource allocation stage. In this way, the response of the sharing rule to a policy depends on its impact on total household monetary resources, the Pareto weight and the household's demand for and production of the public good, Q.[6] Thus, a policy that changes mothers' non-labor income within this framework is expected to alter the sharing rule by changing the total amount of resources to be distributed in the resource allocation stage and its distribution by the policy's impact on the optimal provision of Q and its dual effect in the decision-makers' relative bargaining power. The latter stems from the characterization of the Pareto weight as a function of wages, income and the set of distribution factors described above, which include mothers' share of non-labor income, z^A.

Given that I can sign the first component of 11 and 12 as positive under the assumption that leisure is a normal good since it captures a standard income effect, responses of parents' leisure hours to changes in their contribution to total household non-labor income allows us to sign the corresponding response of the sharing rule. Nonetheless, the extent to which I can sign the response of the Pareto weight to changes in parents' individual non-labor income based on the response of the sharing rule is limited by the inclusion of the public domestic good Q which allows for a potential non-monotonic relationship between the conditional sharing rule and the Pareto weight.[7] This limitation is exacerbated by the presence of home production since, in this case, the response of the sharing rule also encodes information about the household's productivity. I use this shortcoming as a motivation for our structural approach throughout the discussion of the empirical evidence presented in Section 3.

Another advantage of decentralizing the household's problem is that it allows us to distinguish between parents' marginal utility from public consumption from the marginal utility they derive from additional income allotted for private consumption. Differentiating the individual indirect utilities with respect to the public good and the sharing rule permits computing each parent's marginal willingness to pay for the public

[6]This stems from the relationship between household outcomes and the Pareto weight implied by the characterization of behavior within two-parent households as the solution to 2. Browning, Chiappori and Weiss (2014) formalize this relationship through the definition of a collective household demand function. This concept allows us to decompose both income and substitution effects into a Marshallian component and a collective one that captures the response of the Pareto weight to changes in price, wages and non-labor income. Intuitively, by capturing shifts in the Pareto weight, shifts in the sharing rule can be interpreted as a decentralized version of said collective effect.

[7]Blundell, Chiappori and Meghir (2005) characterize the necessary conditions under which an increase in the mother's Pareto weight could lead to an increase in the household's expenditures on Q without implying a reduction in her sharing rule.

good in the following way

$$\theta_Q^A = \frac{\partial V^A(w^A, \rho^A, Q)/\partial Q}{\partial V^A(w^A, \rho^A, Q)/\partial \rho^A}$$
$$\theta_Q^B = \frac{\partial V^B(w^B, \rho^B, Q)/\partial Q}{\partial V^B(w^B, \rho^B, Q)/\partial \rho^B}$$

Note that these marginal willingness to pay for the public good can also be interpreted as the Lindahl prices, which intuitively, serve as a way for each individual spouse to internalize the market price of the public good Q (in the absence of home production or in the case of the domestic production of a marketable good) or the per unit cost of producing the domestic good Q (which in this case is denoted by $P(w^A, w^B; \mathbf{S})$). Denote these Lindahl prices for the wife and husband as θ_Q^A and θ_Q^B, respectively. Given that these are individual prices, an important condition that these must satisfy is the Bowen-Lindahl-Samuelson condition for the optimal provision of the public good. Adjusting this condition for the domestic production of Q yields the following

$$\theta_Q^A + \theta_Q^B = P(w^A, w^B; \mathbf{S})$$

Intuitively, these Lindahl prices describe the way in which the per unit cost of production is shared between parents when living in collectivity, which is governed by both their preference for the domestic good and their relative bargaining position in the household which is described by the Pareto weight.

2.3.2 The Money Metric Welfare Index

The intuition behind the money metric welfare index (MMWI) is to capture a measure of the expenses a married individual would need to incur in a counterfactual single household in order to be able to reach the same level of utility s/he would achieve when living in collectivity. Defining the single-parent household's problem and being able to identify its primitives is then essential since it provides the counterfactual environment needed for the computation of the MMWI. It is then possible to define the MMWI within the context of a collective household model with home production as

$$MMWI^i = \min_{h_D^i, l^i, q^i, q^D} w^i l^i + q^i + w^i h_D^i + q^D \tag{13}$$

s.t.

$$
\begin{aligned}
U^i(l^i, q^i, Q; \mathbf{X}^i) &\geq U^i(l^{i*}, q^{i*}, Q^*; \mathbf{X}^i) \\
Q &= F^s_Q(h^i_D, q^D; \mathbf{S})
\end{aligned}
$$

where $(l^{i*}, q^{i*}, Q^* = F^M_Q(h^{A*}_D, h^{B*}_D, q^{D*}))$ denotes the optimal choices made within a two-parent household. A key point of departure of the extension of the MMWI here proposed with the indifference scales analyzed in Cherchye, De Rock and Vermeulen (2012) is that the production technology here considered to define the economic environment married parents would face upon divorce/separation is precisely the one faced by single parents contrary to using the same production technology and setting the absent spouses' time input to 0 or a fraction of his/her optimal input under marriage. In this way, the proposed MMWI is expected to capture the fact that one of the main economic gains of marriage involves the fact that the production possibilities frontier that an individual faces differs from one living arrangement to the other. Thus, the per unit production cost faced by an individual within collectivity θ^i_Q is expected to be different to that faced in singlehood, $P^{s,i}(w^i, \mathbf{S})$.

A feature of the MMWI worth noting involves its relationship with the sharing rule. By defining one of the constraints of the minimization problem in 13 in terms of the individual indirect utility of parent i, which itself takes the sharing rule as an argument, I implicitly characterize the MMWI as a function of the sharing rule. Nonetheless, by also capturing the differences in the productivity of parent i in both living arrangements, the MMWI adjusts the sharing rule as it accounts for the change in prices experienced by the parent when considering the hypothetical transition from collectivity to singlehood. Thus, the MMWI constitutes the compensating variation of facing the full cost of producing Q, $P^{s,i}(w^i, \mathbf{S})$, instead of θ^i_Q when moving across living arrangements. Section 5 shows that under the parametric specification used in the empirical application of the model I implement, such adjustment made to the sharing rule in the MMWI involves a rescaling using a function of $P^{s,i}(w^i, \mathbf{S})$ and θ^i_Q.

3 Data and Evaluation of *Oportunidades*

3.1 Program Overview

Mexico's *Oportunidades* conditional cash transfer program is one of the most well-known CCT programs in the region, originally implemented in rural areas under the name *Progresa* in 1997. The program was later expanded to semi-urban and urban areas as its national scale was broadened by the new administration in 2002, then renamed as *Oportunidades* (Levy (2007)). The program intervenes simultaneously in the three focal areas of education, nutrition and health. The evaluation design implemented by the program administration has been conducive to the assessment of the program's impact on key development outcomes such as children's school enrollment and health outcomes, most of which has been deemed as positive (Skoufias and Di Maro (2006), Parker and Todd (2017)). While most of the attention in the literature has been focused on the rural implementation of the program, this paper focuses on its 2002 expansion to urban areas. It is worth mentioning that the two implementations differ mainly in their evaluation design and its beneficiary selection procedure.

Under both implementations, the beneficiary selection procedure was implemented in two sequential stages. The first step involved the geographic targeting of the intervention areas. In rural areas, 506 villages in 7 of the 32 states were randomly assigned to control or treatment groups. On the other hand, perfect randomization was infeasible in urban areas due to financial considerations. Therefore, using the 2000 census and the INEGI's 2000 National Survey of Household Income and Expenditure, the program was initially offered in city blocks having the highest incidence of poverty based on which the program administration computed a city block-level propensity score predicting the city block's likelihood to be part of the intervention, thus matching a comparable sample of city blocks based on their similarities in terms of propensity scores. The second stage consisted of the selection of beneficiary households through a discriminant analysis which consisted on comparing each household's marginality index against a local cutoff defined using the minimum well-being line define by the National Council for the Evaluation of Social Development Policy (CONEVAL).[8]

The benefits and conditionalities scheme of the program provides two main channels through which the program can affect consumption patterns and the allocation of time

[8] This minimum well-being line is known as *Linea de Bienestar Minimo*), defined as "the lack of monetary capacity to afford the essential goods for an adequate nutrition even after using all their income to buy food" (CONEVAL, 2000) This multidimensional definition of well-being is used to capture not only extreme poverty but also what is defined as the poverty of means by the National Council for the Evaluation of Social Development Policy (CONEVAL).

within two-parent households as described in Section 2. The first involves the program's gender-based targeting strategy under which once households are deemed eligible, the program administration assigns female household heads as transfer holders. In this way, participation in the program alters women's contribution to total household non-labor income, described in Section 2 as the distribution factor of interest in this paper. The second one involves the pressure exerted by participation in the program on the households' resource constraints through the conditionalities attached to it involving minimum school attendance by school-aged children in the household and regular medical checkups which could potentially affect the amount of time and money households devote to children's human capital accumulation.

3.2 *Oportunidades*' Urban Evaluation Survey

This paper uses a novel mix of survey and administrative data collected from the quantitative evaluation of the urban implementation of *Oportunidades*. The survey data is obtained from 2002-2004 waves of the program's sociodemographic module of the Urban Evaluation Survey (ENCELURB by its acronym in Spanish), which provides a short panel of *Oportunidades*' beneficiary and non-beneficiary households, capturing information on household structure, income and consumption patterns in addition to individual information on labor supply, education, and time use. The ENCELURB data was gathered in three waves. The first wave captured baseline information and was gathered in the fall of 2002, once beneficiary households had been determined but prior to the provision of any benefits. The second and third waves contain the first and second follow-ups gathered during the fall of 2003 and 2004, respectively. Information on households' poverty classification and their city blocks' zone available in this data set allows for the construction of the final sample and the treatment indicator used in the empirical analysis. The ENCELURB's information on a household's eligibility and zone is supplemented with the program's administrative records on the bi-monthly transfers made to households that have been incorporated into the program. Furthermore, this administrative transfer data is also used to construct the wife's share of non-labor income, thereby introducing the exogenous variation of the program into the structural approach developed in the paper. The construction of the variables used in the estimation described in subsection 4.3 is discussed in further detail in the Online Appendix.

3.3 Evaluation Methodology

The imperfect randomization of the program's geographic targeting and household selection process plays an important role on the choice of estimator used to evaluate the program's effect on observed household behavior. The causal analysis implemented in this paper addresses the potential selection into treatment by explicitly modeling the participation decision using a matching difference-in-differences strategy. To understand the identifying assumption of our chosen estimator, suppose I describe our outcome of interest, y_{it}, in the following way

$$y_{it} = \beta_0 + \beta_1 d_i + \beta_2 Post_t + \beta_3 (d_i \times Post_t) + u_{it}$$

where, d_i indicates the program participation status of the household in which individual i resides, being 1 if it is part of the participant group and 0 otherwise. Furthermore, $Post_t$ indicates whether t corresponds to a survey year after the start of the program, being 1 if t is a follow-up survey year and 0 if it captures the baseline year.

Averaging the differences in the evolution of outcomes within groups and averaging yields

$$\mathbb{E}[y_{it_1} - y_{it_0} | d = 1] - \mathbb{E}[y_{it_1} - y_{it_0} | d = 0] = \beta_3 + \mathbb{E}[u_{it_1} - u_{it_0} | d = 1] - \mathbb{E}[u_{it_1} - u_{it_0} | d = 0] \quad (14)$$

Thus, within a difference-in-differences (DID) framework, it follows that β_3 identifies the causal impact of program participation on household behavior if $(u_{it_1} - u_{it_0}) \perp\!\!\!\perp d$, typically known as the conditional independence assumption. This requires for the evolution of outcomes to be the same between both participant and non-participant households. To understand the implications of this assumption, suppose that I decompose the unobserved component of y_{it} into three potential sources of selection bias so that I can describe u_{it} so that,

$$u_{it} = \theta_t + \phi_i + \mu_{it} \quad (15)$$

where θ_t denotes period-specific aggregate shocks, μ_{it} denotes temporary, individual-specific shocks and ϕ_i denotes individual time-invariant characteristics. This implies that the conditional independence assumption of a DID estimator rules out differences in the evolution of outcomes between groups attributable to selection on idiosyncratic shocks, differential macroeconomic shocks and compositional changes.

To rely on a relatively weaker version of the conditional independence assumption, I implement a matching difference-in-differences (MDID) estimator. Heckman, Ichimura and Todd (1998) show that identification of ATT is feasible within this approach if two conditions hold, which together constitute what is known as the strong ignorability condition. The first condition involves a modified version of the conditional independence assumption of a DID framework under which y_{it} is assumed to evolve in the same way within both comparison groups. Let X denote the set of observed household characteristics that determine program participation. To circumvent the curse of dimensionality faced when matching on a high-dimensional X non-parametrically, Rosenbaum and Rubin (1983) propose the use of propensity scores, capturing the likelihood that households participate in *Oportunidades* given their observables X. In this way, the implicit assumption is that $(y_{it_1} - y_{it_0}) \perp\!\!\!\perp d | P(X)$ where $P(X) = Pr(d = 1|X)$. Thus, implying that the sources of differences in the evolution of outcomes over time in the absence of treatment between participant and non-participant households are precisely those that affect program participation. The second condition involves matching households over a region of common support for both groups of households to ensure that all participant households considered in the analysis have at least one counterpart in the non-participant group. This region of common support is defined as $S = Supp(X|d = 1) \cap Supp(X|d = 0)$, or $S = Supp(P(X)|d = 1) \cap Supp(P(X)|d = 0)$.

Formally, following the longitudinal characterization of the estimator presented in Blundell and Dias (2009), the MDID estimator I implement can be described in the following way

$$\hat{\alpha}^{MDID} = \frac{1}{N_1} \sum_{i \in T} \left\{ [y_{it_1} - y_{it_0}] - \sum_{j \in C} \tilde{\omega}_{ij} [y_{jt_1} - y_{jt_0}] \right\} \tag{16}$$

where N_1 denotes the number of treated households in the common support region.

That is, the estimator involves comparing the difference in outcomes across waves of every treated household, $y_{it_1} - y_{it_0}$, to an average of the difference in outcomes across time of *observably similar* control households, $y_{jt_1} - y_{jt_0}$. For a given household, the inclusion of control households into this observably similar group is dependent upon the constructed weight, $\tilde{\omega}_{ij}$, which is obtained in the first stage of the implementation of this estimator as a function of the propensity score $P(X)$ and used in the second stage to retrieve $\hat{\alpha}^{MDID}$ using a DID regression on the resulting matched sample. The MDID explicitly models the program participation decision by non-parametrically constructing a control group for each treated household such that the comparison group becomes more observably similar to its treated counterpart by matching these households on the basis of their propensity to participate in the program, captured by the constructed weight, $\tilde{\omega}_{ij}$. In this way, the estimator involves recreating the targeting strategy implemented by the program's administration by exploiting the differences in observables between participant and non-participant households.

The implementation of the estimator is carried out in two stages. The first stage involves the computation of the propensity score, $P(X)$, at the household level using a probit model. The marginal effects at the mean for the estimation results of this model for two-parent and single-parent households are presented in Tables 10 and 11 in Section C.[9] The distributions of the propensity scores for both types of households are presented in Figure 9 in the same Section .[10] Furthermore, I use a non-parametric algorithm based on an Epanechnikov kernel using Silverman's rule of thumb for bandwidth selection to generate the weights $\tilde{\omega}_{ij}$ which serve to construct the counterfactual for each participant household in the sample using information obtained from non-participant households.[11] The second stage consists on estimating a DID regression model over a sample of matched participant and non-participant households using the following specification:

$$y_{i,t} = \beta_0 + \beta_1 d_i + \beta_2 Post_t + \beta_3 (d_i \times Post_t) + \epsilon_{i,t}$$

[9]The choice of conditioning variables for the estimation of the propensity score builds upon the work of Behrman et al. (2012), and Angelucci and Attanasio (2013). In the estimation of this probit model, I focus on the subset of covariates pertaining to household composition, dwelling characteristics, financial indicators (whether the household has some previous loans, and savings). I also include variables pertaining household participation in other social programs (milk subsidy, breakfast subsidy, and tortilla subsidy), educational attainment of the mother and father, and an index of poverty incidence in the state in which the household resides. Flores (2021) provides a more detailed explanation on the significant differences in these characteristics between participant and non-participant households at baseline.

[10]I impose the MDID's common support condition required for the identification of ATT by first using a minima-maxima approach that only takes the range of propensity scores for which there is some positive amount of observations in both comparison groups. Following Heckman, Ichimura and Todd (1997), I further trim the top and bottom 2% of the resulting propensity score distribution. This ensures that I implement the estimator on a region of higher overlap between the two comparison groups.

[11]The kernel-based matching strategy I use constructs $\tilde{\omega}_{ij}$ using the following algorithm

$$\tilde{\omega}_{ij} = \frac{K\left(\frac{P_j - P_i}{h}\right)}{\sum_{k \in C} K\left(\frac{P_k - P_i}{h}\right)}$$

where the kernel of choice for the analysis implemented in this paper is the Epanechnikov kernel using Silverman's rule of thumb for bandwidth selection, $h = 2.345\sigma N^{-0.2}$.

where β_3 denotes the MDID estimate of *Oportunidades'* impact on intrahousehold time allocation and consumption patterns that I document in the next subsection.

3.4 Description of Estimation Sample and Evaluation of *Oportunidades'* Impact on Time Use and Consumption

This paper focuses on the subsample of single-parent households and nuclear families in the ENCELURB in which the decision-makers are working in the market. While this is a relatively restrictive criteria given the degree of female non-participation that there is in the sample, particularly those in two-parent households, it serves as a sample for estimation that has all the components of the model needed within the framework of Blundell, Chiappori and Meghir (2005). This criteria is similar to the one adopted in Cherchye, De Rock and Vermeulen (2012) given that the model does not account for the extensive margin of labor supply. This would require extending it to a discrete choice framework. As mentioned by Cherchye, De Rock and Vermeulen (2012) and Lise and Yamada (2019), the estimation of a collective household model of labor supply and home production as the one here presented and described in Section 2 poses significant data requirements as valid information is needed on time use, consumption and income. This explains the reduced number of observations in the final estimation sample used in subsection 4.3. Table 1 presents relevant descriptive statistics for the sample of households used in the estimation of the model pertaining to their sociodemographic characteristics, income sources, consumption and time allocation.

For time allocation, the table distinguishes between time spent in home production and time spent in child care. In the estimation described in subsection 4.3, I consolidate these two time use categories into a single measure of home production so that it captures these two dimensions of housework. I document that the median of all types of consumption is higher in two-parent households than in their single counterparts which goes in hand with the higher median income of all sources being higher for two-parent households. In terms of the allocation of time, mothers in two-parent households tend to spend less time working in the market and more time in home production and child care than their single counterparts. Moreover, there is evidence of a high degree of gender specialization in home production and child care within two-parent households with mothers spending more hours in these activities and less time working in the market than their spouses. Specifically, I find that mothers, on average, take on more than 80% of total parental time spent on child care and home production.

Table 1: Descriptive Statistics, Poor (Eligible) Households Included in Estimation Sample

	Two Parent			Single Mother			Single Father		
	Obs	**Mean**	**Median**	**Obs**	**Mean**	**Median**	**Obs**	**Mean**	**Median**
Household Characteristics:									
Household Size	661	5.13	5.00	848	3.89	4.00	130	2.98	2.00
Number of children	661	3.04	3.00	848	2.71	3.00	130	1.93	1.00
Mean Age of Children in Household	657	8.57	8.50	791	10.06	10.17	56	11.61	11.67
Household Consumption:									
Public Expenditures, Yearly	661	7,140.72	6,226.87	848	5,389.30	4,757.04	130	3,314.59	2,567.27
Private Consumption	661	22,046.49	20,867.19	848	16,246.73	14,718.75	130	16,949.58	14,990.40
Food Expenditures	661	17,795.96	16,484.00	848	13,478.18	12,246.00	130	10,412.40	8,840.00
Income									
Total Household Nonlabor Income	661	7,840.21	4,860.73	848	7,198.88	3,713.89	130	4,778.60	1,578.24
Wife's Share	661	0.29	0.05	0	-	-	0	-	-
Total Household Earnings	661	38,809.77	35,429.08	848	16,457.04	14,511.20	130	23,208.37	23,642.79
Parental Characteristics:									
Age, Mother	661	32.75	32.00	848	37.92	36.00	0	-	-
Age, Father	661	36.36	35.00	0	-	-	130	46.79	46.00
Years of Education, Mother	661	6.20	6.00	848	5.66	6.00	0	-	-
Years of Education, Father	661	6.82	6.00	0	-	-	130	5.18	6.00
Market Work Hours, Mother	661	1,081.64	780.00	848	1,490.95	1,456.00	0	-	-
Market Work Hours, Father	661	2,251.26	2,496.00	0	-	-	130	2,146.45	2,366.00
Child Care Hours, Mother	661	575.38	416.00	848	380.31	208.00	0	-	-
Child Care Hours, Father	661	137.12	0.00	0	-	-	130	98.20	0.00
Home Production Hours, Mother	661	1,683.75	1,664.00	848	1,427.33	1,352.00	0	-	-
Home Production Hours, Father	661	211.42	130.00	0	-	-	130	692.80	598.00
Real Wage, Mother	661	17.36	9.62	848	15.39	9.57	0	-	-
Real Wage, Father	661	14.92	11.42	0	-	-	130	14.64	11.14

[1] Monetary values reported in 2002 MXN pesos. 1USD = 10.43MXN pesos. [2] All measures are annualized.

I proceed to investigate the extent to which the *Oportunidades* program has affected the allocation of time within two-parent households and of single mothers.[12] Table 2 presents the overall impact of the program on the intrahousehold time allocation and public expenditures of two-parent households. The results suggest that participation in the program increased mothers' yearly leisure hours stemming from a significant decrease in their home production hours that is not offset by the increase in the time they spend working in the market. On the other hand, the impact of the program on fathers' time allocation is rendered statistically insignificant. In terms of consumption, the results suggest that the program significantly increased yearly public expenditures in participant two-parent households compared to their non-participant counterparts.[13]

[12] This causal analysis is not implemented among single-father households since less than 5% of the sample report participating in the program which can be conjectured to stem from the gender-based targeting of the program under which mothers are prioritized.

[13] I provide evidence of a similar impact of the program within two-parent households in which mothers

Table 2: Overall Impact of *Oportunidades* on Two-Parent Beneficiary Households

	Leisure		Home Production		Market Work		
	Mother	Father	Mother	Father	Mother	Father	Public Exp.
MDID	239.46*	-248.55	-419.03***	-70.57	179.57**	319.12	1967.24**
	(136.88)	(210.36)	(141.10)	(62.89)	(78.87)	(223.13)	(782.04)
Mean	2,321.40	3,196.48	2,452.89	360.61	1,049.70	2,266.90	6,610.25
N	478	478	478	478	478	478	478

Notes: [1] Monetary values reported in 2002 MXN pesos. 1USD = 10.43 MXN. [2] Annualized measures. [3] Bootstrapped standard errors (100 repetitions).

Table 3 presents the estimates of the program's impact on the allocation of time and consumption related to children in single-mother households. The results suggest that while program participation reduced yearly home production hours for mothers, the simultaneous significant increase in their yearly market work hours more than offsets such reduction in a way that it decreases their leisure hours, though such decrease is rendered statistically insignificant. Moreover, in contrast with two-parent households, the results suggest that participation in the program significantly decreases single-mother households' child-related expenditures.

