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

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Abstract

This paper exploits the exogenous variation of Mexico's *Oportunidades* conditional cash transfer program on urban households' time and consumption allocations to identify and structurally estimate a collective labor supply model with home production. I use my structural estimates to show that participation in *Oportunidades* increased maternal intrahousehold bargaining power by almost 13%, which is associated with an increase of approximately 14% in the production of a child-related public good in dual-earner beneficiary households. Counterfactual exercises show that *Oportunidades* is as effective as alternative