Table 3: Overall Impact of *Oportunidades* on Single-Mother Beneficiary Households

	Leisure	Home Prod.	Market Work	Public Exp.
MDID	-153.893	-303.262**	454.045***	-1837.540***
	(174.652)	(136.465)	(122.948)	(710.979)
Mean, Dep. Var.	2,446.977	1,946.624	1,430.397	4,599.455
N	632	632	632	632

[1] Monetary values reported in 2002 MXN pesos. 1USD = 10.43 MXN pesos.
[2] All measures are annualized. [3] Bootstrapped standard errors (100 repetitions).

The significant reduction in home production hours observed among both married and single mothers is consistent with the evidence presented by Skoufias and Di Maro (2006) in rural areas. Nonetheless, the main point of departure of the evidence here presented from that documented by Skoufias and Di Maro (2006) relates to the significant increase in yearly leisure hours I observe among married mothers which is not robust across marital status since I do not find a significant effect of the program on single

are not working in the market. The results are included in the Online Appendix.

mothers' leisure hours. A similar discrepancy in household responses to the program is observed in terms of public expenditures. I find that while two-parent households increase their public expenditures in response to participation in *Oportunidades*, their single counterparts reduce such monetary investments that go into the production of the domestic good described in Section 2. Such reduction in both time and monetary expenditures in the domestic good associated with children is likely to have translated into a significant decrease in its production, which is discussed in Section 5.2.

The contrasting results documented for both types of households can be rationalized within the framework presented in Section 2. Specifically, the results suggest differences in the mix of income and substitution effects triggered by the program's benefits and conditionalities scheme within the two types of households. Throughout the treatment effects framework presented in this section, as the participation indicator captures changes in y^A generated by *Oportunidades*, the MDID estimates here presented for single-parent and two-parent households capture the empirical counterpart of the theoretical predictions relating the responses of parents' leisure to changes in mothers' non-labor income within a standard unitary labor supply model and a collective labor supply model, respectively, in the presence of home production. Focusing on two-parent households, the theoretical implications of an increase in y^A are presented in 11 and 12. Thus, the results for two-parent households suggest a significant increase in mothers' sharing rule in response to participation in the program. Such increase in mothers' sharing rule encode information about both changes in the productivity of the household in response to the program's conditionality and impact on the demand for the domestic good Q and changes in the Pareto weight stemming from the gender-targeted strategy of the program. In this way, differences in the responses of time use and consumption in both types of households indicate not only differences in home productivity but also an impact of the program on the decision-making process within two-parent households.

As mentioned in Section 2, the extent to which I can attribute the positive impact of the program on mothers' sharing rule to an increase in mothers' Pareto weight in response to the increase in y^A generated by the receipt of the *Oportunidades* cash transfer is limited by the fact that the response of the sharing rule is also capturing the impact of the program on total household monetary resources and on the household's demand for and production of the public good, Q in the household's resource allocation stage. Thus, such positive impact of *Oportunidades* on mothers' sharing rule constitutes suggestive evidence of an empowerment effect in favor of mothers in beneficiary households.

Therefore, the results from the analysis I have presented throughout this section yields motivating evidence for further investigating the extent to which such differential impact of the program can be attributable to a shift in the balance of power within two parent households. To this end, I formalize the link between a shift in mothers' bargaining power and the observed increase in their leisure hours and public expenditures within two-parent households through the structural estimation procedure described in Subsection 4.3 based on the model presented in Section 2. Upon the recovery of the bargaining structure of two-parent households, I quantify the program's impact on the model's primitives in Subsection 5.2.

4 Estimation and Identification

This section describes the identification and structural estimation procedure of the model presented in Section 2. While the model is parametrically estimated, I explore the non-parametric identification of parental preferences, the production technology of two-parent and single-parent households and the Pareto weight, which describes the decision-making structure of two-parent households. This non-parametric identification analysis informs the parametric identification of the model which ultimately leads to the two-step estimation procedure here described.

4.1 Identification

Proposition 1 (Identification of Two-Parent Households' Production Technology).
Let (h_D^A, h_D^B, q^D) be observed functions of $(w^A, w^B, y, \boldsymbol{S}, \boldsymbol{z})$ for two-parent households. Then, the production function for two-parent households, $F_Q^M(h_D^A, h_D^B, q^D, \boldsymbol{s})$ is identified up to a strictly monotone (and thus, invertible) transformation G_M so that $F_Q^M(h_D^A, h_D^B, q^D, \boldsymbol{s}) = G_M^{-1}[\bar{F}_Q^M(h_D^A, h_D^B, q^D; \boldsymbol{s})]$.

Proof: See A.1 in Section A.

This follows from the identification result considered in the application of the model to household production in Blundell, Chiappori and Meghir (2005). Intuitively, the optimality conditions derived from productive efficiency in 7 provide a direct relationship between the marginal rates of technical substitution of the three inputs of production, h_D^A, h_D^B and q^D and the spouses' wages w^A and w^B. By exploiting the observability of these inputs of production and their reduced-form relationship with wages and the continuous differentiability of the production function, F_Q^M, additional conditions can be derived to separately identify the marginal productivity of each input, which can then be integrated to recover F_Q^M up to an increasing transformation.

Proposition 2 (Identification of Single-Parent Households' Production Technology). *Let (h_D^i, q^D) be observed functions of $(w^i, y^i, \boldsymbol{S})$ for single parents $i = (A, B)$ with sufficient variation induced by at least one production shifter, $s_j \in \boldsymbol{S}$, in their marginal productivity. Then, the production function for single-parent households, $F_Q^{S,i}(h_D^i, q^D, \boldsymbol{s})$ is identified up to a strictly monotone (and thus, invertible) transformation G_S so that $F_Q^{S,i}(h_D^i, q^D, \boldsymbol{s}) = G_S^{-1}[\bar{F}_Q^{S,i}(h_D^i, q^D; \boldsymbol{s})]$.*

Proof: See A.2 in Section A.

This follows a similar intuition to the one followed in the proof of Proposition 1. The identification result stems from the optimality condition in 1 relating the marginal rate of substitution between parental time and monetary investments, h_D^i and q^D and wages w^i for both single mothers and fathers $(i = A, B)$. I further use the response of these marginal rates of technical substitution to shifts in the production shifter s_j to derive an additional condition that allows us to identify each individual marginal productivity which can then be integrated to recover $F_Q^{s,i}$ up to an increasing transformation.

Proposition 3 (Identification of Individual Preferences and the Pareto Weight). *Let l^i be an observed function of $(w^i, y^i, \boldsymbol{S})$ for $i = (A, B)$ for single-parent households and let (l^A, l^B) be observed functions of $(w^A, w^B, y, \boldsymbol{S}, \boldsymbol{z})$ for two-parent households. With the marginal productivities of mothers and fathers identified within both types of households, if (1) there exists an exogenous variation inducing changes in at least one production shifter $s_j \in \boldsymbol{S}$ and at least one distribution $z \in \boldsymbol{z}$ such that it affects married mothers' time allocation in a way that increases their consumption of leisure, (2) the Pareto weight is non-decreasing in z^A, (3) married mothers are more productive at home than their single counterparts, and (4) the responses of single and married mothers' marginal productivities to changes in the production shifter are contrasting, the Pareto weight and parental preferences are identified.*

Proof: See A.3 in Section A.

Once the production technology of single-parent and two-parent households have been identified, I first focus on the relationship between the known individual marginal productivities of mothers and fathers and the marginal rate of substitution of leisure for public consumption within the two types of households presented in the optimality conditions 1, 4, and 5. I use these to derive a set of two conditions relating parents' marginal utility for leisure, the Pareto weight and both parents' marginal productivity both within a collective and a single-parent household by exploiting the responsiveness of the Pareto weight to shifts in the distribution factor z and of the observed leisure and home time hours to the production shifter s_j. A third condition relating mothers' and fathers' marginal utility for leisure, the Pareto weight and their wage rate is obtained from the third condition in 3 to complete a system of 3 equations for which a solution exists if: (1) I find an empirical positive relationship between mothers' leisure hours and the distribution factor z and the production shifter s_j, (2) the Pareto weight is non-decreasing on the distribution factor z^A, (3) mothers are more productive when living in collectivity than when living in singlehood, and (4) the response of mothers' marginal productivity at home to shifts in the production shifter s_j differs across the two types of households here considered. Once parents' marginal utility for leisure is recovered, I combine these with information on their wages to recover their marginal utility for private market consumption using the first two conditions in 3. Moreover, I use the information on the Pareto weight, parents' marginal productivity at home and their marginal utility for leisure to recover their individual marginal utilities for public consumption using 4 and 5.

The reliance of this identification result on establishing an empirical relationship between the leisure hours of at least one parent (here being case, the mother) and changes in at least one distribution factor and one production shifter is attuned with the important role that both exclusive goods (here being leisure) and distribution factors play in facilitating the identification of the model's primitives as argued by Chiappori and Ekeland (2009). More importantly, as shown by Cherchye, De Rock and Vermeulen (2012), in the presence of home production, the existence of a production shifter combined with a distribution factor allows us to separately identify differences in home productivity from differences in the households' decision-making structure when observing changes in household behavior.

A caveat accompanying the third proposition involves its generalizability beyond the application I consider in this paper as it relies on the documented gender-asymmetric impact of *Oportunidades* on the allocation of time within two-parent households. It would be of interest to investigate how the required conditions would change within the context of an application in which a different empirical pattern is observed with respect to the way in which leisure is spent within the household. It would also be interesting to understand the extent to which I can use similar exogenous variation on other aspects of observed household behavior, such as public expenditures. This is of particular relevance given the existing empirical evidence focused on the impact of development policies on observed household behavior.

4.2 Parametrization of Preferences, Technology and Bargaining Structure

I now describe the parametrization of preferences, the households' production technology and two-parent households' decision making structure. Based on this parametrization, I explore the parametric identification of the model described in further detail in Section B.

4.2.1 Preferences

As mentioned in the non-parametric identification analysis, I assume that preferences are strongly separable on leisure, private consumption and the public domestic good such that this allows for an additively separable representation. Suppose that each subutility is described by a logarithmic function to form the following Cobb-Douglas utility function.

$$U^i(l^i, q^i, Q; \mathbf{X}^i) = \alpha_1^i(\mathbf{X}^i)\ln(l^i) + \alpha_2^i(\mathbf{X}^i)\ln(q^i) + (1 - \alpha_1^i(\mathbf{X}^i) - \alpha_2^i(\mathbf{X}^i))\ln(Q) \quad (i = A, B)$$

where

$$\alpha_1^i(\mathbf{X}^i) = \frac{\exp(\alpha_1^{i\prime}\mathbf{X}^i)}{1 + \exp(\alpha_1^{i\prime}\mathbf{X}^i) + \exp(\alpha_2^{i\prime}\mathbf{X}^i)}; \;\; \alpha_2^i(\mathbf{X}^i) = \frac{\exp(\alpha_2^{i\prime}\mathbf{X}^i)}{1 + \exp(\alpha_1^{i\prime}\mathbf{X}^i) + \exp(\alpha_2^{i\prime}\mathbf{X}^i)}$$

For simplicity, let $\mathbf{X}^i$ denotes a vector of sociodemographic characteristics containing a constant other characteristics of spouse i such as his/her age and education as well as the number of children in the household. Since I have assumed that preferences are invariant to marital status, the preferences of single mothers and fathers are the same as the preferences of their married counterparts, thereby implying the same parametrization for the preferences of both types of parents.

4.2.2 Home Production Technology

For two-parent households, I use the following constant returns to scale specification to describe the household's production technology

$$Q = F_Q(h_D^A, h_D^B) = [\psi(\mathbf{S})(h_D^A)^\gamma + (1-\psi(\mathbf{S}))(h_D^B)^\gamma]^{\frac{\rho}{\gamma}}(q^D)^{1-\rho} \text{ where } \psi(\mathbf{S}) = \frac{\exp(\psi'\mathbf{S})}{1+\exp(\psi'\mathbf{S})}$$

I let $\mathbf{S}$ denote a vector of production shifters including a constant and the number of children in the household attending school. Furthermore, as in Lise and Yamada (2019), I let $\rho \in [0,1]$ and $\gamma \leq 1$.

For households headed by a single parent, I assume that the production function can be characterized as by the following CES specification

$$Q = [\phi^i(\mathbf{S})(h_D^i)^{\beta^i} + (1-\phi^i(\mathbf{S}))(q^D)^{\beta^i}]^{\frac{1}{\beta^i}} \text{ where } \phi^i(\mathbf{S}) = \frac{\exp(\phi^{i'}\mathbf{S})}{1+\exp(\phi^{i'}\mathbf{S})} \tag{17}$$

where, as in the production function of two-parent households, $\mathbf{S}$ denotes a vector of production shifters. To distinguish between single men and women, I estimate this separately for single mothers and for single fathers to allow for ϕ^i and β^i to vary by gender.

4.2.3 Pareto weight

I parametrize the Pareto weight of the collective model for two-parent households in the following way

$$\lambda(w^A, w^B, y, \mathbf{z}) = \frac{\exp(\lambda_0 + \lambda_1(w^A/w^B) + \lambda_2 y + \lambda_3'\mathbf{z})}{1+\exp(\lambda_0 + \lambda_1(w^A/w^B) + \lambda_2 y + \lambda_3'\mathbf{z})}$$

where $\lambda(w^A, w^B, y, \mathbf{z})$ will be denoted as $\lambda(\mathbf{z})$ hereafter under the understanding that this primitive is dependent upon w^A, w^B and y but the primary sources of variation for its identification will be stemming from $\mathbf{z}$. Throughout the estimation of the model, I use the wife's share of non-labor income (which contains the variation induced by program participation through variation in transfer size as described in Section 2) and the state-level, age-specific sex ratios as distribution factors.

4.2.4 Optimality Conditions

Given the parametric specification adopted, I derive the three sets of optimality conditions for two-parent households mentioned in Section 2. I begin by deriving the conditions for single-parent households by first focusing on productive efficiency. Given the parametrization imposed so far on these households' production technology, these conditions show that the ratio of the input prices govern the ratio of the inputs used by the household in the production of Q.

$$\frac{\phi^i(\mathbf{S})}{1-\phi^i(\mathbf{S})}\left(\frac{h_D^i}{q^D}\right)^{\beta^i-1} = w^i \tag{18}$$

Then deriving the optimality condition related to private consumption

$$\frac{\alpha_1^i(\mathbf{X})}{\alpha_2^i(\mathbf{X})}\frac{q^i}{l^i} = w^i \tag{19}$$

To then focus on the optimality conditions governing public consumption

$$\frac{\alpha_1^i(\mathbf{X})[\phi^i(\mathbf{S})(h_D^i)^{\beta^i} + (1-\phi^i(\mathbf{S}))(q^D)^{\beta^i}]}{(1-\alpha_1^i(\mathbf{X})-\alpha_2^i(\mathbf{X}))\phi^i(\mathbf{S})}\frac{(h_D^i)^{1-\beta^i}}{l^i} = 1 \tag{20}$$

$$\frac{\alpha_2^i(\mathbf{X})[\phi^i(\mathbf{S})(h_D^i)^{\beta^i} + (1-\phi^i(\mathbf{S}))(q^D)^{\beta^i}]}{(1-\alpha_1^i(\mathbf{X})-\alpha_2^i(\mathbf{X}))(1-\phi^i(\mathbf{S}))}\frac{(q^D)^{1-\beta^i}}{q^i} = 1 \tag{21}$$

I then proceed to derive the optimality conditions for two-parent households. As in the case of single-parent households, I begin by focusing on the conditions related to productive efficiency for which, given the production function's parametrization, I find that the ratios with which the inputs of production are used are governed by the ratio of their prices. For parental time, these ratios are re-weighted by their relative productivity in domestic production, captured by $\psi(\mathbf{S})$, by the coefficient of substitution γ and by the production share or parental time ρ.

$$\frac{\psi(\mathbf{S})}{1-\psi(\mathbf{S})}\left(\frac{h_D^A}{h_D^B}\right)^{\gamma-1} = \frac{w^A}{w^B} \tag{22}$$

$$\psi(\mathbf{S})\frac{\rho}{(1-\rho)}\frac{(h_D^A)^{\gamma-1}q^D}{\psi(\mathbf{S})(h_D^A)^{\gamma}+(1-\psi(\mathbf{S}))(h_D^B)^{\gamma}} = w^A \tag{23}$$

$$(1-\psi(\mathbf{S}))\frac{\rho}{(1-\rho)}\frac{(h_D^B)^{\gamma-1}q^D}{\psi(\mathbf{S})(h_D^A)^{\gamma}+(1-\psi(\mathbf{S}))(h_D^B)^{\gamma}} = w^B \tag{24}$$

I then focus on the conditions related to private consumption, q^i and l^i. Given the parametrization imposed on preferences, these conditions show that the ratio of the spouses' leisure hours $\frac{l^A}{l^B}$ is governed not only by the ratio of their wages but also by their relative bargaining power within the household $\lambda(\mathbf{z})$.

$$\frac{\alpha_1^A(\mathbf{X})}{\alpha_2^A(\mathbf{X})}\frac{q^A}{l^A} = w^A;\ \ \frac{\alpha_B^1(\mathbf{X})}{\alpha_2^B(\mathbf{X})}\frac{q^B}{l^B} = w^B;\ \ \left(\frac{\lambda(\mathbf{z})}{1-\lambda(\mathbf{z})}\right)\frac{\alpha_1^A(\mathbf{X})}{\alpha_1^B(\mathbf{X})}\frac{l^B}{l^A} = \frac{w^A}{w^B};\ \ \left(\frac{\lambda(\mathbf{z})}{1-\lambda(\mathbf{z})}\right)\frac{\alpha_2^A(\mathbf{X})}{\alpha_2^B(\mathbf{X})}\frac{q^B}{q^A} = 1 \tag{25}$$

Lastly, I derive the conditions related to public consumption, connecting the household's marginal utility for public consumption, the spouses' marginal productivity at home and their marginal utility for leisure.

$$\lambda(\mathbf{z})\frac{\alpha_1^A(\mathbf{X})}{l^A} = \frac{\psi(\mathbf{S})\rho(h_D^A)^{\gamma-1}[\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))+(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))]}{[\psi(\mathbf{S})(h_D^A)^{\gamma}+(1-\psi(\mathbf{S}))(h_D^B)^{\gamma}]} \tag{26}$$

$$(1-\lambda(\mathbf{z}))\frac{\alpha_1^B(\mathbf{X})}{l^B} = \frac{(1-\psi(\mathbf{S}))\rho(h_D^B)^{\gamma-1}[\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))+(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))]}{[\psi(\mathbf{S})(h_D^A)^{\gamma}+(1-\psi(\mathbf{S}))(h_D^B)^{\gamma}]} \tag{27}$$

$$\lambda(\mathbf{z})\frac{\alpha_2^A(\mathbf{X})}{q^A} = \frac{(1-\rho)[\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))+(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))]}{q^D} \tag{28}$$

I then exploit the inclusion of a production shifter, s_j, and the use of the wife's share of non-labor income, z^A, as a distribution factor to derive the experimental moments by taking the derivatives of some of these conditions with respect to z^A and s_j. I begin by taking the derivative of the optimality conditions relating productive efficiency for single-parent and two-parent households in 18 and 22, respectively. For the former, I focus on the spouses' home time ratios and for the latter I focus on the parental time to monetary investments ratio and take the derivative of these conditions with respect to s_j. Letting $\Delta_{s_j}^{h_D}(d) = \frac{\partial}{\partial s_j}\left[\frac{h_D^A}{h_D^B}\right]$ and $\Delta_{s_j}^{h_D,q^D}(d) = \frac{\partial}{\partial s_j}\left[\frac{h_D^A}{q^D}\right]$.

$$\Delta_{s_j}^{h_D}(d) = -\frac{1}{1-\gamma}\left(\frac{w^B}{w^A}\frac{\psi(\mathbf{S})}{(1-\psi(\mathbf{S}))}\right)^{\frac{1}{1-\gamma}}\frac{\partial\psi(\mathbf{S})}{\partial s_j} \tag{29}$$

$$\Delta_{s_j}^{h_D,q^D}(d) = -\frac{1}{1-\beta^i}\left((w^A)^{\frac{1}{\beta^i}}\left(\frac{(1-\phi^i(\mathbf{S}))}{\phi^i(\mathbf{S})}\right)^{\frac{\beta^i}{1-\beta^i}}\frac{\partial\phi^i(\mathbf{S})}{\partial s_j}\right) \tag{30}$$

Intuitively, for two-parent households, 29 captures the response of $\frac{h_D^A}{h_D^B}$ to changes in the production shifter, s_j. Thus, capturing the extent to which the production shifter can be used to affect the degree of gender specialization within the household. For single-parent households, 30 captures the response of $\frac{h_D^A}{q^D}$ to changes in the production shifter s_j.

I then focus on two-parent households to take the derivative of the third condition related to private consumption in 25 and the conditions related to public consumption in 26 and 27 with respect to z^A. Letting $\Delta_{z^A}^{l}(d) = \frac{\partial}{\partial z^A}\left[\frac{l^A}{l^B}\right]$, $\Delta_{z^A}^{l,h_D}(d,A) = \frac{\partial}{\partial z^A}\left[\frac{l^A}{h_D^A}\right]$ and $\Delta_{z^A}^{l,h_D}(d,B) = \frac{\partial}{\partial z^A}\left[\frac{l^B}{h_D^B}\right]$, I define the following conditions

$$\Delta_{z^A}^{l}(d) = \frac{\partial\lambda(\mathbf{z})}{\partial z^A}\frac{1}{(1-\lambda(\mathbf{z}))^2}\frac{\alpha_1^A(\mathbf{X})}{\alpha_1^B(\mathbf{X})}\frac{w^B}{w^A} \tag{31}$$

$$\Delta_{z^A}^{l,h_D}(d,A) = \frac{\partial\lambda(\mathbf{z})}{\partial z^A}\frac{\alpha_1^A(\mathbf{X})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))[\psi(\mathbf{S})+(1-\psi(\mathbf{S}))(h_D^B/h_D^A)^\gamma]}{C_1^2\rho\psi(\mathbf{S})} \tag{32}$$

$$\Delta_{z^A}^{l,h_D}(d,B) = -\frac{\partial\lambda(\mathbf{z})}{\partial z^A}\frac{\alpha_1^B(\mathbf{X})(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))[\psi(\mathbf{S})(h_D^A/h_D^B)^\gamma+(1-\psi(\mathbf{S}))]}{C_1^2\rho(1-\psi(\mathbf{S}))} \tag{33}$$

The condition in 31 captures the extent to which shifts in the distribution factor z^A can affect the intrahousehold allocation of leisure hours between spouses. Similarly, the conditions in 32 and 33 capture the extent to which shifts in the distribution factor can affect the spouses' leisure-to-home time ratios. A motivation for using these conditions in the estimation procedure is based on the results presented in Section 3, participation in *Oportunidades* had an impact on this ratio for mothers by inducing an increase in their leisure hours stemming from the significant decrease observed in their home production hours.

I then exploit the fact that the conditions in 26 and 27 are also a function of the production shifter, s_j so that I also take the derivative of these two conditions with respect to s_j to obtain two additional exogenous moments. Letting $\Delta_{s_j}^{l,h_D}(d,A) = \frac{\partial}{\partial s_j}\left[\frac{l^A}{h_D^A}\right]$ and $\Delta_{s_j}^{l,h_D}(d,B) = \frac{\partial}{\partial s_j}\left[\frac{l^B}{h_D^B}\right]$, I derive the following

$$\Delta_{s_j}^{l,h_D}(d,A) = \frac{\lambda(\mathbf{z})\alpha_1^A(\mathbf{X})}{\rho C_1}\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\left[\left(\frac{w^A}{w^B}\right)^{\frac{1}{1-\gamma}}\frac{1}{1-\gamma}\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\right)^{\frac{\gamma}{1-\gamma}}\frac{\partial\psi(\mathbf{S})}{\partial s_j}\right]\right) \tag{34}$$

$$\Delta_{s_j}^{l,h_D}(d,B) = -\frac{(1-\lambda(\mathbf{z}))\alpha_1^B(\mathbf{X})}{\rho C_1}\left(\frac{\psi(\mathbf{S})}{1-\psi(\mathbf{S})}\left[\left(\frac{w^A}{w^B}\right)^{\frac{1}{\gamma-1}}\frac{1}{1-\gamma}\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\right)^{\frac{\gamma}{1-\gamma}}\frac{\partial\psi(\mathbf{S})}{\partial s_j}\right]\right) \tag{35}$$

As in the conditions in 32 and 33, the conditions in 34 and 35 capture changes in the spouses' leisure-to-home time ratios with the only difference is that these relate to changes in the production shifter s_j.

4.3 Estimation

4.3.1 Step 1

The first step of the estimation procedure involves quantifying the experimental estimates captured in the left-hand side of the conditions presented in 29-35 using the experimental variation of the *Oportunidades* program. While this step is motivated by the empirical evidence presented in Section 3, we take an additional step in using the participation in the program to provide the empirical counterpart of the derivatives captured by these conditions exploiting the administrative information we have on the bi-monthly cash disbursements made to participant households. This approach resembles the one adopted in Attanasio, Meghir and Santiago (2012) who use information on the size of the education grants within a structural estimation strategy. As before, our choice of estimator for the evaluation of the program is based on the MDID estimator described in Section 3.3 with an adjustment made to allow for interacting the MDID interaction term with the continuous variable capturing the size of the transfer, say z_{it}. Formally, this involves estimating the following regression

$$y_{it} = \beta_0 + \beta_1 d_i + \beta_2 Post_t + \beta_3(d_i \times Post_t) + \beta_4(d_i \times Post_t \times z_{it}) + \epsilon_{it} \tag{36}$$

over a sample that has been matched using the propensity score that captures the households' likelihood to participate in *Oportunidades*.[14] In terms of notation, we let y_{it} denote $\frac{l^A_{it}}{l^B_{it}}$, $\frac{l^A_{it}}{l^B_{it}}$, $\frac{l^A_{it}}{h^A_{D,it}}$, $\frac{l^B_{it}}{h^B_{D,it}}$, $\frac{h^A_{D,it}}{h^B_{D,it}}$ and $\frac{h^A_{D,it}}{q^D_{it}}$. We make a distinction of what we use as z_{it} for the two types of households described in Section 2. For two-parent households, we use z^A_{it} as the variable capturing information on the size of the transfer given that the transfer is placed in the hands of mothers in their role as transfer holders. For single-parent households, we directly use information on the transfer size as z_{it}. Thus, β_4 serves to capture the heterogeneous impact of the program on y_{it} based on the transfer size received by the household. Thus, we can interpret β_4 as the estimate for $\Delta^l_{z^A}(d)$, $\Delta^{l,h_D}_{z^A}(d, A)$, $\Delta^{l,h_D}_{z^A}(d, B)$, $\Delta^{h_D}_{z^A}(d)$ and $\Delta^{h_D,q^D}_{z^A}(d)$ by letting y_{it} denote the corresponding time and consumption ratios of interest highlighted in 4.2.

However, an intermediate step is needed for obtaining estimates of the derivatives with respect to s_j. Again, the goal is to explicitly use the exogenous variation provided by the program to identify the model, for which we want to define these derivatives in terms of the program's indirect effect on s_j. For this, we can first start by recovering the effect of the transfer size on the relevant ratio by using 36. We can then estimate the effect of z^A on s_j using a similar specification:

$$s_{j,it} = \beta_{s0} + \beta_{s1} d_i + \beta_{s2} Post_t + \beta_{s3}(d_i \times Post_t) + \beta_{s4}(d_i \times Post_t \times z_{it}) + \xi_{it} \tag{37}$$

It is then possible to obtain an estimate of $\Delta^y_{s_j}$ by using $\frac{\beta_4}{\beta_{s4}}$. The intuition follows from applying the chain rule to $\frac{\partial y}{\partial z^A}$ so that $\frac{\partial y}{\partial z^A} = \frac{\partial y}{\partial s_j}\frac{\partial s_j}{\partial z^A}$ implies that we can write down $\frac{\partial y}{\partial s_j} = \frac{\partial y}{\partial z^A} / \frac{\partial s_j}{\partial z^A}$. In this way, we can capture the effect of the production shifters on the relevant ratios exploiting the variation induced by *Oportunidades*. With this, we complete the set of experimental moments captured in conditions 29-35. Thus, this stage then yields the estimates for $\hat{\Delta}^l_{z^A}(d)$, $\hat{\Delta}^{l,h_D}_{s_j}(d, A)$, $\hat{\Delta}^{l,h_D}_{s_j}(d, B)$, $\hat{\Delta}^{l,h_D}_{z^A}(d, A)$, $\hat{\Delta}^{l,h_D}_{z^A}(d, B)$, and $\hat{\Delta}{s_j}^{h_D}(d)$ for two-parent households and $\Delta^{h_d,q^D}_{s_j}(d)$ for single-parent households which

[14]At this stage, we build upon the matching procedure implemented in the evaluation of the program's impact on observed household behavior presented in Section 3.

we then take to the second step of the estimation strategy.

4.3.2 Step 2

This step consists of implementing a two-step estimator, described by Newey and McFadden (1994) as a sequential GMM estimator, which closely follows the parametric identification analysis presented in Appendix B. Suppose we partition the parameter vector into two: one containing only the home production parameters, denoted by θ_1 and the other one containing the preference and Pareto weight parameters, denoted by θ_2. In the first stage, which we call Step 2A, we implement the following GMM estimator for the production function of the two types of households considered

$$\hat{\boldsymbol{\theta}}_1^{GMM} = \arg\min_{\boldsymbol{\theta}} Q_N^{(1)}(\boldsymbol{\theta}_1)$$
$$\text{where } \; Q_N^{(1)}(\boldsymbol{\theta}_1) = \left[\frac{1}{N}\sum_{n=1}^{N}\mathbf{g}(\mathbf{S}_n, \boldsymbol{\Delta}, \boldsymbol{\theta}_1)\right]' \boldsymbol{W}_N \left[\frac{1}{N}\sum_{n=1}^{N}\mathbf{g}(\mathbf{S}_n, \boldsymbol{\Delta}, \boldsymbol{\theta}_1)\right]$$

where $\boldsymbol{\theta}_1 = \boldsymbol{\theta}_1^M = (\rho, \gamma, \boldsymbol{\psi})$ for two-parent households and $\boldsymbol{\theta}_1 = \boldsymbol{\theta}_1^S = (\beta, \boldsymbol{\phi})$ for single-parent households. Furthermore, $\mathbf{g}()$ contains the orthogonality conditions described in 19 and 22-24 for single-parent and two-parent households, respectively. $\mathbf{W}_N$ is a symmetric positive definite weighting matrix, for which we use an optimal weight matrix, evaluating the differences between the data and theoretical moments used in this stage by first implementing a version of the estimator in which the weight matrix used is the identity matrix $\mathbf{I}_N$, so that

$$W_N = g(\mathbf{S}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\Delta})g(\mathbf{S}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\Delta})'$$

In the second stage, which we call Step 2B, we implement the following GMM estimator for parental preferences and the Pareto weight using the results for the production function parameters obtained in Step 2A

$$\hat{\boldsymbol{\theta}}_2^{GMM} = \arg\min_{\boldsymbol{\theta}} Q_N^{(2)}(\hat{\boldsymbol{\theta}}_1, \boldsymbol{\theta}_2)$$
$$\text{where } \; Q_N^{(2)}(\hat{\boldsymbol{\theta}}_1, \boldsymbol{\theta}_2) = \left[\frac{1}{N}\sum_{n=1}^{N}\mathbf{h}(\mathbf{X}_n, \mathbf{z}_n, \boldsymbol{\Delta}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\theta}_2)\right]' \boldsymbol{W}_N \left[\frac{1}{N}\sum_{n=1}^{N}\mathbf{h}(\mathbf{X}_n, \mathbf{z}_n, \boldsymbol{\Delta}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\theta}_2)\right]$$

where $\boldsymbol{\theta}_2 = (\boldsymbol{\lambda}, \boldsymbol{\alpha}^{\boldsymbol{A}}, \boldsymbol{\alpha}^{\boldsymbol{B}})$. and $\hat{\boldsymbol{\theta}}_1 = [\boldsymbol{\theta}_1^M \boldsymbol{\theta}_1^S] = (\hat{\rho}, \hat{\gamma}, \hat{\boldsymbol{\psi}}, \hat{\beta}, \hat{\boldsymbol{\phi}})$ are the estimates obtained in Step 2A. Furthermore, $\mathbf{h}()$ contains the orthogonality conditions derived from the optimality conditions and $\mathbf{W}_N$ is a symmetric positive definite weighting matrix for which we use an optimal weight matrix. We estimate $\mathbf{W}_N$ by implementing a correction to the standard weight matrix used in a simple GMM to account for the fact that the estimator being used is a two-step one. This correction is based upon the results of Newey and McFadden (1994) for the asymptotic variance of two-step GMM estimators to correct for the efficiency loss incurred by the two-step nature of the estimator. For this matter, we use the following as the optimal weight matrix throughout the estimation process:

$$W_N = \{h(\mathbf{X}, \mathbf{z}, \hat{\boldsymbol{\theta}}_1, \hat{\boldsymbol{\theta}}_2, \boldsymbol{\Delta}) + G_{\theta_1}\xi(\mathbf{S})\}\{h(\mathbf{X}, \mathbf{z}, \hat{\boldsymbol{\theta}}_1, \hat{\boldsymbol{\theta}}_2, \boldsymbol{\Delta}) + G_{\theta_1}\xi(\mathbf{S})\}'$$

where

$$\begin{aligned} G_{\theta_1} &= \nabla_{\theta_1} h(\mathbf{X}, \mathbf{z}, \hat{\boldsymbol{\theta}}_1, \hat{\boldsymbol{\theta}}_2, \boldsymbol{\Delta}) \\ \xi(\mathbf{S}) &= -(\nabla_{\theta_1} g(\mathbf{S}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\Delta}))^{-1} g(\mathbf{S}, \hat{\boldsymbol{\theta}}_1, \boldsymbol{\Delta}) \end{aligned}$$

where $h(\cdot)$ denotes the objective function (set of moment conditions) used in the GMM implemented in the second step of the estimator and $g(\cdot)$ denotes the objective function used in the GMM implemented in the first step of the estimator. Furthermore, $\boldsymbol{\theta_1} = (\rho, \gamma, \boldsymbol{\psi}, \beta^A, \boldsymbol{\phi}^A, \beta^B, \boldsymbol{\phi}^B)$ and $\boldsymbol{\theta}_2 = (\boldsymbol{\lambda}, \boldsymbol{\alpha}_1^A, \boldsymbol{\alpha}_2^A, \boldsymbol{\alpha}_1^B, \boldsymbol{\alpha}_2^B)$. Thus, the individual components of the correction take into consideration both the sensitivity of the moments used in the second-step GMM to the set of pre-estimated parameters and how well the parameter estimates obtained in the first-step GMM fit the moments used in that first step.

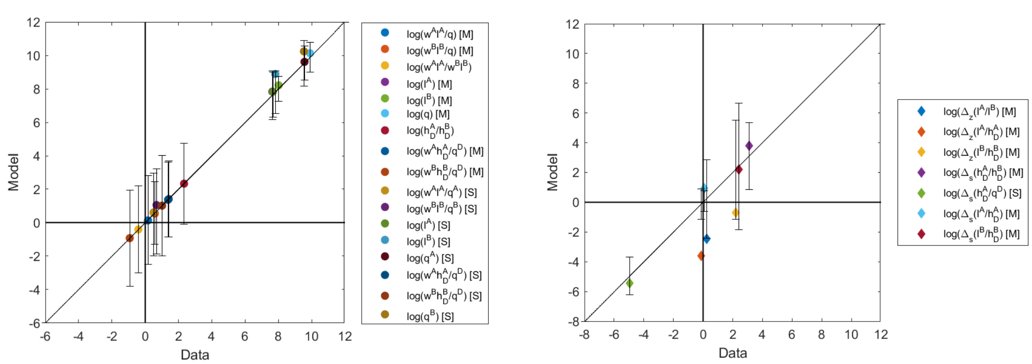
Throughout the estimation procedure, we use the two-step nature of the estimator to define four different specifications characterized by the exclusion/inclusion of the experimental moments described in 29-35 either in Step 2A or Step 2B. That is, these specifications are distinguished by the orthogonality conditions included in **g** and **h**, respectively. The first specification excludes all the experimental conditions and, therefore, relies solely on the orthogonality conditions derived from the optimality conditions from the two types of households. The second specification includes 29 and 30 in the orthogonality conditions of Step 2A estimated over the two-parent and single-parent households sub-samples, respectively but does not use any experimental condition in Step 2B. The third specification does not use any experimental moment in Step 2A but includes the experimental moments described in 31-33 in the orthogonality conditions of Step 2B.

Lastly, the fourth specification, which is chosen as the preferred specification, includes 29 and 30 in Step 2A and 31-33 in Step 2B. To test the external validity of the model, 34 and 35 are left untargeted in Step 2B in all specifications considered. Furthermore, as in Lise and Yamada (2019), the orthogonality conditions used to form the respective GMM objective functions are derived by taking logs of the targeted optimality conditions and of the derived experimental moments.

4.3.3 Model Fit by Specifications Used

Upon the estimation of the model, we proceed to check how well the model fits the moments targeted in all four specifications considered. For the purpose of assessing the external validity of the model, we also check how well the model fits moments that were left untargeted in the estimation procedure. When implementing these model fit checks, we make a distinction between the *theoretical moments* derived from the optimality conditions that are targeted in all of the specifications considered and the experimental moments that are obtained from the impact of *Oportunidades* on parents' home production and leisure hours. Figure 1 - Figure 4 present the model fit checks implemented for each of the specifications. For the experimental moments, there is a further distinction between those that are untargeted in each specification (represented by diamonds) and those that were targeted (represented by squares) in each of the specifications considered.

Figure 1: Theoretical and Experimental Moments, Specification 1

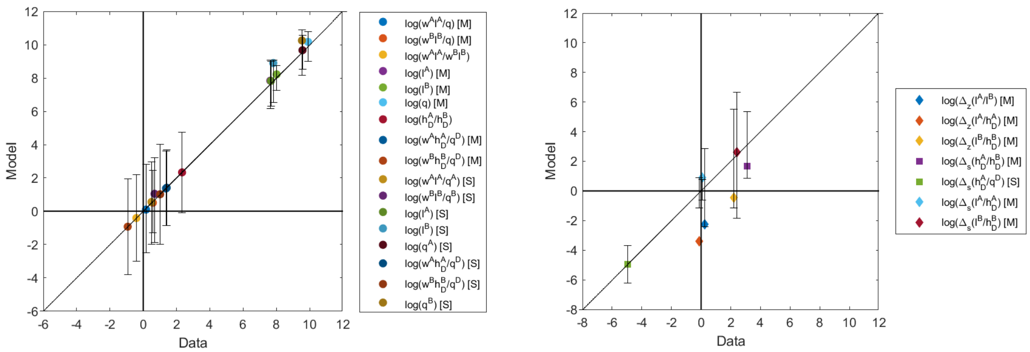


Theoretical Moments　　　　Experimental Moments

All specifications seem to be fitting the theoretical moments relatively well.[15] The

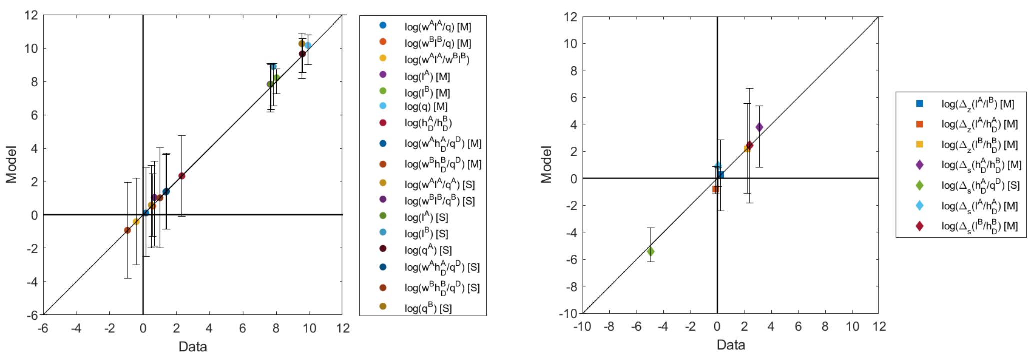
[15]Each of the graphs containing the model fit checks include their corresponding confidence intervals

Figure 2: Theoretical and Experimental Moments, Specification 2



Theoretical Moments Experimental Moments

Figure 3: Theoretical and Experimental Moments, Specification 3



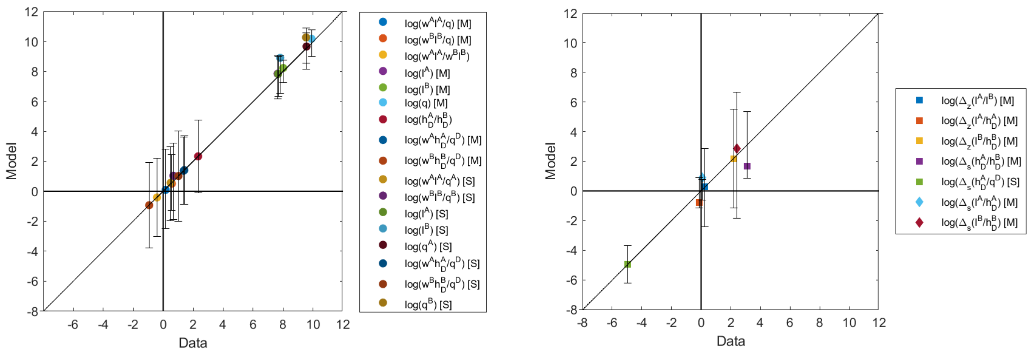
Theoretical Moments Experimental Moments

only theoretical moments that seem to be off are the ones related to single-father households. However, this might be expected given that these households represent a relatively small share of the estimation sample (around 8% of the observations) so that most of the estimation related to fathers' preferences might be driven by the sample of married fathers. Overall, the model seems to be over-predicting single fathers' leisure hours and private market consumption.

The model hits the experimental moments related to the effect of *Oportunidades* on the leisure-to-home time ratios of both fathers and mothers through the effect on the produc-

around the 45° line plotted, showing the extent to which the model predictions can deviate from the ones observed in the data for it to be considered a proper fit. We still need to include the standard errors of the estimates in the computation of these confidence intervals.

Figure 4: Theoretical and Experimental Moments, Specification 4



Theoretical Moments | Experimental Moments

tion shifter (number of children attending school) the fact that these remain untargeted in all of the specifications. However, specifications 1 and 2 fail to fit the experimental moments related to the effect of *Oportunidades* on the spouses' leisure ratio, and their individual leisure-to-home time ratios through the program's effect on the distribution factor z^A (i.e. the mothers' share of non-labor income). Both specifications 3 and 4 target these remaining experimental moments, improving the model fit in this regard as even though the model seems to be slightly under-predicting the effect of the program on mothers' leisure-to-home time ratio through its effect on z^A, this still constitutes a better fit than the one yielded by specifications 1 and 2. As aforementioned, a significant difference in the results obtained from specifications that leave these moments untargeted and these that target them is that we obtain a coefficient for z^A in the Pareto weight that is higher in the ones in which these moments are targeted. Thus, when evaluating policies aimed at using z^A as a lever of mothers' empowerment to induce changes in household behavior, the first two specifications would underestimate these policies' impact on the Pareto weight.

Regarding the moments related to the program's impact on the domestic input ratios through the effect on the production shifter for both two-parent and single-parent households, we can see that specifications that target the experimental moment for single-parent households fit this moment better. However, this is not necessarily the case for two-parent households as it seems that the specifications that do not target this moment seem to fit it slightly better. For specifications 2 and 4 that target this moment, the model seems to slightly under-predict the magnitude of this effect within two-parent households.

Overall, we find that the specifications that target the experimental moments related to the impact of *Oportunidades* on spouses' leisure and leisure-to-home time ratios through its effect on the distribution factor do a relatively better job at fitting the data than the specifications that leave these moments untargeted. In order to exploit the use of the exogenous variation of the program in both steps of the GMM estimator implemented, we choose the fourth specification to carry out the evaluation of the program's impact on intrahousehold bargaining and individual welfare.

4.4 Results

4.4.1 Step 1

Table 4 presents the intermediate step implemented to compute the experimental moments described in Section 4.2 that are targeted in the GMM estimation implemented in the second stage. We find that effectively, participation in *Oportunidades* significantly increased the amount of mothers' leisure hours to fathers' through its impact on the wife's share of non-labor income. Similarly, we find that participation in *Oportunidades* interacted with mothers' share of non-labor income significantly increased mothers' leisure-to- home time ratio and the number of children attending school. The latter effect is observed within both two-parent and single-mother households, though for the latter, the effect is mediated through the size of the transfer. Furthermore, we find a negative, though statistically insignificant, relationship between mothers' share of non-labor income upon participation in the program and fathers' leisure to home time ratios. We document a similar statistically insignificant negative relationship with parents' relative time spent in home production.[16]

4.4.2 Step 2

Table 5 presents the results obtained from the two-step GMM estimator implemented in the second stage of the estimation described above. We break down the discussion of these results into different sets of parameters, those related to home production,

[16]It is worth noting that we can use the negative coefficients associated with the interaction of the MDID and z_{it}^{A} for l^{B}/h_{D}^{B} and h_{D}^{A}/h_{D}^{B} as orthogonality conditions in the GMM requiring transforming these into logarithmic terms since the theoretical counterparts of these moments derived through the model are negatively signed given the parametric specification adopted. Thus, when taking logs to generate these orthogonality conditions, the negative terms are offset and the conditions properly defined.

Table 4: Overall Impact of the *Oportunidades* Transfer on Beneficiary Households

	Two-Parent					*Single-Mother*		
	l^A/h^A_D	l^A/l^B	l^B/h^B_D	h^A_D/h^B_D	s_j	l^A/h^A_D	q^D/h^A_D	s_j
$d_i \times Post_t \times z_{it}$	0.411*	1.227**	-1.710	-9.207	0.934**	7.658e-05	0.022***	1.797e-04***
	(0.211)	(0.586)	(16.678)	(8.619)	(0.416)	(5.886e-05)	(0.005)	(2.180e-05)
N	474	474	474	474	474	640	640	640

those related to parental preferences and those related to the bargaining structure of two-parent households.

Home Production

For two-parent households, we find that women are, on average, equally or more productive at home than fathers. Furthermore, when comparing single and married mothers, we find that married mothers are, on average, more productive than their single counterparts. This ties back to one of the conditions facilitating the result outlined in Proposition 3 of Section 4.1. Among single parents, however, we find that when using the estimates obtained from the specifications including the experimental variation of *Oportunidades* in Step 2A mothers are, on average, more productive at home than their male counterparts. The opposite holds when we exclude the experimental variation of the program in Step 2A for single parents.

Focusing on our preferred specification presented in the fourth column, we find that the production shifter affects mothers' productivity at home differently depending on their marital status. For married mothers, we find that as the number of children attending school slightly increases their productivity at home. On the other hand, we find that children's school attendance decreases single mothers' productivity at home. A similar result holds for single fathers. It is worth noting that this is in accordance with the conditions outlined in Proposition 3 of the non-parametric identification analysis discussed in Section 4.1. Moreover, this is also going to have significant implications for the assessment of the impact of *Oportunidades* on individual welfare presented in Section 5 since the MMWI captures the extent to which mothers' productivity is affected by the program's effect on children's school attendance when moving from collectivity to singlehood.

Preferences

With respect to parental preferences, we find that mothers, on average, have a lower

Table 5: Structural Estimation Results, Model with Home Production

	(1)		(2)		(3)		(4)	
	Estimate	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**
Home Production Parameters, Two-Parent HHs:								
γ	0.8545	4.194E-06	0.9854	1.185E-05	0.8545	4.194E-06	0.9854	1.185E-05
ρ	0.8193	1.279E-06	0.8213	6.459E-07	0.8193	1.279E-06	0.8213	6.459E-07
ψ_2 [n_s]	0.1530	5.333E-07	2.480E-09	1.718E-09	0.1530	5.333E-07	2.480E-09	1.718E-09
Sample mean $\psi(\mathbf{S})$ =	0.5750		0.5000		0.5750		0.5000	
Home Production Parameters, Single-Mother HHs:								
β	-1.4809	0.0104	-1.5047	0.0203	-1.4809	0.0104	-1.5047	0.0203
ϕ_2^A [n_s]	-0.0300	0.0074	-0.0435	0.0162	-0.0300	0.0074	-0.0435	0.0162
Sample mean $\phi(\mathbf{S})$ =	0.4870		0.4812		0.4870		0.4812	
Home Production Parameters, Single-Father HHs:								
β	-0.7525	0.0532	-0.7912	0.2633	-0.7525	0.0532	-0.7912	0.2633
ϕ_2^B [n_s]	-0.0449	0.0138	-0.1299	0.0963	-0.0449	0.0138	-0.1299	0.0963
Sample mean $\phi(\mathbf{S})$ =	0.4929		0.4794		0.4929		0.4797	
Wife's Preference for Leisure Parameters:								
$\alpha_{1,1}^A$ [Constant]	-0.0713	0.0459	-0.0756	0.0001	0.0477	0.0108	0.0455	0.0049
$\alpha_{1,2}^A$ [Age]	0.0105	1.6714	0.0103	0.0018	0.0086	0.4121	0.0085	0.1799
$\alpha_{1,3}^A$ [Education]	-0.0032	0.2679	-0.0031	0.0004	-0.0165	0.0607	-0.0161	0.0287
$\alpha_{1,4}^A$ [Number of Children]	-0.0684	0.1306	-0.0670	0.0002	-0.0572	0.0292	-0.0576	0.0138
Sample mean $\alpha_1^A(\mathbf{X})$ =	0.4143		0.4094		0.4081		0.4067	
Wife's Preference for Private Consumption Parameters:								
$\alpha_{2,1}^A$ [Constant]	-3.1591	0.0515	-3.1433	0.0001	-1.7563	0.0115	-1.7548	0.0057
$\alpha_{2,2}^A$ [Age]	0.0651	1.8566	0.0660	0.0027	0.0377	0.4204	0.0378	0.2134
$\alpha_{2,3}^A$ [Education]	0.0304	0.3022	0.0299	0.0004	-0.0033	0.0665	-0.0029	0.0321
$\alpha_{2,4}^A$ [Number of Children]	0.0138	0.1487	0.0142	0.0002	-0.0397	0.0325	-0.0393	0.0154
Sample mean $\alpha_2^A(\mathbf{X})$ =	0.1882		0.1954		0.2031		0.2047	
Husband's Preference for Leisure Parameters:								
$\alpha_{1,1}^B$ [Constant]	3.2582	0.0262	3.2399	0.0002	3.5966	0.0036	3.6594	0.0010
$\alpha_{1,2}^B$ [Age]	-0.0030	0.9946	-0.0030	0.0061	-0.0012	0.1350	-0.0012	0.0382
$\alpha_{1,3}^B$ [Education]	-0.0693	0.1723	-0.0691	0.0011	-0.0350	0.0248	-0.0365	0.0060
$\alpha_{1,4}^B$ [Number of Children]	-0.1008	0.0658	-0.1028	0.0004	-0.2575	0.0099	-0.2609	0.0021
Sample mean $\alpha_1^B(\mathbf{X})$ =	0.7478		0.7419		0.7890		0.7950	
Husband's Preference for Private Consumption Parameters:								
$\alpha_{2,1}^B$ [Constant]	1.1039	0.0044	1.1125	0.0000	1.3503	0.0004	1.3441	0.0001
$\alpha_{2,2}^B$ [Age]	0.0014	0.1633	0.0012	0.0018	-0.0019	0.0166	-0.0019	0.0053
$\alpha_{2,3}^B$ [Education]	0.0191	0.0420	0.0203	0.0005	0.0186	0.0034	0.0186	0.0010
$\alpha_{2,4}^B$ [Number of Children]	-0.1155	0.0164	-0.1128	0.0002	-0.1907	0.0021	-0.1861	0.0007
Sample mean $\alpha_2^B(\mathbf{X})$ =	0.1812		0.1863		0.1451		0.1413	
Pareto Weight Parameters:								
λ_0 [Constant]	0.6626	0.0026	0.6656	0.0003	0.9002	0.0032	0.9024	0.0020
λ_1 [w^A/w^B]	0.0484	0.0021	0.0463	0.0004	0.0457	0.0049	0.0468	0.0030
λ_2 [y]	-0.0076	0.0201	-0.0076	0.0022	0.0049	0.0301	0.0050	0.0175
λ_3 [z^A]	0.1064	0.0006	0.1208	0.0001	0.8062	0.0049	0.8098	0.0022
λ_4 [Sex ratio]	-0.6381	0.0023	-0.6336	0.0003	-1.2089	0.0029	-1.2063	0.0018
Sample mean $\lambda(\mathbf{z})$ =	0.5247		0.5266		0.5224		0.5243	
Additional Restriction, Step 2A	No		Yes		No		Yes	
Additional Restriction, Step 2B	No		No		Yes		Yes	

Notes: The normalization imposed for $\psi(\mathbf{S})$, $\phi^A(\mathbf{S})$ and $\phi^B(\mathbf{S})$, render $\psi_1^A = \psi_1^B = 0$, and $\phi_1 = 0$ for both mothers and fathers utility weight on leisure than fathers and that the utility weight attached to private market consumption is slightly higher for mothers than for fathers. We now focus on assessing the premise that mothers tend to have a higher preference for public consumption than fathers. Within the parametric specification adopted in the analysis, we define the utility weight attached to the public domestic good is as $1 - \alpha_1^i(\mathbf{X}) - \alpha_2^i(\mathbf{X})$ for $(i = A, B)$. Based on the estimates obtained from all four specifications, we find that mothers do assign a higher utility weight to the consumption of the public good Q. Evaluated at the sample mean, we find that this utility weight among mothers is 0.398, 0.395, 0.389, and 0.389. On the other hand, evaluated at the sample mean for fathers, this weight is 0.071, 0.072, 0.066, and 0.064.

We then proceed to investigate how differences in parents' sociodemographic characteristics affect their preferences for leisure, private consumption and the public domestic good. Focusing on our chosen specification, we find that the number of children in the household increases both parents' preference for the domestic public good through a reduction on the utility weights attached to both leisure and private consumption. Similarly, we find that parental education increases the utility weight attached to the public good. Furthermore, while fathers' age increases their preference for the public good, we find that the opposite holds for mothers.

Pareto Weight

Regarding the decision-making structure of two-parent households, we now focus on the results obtained for the Pareto weight. Using the estimates obtained from the four specifications considered and evaluated at the sample mean, we find that the Pareto weight attached to mothers' preferences is 0.525, 0.527, 0.522, and 0.524. In particular, we find that both relative market returns (w^A/w^B) and women's contribution to total household income (z^A) significantly increase mothers' bargaining power. While the coefficient attached to the spouses' relative wages is robust across all four specifications (around 0.05), the coefficient attached to the wife's share of non-labor income, the distribution factor we focus on, increases substantially from 0.10 to 0.8 upon the inclusion of the experimental moments related to the effect of *Oportunidades* on the intrahousehold allocation of leisure and home production hours through the change in z^A. That is, the distribution factor is being informative about the responses of the decision-making process to a policy that targets mothers' contribution to non-labor income. Importantly, we find that the estimates for the Pareto weight yielded by these specifications that are consistent with the external validity and non-parametric identification of the model are more robust compared to those of specifications more reliant on functional form. Moreover, we find that the sex ratio we use in the estimation (defined as the number of women per men for different age groups at the state level) decreases women's bargaining power. In this way, we find that as women become relatively more scarce, their bargaining power increases. This is consistent with empirical evidence in the literature documenting a significant relationship between women's empowerment and sex ratios, such as in Chiappori, Fortin and Lacroix (2002).

5 Intrahousehold Gender Inequality and Gender-Targeted Policies

Throughout this section, we focus on quantifying bargaining power and individual welfare within two-parent households as described in Section 2 using the estimates obtained in Section 4.4. The measures of individual welfare include the conditional sharing rule (CSR) and the money metric welfare index (MMWI). The first measure captures the amount monetary resources available to each decision maker for their own private consumption as a result of a bargaining process in which total household resources are allocated among spouses. Intuitively, the higher the bargaining power of a decision maker, the higher the amount of resources he or she should be able to secure for his or her own consumption. While the CSR constitutes a form of money metric utility, it disregards the utility parents derive from public consumption by focusing on private consumption. This shortcoming of the CSR stems from the decentralization used to derive this measure as it deals with the externalities of public consumption at the household level and fails to provide a way for household members to internalize such externalities. The MMWI, on the other hand, describes the minimum amount of expenditures an individual would need to incur in order to reach the same level of intrahousehold utility reached in collectivity in the case in which he or she were to become single, thereby taking into consideration how the change in living arrangement will ultimately affect not only their private consumption but also their consumption of the public good.

5.1 Derivation of Individual Welfare within a Collective Household Framework

We start by providing a more thorough overview of each measure and how these can be derived within the model given the parametrization described in Section 4.2. These are the measures computed to implement the intrahousehold inequality analysis to evaluate the *Oportunidades'* impact on individual welfare and assess the extent to which counterfactual policies are effective at empowering mothers and improving their individual welfare.

5.1.1 The Conditional Sharing Rule

As mentioned in Section 2, we derive the conditional sharing rule given the parametrization imposed so far by characterizing the household's problem as a two-stage process under the assumption that household outcomes are Pareto efficient. In the first stage, the household solves for ρ^A, ρ^B, and Q. In the second stage, the decision makers then solve for their own l^i and q^i privately taking the solution to the first stage as given. Thus, in the first stage, the household solves

$$\max_{\rho^A,\rho^B,Q} \lambda(\mathbf{z})V^A(w^A,\rho^A,Q) + (1-\lambda(\mathbf{z}))V^B(w^B,\rho^B,Q) \;\text{ s.t. }\; \rho^A+\rho^B+P(w^A,w^B;\mathbf{S})Q = y^A+y^B$$

where $P(w^A,w^B;\mathbf{S})Q$ is the cost function coming from the household's production stage which can be written linearly since we have a constant returns to scale production function. Specifically, given the specification imposed so far on the household's production technology, we can derive the per unit cost of producing Q in the following way

$$\begin{aligned} P(w^A,w^B;\mathbf{S}) = &\left(\rho^\rho\left[\psi(\mathbf{S})\left(\frac{\psi(\mathbf{S})(w^A)^{-1}}{\psi(\mathbf{S})+(1-\psi(\mathbf{S}))\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\frac{w^A}{w^B}\right)^{\frac{\gamma}{1-\gamma}}}\right)\right.\right.\\ &\left.\left.+(1-\psi(\mathbf{S}))\left(\frac{(1-\psi(\mathbf{S}))(w^B)^{-1}}{\psi(\mathbf{S})\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\frac{w^A}{w^B}\right)^{\frac{\gamma}{\gamma-1}}+(1-\psi(\mathbf{S}))}\right)\right]^{\frac{\rho}{\gamma}}(1-\rho)^{1-\rho}\right)^{-1}\\ &\times\left(\frac{\psi(\mathbf{S})\rho}{\psi(\mathbf{S})+(1-\psi(\mathbf{S}))\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\frac{w^A}{w^B}\right)^{\frac{\gamma}{1-\gamma}}}+\frac{(1-\psi(\mathbf{S}))\rho}{\psi(\mathbf{S})\left(\frac{1-\psi(\mathbf{S})}{\psi(\mathbf{S})}\frac{w^A}{w^B}\right)^{\frac{\gamma}{\gamma-1}}+(1-\psi(\mathbf{S}))}+1-\rho\right) \end{aligned} \tag{38}$$

In the second stage, each individual decision maker then solves the following taking Q and ρ^i as given

$$\max_{l^A,q^A} \alpha_1^i(\mathbf{X}^i)\ln(l^A) + \alpha_2^i(\mathbf{X}^i)\ln(q^i) + (1-\alpha_1^i(\mathbf{X}^i) - \alpha_2^i(\mathbf{X}^i)\ln(Q) \ \text{ s.t. } \ w^i l^i + q^i = w^i T + \rho^i$$

Intuitively, $\rho^i + w^i T$ captures a measure of full individual income that is available to each decision-maker for their individual consumption of leisure and the private market good q upon the optimal transfers of household non-labor income made among spouses in the first stage.

From the solution to the second stage, we then have the following

$$l^{i*} = \frac{\alpha_1^i(\mathbf{X}^i)(w^i T + \rho^i)}{w^i(\alpha_1^i(\mathbf{X}^i) + \alpha_2^i(\mathbf{X}^i))}; \ \ q^{i*} = \frac{\alpha_2^i(\mathbf{X}^i)(w^i T + \rho^i)}{\alpha_1^i(\mathbf{X}^i) + \alpha_2^i(\mathbf{X}^i)}$$

We then use (l^{i*}, q^{i*}) to define each spouse's individual indirect utility from which we can derive the solution to the first stage

$$\rho^A = \lambda(\mathbf{z})(\alpha_1^A(\mathbf{X}^A) + \alpha_2^A(\mathbf{X}^A))\bar{Y} - w^A T; \ \ \rho^B = (1-\lambda(\mathbf{z}))(\alpha_1^B(\mathbf{X}^B) + \alpha_2^B(\mathbf{X}^B))\bar{Y} - w^B T$$
$$Q^* = \frac{(\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X}^A) - \alpha_2^A(\mathbf{X}^A)) + (1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X}^B) - \alpha_2^B(\mathbf{X}^B)))\bar{Y}}{P(w^A, w^B; \mathbf{S})}$$

where $\bar{Y} = (w^A + w^B)T + y^A + y^B$.

Moreover, we can compute the marginal willingness to pay for the public good from both spouses in the following way:

$$MWP^A = \frac{\partial V^A(w^A, \rho^A, Q)/\partial Q}{\partial V^A(w^A, \rho^A, Q)/\partial \rho^A}; \ \ MWP^B = \frac{\partial V^B(w^B, \rho^B, Q)/\partial Q}{\partial V^B(w^B, \rho^B, Q)/\partial \rho^B} \tag{39}$$

As mentioned in Section 2 these marginal willingness to pay for the public good can also be interpreted as the Lindahl prices, which intuitively, serve as a way for each individual spouse to internalize the per unit cost of producing the domestic good Q (which in this case is denoted by $P(w^A, w^B; \mathbf{S})$). We show this formally by using (l^{i*}, q^{i*}) to derive the individual indirect utility of each parent $V^i(w^i, \rho^i, Q)$, differentiating accordingly and substituting into 39. Letting the Lindahl prices for the wife and husband be denoted as

θ_Q^A and θ_Q^B, respectively, this yields

$$\theta_Q^A = MWP^A = \frac{\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))\cdot P(w^A,w^B,\mathbf{S})}{\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))+(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))} \tag{40}$$

$$\theta_Q^B = MWP^B = \frac{(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))\cdot P(w^A,w^B,\mathbf{S})}{\lambda(\mathbf{z})(1-\alpha_1^A(\mathbf{X})-\alpha_2^A(\mathbf{X}))+(1-\lambda(\mathbf{z}))(1-\alpha_1^B(\mathbf{X})-\alpha_2^B(\mathbf{X}))} \tag{41}$$

This corroborates that these individual prices satisfy the Bowen-Lindahl-Samuelson condition for the optimal provision of the public good, which we adjust to account for the assumption that this good is domestically produced

$$\theta_Q^A + \theta_Q^B = P(w^A, w^B; \mathbf{S})$$

5.1.2 The Money Metric Welfare Index

The intuition behind the money metric welfare index (MMWI) is to obtain a measure of the expenses a married individual would need to incur in a counterfactual single household in order to be able to reach the same level of utility s/he would achieve when living in collectivity. Defining the single-parent household's problem and being able to identify its primitives is then essential since it provides the counterfactual environment needed for the computation of the MMWI. It is then possible to define the MMWI within the context of a collective household model with home production as

$$MMWI^i = \min_{h_D^i, l^i, q^i, q^D} [w^i l^i + q^i + w^i h_D^i + q^D | u^i(l^i, q^i, Q; \mathbf{X}^i) \geq u^i(l^{i*}, q^{i*}, Q^*; \mathbf{X}^i); Q = F_Q^s(h_D^i, q^D; \mathbf{S})] \tag{42}$$

where $(l^{i*}, q^{i*}, Q^* = F_Q(h_D^{A*}, h_D^{B*}, q^{D*}))$ denotes the optimal choices made within a two-parent household. In order to define the counterfactual environment of singlehood that the spouses would face, we use the production function estimates from the model defined for single mothers and fathers to capture the potential economies of scale in production that can be lost from moving from a collective household to a single-parent one.

Modifying the definition of the MMWI in Cherchye et al. (2018) and given the estimates for preferences and the households' production technology obtained at this point, we can define the MMWI as

$$MMWI^i = \min_{h_D^i, l^i, q^i, q^D} w^i l^i + q^i + w^i h_D^i + q^D \tag{43}$$

s.t.

$$\begin{aligned}
\hat{\alpha}_1^i(\mathbf{X}^i)\ln(l^i) + \hat{\alpha}_2^i(\mathbf{X}^i)\ln(q^i) + (1 - \hat{\alpha}_1^i(\mathbf{X}^i) - \hat{\alpha}_2^i(\mathbf{X}^i))\ln(Q) \geq \\
\hat{\alpha}_1^i(\mathbf{X}^i)\ln(l^{i*}) + \hat{\alpha}_2^i(\mathbf{X}^i)\ln(q^{i*}) + (1 - \hat{\alpha}_1^i(\mathbf{X}^i) - \hat{\alpha}_2^i(\mathbf{X}^i))\ln(Q^*) \\
Q^* = [\hat{\psi}(\mathbf{S})(h_D^{A*})^{\hat{\gamma}} + (1 - \hat{\psi}(\mathbf{S}))(h_D^{B*})^{\hat{\gamma}}]^{\frac{\hat{\rho}}{\hat{\gamma}}}(q^{D*})^{1-\hat{\rho}} \\
Q = [\phi(\mathbf{S})(h_D^i)^{\beta} + (1 - \phi(\mathbf{S}))(q^D)^{\beta}]^{\frac{1}{\beta}} \text{ for } i = (A, B) \\
l^i + h_D^i + h_M^i = T
\end{aligned}$$

The solution to this minimization problem yields the following characterization of the MMWI for both spouses:

$$\begin{aligned}
MMWI^i = (\rho^i)\left(\frac{1}{\theta_Q P^S(w^i, \mathbf{S})}\right)^{(1-\alpha_1^i(\mathbf{X})-\alpha_2^i(\mathbf{X}))} \\
\times \left(\frac{\phi^i(\mathbf{S})}{\phi^i(\mathbf{S})(C_s^i)^{\frac{\beta^i}{\beta^i-1}} + (1-\phi^i(\mathbf{S}))} + \frac{1-\phi^i(\mathbf{S})}{\phi^i(\mathbf{S}) + (1-\phi^i(\mathbf{S}))(C_s^i)^{\frac{\beta^i}{1-\beta^i}}}\right)
\end{aligned} \tag{44}$$

where

$$P^S(w^i; \mathbf{S}) = \left[\phi^i(\mathbf{S})\left(\frac{\phi^i(\mathbf{S})}{w^i(\phi^i(\mathbf{S}) + (1-\phi^i(\mathbf{S}))(C_s^i)^{\frac{\beta^i}{1-\beta^i}})}\right)^{\beta^i} + (1-\phi^i(\mathbf{S}))\left(\frac{1-\phi^i(\mathbf{S})}{\phi^i(\mathbf{S})(C_s^i)^{\frac{\beta^i}{\beta^i-1}} + (1-\phi^i(\mathbf{S}))}\right)\right.$$

and

$$C_s^i = w^i \frac{1-\phi^i(\mathbf{S})}{\phi^i(\mathbf{S})}$$

Intuitively, the MMWI constitutes a compensating variation in which each spouse faces a different price for the domestic public good Q as their living arrangement is changed from living collectively with their spouse to becoming a single parent. From paying the Lindahl price θ^i_Q, each spouse then faces the full per unit cost $P^{S,i}(w^i, \mathbf{S})$. Note that, in the case of home production, even the price of the public good changes as the living arrangement changes since the production possibilities of each spouse changes as well.

Focusing on the latter, the connection between the sharing rule and the MMWI described non-parametrically in Section 2 is presented more explicitly in 44 given the parametrization of the model used so far. Specifically, the MMWI incorporates an adjustment to the sharing rule through a reweighing that can be characterized as a function of (i) the two-parent household's marginal utility for public consumption, (ii) the individual's own preferences for the public good, (iii) the opportunity cost incurred by each spouse for spending time in home production and (iv) the per unit cost incurred by the household in the production of the public good as internalized by each spouse.[17]

5.2 The Impact of *Oportunidades* on Bargaining Power and Individual Welfare

Using the estimates obtained from the fourth specification (column 4) presented in Table 5, we compute the Pareto weight, MMWI and sharing rule of each two-parent household included in the estimation sample and then implement a MDID estimator to quantify the impact of *Oportunidades* on beneficiary households' decision-making structure and individual welfare within two-parent households. For the purpose of documenting differences in the allocation of welfare within households, we report welfare measures as a fraction of household income. Figure 10 in Appendix C presents a description of the predicted measures of bargaining power and individual welfare obtained for the estimation sample, making a before and after comparison among participant and non-participant households. Besides the Pareto weight and individual welfare measures, we also quantify the effect of the program on other unobservable primitives generated through the model that are of interest, such as household's domestic production of Q, given the program's objectives. For the sake of comparison, we also report the impact of *Oportunidades*

[17]This is similar to the characterization of the MMWI in the presence of public consumption without home production presented in Chiappori and Meghir (2015). In that case, the sharing rule is reweighed by i's own willingness to pay and preferences for the domestic good. Once home production is introduced, this is further reweighed by the cost faced by the household in the production of the domestic good, by i's relative productivity in the household and the intensity with which parental time and monetary investments are used in the production of the domestic good. This highlights one of the main ways through which this welfare measure can be used to account for home production in the computation of individual welfare upon which policy implications can be derived.

on the domestic production of Q in single-mother households.

Table 6 presents the level effects while Table 7 presents the percentage changes obtained from the causal analysis implemented on these measures. The results suggest that the participation in the program is associated with a strongly significant increase of almost 24% (of almost 13 percentage points) in mothers' bargaining power which translates into a significant 20% increase in their individual welfare characterized by the MMWI. This constitutes an increase of approximately 3,067 MXN pesos (294 USD) in mothers' individual welfare. Such impact on individual welfare is asymmetric as fathers' individual welfare decreases by almost 25% as characterized by their MMWI, constituting a decrease of approximately 2,645 MXN pesos (254 USD). It is important to note that the gender-asymmetric effect documented on individual welfare suggests a mitigation in the degree of gender inequality in terms of welfare observed at baseline as, overall, the ratio of mothers' money metric welfare index to that of fathers' is approximately 0.785 (being 0.787 among beneficiary households and 0.784 among non-participants) prior to the start of the program.[18]

Given the significant empowerment effect documented in favor of mothers, we now investigate whether such empowerment effect is consistent with a higher production of the public good Q. In this regard, we find that participation in *Oportunidades* can also be associated with a significant increase of almost 25% in the production of the public good Q. This is of particular relevance given the context in which we are working in since we use the public good Q in the model as a way to capture investments in

Table 6: Overall Impact of *Oportunidades* on Beneficiary Households

	Two-Parent						*Single-Parent*
		Money Metric Welfare		**Sharing Rule**			
	Pareto Weight	Mother	Father	Mother	Father	Domestic Output	Domestic Output
MDID	0.130***	0.101***	-0.115***	0.085***	-0.118***	711.007***	-338.417*
	(0.005)	(0.020)	(0.016)	(0.004)	(0.005)	(201.704)	(163.203)
N	478	478	478	478	478	478	478

Notes: [1] Bootstrapped standard errors (100 repetitions).

[18]While the drop in fathers' individual welfare captured by the MMWI is significantly larger than the increase in mothers' individual welfare, participation in the program does not (statistically) increase nor decrease the total welfare within the household (defined as the sum of the parents' MMWI, weighted by their Pareto weight) since participation in the program increases total household welfare by a statistically insignificant 0.11%. This is consistent with the result observed that participation in the program increases the weight attached to mothers' preferences.

Table 7: Overall Impact of *Oportunidades* on Beneficiary Households, Percentage Change

	Two-Parent						*Single-Parent*
		Money Metric Welfare		**Sharing Rule**			
	Pareto Weight	Mother	Father	Mother	Father	Domestic Output	Domestic Output
MDID	23.807***	19.559***	-25.081***	25.513***	-28.869***	24.611***	-12.470*
	(0.963)	(4.133)	(3.644)	(1.297)	(1.326)	(6.843)	(7.388)
N	478	478	478	478	478	478	478

Notes: [1] Bootstrapped standard errors (100 repetitions).

children's human capital, which is what development programs target as a core objective. This result is in line with the overall positive impact of the urban implementation of *Oportunidades* on children's educational outcomes in two-parent beneficiary households documented in Behrman et al. (2012) and Flores (2021). Going back to the empirical evidence presented in Section 3, such increase in domestic output suggests that the observed increase in the monetary investments made by the household in the production of the public good Q offsets the documented decrease in parental time investments. Based on the estimation results and the observed empowerment effect, this suggests that by empowering mothers, who tend to have a higher preference for the public good Q, the program effectively increases domestic production within two-parent households by allowing them to substitute parental time investments with monetary investments in children. In this way, as mothers' bargaining position improves, they are able to enjoy more leisure hours while the level of domestic production within the household increases.

5.3 The Impact of Counterfactual Policies on Bargaining Power and Individual Welfare

In this subsection, we quantify the impact of counterfactual gender-targeted policies on women's empowerment and individual welfare. The collective household model we have developed and estimated allows us to explore different types of policies involving gender-targeted benefits to assess the extent to which these exacerbate or mitigate existing patterns of gender inequality within the household. In particular, we consider targeted benefits in the form of cash transfers (non-labor income) and wage subsidies. The benchmark that we will use to compare the impact of these counterfactual policies will be the ones documented for the *Oportunidades* program.

Throughout each of these exercises, we take the households observed at baseline (i.e. in the year 2002) and then, change either the spouses' non-labor income or wage rate depending on the counterfactual scenario of interest (keeping everything else fixed at 2002 values) for each of these households. Our choice of baseline stems from the fact that 2002 sample of the ENCELURB constitutes the experimental baseline used in the evaluation of the *Oportunidades* CCT program. This allows us to use the same baseline used to conduct the intended counterfactual exercises, thereby capitalizing on the experimental setup of the program and its evaluation data.

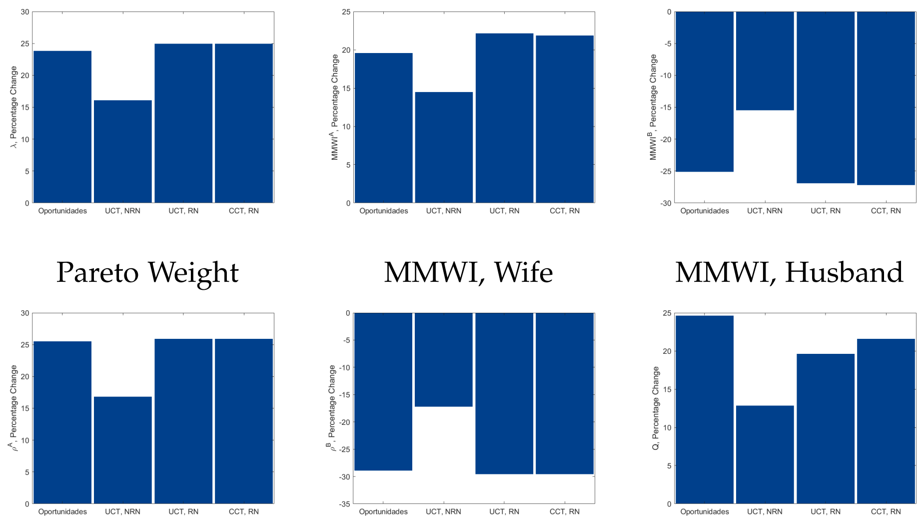
Cash Transfer Targeted to Mothers:

We first consider alternative designs of a cash transfer. Let y_{CT} be the average size of the transfer observed in the data.[19] Suppose we assign this to the mothers' non-labor income, so that $y^A = y^A_{old} + y_{CT}$, without imposing the conditionality that the number of children attending school is equal to the total number of children in the household. We have two options throughout the implementation of this exercise: (1) we can let this cash transfer not be revenue neutral or (2) we can make this revenue neutral by triggering a re-distribution of non-labor income within spouses so that $y^B = y^B_{old} - y_{CT}$. This has important implications in terms of the expected effect on bargaining power and intra-household behavior since the revenue-neutral cash transfer would affect only mothers' share of non-labor income, z^A, while the cash transfer that is not revenue-neutral would lead to an increase in total household non-labor income (thereby, triggering income effects). Figure 5 compares the results of the impact of a cash transfer targeted to mothers on the households' bargaining structure and individual welfare. UCT denotes an unconditional cash transfer, CCT denotes a conditional cash transfer, NR denotes a revenue neutral cash transfer, and NRN denotes a non-revenue neutral cash transfer.

The results indicate that unconditional transfers are effective at inducing an empowerment effect comparable to that observed from participation in *Oportunidades* if revenue neutrality is guaranteed at the household level. This is expected given that revenue neutrality in this scenario increases z^A while keeping total household non-labor income constant, thereby not triggering an income effect. The results also show that a conditional cash transfer that is revenue neutral triggers a slightly larger increase in mothers' bargaining power and individual welfare captured by both the MMWI and the

[19] This is an annual 4,427 MXN pesos in the estimation sample. That is, an average bimonthly disbursement of 737.8 MXN pesos.

Figure 5: Overall Impact on Intrahousehold Bargaining Power and Individual Welfare, Cash Transfer Targeted to Mothers



Pareto Weight | MMWI, Wife | MMWI, Husband

Sharing Rule, Wife | Sharing Rule, Husband | Domestic Output, Q

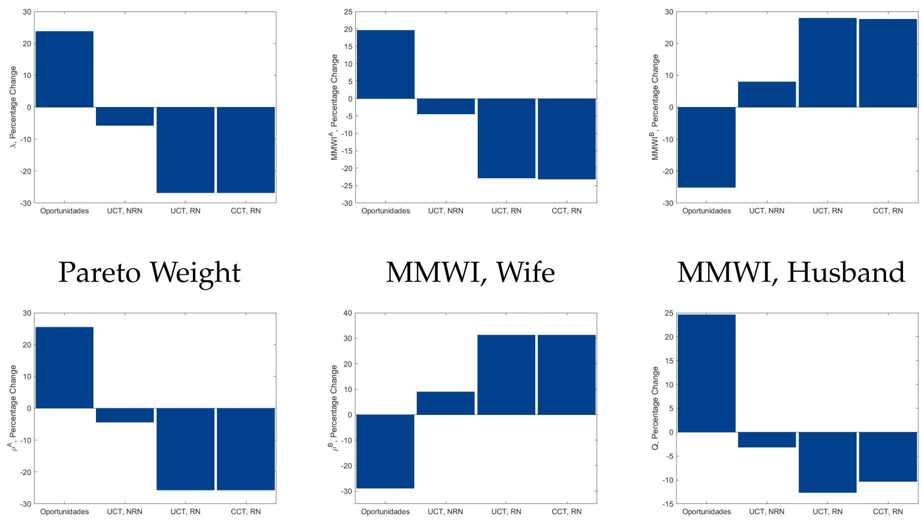
sharing rule.

Cash Transfer Targeted to Fathers:
Similar to the first counterfactual exercise, y_{CT} will be assigned to one of the parents. In this instance, we target this cash transfer to fathers in two-parent households. For this matter, let $y^B = y^B_{old} + y_{CT}$. Again, we let this transfer targeted to the father be revenue neutral or not. As before, in the case of a revenue neutral transfer, we set $y^A = y^A_{old} - y_{CT}$. Note that since we are targeting the cash transfer to the father, this would constitute a decrease in z^A.

Furthermore, another exercise involves simultaneously imposing the conditionality that the number of children in the household currently attending school matches the number of children in the household.[20] Figure 6 compares the results of the impact of a cash transfer targeted to fathers on the households' bargaining structure and individual

[20]In the case of a cash transfer that is not revenue neutral, we cannot really tell beforehand what the effect of the transfer on the Pareto weight will be since the decrease in z^A would coincide with an increase in household income for which the coefficient in the Pareto weight is positive. Furthermore, the conditionality would not affect the Pareto weight but can potentially affect household behavior and the money metric measures of welfare through its impact on the per unit cost of producing the domestic good *and* the per unit cost of producing the domestic good in the counterfactual environment of singlehood (this would be relevant only in the computation of the welfare measures).

Figure 6: Overall Impact on Intrahousehold Bargaining Power and Individual Welfare, Cash Transfer Targeted to Fathers



Pareto Weight | MMWI, Wife | MMWI, Husband

Sharing Rule, Wife | Sharing Rule, Husband | Domestic Output, Q

welfare. UCT denotes an unconditional cash transfer, CCT denotes a conditional cash transfer, NR denotes a revenue neutral cash transfer, and NRN denotes a non-revenue neutral cash transfer.

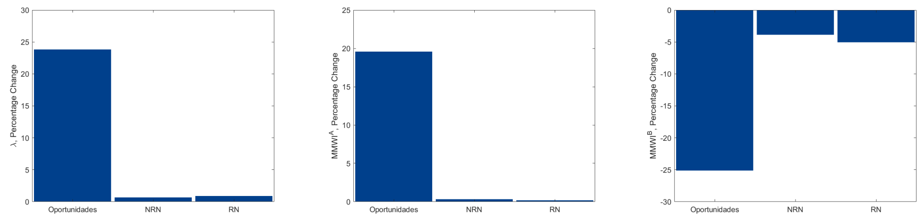
As expected, the results show that an increase in fathers' contribution to non-labor income reduces mothers' bargaining power and individual welfare. As observed in the first counterfactual exercise, the strength of the effect of unconditional cash transfers is larger when this is revenue neutral. Thus, when focusing at revenue neutral cash transfers, both conditional and unconditional cash transfers yield a similar effect. Moreover, while the direction of the effects on bargaining power and individual welfare are different, the magnitudes of those associated with revenue neutral cash transfers are similar to those documented for the *Oportunidades* program.

Wage Subsidy Targeted to Mothers:

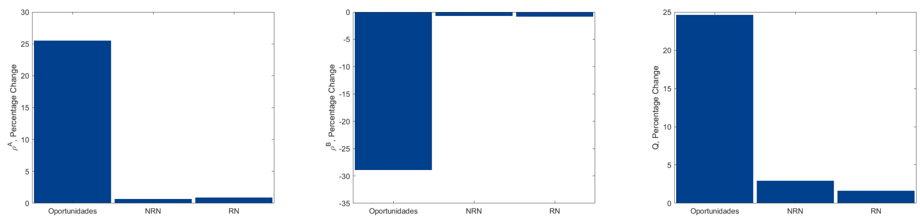
We now move away from cash transfers to investigate the effectiveness of wage subsidies at empowering mothers. Let τ be a wage subsidy intended to be targeted to mothers. Suppose we define a new wage rate for mothers: $w^A = (1+\tau)w^A_{old}$. If we want this to be revenue neutral, suppose we adjust the husband's wage rate to keep full household income constant, so that $w^B = \frac{\bar{Y}_{old}-y^A-y^B}{T} - (w^A_{old}+\tau)$, where $\bar{Y}_{old} = y^A + y^B + (w^A_{old} +$

$w^B_{old})T$. By forcing a redistribution of labor market returns, we can induce a change in $\frac{w^A}{w^B}$ which is expected to increase the wife's Pareto weight based on the estimates obtained in all specifications.

Figure 7: Overall Impact on Intrahousehold Bargaining Power and Individual Welfare, Wage Subsidy for Mothers



Pareto Weight   MMWI, Wife   MMWI, Husband



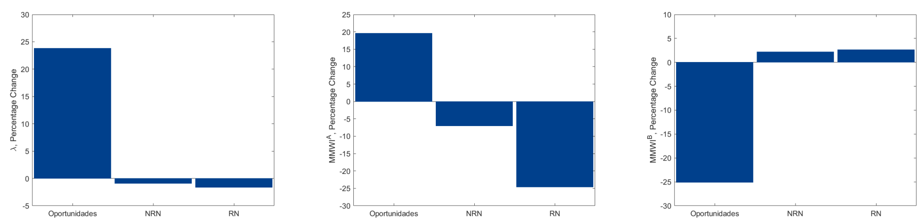
Sharing Rule, Wife   Sharing Rule, Husband   Domestic Output, Q

We conduct this counterfactual letting τ amount to a 25% increase in mothers' wage rate reported in 2002 (bringing the average w^A/w^B just above unity in the scenario in which the subsidy is not revenue neutral, even higher when ensuring revenue neutrality at the household level). Figure 7 compares the results of the impact of a wage subsidy targeted to mothers on the households' bargaining structure and individual welfare. NR denotes a revenue neutral wage subsidy while NRN denotes a non-revenue neutral wage subsidy.

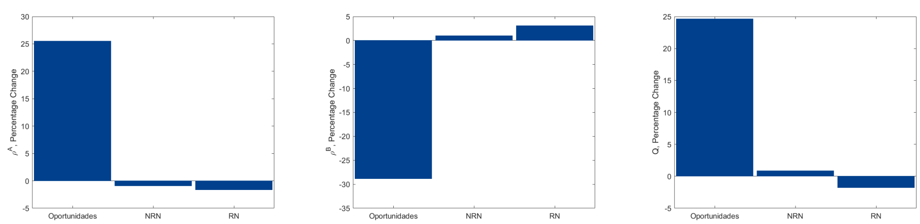
The results show that wage subsidies have a virtually negligible impact on mothers' bargaining position. This is aligned with the magnitude of the estimate obtained for the coefficient associated with the spouses' relative labor market returns in the Pareto weight. Besides the impact on the Pareto weight, as shown in 44, we expect this change in the spouses' wage ratio to affect the individual welfare measures by generating changes in the per unit cost of producing the domestic good both in collectivity and in singlehood.

Wage Subsidy Targeted to Fathers:
Now, let τ be a wage subsidy intended to be targeted to fathers. Suppose we define a new wage rate for mothers: $w^B = (1+\tau)w^B_{old}$. We can make this revenue neutral by adjusting the wife's wage rate in a similar way as we do in the previous counterfactual exercise, $w^A = \frac{\bar{Y}_{old} - y^A - y^B}{T} - ((1+\tau)w^B_{old})$. Mirroring the subsidy granted to mothers, the subsidy used to conduct this counterfactual amounts to a 25% increase in the husband's wage rate reported in 2002. Figure 8 compares the results of the impact of a wage subsidy targeted to fathers on the households' bargaining structure and individual welfare.

Figure 8: Overall Impact on Intrahousehold Bargaining Power and Individual Welfare
Wage Subsidy for Fathers



Pareto Weight MMWI, Wife MMWI, Husband



Sharing Rule, Wife Sharing Rule, Husband Domestic Output, Q

As in the counterfactual involving wage subsidies targeted to mothers, the results indicate that the Pareto weight does not respond significantly to changes in the spouses' wage ratio. Nonetheless, in this case, the MMWI of the wife seems to be very responsive to this ratio, which is aligned with the relationship between these relative wages and the per unit cost of producing the domestic good. Compared to the results on the response of fathers' MMWI to changes in relative wages, it seems that the MMWI of the spouse that is relatively more productive at home tends to be more sensitive to changes in relative wages. We can infer this from the strong decrease observed for mothers' MMWI when considering a revenue-neutral cash transfer.

Overall, the intrahousehold gender inequality analysis implemented throughout this section suggests that cash transfers like *Oportunidades* are as effective at empowering mothers and individual welfare as alternative designs of cash transfers targeted to mothers. Furthermore, as expected, we find that both cash transfers and wage subsidies targeted to fathers tend to have a negative impact on mothers' bargaining position and individual welfare. More importantly, we find that wage subsidies targeted to mothers are virtually ineffective at empowering them and improving their individual welfare. In terms of policy implications, this suggests that the income source targeted by development programs like *Oportunidades* matter as changes in non-labor income seem to be more effective than wage income at generating shifts in the decision making structure of two-parent households.

6 Individual Poverty Analysis: Revisiting the Targeting Strategy of *Oportunidades*

I build upon the forms of money metric utility derived within the collective household framework developed in this paper to revisit the original targeting strategy of *Oportunidades*. The motivating question involves assessing whether by determining the selection of beneficiaries on household-level poverty rates and disregarding the unequal sharing of resources within households, the second stage of the program's targeting strategy discussed in Section 3 exclude mothers living in non-poor households who could have benefited from participating in the program. This generates two auxiliary questions that can be answered through the model. The first question involves investigating whether the individual welfare measures I focus on can help identify these individually poor mothers. The second question involves assessing whether a cash transfer can effectively translate into improvements in these mothers' bargaining position, individual welfare and a higher production of the domestic public good Q.

To answer this question, I start by implementing the estimation strategy described in Section 4.3 including households considered as non-poor by the program administration in the sample.[21] I then use the estimates obtained from the fourth specification (yielding the best model fit) to compute the two individual welfare metrics I have been focusing on so far: the sharing rule and the MMWI. I compare these money metrics with what would be an individual poverty line below which a particular parent would be deemed

[21] The estimation and program evaluation results obtained when including non-poor households in the estimation sample can be found in the Online Appendix.

as poor. The focus is set particularly on mothers since they (1) are originally targeted by the program and (2) have a relatively higher preference for the public good as indicated by the estimation results I presented in the previous section.

The individual poverty analysis here proposed follows a similar analysis implemented in Cherchye et al. (2018). Nonetheless, my analysis departs from their approach in two main aspects. Firstly, while they define the poverty line for an individual as half of 60% of the median full household income observed in the sample, I use the country's official poverty line for the years covered by the ENCELURB (2002-2004) (allowing for the presence of a parent and at least one child) reported by the CONEVAL.[22] It is worth noting that this agency's poverty line for 2000 was used to determine the eligibility for *Oportunidades* was originally defined. Lastly, I use a version of the MMWI that accounts for home production, which is not accounted for in the MMWI used in the authors' individual poverty analysis. I define the poverty line to determine a parent's poverty classification considering the case in which mothers are granted full custody of children. In this case, the poverty line for mothers is determined by obtaining the poverty line for a household comprised by the mother and all her children (multiplying the per person poverty line from the CONEVAL data by the household size equal to 1 plus the number of children in the household). For fathers, on the other hand, I define their poverty line as the poverty line obtained from the CONEVAL for a 1-person household. Table 8 presents the individual poverty rates obtained under this poverty line definition.

I find that 53% (corresponding to 216 households) and 44% (corresponding to 179 households) of mothers in two-parent non-poor households can be classified as individually poor when measuring poverty based on their sharing rule and MMWI respectively.[23] These individual poverty analysis results are consistent with those in Cherchye et al. (2018) in the sense that I find that individual poverty rates computed using the sharing rule tend to be larger than the individual poverty rates computed using the MMWI. This is attuned with the finding that the sharing rule tends to be lower than the MMWI for any value of the Pareto weight since the sharing rule does not account for the economies of scale in production and consumption generated by the domestic production of the public good Q. Furthermore, the results further highlight a significant

[22]This is defined at approximately 17,496 yearly MXN pesos per person, where 1USD = 10.43 MXN pesos. The poverty lines defined by the CONEVAL can be found in https://www.coneval.org.mx/Medicion/MP/Paginas/Lineas-de-bienestar-y-canasta-basica.aspx

[23]Such relatively high individual poverty rates can be explained, to some extent, by the fact that more than 50% of these non-poor households have incomes barely falling just above the poverty line used by the administration of the program and were, therefore, originally categorized as almost poor.

Table 8: Individual Poverty Rates among Non-Poor Households Computed Using the MMWI and Sharing Rule

	All Households	HHs with 1 Child	HHs with 2 Children	HHs with 3+ Children
Sharing rule				
All	27.51%	16.99%	25.65%	36.51%
Mothers	52.81%	28.16%	50.00%	72.37%
Only Mothers	50.61%	22.33%	48.70%	71.71%
Both	2.20%	5.83%	1.30%	0.66%
Fathers	2.20%	5.83%	1.30%	0.66%
Only Fathers	0.00%	0.00%	0.00%	0.00%
Both	2.20%	5.83%	1.30%	0.66%
Intrahousehold Pov. Ineq.	100.00%	100.00%	100.00%	100.00%
MMWI				
All	22.49%	10.68%	20.45%	32.57%
Mothers	43.77%	18.45%	39.61%	65.13%
Only Mothers	42.54%	15.53%	38.31%	65.13%
Both	1.22%	2.91%	1.30%	0.00%
Fathers	1.22%	2.91%	1.30%	0.00%
Only Fathers	0.00%	0.00%	0.00%	0.00%
Both	1.22%	2.91%	1.30%	0.00%
Intrahousehold Pov. Ineq.	100.00%	100.00%	100.00%	100.00%
	N = 409	N = 103	N = 154	N = 152

Intrahousehold Pov. Inequality captures the percentage of households in which the only poor parent is the mother among households in which only one parent is deemed poor

pattern of intrahousehold gender inequality that pervades among non-poor households. This relates to my finding that in all households in which I can categorize only one of the parents as individually poor, such parent is the mother.

Table 9: Overall Impact on Intrahousehold Bargaining Power and Individual Welfare, Cash Transfers to Poor Mothers in Non-Poor Households

	CCT, NRN	UCT, NRN	CCT, RN	UCT, RN
Pareto Weight	10.2601	10.2601	14.5260	14.5260
MMWI, Wife	10.8987	9.7452	12.2175	11.0615
MMWI, Husband	-7.2012	-6.7051	-12.1165	-11.6173
Sharing Rule, Wife	12.6668	12.6668	14.6068	14.6068
Sharing Rule, Husband	-8.8393	-8.8393	-14.6219	-14.6219
Domestic Output	14.1207	7.6971	13.8982	7.4922

Notes: [1] CCT denotes conditional cash transfers, UCT denotes unconditional cash transfers
[2] RN denotes revenue neutrality, NRN denotes non-revenue neutrality.

Table 9 presents the percentage change in the Pareto weight and individual welfare measures associated with targeting a cash transfer constituting 30% of these households' non-labor income to mothers living in two-parent non-poor households who have been deemed as poor within the individual poverty analysis here presented.[24] As in the counterfactual exercises explored in Section 5.3, I consider four different alternative designs of this cash transfer based on whether I impose conditionalities and revenue neutrality.[25] I summarize my main findings below.

Pareto Weight

The results show that non-revenue neutral cash transfers yield the lowest response in terms of the Pareto weight irrespective of whether a conditionality is imposed (a 10% increase in mothers' bargaining power compared to the 14% increase generated by revenue neutral transfers). The unresponsiveness of the Pareto weight to the conditionality is expected since this is not used as a distribution factor. On the other hand, the higher impact of the revenue neutral cash transfer is primarily driven by the fact that while the income effect of the cash transfer on the Pareto weight is ruled out, the revenue neutral cash transfer increases z^A significantly more than the non-revenue neutral cash transfer by forcing a redistribution of non-labor income from the father to the mother.

Individual Welfare Metrics and Domestic Output

Consistent with the sharper increase in the Pareto weight generated by revenue neutral cash transfers than their non revenue neutral counterparts, I find that the shifts generated by revenue neutral cash transfers on both the sharing rule and the MMWI are larger than those generated by non revenue neutral transfers. As expected, I find no difference between conditional and unconditional transfers in terms of their effect on the sharing rule. Nonetheless, I find that conditional transfers generate sharper shifts in parents' MMWI than their unconditional transfers. This is mainly because the derivation of the MMWI accounts for changes induced by the production shifter on parents' relative marginal productivity at home. Thus, when imposing the conditionality, the MMWI adjusts to reflect changes in the number of children in the household attending school. Furthermore, I find that conditional cash transfers tend to have a relatively larger impact on the household's level of domestic output relative to unconditional cash transfers. Furthermore, the results also indicate that non revenue neutral cash transfers tend to generate larger shifts in domestic output than revenue neutral cash transfers. This can be explained by the income effect generated by non revenue neutral cash transfers which allow for more resources to be allocated for domestic production.

[24] I assign this transfer size since I find that in the estimation sample, on average, the transfer amount accounts for 30% of households' non-labor income.

[25] The conditionality in this case is imposed by setting the number of children in the household attending school equal to the number of school-aged children in the household.

So far, I have found that while *Oportunidades* has been as effective as alternative cash transfer designs and considerably more effective than wage subsidies in improving mothers' bargaining position within the household, there is scope for improving the implementation of the program in terms of its targeting strategy. Specifically, I show that by determining the eligibility of mothers on the basis of household-level poverty rates thereby disregarding existing patterns of intrahousehold inequality, the current targeting strategy of the program misses mothers living in non-poor two-parent households who would benefit from participating in the program. Thus, these results show that this shortcoming could be addressed by adjusting the selection of program beneficiaries on the basis of individual poverty rates.

7 Conclusion

I provide novel evidence on the impact of gender-targeted policies on women's bargaining power by documenting the response of mothers' Pareto weight to participation in Mexico's *Oportunidades*. To do so, I present identification results that allow us to identify the household's production technology, parental preferences and the Pareto weight of two-parent households even when the intrahousehold allocation of time and consumption is partially observed. Importantly, this approach exploits the exogenous variation induced by the program on parents' time use by placing the cash transfer in the hands of mothers and by requiring school-aged children to attend school. Such alternative identification approach addresses a common data shortcoming that tends to thwart the extent to which I can use empirical applications of the collective labor supply model with home production presented in Blundell, Chiappori and Meghir (2005) to assess the impact of targeted benefits on intrahousehold inequality.

My results indicate that the receipt of the program's cash transfer is associated with a significant increase in mothers' Pareto weight which effectively translated into an increase in their individual welfare, characterized by the generalization of the money metric welfare index of Chiappori and Meghir (2015) I propose in this paper. Importantly, I also find that such empowerment effect associated with participation in *Oportunidades* coincides with an increase in domestic production within two-parent households. Given that the production of the public good is used in the model to account for the presence of children, I provide convincing evidence in favor of the argument that empowering mothers is beneficial for children. Specifically, I find that by empowering mothers, who tend to have a higher preference for the public good as shown by the estimation results in Section 4.4, the program effectively increases domestic production within two-parent households by allowing them to substitute parental time investments with monetary investments in children. My counterfactual exercises show that *Oportunidades* is as effective as alternative cash transfer designs and considerably more effective than wage subsidies in serving as a policy lever for mothers' empowerment.

As is common in the applications of the model I consider, my analysis is limited by the focus on the sub-sample of working parents, thereby losing potentially useful information from households in which there are patterns of full specialization under which mothers devote most of their time to home production but none to market work. Thus, the analysis here developed would benefit from incorporating non-participation into the model. This would involve extending my proposed approach in a way that permits modeling the continuous choices related to parents' time allocation and consumption as well as their discrete choice relating their decision to participate or not in either market work or home production within a generalization of the framework developed in Blundell et al. (2007). Besides involving novel identification results, such extension could help yield more generalizable results of the impact of gender-targeted policies on women's bargaining power, individual welfare and household investments in children.

References

Aguiar, Mark, and Erik Hurst. 2007. "Measuring trends in leisure: The allocation of time over five decades." *The Quarterly Journal of Economics*, 122(3): 969–1006.

Angelucci, Manuela, and Orazio Attanasio. 2009. "Oportunidades: program effect on consumption, low participation, and methodological issues." *Economic Development and Cultural Change*, 57(3): 479–506.

Angelucci, Manuela, and Orazio Attanasio. 2013. "The demand for food of poor urban mexican households: Understanding policy impacts using structural models." *American Economic Journal: Economic Policy*, 146–178.

Angelucci, Manuela, Orazio Attanasio, and Jonathan Shaw. 2005. "The Effect of Oportunidades on the Level and Composition of Consumption in Urban Areas." *External Evaluation of the Impact of Oportunidades Porgram 2004: Education*, 105–152.

Apps, Patricia F, and Ray Rees. 1988. "Taxation and the Household." *Journal of Public Economics*, 35(3): 355–369.

Apps, Patricia F, and Ray Rees. 1996. "Labour supply, household production and intra-family welfare distribution." *Journal of Public Economics*, 60(2): 199–219.

Armand, Alex, Orazio Attanasio, Pedro Carneiro, and Valérie Lechene. 2020. "The effect of gender-targeted conditional cash transfers on household expenditures: Evidence from a randomized experiment." *The Economic Journal*, 130(631): 1875–1897.

Attanasio, Orazio, and Valerie Lechene. 2002. "Tests of the income pooling in household decisions." *Review of Economic Dynamics*, 5(4): 720–748.

Attanasio, Orazio, and Valérie Lechene. 2010. "Conditional cash transfers, women and the demand for food." IFS working papers.

Attanasio, Orazio, and Valérie Lechene. 2014. "Efficient responses to targeted cash transfers." *Journal of Political Economy*, 122(1): 178–222.

Attanasio, Orazio P, Costas Meghir, and Ana Santiago. 2012. "Education choices in Mexico: using a structural model and a randomized experiment to evaluate Progresa." *The Review of Economic Studies*, 79(1): 37–66.

Behrman, Jere, and Susan Parker. 2011. "The impact of the PROGRESA/Oportunidades conditional cash transfer program on health and related outcomes for the aging in Mexico."

Behrman, Jere R, Jorge Gallardo-Garcıa, Susan W Parker, Petra E Todd, and Viviana Vélez-Grajales. 2011. "Are Conditional Cash Transfers Effective in Urban Areas? Evidence from Mexico."

Behrman, Jere R, Jorge Gallardo-Garcia, Susan W Parker, Petra E Todd, and Viviana Vélez-Grajales. 2012. "Are conditional cash transfers effective in urban areas? Evidence from Mexico." *Education Economics*, 20(3): 233–259.

Behrman, Jere R, Piyali Sengupta, and Petra Todd. 2005. "Progressing through PROGRESA: An impact assessment of a school subsidy experiment in rural Mexico." *Economic development and cultural change*, 54(1): 237–275.

Blundell, Richard, and Monica Costa Dias. 2009. "Alternative approaches to evaluation in empirical microeconomics." *Journal of Human Resources*, 44(3): 565–640.

Blundell, Richard, Pierre-André Chiappori, and Costas Meghir. 2005. "Collective labor supply with children." *Journal of Political Economy*, 113(6): 1277–1306.

Blundell, Richard, Pierre-Andre Chiappori, Thierry Magnac, and Costas Meghir. 2007. "Collective labour supply: Heterogeneity and non-participation." *The Review of Economic Studies*, 74(2): 417–445.

Bobonis, Gustavo J. 2009. "Is the allocation of resources within the household efficient? New evidence from a randomized experiment." *Journal of political Economy*, 117(3): 453–503.

Browning, Martin, and Pierre-André Chiappori. 1998. "Efficient intra-household allocations: A general characterization and empirical tests." *Econometrica*, 1241–1278.

Browning, Martin, Pierre-André Chiappori, and Yoram Weiss. 2014. *Economics of the Family.* Cambridge University Press.

Calvi, Rossella. 2020. "Why are older women missing in India? The age profile of bargaining power and poverty." *Journal of Political Economy*, 128(7): 2453–2501.

Cherchye, Laurens, Bram De Rock, and Frederic Vermeulen. 2012. "Married with children: A collective labor supply model with detailed time use and intrahousehold expenditure information." *American Economic Review*, 102(7): 3377–3405.

Cherchye, Laurens, Bram De Rock, Arthur Lewbel, and Frederic Vermeulen. 2015. "Sharing rule identification for general collective consumption models." *Econometrica*, 83(5): 2001–2041.

Cherchye, Laurens, Sam Cosaert, Bram De Rock, Pieter Jan Kerstens, and Frederic Vermeulen. 2018. "Individual welfare analysis for collective households." *Journal of Public Economics*, 166: 98–114.

Chiappori, P-A, and Ivar Ekeland. 2009. "The Microeconomics of Efficient Group Behavior: Identification 1." *Econometrica*, 77(3): 763–799.

Chiappori, Pierre-André. 1988. "Rational household labor supply." *Econometrica: Journal of the Econometric Society*, 63–90.

Chiappori, Pierre-André. 1992. "Collective labor supply and welfare." *Journal of political Economy*, 100(3): 437–467.

Chiappori, Pierre-Andre. 1997. "Introducing household production in collective models of labor supply." *Journal of Political Economy*, 105(1): 191–209.

Chiappori, Pierre-André, and Costas Meghir. 2015. "Intrahousehold inequality." In *Handbook of income distribution*. Vol. 2, 1369–1418. Elsevier.

Chiappori, Pierre-Andre, Bernard Fortin, and Guy Lacroix. 2002. "Marriage market, divorce legislation, and household labor supply." *Journal of political Economy*, 110(1): 37–72.

Dávila Lárraga, Laura G. 2016. "How does Prospera work?: Best practices in the implementation of conditional cash transfer programs in Latin America and the Caribbean." *Inter-American Development Bank*.

Doss, Cheryl. 2013. "Intrahousehold bargaining and resource allocation in developing countries." *The World Bank Research Observer*, 28(1): 52–78.

Dubois, Pierre, Alain De Janvry, and Elisabeth Sadoulet. 2012. "Effects on school enrollment and performance of a conditional cash transfer program in Mexico." *Journal of Labor Economics*, 30(3): 555–589.

Duflo, Esther. 2003. "Grandmothers and granddaughters: old-age pensions and intrahousehold allocation in South Africa." *The World Bank Economic Review*, 17(1): 1–25.

Duflo, Esther. 2012. "Women empowerment and economic development." *Journal of Economic literature*, 50(4): 1051–79.

Duflo, Esther, and Christopher Udry. 2004. "Intrahousehold resource allocation in Cote d'Ivoire: Social norms, separate accounts and consumption choices." National Bureau of Economic Research.

Dunbar, Geoffrey R, Arthur Lewbel, and Krishna Pendakur. 2013. "Children's resources in collective households: identification, estimation, and an application to child poverty in Malawi." *American Economic Review*, 103(1): 438–71.

Flores, Andrea. 2021. "Conditional Cash Transfers and Intrahousehold Time Allocation: Evidence from Urban Mexico." *Available at SSRN 3937012*.

Gayle, George-Levi, and Andrew Shephard. 2019. "Optimal taxation, marriage, home production, and family labor supply." *Econometrica*, 87(1): 291–326.

Heckman, James, Hidehiko Ichimura, Jeffrey Smith, and Petra Todd. 1998. "Characterizing selection bias using experimental data." National bureau of economic research.

Heckman, James J, Hidehiko Ichimura, and Petra E Todd. 1997. "Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme." *The review of economic studies*, 64(4): 605–654.

Heckman, James J, Hidehiko Ichimura, and Petra Todd. 1998. "Matching as an econometric evaluation estimator." *The Review of Economic Studies*, 65(2): 261–294.

INEGI. 2009. "Uso del tiempo, una perspectiva estadistica de genero, 2009."

Levy, Santiago. 2007. *Progress against poverty: sustaining Mexico's Progresa-Oportunidades program.* Brookings Institution Press.

Lise, Jeremy, and Ken Yamada. 2019. "Household sharing and commitment: Evidence from panel data on individual expenditures and time use." *The Review of Economic Studies*, 86(5): 2184–2219.

Lise, Jeremy, Shannon Seitz, and Jeffrey Smith. 2004. "Equilibrium policy experiments and the evaluation of social programs." National Bureau of Economic Research.

Lundberg, Shelly J, Robert A Pollak, and Terence J Wales. 1997. "Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit." *Journal of Human resources*, 463–480.

Newey, Whitney K, and Daniel McFadden. 1994. "Large sample estimation and hypothesis testing." *Handbook of econometrics*, 4: 2111–2245.

Parker, Susan, and Emmanuel Skoufias. 2000. "The impact of PROGRESA on work, leisure and time allocation." *Washington, DC: International Food Policy Research Institute*.

Parker, Susan W, and Petra E Todd. 2017. "Conditional cash transfers: The case of Progresa/Oportunidades." *Journal of Economic Literature*, 55(3): 866–915.

Rangel, Marcos A. 2006. "Alimony rights and intrahousehold allocation of resources: evidence from Brazil." *The Economic Journal*, 116(513): 627–658.

Rosenbaum, Paul R, and Donald B Rubin. 1983. "The central role of the propensity score in observational studies for causal effects." *Biometrika*, 70(1): 41–55.

Rubio-Codina, Marta. 2010. "Intra-household time allocation in rural Mexico: Evidence from a randomized experiment." *Research in Labor Economics*, 31: 219–257.

Skoufias, Emmanuel. 2005. *PROGRESA and its impacts on the welfare of rural households in Mexico.* Vol. 139, Intl Food Policy Res Inst.

Skoufias, Emmanuel, and Vincenzo Di Maro. 2006. *Conditional cash transfers, adult work incentives, and poverty.* The World Bank.

Skoufias, Emmanuel, Susan W Parker, Jere R Behrman, and Carola Pessino. 2001. "Conditional cash transfers and their impact on child work and schooling: Evidence from the Progresa program in Mexico." *Economia*, 2(1): 45–96.

Sokullu, Senay, and Christine Valente. 2021. "Individual consumption in collective households: Identification using repeated observations with an application to progresa." *Journal of Applied Econometrics*.

Stampini, Marco, and Leopoldo Tornarolli. 2012. "The growth of conditional cash transfers in Latin America and the Caribbean: did they go too far?" IZA Policy Paper.

Todd, Petra E, and Kenneth I Wolpin. 2006. "Assessing the impact of a school subsidy program in Mexico: Using a social experiment to validate a dynamic behavioral model of child schooling and fertility." *American Economic Review*, 96(5): 1384–1417.

Tommasi, Denni. 2019. "Control of resources, bargaining power and the demand of food: evidence from PROGRESA." *Journal of Economic Behavior & Organization*, 161: 265–286.

Tommasi, Denni, and Alexander Wolf. 2016. "Overcoming weak identification in the estimation of household resource shares." *Unpublished Manuscript, ECARES*, 2.

Udry, Christopher. 1996. "Gender, agricultural production, and the theory of the household." *Journal of political Economy*, 104(5): 1010–1046.

A Non-Parametric Identification

The non-parametric identification of the model is carried out in three main steps. The first step involves the identification of two-parent households' production function. The second step involves the identification of single-parent household. Lastly, the third step involves the identification of individual parental preferences and the Pareto weight exploiting the effect of *Oportunidades* on this distribution factor and production shifter and the fact that I observe the behavior of single-parent households. As will be highlighted throughout the analysis, even though this approach involves solving for the household's allocation by directly solving the social planner's problem, this approach follows a similar intuition to the identification approach used when working within the two-stage, decentralized characterization of the household's problem as in Chiappori and Ekeland (2009) and Cherchye, De Rock and Vermeulen (2012) as it relies on the use of an exclusive good (namely, leisure) and the variation generated by a distribution factor and a production shifter. I first present a set of assumptions that facilitate the non-parametric identification of the model.

A1 Preferences are strongly separable on leisure, private consumption and the public domestic good so that these allow for an additively separable representation of the form

$$U^i(l^i, q^i, Q; \mathbf{X}^i) = u^{l,i}(l^i; \mathbf{X}^i) + u^{q,i}(q^i; \mathbf{X}^i) + u^{Q,i}(Q; \mathbf{X}^i)$$

This allows me to characterize each individual marginal utility as $\frac{\partial U^i(l^i,q^i,Q;\mathbf{X}^i)}{\partial l^i} = \frac{\partial u^{l,i}(l^i;\mathbf{X}^i)}{\partial l^i}$, $\frac{\partial U^i(l^i,q^i,Q;\mathbf{X}^i)}{\partial q^i} = \frac{\partial u^{q,i}(q^i;\mathbf{X}^i)}{\partial q^i}$ and $\frac{\partial U^i(l^i,q^i,Q;\mathbf{X}^i)}{\partial Q} = \frac{\partial u^{Q,i}(Q;\mathbf{X}^i)}{\partial Q}$.

A2 The Pareto weight is non-decreasing in z^A. That is, $\frac{\partial \lambda(w^A,w^B,y,\hat{z}^A)}{\partial z^A} \geq 0$.

A3 There exist some known $\hat{l}^A, \hat{l}^B$ and $\hat{z}^A$ such that $\frac{\partial U^A(\hat{l}^A,q^A,Q;\mathbf{X})}{\partial l^A} = \frac{\partial u^{l,A}(\hat{l}^A;\mathbf{X}^A)}{\partial l^A} = c_A$, $\frac{\partial U^B(\hat{l}^B,q^B,Q;\mathbf{X})}{\partial l^B} = \frac{\partial u^{l,B}(\hat{l}^B;\mathbf{X}^B)}{\partial l^B} = c_B$ and $\lambda(w^A, w^B, y, \hat{z}^A) = c$, where c_A, c_B and c are some known constants. Specifically, I assume that these normalizations are imposed at the lower boundaries of the domains of $\frac{\partial u^{l,A}(\hat{l}^A;\mathbf{X}^A)}{\partial l^A}$, $\frac{\partial u^{l,B}(\hat{l}^B;\mathbf{X}^B)}{\partial l^B}$ and $\lambda(w^A, w^B, y, \hat{z}^A)$.

A4 Married mothers are more productive at home than their single counterparts: $\frac{\partial F_Q^M(h_D^A,h_D^B,q^D;\mathbf{S})}{\partial h_D^A} > \frac{\partial F_Q^S(h_D^A,q^D;\mathbf{S})}{\partial h_D^A}$.

A5 The empirical relationship between z^A and l^A is positive. Similarly, the empirical relationship between s_j and l^A is positive. That is, I find empirical evidence suggesting that $\frac{\partial l^A}{\partial z^A} > 0$ and $\frac{\partial l^A}{\partial s_j} > 0$ in the data while fathers' time use is virtually unaffected by z^A and s_j.

A6 Shifts in the production shifter affect married and single mothers' productivity at home differently. That is, either $\frac{\partial}{\partial s_j}\left[\frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^A}\right] \geq 0$ and $\frac{\partial}{\partial s_j}\left[\frac{\partial F_Q^S(h_D^A, q^D; \mathbf{S})}{\partial h_D^A}\right] \leq 0$ or vice versa.

A.1 Step 1: Identifying the Production Function of Two-Parent Households

Data availability on the amount of time each individual parent spends on home production and on the household's child-related expenditures allow for the identification of the household's production function despite Q being unobserved. This is a result that has been outlined in Blundell, Chiappori and Meghir (2005) and Chiappori and Ekeland (2009).[26]

From cost minimization, I can obtain a mapping between observed wages and the marginal rates of technical substitution of parental time and monetary investments on children. Following the notation from Blundell, Chiappori and Meghir (2005), productive efficiency yields the following conditions

$$\varphi_M^A(h_D^A, h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})/\partial h_D^A}{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})/\partial q^D} = w^A$$
$$\varphi_M^B(h_D^A, h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})/\partial h_D^B}{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})/\partial q^D} = w^B$$

From Blundell, Chiappori and Meghir (2005), these conditions are sufficient to identify φ_M^i for $i = (A, B)$ given the existence of a mapping between (w^A, w^B, y) and (h_D^A, h_D^B, q^D) generated by the reduced-form equations relating the observed inputs of production as functions of w^A, w^B and y (which are also observed in the data). However,

[26] Chiappori and Ekeland (2009) also emphasize that additional inputs can be introduced into the production function at no cost in terms of identification as long as these are observable. Thus, adding home production into the model does not constitute a significant challenge for identification as long as I have data on all inputs of production.

this only recovers the φ^i_M's, but not the production function. Given this, Blundell, Chiappori and Meghir (2005) and Cherchye, De Rock and Vermeulen (2012) mention that at least one overidentifying condition is needed to recover F^M_Q. In both papers, the recommendation is to impose an additional condition reflecting that these marginal rates of technical substitution stem from the same function. Such condition yields the following restriction that need to be satisfied by the marginal productivity of parental time and monetary investments in Q:

$$\frac{\partial \varphi^A_M(h^A_D, h^B_D, q^D; \mathbf{S})}{\partial h^B_D} + \varphi^A_M(h^A_D, h^B_D, q^D)\frac{\partial \varphi^B_M(h^A_D, h^B_D, q^D; \mathbf{S})}{\partial q^D} = \frac{\partial \varphi^B_M(h^A_D, h^B_D, q^D; \mathbf{S})}{\partial h^A_D} + \varphi^B_M(h^A_D, h^B_D, q^D; \mathbf{S})\frac{\partial \varphi^A_M(h^A_D, h^B_D, q^D; \mathbf{S})}{\partial q^D} \tag{45}$$

The third condition presented in 45 stems from the assumption that F^M_Q is $\mathcal{C}^2$ and exploiting the symmetry of its Hessian invoking Young's Theorem. To see this, consider the derivative of φ^A_M and φ^B_M with respect to each input of production. Furthermore, for the sake of keeping notation clean, let F^M_Q denote $F^M_Q(h^A_D, h^B_D, q^D; \mathbf{S})$ and φ^i_M denote $\varphi^i_M(h^A_D, h^B_D, q^D, \mathbf{S})$ for $i = (A, B)$.

Differentiating φ^A_M with respect to h^B_D and q^D yields

$$\frac{\partial \varphi^A_M}{\partial h^B_D} = \frac{\frac{\partial}{\partial h^B_D}\left[\frac{\partial F^M_Q}{\partial h^A_D}\right]}{\frac{\partial F^M_Q}{\partial q^D}} - \varphi^A_M \frac{\frac{\partial}{\partial h^B_D}\left[\frac{\partial F^M_Q}{\partial q^D}\right]}{\frac{\partial F^M_Q}{\partial q^D}} \tag{46}$$

$$\frac{\partial \varphi^A_M}{\partial q^D} = \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F^M_Q}{\partial h^A_D}\right]}{\frac{\partial F^M_Q}{\partial q^D}} - \varphi^A_M \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F^M_Q}{\partial q^D}\right]}{\frac{\partial F^M_Q}{\partial q^D}} \tag{47}$$

Similarly, differentiating φ_M^B with respect to h_D^A and q^D yields

$$\frac{\partial \varphi_M^B}{\partial h_D^A} = \frac{\frac{\partial}{\partial h_D^A}\left[\frac{\partial F_Q^M}{\partial h_D^B}\right]}{\frac{\partial F_Q^M}{\partial q^D}} - \varphi_M^B \frac{\frac{\partial}{\partial h_D^A}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} \tag{48}$$

$$\frac{\partial \varphi_M^B}{\partial q^D} = \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F_Q^M}{\partial h_D^B}\right]}{\frac{\partial F_Q^M}{\partial q^D}} - \varphi_M^B \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} \tag{49}$$

Given the symmetry of the Hessian of F_Q^M, I know that $\frac{\frac{\partial}{\partial h_D^B}\left[\frac{\partial F_Q^M}{\partial h_D^A}\right]}{\frac{\partial F_Q^M}{\partial q^D}} = \frac{\frac{\partial}{\partial h_D^A}\left[\frac{\partial F_Q^M}{\partial h_D^B}\right]}{\frac{\partial F_Q^M}{\partial q^D}}$, which can be rewritten using 46 and 48 as

$$\frac{\partial \varphi_M^A}{\partial h_D^B} + \varphi_M^A \frac{\frac{\partial}{\partial h_D^B}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} = \frac{\partial \varphi_M^B}{\partial h_D^A} + \varphi_M^B \frac{\frac{\partial}{\partial h_D^A}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} \tag{50}$$

Furthermore, exploiting the fact that $\frac{\frac{\partial}{\partial h_D^i}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} = \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F_Q^M}{\partial h_D^i}\right]}{\frac{\partial F_Q^M}{\partial q^D}}$ for $i = (A, B)$, rearranging 47 and 49 and substituting the second term in both sides of 50 yields

$$\frac{\partial \varphi_M^A}{\partial h_D^B} + \varphi_M^A \frac{\partial \varphi_M^B}{\partial q^D} + \varphi_M^A \varphi_M^B \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}} = \frac{\partial \varphi_M^B}{\partial h_D^A} + \varphi_M^B \frac{\partial \varphi_M^A}{\partial q^D} + \varphi_M^B \varphi_M^A \frac{\frac{\partial}{\partial q^D}\left[\frac{\partial F_Q^M}{\partial q^D}\right]}{\frac{\partial F_Q^M}{\partial q^D}}$$

since the third term of each side is identical, the additional restriction that needs to be satisfied by the marginal rates of technical substitution of parental time for monetary investments is precisely the one presented in 45

$$\frac{\partial \varphi_M^A}{\partial h_D^B} + \varphi_M^A \frac{\partial \varphi_M^B}{\partial q^D} = \frac{\partial \varphi_M^B}{\partial h_D^A} + \varphi_M^B \frac{\partial \varphi_M^A}{\partial q^D} \tag{51}$$

With this last condition obtained from the assumptions made on the household's production function, I obtain the following system of equations

$$\varphi_M^A(h_D^A, h_D^B, q^D; \mathbf{S}) - w^A = 0 \tag{52}$$

$$\varphi_M^B(h_D^A, h_D^B, q^D; \mathbf{S}) - w^B = 0 \tag{53}$$

$$\frac{\partial \varphi_M^A(h_D^A, h_D^B, q^D)}{\partial h_D^B} + \varphi_M^A(h_D^A, h_D^B, q^D; \mathbf{S}) \frac{\partial \varphi_M^B(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial q^D} - \frac{\partial \varphi_M^B(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^A} -$$

$$\varphi_M^B(h_D^A, h_D^B, q^D; \mathbf{S}) \frac{\partial \varphi_M^A(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial q^D} = 0 \tag{54}$$

This allows me to recover each individual marginal productivity separately allowing for the identification of F_Q^M up to a strictly monotone (and therefore invertible) transformation. Formally, the solution to the system of equations described above can be integrated to recover $\bar{F}_Q^M(h_D^A, h_D^B, q^D; \mathbf{S}) = G_M[F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})]$ so that $F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S}) = G_M^{-1}[\bar{F}_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})]$. Within a parametric approach, G_M^{-1} is pinned down by the functional form imposed on F_Q^M.[27]

A.2 Step 2: Identifying the Production Function of Single-Parent Households

Letting the gender of a single parent be denoted by g, similar to the case of two-parent households, productive efficiency allows me to define the following rate of technical substitution of time for monetary investments in the production of the public good

$$\varphi_S^g = \frac{\partial F_Q^{S,g}(h_D^g, q^D; \mathbf{S}) / \partial h_D^g}{\partial F_Q^{S,g}(h_D^g, q^d; \mathbf{S}) / \partial q^D} = w^g$$

which, given that I have data on both single parents' monetary and time investments on Q can be identified by applying a similar result to the one for used two-parent house-

[27]While it has already been established in the literature that observing all inputs of production is sufficient to recover the household's production technology, allows me to pinpoint the main drivers of the identification of two-parent households' production technology. Since I am able to use each parent's wage as the price for parental time and q^D is part of a Hicksian composite good with price normalized to unity, I observe the responses of h_D^A, h_D^B and q^D to these prices. More importantly, I exploit the fact that the marginal rates of technical substitution are equal to the ratio of their prices and the continuous differentiability of the production function to obtain the restriction needed to separately identify each of the marginal productivities.

holds, relying on the invertibility of the following Jacobian of reduced-form equations

$$D_{(w^A,Y)}(h_D^g, q^D) = \begin{pmatrix} \frac{\partial h_D^g}{\partial w^g} & \frac{\partial h_D^g}{\partial y} \\ \frac{\partial q^D}{\partial w^g} & \frac{\partial q^D}{\partial y} \end{pmatrix} \tag{55}$$

While this recovers φ_S^g, I am still falling short of one condition that could allow me to identify each marginal productivity separately. While in the case of two-parent households, this additional condition could be obtained from exploiting the continuous differentiability of the production function to ensure that the marginal rates of technical substitution of both parents' home time for monetary investments on the domestic good corresponded to the same production function F_Q^M, this is not feasible in the case of a single-parent household since there are only two inputs of production, and therefore only one marginal rate of technical substitution that can be used. It is in here where I can use (1) the role of the number of children in the household attending school, s_j, as a production shifter, (2) the relationship between the conditional factor demands for h_D^A and q^D with s_j, and (3) the variation induced by the *Oportunidades* cash transfer program on children's school attendance to generate an additional condition in terms of both marginal productivities that can help me separately identify each of them. For this, I can differentiate φ_S^g with respect to s_j taking into consideration the reduced-form relationship between h_D^g and s_j and between q^D and s_j:

$$\frac{\partial h_D^g}{\partial s_j}\frac{\partial}{\partial h_D^g}\left[\frac{\partial F_Q^{S,g}}{\partial h_D^g}\right] + \frac{\partial}{\partial s_j}\left[\frac{\partial F_Q^{S,g}}{\partial h_D^g}\right] - w^g\left(\frac{\partial q^D}{\partial s_j}\frac{\partial}{\partial q_D}\left[\frac{\partial F_Q^{S,g}}{\partial q^D}\right] + \frac{\partial}{\partial s_j}\left[\frac{\partial F_Q^{S,g}}{\partial q^D}\right]\right) = 0 \tag{56}$$

where $\frac{\partial h_D^g}{\partial s_j}$ and $\frac{\partial q^D}{s_j}$ is observed in the data, and therefore, known to the researcher. Similar to the case of two-parent households, 55 and 56 generate a 2×2 system of equations that allows me to recover the marginal productivity of single parents' time and monetary investments in the production of Q. This allows me to identify the production function $F_Q^{S,g}$ up to a strictly monotone transformation, $G_{s,g}$ such that $F_Q^{S,g}(h_D^g, q^D; \mathbf{S}) = G_{S,g}^{-1}[\bar{F}^{S,g}(h_D^g, q^D; \mathbf{S})]$.

A.3 Step 3: Identification of Preference Parameters and Pareto Weight

At this point, I can then take $\frac{\partial F_Q^M}{\partial h_D^A}$, $\frac{\partial F_Q^M}{\partial h_D^B}$, $\frac{\partial F_Q^M}{\partial q^D}$, $\frac{\partial F_Q^{S,A}}{\partial h_D^A}$, $\frac{\partial F_Q^{S,B}}{\partial h_D^B}$, $\frac{\partial F_Q^{S,A}}{\partial q^D}$, and $\frac{F_Q^{S,B}}{\partial q^D}$.

The following notation is adopted hereafter.

Unknowns

For the household's decision making structure, the only unknown is $\lambda(\mathbf{z})$. For individual preferences, let $\Gamma_l^i(l^i, q^i, Q, \mathbf{X}^i) = \frac{\partial U^i(l^i, q^i, Q; \mathbf{X}^i)}{\partial l^i}$, $\Gamma_Q^i(l^i, q^i, Q, \mathbf{X}^i) = \frac{\partial U^i(l^i, q^i, Q; \mathbf{X}^i)}{\partial Q}$ and $\Gamma_q^i(l^i, q^i, Q, \mathbf{X}^i) = \frac{\partial U^i(l^i, q^i, Q; \mathbf{X}^i)}{\partial q^i}$ for $i = (A, B)$. Furthermore, given that preferences are strongly separable as described in A1, I have that $\Gamma_l^i(l^i, \mathbf{X}^i) = \frac{\partial u^{l,i}(l^i; \mathbf{X}^i)}{\partial l^i}$, $\Gamma_Q^i(Q, \mathbf{X}^i) = \frac{\partial u^{Q,i}(Q; \mathbf{X}^i)}{\partial Q}$ and $\Gamma_q^i(q^i, \mathbf{X}^i) = \frac{\partial u^{q,i}(q^i; \mathbf{X}^i)}{\partial q^i}$ for $i = (A, B)$.

Known (from the data and recovered in Step 1)

Recovered in Step 1:

For two-parent households

$$\phi_M^A = \phi_M^A(h_D^A, h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^A} \tag{57}$$

$$\phi_M^B = \phi_M^B(h_D^A, h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^B} \tag{58}$$

$$\phi_M^D = \phi_M^D(h_D^A, h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^M(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial q^D} \tag{59}$$

For single-parent households

$$\phi_S^A = \phi_S^A(h_D^A, q^D; \mathbf{S}) = \frac{\partial F_Q^{S,A}(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^A} \tag{60}$$

$$\phi_S^B = \phi_S^B(h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^{S,B}(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial h_D^B} \tag{61}$$

$$\phi_S^{D,A} = \phi_S^{D,A}(h_D^A, q^D; \mathbf{S}) = \frac{\partial F_Q^{S,A}(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial q^D} \tag{62}$$

$$\phi_S^{D,B} = \phi_S^{D,B}(h_D^B, q^D; \mathbf{S}) = \frac{\partial F_Q^{S,B}(h_D^A, h_D^B, q^D; \mathbf{S})}{\partial q^D} \tag{63}$$

Data only

$$\Delta^{l}_{z^A}(d, A) = \frac{\partial l^A}{\partial z^A} \tag{64}$$

$$\Delta^{l}_{z^A}(d, B) = \frac{\partial l^B}{\partial z^A} \tag{65}$$

$$\Delta^{l}_{s_j}(d, A) = \frac{\partial l^A}{\partial s_j} = \frac{\Delta^{l}_{z^A}(d, A)}{\Delta^{s_j}_{z^A}(d)} \tag{66}$$

$$\Delta^{l}_{s_j}(d, B) = \frac{\partial l^B}{\partial s_j} = \frac{\Delta^{l}_{z^A}(d, B)}{\Delta^{s_j}_{z^A}(d)} \tag{67}$$

$$\Delta^{h^D}_{z^A}(d, A) = \frac{\partial h^A_D}{\partial z^A} \tag{68}$$

$$\Delta^{h^D}_{z^A}(d, B) = \frac{\partial h^B_D}{\partial z^A} \tag{69}$$

$$\Delta^{h^D}_{s_j}(d, A) = \frac{\partial h^A_D}{\partial s_j} = \frac{\Delta^{h^D}_{z^A}(d, A)}{\Delta^{s_j}_{z^A}(d)} \tag{70}$$

$$\Delta^{h^D}_{s_j}(d, B) = \frac{\partial h^B_D}{\partial s_j} = \frac{\Delta^{h^D}_{z^A}(d, B)}{\Delta^{s_j}_{z^A}(d)} \tag{71}$$

$$\Delta^{q^D}_{z^A}(d) = \frac{\partial q^D}{\partial z^A} \tag{72}$$

$$\Delta^{q^D}_{s_j}(d) = \frac{\partial q^D}{\partial s_j} = \frac{\Delta^{q^D}_{z^A}(d)}{\Delta^{s_j}_{z^A}(d)} \tag{73}$$

$$\Delta^{q}_{z^A}(d) = \frac{\partial q}{\partial z^A} \tag{74}$$

$$\Delta^{q}_{s_j}(d) = \frac{\partial q}{\partial s_j} = \frac{\Delta^{q}_{z^A}(d)}{\Delta^{s_j}_{z^A}(d)} \tag{75}$$

Combination of data and components recovered in Steps 1 and 2

$$\Delta^{\phi}_{z^A}(d,A) = \frac{\partial \phi^A}{\partial z^A} = \frac{\partial \phi^A}{\partial h^A_D}\Delta^{h^D}_{z^A}(d,A) + \frac{\partial \phi^A}{\partial h^B_D}\Delta^{h^D}_{z^A}(d,B) + \frac{\partial \phi^A}{\partial q^D}\Delta^{q^D}_{z^A}(d) \tag{76}$$

$$\Delta^{\phi}_{s_j}(d,A) = \frac{\partial \phi^A}{\partial s_j} = \frac{\partial \phi^A}{\partial h^A_D}\Delta^{h^D}_{s_j}(d,A) + \frac{\partial \phi^A}{\partial h^B_D}\Delta^{h^D}_{s_j}(d,B) + \frac{\partial \phi^A}{\partial q^D}\Delta^{q^D}_{s_j}(d) \tag{77}$$

$$\Delta^{\phi}_{z^A}(d,B) = \frac{\partial \phi^B}{\partial z^A} = \frac{\partial \phi^B}{\partial h^A_D}\Delta^{h^D}_{z^A}(d,A) + \frac{\partial \phi^B}{\partial h^B_D}\Delta^{h^D}_{z^A}(d,B) + \frac{\partial \phi^B}{\partial q^D}\Delta^{q^D}_{z^A}(d) \tag{78}$$

$$\Delta^{\phi}_{s_j}(d,B) = \frac{\partial \phi^B}{\partial s_j} = \frac{\partial \phi^B}{\partial h^A_D}\Delta^{h^D}_{s_j}(d,A) + \frac{\partial \phi^B}{\partial h^B_D}\Delta^{h^D}_{s_j}(d,B) + \frac{\partial \phi^B}{\partial q^D}\Delta^{q^D}_{s_j}(d) \tag{79}$$

$$\Delta^{\phi^D}_{z^A}(d) = \frac{\partial \phi^B}{\partial z^A} = \frac{\partial \phi^D}{\partial h^A_D}\Delta^{h^D}_{z^A}(d,A) + \frac{\partial \phi^D}{\partial h^B_D}\Delta^{h^D}_{z^A}(d,B) + \frac{\partial \phi^D}{\partial q^D}\Delta^{q^D}_{z^A}(d) \tag{80}$$

$$\Delta^{\phi^D}_{s_j}(d) = \frac{\partial \phi^D}{\partial s_j} = \frac{\partial \phi^B}{\partial h^A_D}\Delta^{h^D}_{s_j}(d,A) + \frac{\partial \phi^D}{\partial h^B_D}\Delta^{h^D}_{s_j}(d,B) + \frac{\partial \phi^D}{\partial q^D}\Delta^{q^D}_{s_j}(d) \tag{81}$$

$$\Delta^{Q}_{z^A}(d) = \frac{\partial Q}{\partial z^A} = \phi^A\Delta^{h^D}_{z^A}(d,A) + \phi^B\Delta^{h^D}_{z^A}(d,B) + \phi^D\Delta^{q^D}_{z^A}(d) \tag{82}$$

$$\Delta^{Q}_{s_j}(d) = \frac{\partial Q}{\partial s_j} = \phi^A\Delta^{h^D}_{s_j}(d,A) + \phi^B\Delta^{h^D}_{s_j}(d,B) + \phi^D\Delta^{q^D}_{s_j}(d) \tag{83}$$

I start by focusing on the first order conditions relating parents' marginal utility for public consumption and their marginal utility for leisure. For single mothers and fathers, respectively, I have that

$$\frac{\partial F^{S,A}_Q}{\partial h^A_D}\frac{\partial U^A}{\partial Q} = \frac{\partial U^A}{\partial l^A}$$
$$\frac{\partial F^{S,B}_Q}{\partial h^B_D}\frac{\partial U^B}{\partial Q} = \frac{\partial U^B}{\partial l^B}$$

Substituting $\frac{\partial U^A}{\partial Q}$ into the two-parent households' marginal utility for public consumption, yielding

$$\frac{\partial F^M_Q}{\partial h^A_D}\left[\lambda(\mathbf{z})\frac{\partial U^A/\partial l^A}{\partial F^{S,A}_Q/\partial h^A_D} + (1-\lambda(\mathbf{z}))\frac{\partial U^B/\partial l^B}{\partial F^{S,B}_Q/\partial h^B_D}\right] = \lambda(\mathbf{z})\frac{\partial U^A}{\partial l^A} \tag{84}$$

Differentiating this with respect to s_j and z^A could yield 2 additional restrictions to the two-parent households first order condition relating both parents' marginal utilities for leisure

$$\frac{\lambda(\mathbf{z})}{1-\lambda(\mathbf{z})}\frac{\partial U^A/\partial l^A}{\partial U^B/\partial l^B} = \frac{w^A}{w^B}$$

Thus, I have the following 3×3 system of equations that can be used to recover parents' marginal utility for leisure and the Pareto weight

$$\frac{\lambda(\mathbf{z})}{1-\lambda(\mathbf{z})}\frac{\Gamma_l^A}{\Gamma_l^B} - \frac{w^A}{w^B} = 0 \tag{85}$$

$$(1-\lambda(\mathbf{z}))\left(\frac{\phi_S^B \Delta_{s_j}^l(d,B)\frac{\partial \Gamma_l^B}{\partial l^B} - \Gamma_l^B \Delta_{s_j}^{\phi_S}(d,B)}{(\phi_S^B)^2}\right)$$
$$-\lambda(\mathbf{z})\left(\frac{\phi_M^A \Delta_{s_j}^l(d,A)\frac{\partial \Gamma_l^A}{\partial l^A} - \Gamma_l^A \Delta_{s_j}^{\phi_M}(d,A)}{(\phi_M^A)^2} - \frac{\phi_S^A \Delta_{s_j}^l(d,A)\frac{\partial \Gamma_l^A}{\partial l^A} - \Gamma_l^A \Delta_{s_j}^{\phi_S}(d,A)}{(\phi_S^A)^2}\right) = 0 \tag{86}$$

$$-\frac{\partial \lambda(\mathbf{z})}{\partial z}\frac{\Gamma_l^B}{\phi_S^B} + \frac{(1-\lambda(\mathbf{z}))}{\phi_S^B}\Delta_{z^A}^l(d,B)\frac{\partial \Gamma_l^B}{\partial l^B} - \frac{\phi_M^A\left(\frac{\partial\lambda(\mathbf{z})}{\partial z^A}\Gamma_l^A + \lambda(\mathbf{z})\Delta_{z^A}^l(d,A)\frac{\Gamma_l^A}{\partial l^A}\right) - \Gamma_l^A\lambda(\mathbf{z})\Delta_{z^A}^{\phi_M}(d,A)}{(\phi_M^A)^2}$$
$$+\frac{1}{\phi_S^A}\left(\frac{\partial\lambda(\mathbf{z})}{\partial z^A}\Gamma_l^A + \lambda(\mathbf{z})\Delta_{z^A}^l(d,A)\frac{\Gamma_l^A}{\partial l^A}\right) = 0 \tag{87}$$

The first equation corresponds to the relationship between the marginal rate of substitution of spouses' leisure within two-parent households. The second equation is obtained by differentiating 84 with respect to s_j. Finally, the third one is obtained by differentiating 84 with respect to z^A. Note that I can exploit the variation of the program on h_D^A through z^A only for mothers in two-parent households since only in this type of household structure I have that the conditional factor demand for h_D^A, h_D^B and q^D are functions of z^A.

The normalizations described in A3 allow me to characterize 85-87 as a non-linear system of equations of the form $\mathbf{F}(\Gamma_l^A, \Gamma_l^B, \lambda) = \mathbf{0}$. Formally, I describe these normalizations in the following way

$$\frac{\partial \Gamma_l^A}{\partial l^A} \approx f_\Gamma^A = \frac{\Gamma_l^A - c_A}{l^A - \hat{l}^A} \tag{88}$$

$$\frac{\partial \Gamma_l^B}{\partial l^B} \approx f_\Gamma^B = \frac{\Gamma_l^B - c_B}{l^B - \hat{l}^B} \tag{89}$$

$$\frac{\partial \lambda(\mathbf{z})}{\partial z^A} \approx f_\lambda = \frac{\lambda - c}{z^A - \hat{z}^A} \tag{90}$$

Thus, I define $\mathbf{F}(\Gamma_l^A, \Gamma_l^B, \lambda) = \mathbf{0}$ so that

$$F1 = \frac{\lambda(\mathbf{z})}{1-\lambda(\mathbf{z})}\frac{\Gamma_l^A}{\Gamma_l^B} - \frac{w^A}{w^B} = 0 \tag{91}$$

$$\begin{aligned} F2 = {} & (1-\lambda(\mathbf{z}))\left(\frac{\phi_S^B \Delta_{s_j}^l(d,B) f_\Gamma^B - \Gamma_l^B \Delta_{s_j}^{\phi_S}(d,B)}{(\phi_S^B)^2}\right) \\ & -\lambda(\mathbf{z})\left(\frac{\phi_M^A \Delta_{s_j}^l(d,A) f_\Gamma^A - \Gamma_l^A \Delta_{s_j}^{\phi_M}(d,A)}{(\phi_M^A)^2} - \frac{\phi_S^A \Delta_{s_j}^l(d,A) f_\Gamma^A - \Gamma_l^A \Delta_{s_j}^{\phi_S}(d,A)}{(\phi_S^A)^2}\right) = 0 \end{aligned} \tag{92}$$

$$\begin{aligned} F3 = {} & -\frac{\partial \lambda(\mathbf{z})}{\partial z}\frac{\Gamma_l^B}{\phi_S^B} + \frac{(1-\lambda(\mathbf{z}))}{\phi_S^B}\Delta_{z^A}^l(d,B) f_\Gamma^B - \frac{\phi_M^A\left(\frac{\partial \lambda(\mathbf{z})}{\partial z^A}\Gamma_l^A + \lambda(\mathbf{z})\Delta_{z^A}^l(d,A) f_\Gamma^A\right) - \Gamma_l^A \lambda(\mathbf{z})\Delta_{z^A}^{\phi_M}(d,A)}{(\phi_M^A)^2} \\ & + \frac{1}{\phi_S^A}\left(\frac{\partial \lambda(\mathbf{z})}{\partial z^A}\Gamma_l^A + \lambda(\mathbf{z})\Delta_{z^A}^l(d,A) f_\Gamma^A\right) = 0 \end{aligned} \tag{93}$$

Invoking the Inverse Function Theorem, a solution to $\mathbf{F}(\Gamma_l^A, \Gamma_l^B, \lambda) = \mathbf{0}$ exists if I can show that $\mathbf{DF}(\Gamma_l^A, \Gamma_l^B, \lambda)$ is invertible. That is, I need to show that $det(\mathbf{DF}(\Gamma_l^A, \Gamma_l^B, \lambda)) \neq 0$.

To keep notation clean, let

$$C1 = \frac{1}{\phi_S^A} - \frac{1}{\phi_M^A}$$

$$C2 = \frac{\Delta_{s_j}^{\phi_M}(d,A)}{(\phi_M^A)^2} - \frac{\Delta_{s_j}^{\phi_S}(d,A)}{(\phi_S^A)^2}$$

where $C1, C2 > 0$, by assumptions A4 and A6, respectively.

Note that I can sign the following by the assumption that $\lambda \in (0,1)$ and that $U^A(l^A, q^A, Q; \mathbf{X}^A)$ and $U^B(l^B, q^B, Q; \mathbf{X}^A)$ are increasing on (l^i, q^i, Q) for both A and B, implying that $\Gamma_l^A, \Gamma_l^B > 0$:

$$\frac{\partial F_1}{\partial \lambda} = \frac{\Gamma_l^A}{(1-\lambda)^2 \Gamma_l^B} > 0$$
$$\frac{\partial F_1}{\partial \Gamma_l^A} = \frac{\lambda}{(1-\lambda)\Gamma_l^B} > 0$$
$$\frac{\partial F_1}{\partial \Gamma_l^B} = -\frac{\lambda \Gamma_l^A}{(1-\lambda)(\Gamma_l^B)^2} < 0$$

Moreover, given that in assumption A3, the normalization imposed relative to the lower boundary of l^A and l^B and that U^i is assumed to be concave, I know then that $f_\Gamma^i < 0$ for $i = (A, B)$. Furthermore, assuming that λ is non-decreasing on z^A, it follows that $f_\lambda >= 0$.

To simplify the derivation of $det(\mathbf{DF}(\Gamma_l^A, \Gamma_l^B, \lambda))$ that could allow me to sign it, I consider the particular case I have in our empirical application. Recall that in Section 3 I showed that participation in the program leaves fathers' time allocation unaffected. Similarly, I find that mothers' leisure increases with program participation. Thus, suppose that $\Delta_{s_j}^l(d, B) = \Delta_{z^A}^l(d, B) = 0$, $\Delta_{s_j}^l(d, A) \geq 0$ and $\Delta_{z^A}^l(d, A) \geq 0$. That is, fathers' leisure is unresponsive to changes in z^A and s_j while mothers' leisure in two-parent households is positively related with changes in z^A and s_j associated with participation in a program like *Oportunidades*.[28] Then, I describe $det(\mathbf{DF}(\Gamma_l^A, \Gamma_l^B, \lambda))$ and sign it in the following way

$$\begin{aligned} det(\mathbf{DF}(\Gamma_l^A, \Gamma_l^B, \lambda)) = &- \frac{\Gamma_l^A}{(1-\lambda)^2 \Gamma_l^B} \frac{\lambda f_\lambda C1 \Delta_{s_j}^l (d, A)}{\phi_S^B (l^A - \hat{l}^A)} + f_\Gamma^A \frac{\lambda}{(1-\lambda)\Gamma_l^B} \frac{\Delta_{s_j}^l (d, A) C1}{\phi_S^B} \\ &- \frac{\Gamma_l^A}{(1-\lambda)^2} \frac{\lambda f_\lambda C2}{\phi_S^B} - \frac{\lambda}{(1-\lambda)\Gamma_l^B} \frac{\Gamma_l^A C2}{\phi_S^B} \\ &- \frac{\lambda}{1-\lambda} \frac{\Gamma_l^A}{(\Gamma_l^B)^2} \Bigg[\underbrace{\left(-C1 \Delta_{s_j}^l (d, A) f_\Gamma^A + \Gamma_l^A C2 \right) \left(C1 \left(f_\lambda + \frac{\lambda \Delta_{z^A}^l (d, A)}{l^A - \hat{l}^A} \right) + \frac{\lambda \Delta_{z^A}^{\phi_M} (d, A)}{(\phi_M^A)^2} \right)}_{+} \\ &- \Bigg(\underbrace{\frac{1}{z^A - \hat{z}^A} \left(-\frac{\Gamma_l^B}{\phi_S^B} + \Gamma_l^A C1 \right) + f_\Gamma^A \Delta_{z^A}^l (d, A) C1}_{-} \Bigg) \Bigg(\underbrace{C1 \frac{\lambda \Delta_{s_j}^l (d, A)}{l^A - \hat{l}^A} + \lambda C2}_{+} \Bigg) \Bigg] \end{aligned}$$

Given the signs of Γ_l^A, Γ_l^B, f_Γ^A, f_Γ^B, and f_λ, this is **negative**. Thus, a solution to the system of equations generated by 85-87 exists.

Given the solution obtained for $(\Gamma_l^A, \Gamma_l^B, \lambda)$, I proceed to recover $\Gamma_Q^A, \Gamma_Q^B, \Gamma_q^A, \Gamma_q^B$. I start by focusing on parents' marginal rate of substitution of leisure for private consumption implied by the optimality condition relating leisure and private consumption. This allows me to recover Γ_q^i using $\frac{\Gamma_l^i}{\Gamma_q^i} = w^i$ as Γ_l^i is known at this stage and I observe w^i in the data. I then combine the marginal rates of substitution of leisure for public consumption for parents in both types of households to derive the following

$$\begin{aligned} \Gamma_Q^A &= \frac{1}{\lambda(\mathbf{z})} \left(\lambda(\mathbf{z}) \frac{\Gamma_l^A}{\phi_M^A} - (1 - \lambda(\mathbf{z})) \frac{\Gamma_l^B}{\phi_S^B} \right) \\ \Gamma_Q^B &= \frac{1}{1 - \lambda(\mathbf{z})} \left((1 - \lambda(\mathbf{z})) \frac{\Gamma_l^B}{\phi_M^B} - \lambda(\mathbf{z}) \frac{\Gamma_l^A}{\phi_S^A} \right) \end{aligned}$$

Since Γ_l^i, λ, ϕ_S^i and ϕ_M^i (for $i = A, B$) are known at this stage, the identification of Γ_Q^i follows. Thus, the marginal utilities of both mothers and fathers and the Pareto weight are recoverable.

[28] The positive relationship between program participation and changes in s_j is established by the evidence I find that program participation increases the number of children attending school as shown in Section 4.4. The subsequent impact on parents' time allocation within two-parent households is derived as described in Step 1 in Section 4.3.

B Parametric Identification

This section describes the parametric identification of the model from which the estimation strategy described in Section 4.3 is derived.

Proposition C1 (Parametric Identification of Two-Parent Households' Production Technology).
Let (h_D^A, h_D^B, q^D) be observed functions of $(w^A, w^B, y, \boldsymbol{S}, \boldsymbol{z})$ for two-parent households. If for at least one production shifter $s_j \in \boldsymbol{S}$, $\exists s_j^*$ such that $\psi(\boldsymbol{S}^*) = 1/2$, the substitution parameter γ is identified. Once γ is identified, the relative productivity of the spouses can be recovered from the home time ratios observed in the data, $\frac{h_D^A}{h_D^B}$. With γ and $\psi(\boldsymbol{S})$ identified, the output share of parental time, ρ, is identified upon observing at least one of the home time to monetary investment ratios, $\frac{h_D^i}{q^D}$, for $i = (A, B)$.

Proof: Identification of the home production parameters stems from the optimality conditions related to productive efficiency described in 22-24. However, even though there are three equations containing three unknowns, the three equations alone do not allow me to explicitly solve for each parameter in terms of observables unless I impose a normalization. Since the sample of households in the application here considered has any positive number of children, I let s_j be the number of children that attend school. Since, for now, the only observable included in the estimation of $\psi(\mathbf{S})$ is this s_j, a useful normalization to consider involves focusing on the sub-sample with no children for whom, using 22, I can let $\psi(\mathbf{S}) = 1/2$ to recover γ. Taking γ as known, I can recover $\psi(\mathbf{S})$ using 22 on the sub-sample of households with at least one child attending school. Once I have γ and $\psi(\mathbf{S})$, I can use either 23 or 24 to recover ρ. Thus, I find that either of these two conditions can also serve as an overidentifying restriction in this case.

Proposition C2 (Parametric Identification of Single-Parent Households' Production Technology).
Let (h_D^i, q^D) be observed functions of $(w^i, y^i, \boldsymbol{S})$ for $i = (A, B)$. If for at least one production shifter $s_j \in \boldsymbol{S}$, $\exists s_j^*$ such that $\phi(\boldsymbol{S}^*) = 1/2$, the substitution parameter β is identified. Once β^i is identified, the relative productivity of parental time, $\phi^i(\boldsymbol{S})$, can be recovered from single parents' home time to monetary investment ratios observed in the data, $\frac{h_D^i}{q^D}$.

Proof: Identification of single-parent households' production technology is derived from the optimality condition related to productive efficiency and described in 19. Note that in this case I face a similar problem in the identification of β and $\phi(\mathbf{S})$ as when focusing on the production technology of two-parent households. This involves the lack of a condition I can use to begin solving for each individual production function parameter. Again, since the production shifter of interest involves the number of children enrolled in school, I can then impose a similar normalization to the one used for two-parent households such that for parents with no children enrolled in school ($s_j = 0$), $\phi(\mathbf{S}) = 1/2$. Thus, from these households, I can recover β. Once I recover β, I can then estimate $\phi(\mathbf{S})$ taking β as given over the sample of households in which there are children attending school ($s_j > 0$).

Proposition C3 (Parametric Identification of Individual Preferences).
Let (l^i, q^i) be observed functions of (w^i, y^i, S) for $i = (A, B)$. With $\phi^A(S)$ and β^A identified, mothers' marginal rate of substitution of leisure for private consumption is identified by observing mothers' wages and leisure to private consumption ratios following 19. Upon the identification of the marginal rate of substitution, preference for leisure, $\alpha_1^A(X)$, and for private consumption, $\alpha_2^A(X)$, are separately identified by observing single mothers' leisure to home production hours ratio following 20 and their private consumption to monetary investments in the production of the public good following 21. A symmetric result holds for the identification of single fathers' preferences for leisure and private market consumption. Assuming that preferences are invariant to marital status, the identification of the individual preferences within two-parent households follows.

Proof: Once the production function for the sample of single-parent households has been identified, I can then take β^i and $\phi^i(\mathbf{S})$ as known in 20 and 21. These two conditions yield two expressions for $\alpha_1^i(\mathbf{X})$ and for $\alpha_2^i(\mathbf{X})$ for both men and women. This follows from using 19 to write down either $\alpha_1^i(\mathbf{X})$ in terms of $\alpha_2^i(\mathbf{X})$, or vice versa, and using this in 20 or 21 to solve the system of equations, yielding

$$\alpha_1^i(\mathbf{X}) = \left(1 - \frac{1}{w^i l^i}[(\phi^i(\mathbf{S})(h_D^A)^{\beta^i} + (1 - \phi^i(\mathbf{S}))(q^D)^{\beta^i})(q^D)^{1-\beta^i} + q^i]\right)^{-1}$$
$$\alpha_2^i(\mathbf{X}) = \left(1 - \frac{w^i}{q^i}[(\phi^i(\mathbf{S})(h_D^A)^{\beta^i} + (1 - \phi^i(\mathbf{S}))(q^D)^{\beta^i})(h_D^A)^{1-\beta^i} + l^i]\right)^{-1}$$

Proposition C4 (Parametric Identification of the Pareto Weight).
Let (l^A, l^B, q) *be observed functions of* $(w^A, w^B, y, \mathbf{S}, \boldsymbol{z})$ *for two-parent households. With individual preferences identified, identification of the Pareto weight,* $\lambda(z)$ *follows from the relationship between the spouses' relative bargaining power, observed leisure and wage ratios and distribution factors as described in the third optimality condition presented in 25.*

Proof: Once the parents' individual preferences for leisure have been identified, I can take these as known in the first order conditions of two-parent households, from which I can recover $\lambda(\mathbf{z})$ without needing a normalization since it can come directly from the third condition presented in 25 upon substitution of α_1^i $(i = A, B)$. This yields the following relationship between the Pareto weight and what is known at this stage

$$\lambda(\mathbf{z}) = \frac{w^A l^A \alpha_1^B(\mathbf{X})}{w^A l^A \alpha_1^B(\mathbf{X}) + w^B l^B \alpha_1^A(\mathbf{X})}$$

Corollary C4.1 (Overidentification of the Pareto Weight).
With individual preferences and two-parent households' production technology identified, there exist two sets of overidentifying conditions for the Pareto weight. The first set relates the household's public consumption optimality conditions and the second set relates the restrictions derived using the experimental variation of Oportunidades on household behavior.

Proof: While the identification of the Pareto weight is guaranteed by the relationship described in the third optimality condition presented in 25, the conditions related to the household's marginal utility for public consumption and for leisure and the spouses' marginal productivity at home described in 26 and 27 yield two additional conditions to identify the Pareto weight since both parental preferences and two-parent households' production technology is known at this stage. Furthermore, the conditions related to the experimental variation of *Oportunidades* on household behavior described in 31-35 yield another set of overidentifying restrictions relating the Pareto weight, individual preferences and the production technology parameters.

C Supplemental Tables and Figures

C.1 Propensity Score Estimation and Distribution

The first step of the MDID estimator described in Section 3 involves estimating a probit model of program participation. For two-parent households, I present the marginal effects at the mean in 10. For single parent households, a comparable set of covariates

Table 10: Probit Estimates: Marginal Effects at the Mean

	$\Pr(D = 1 \mid X)$	
HH Poverty Index	0.375*	(0.16)
(HH Poverty Index)^2	-0.129***	(0.04)
Household size	0.0617	(0.06)
Number of children, 0-5	0.0453	(0.07)
Number of children, 6-12	-0.106	(0.11)
Number of children, 13-15	-0.0999	(0.10)
Number of children, 16-20	-0.231*	(0.11)
(Number of children in school)^2	-0.0188	(0.01)
Number of children in school, 6-12	0.256*	(0.10)
Number of children in school, 13-15	0.236*	(0.11)
Number of children in school, 16-20	0.369**	(0.14)
Female head	0.243**	(0.09)
Wants children to get more education	0.0194	(0.18)
Number of rooms	-0.0602	(0.04)
Floors made of dirt	0.160**	(0.05)
Walls made of weak material	0.208***	(0.05)
Gas stove ownership	-0.125	(0.11)
Refrigerator ownership	-0.0203	(0.06)
Has had loans	0.105*	(0.05)
Has had savings	0.0765	(0.10)
Local incidence of poverty	0.0311**	(0.01)
(Local incidence of poverty)^2	-0.000216	(0.00)
Tortilla subsidy	0.269***	(0.07)
Milk subsidy	-0.0885	(0.08)
Breakfast subsidy	-0.0590	(0.07)
Employed in 2001, mother	-0.0797	(0.06)
Employed in 2000, mother	0.0410	(0.07)
Employed in 1999, mother	0.0654	(0.06)
Employed in 2001, father	0.0702	(0.18)
Employed in 2000, father	-0.171	(0.18)
Employed in 1999, father	-0.0794	(0.16)
Completed years of education, mother	-0.0150	(0.01)
Completed years of education, father	-0.0309*	(0.01)
Age, mother	-0.00978	(0.01)
Age, father	0.00663	(0.00)
N	629	

Standard errors in parentheses

are used to estimate the model, yielding the marginal effects at the mean presented in Table 11. The distributions of the predicted propensity scores are presented 9.

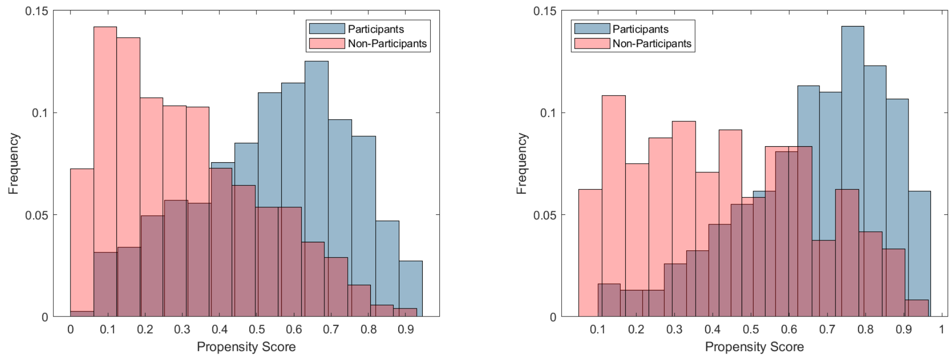
Table 11: Probit Estimates: Marginal Effects at the Mean

	$\Pr(D=1\|X)$	
HH Poverty Index	0.0500	(0.15)
(HH Poverty Index)^2	-0.0376	(0.04)
Household size	-0.0773	(0.05)
Number of children, 0-5	0.205**	(0.06)
Number of children, 6-12	0.0893	(0.08)
Number of children, 13-15	0.0520	(0.09)
Number of children, 16-20	0.0724	(0.08)
(Number of children in school)^2	-0.00265	(0.01)
Number of children in school, 6-12	0.107	(0.07)
Number of children in school, 13-15	0.0974	(0.09)
Number of children in school, 16-20	0.0352	(0.11)
Wants children to get more education	0.0519	(0.12)
Number of rooms	-0.169***	(0.04)
Floors made of dirt	0.153**	(0.06)
Walls made of weak material	0.137*	(0.05)
Refrigerator ownership	-0.00573	(0.07)
Gas stove ownership	-0.208	(0.12)
Has had loans	0.0918	(0.06)
Has had savings	0.0460	(0.12)
Local incidence of poverty	0.0571***	(0.01)
(Local incidence of poverty)^2	-0.000524***	(0.00)
Tortilla subsidy	0.271***	(0.07)
Milk subsidy	0.0595	(0.09)
Breakfast subsidy	-0.00791	(0.08)
Employed in 2001	0.0712	(0.08)
Employed in 2000	0.0181	(0.08)
Employed in 1999	-0.0363	(0.06)
Age	0.00800*	(0.00)
Completed years of education	-0.0202	(0.01)
N	650	

Standard errors in parentheses

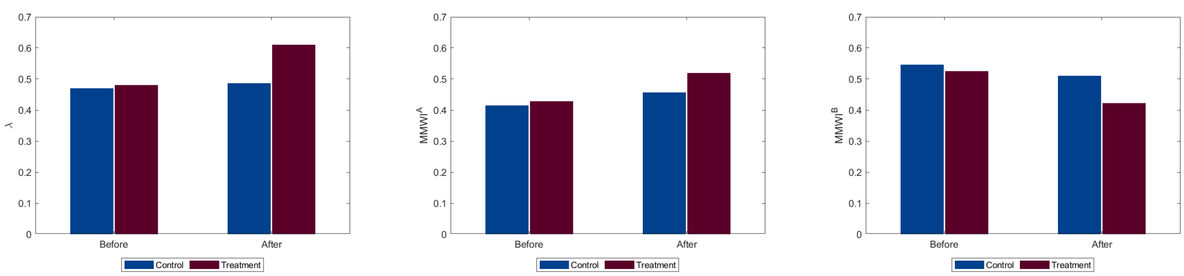
C.2 Graphs: Bargaining Power and Individual Welfare Measures

Figure 9: Propensity Score Distribution by Type of Household

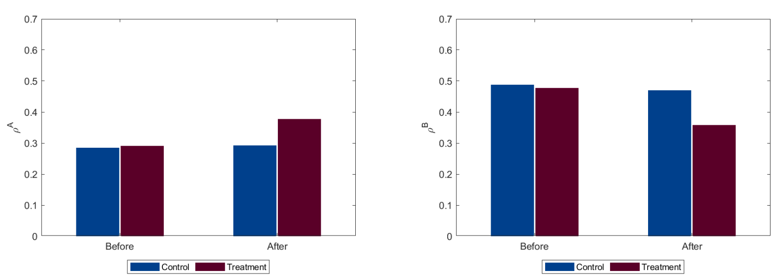


Two-Parent Single-Parent

Figure 10: Overall Impact of *Oportunidades* on Intrahousehold Bargaining Power and Individual Welfare



Pareto Weight MMWI, Wife MMWI, Husband



Sharing Rule, Wife Sharing Rule, Husband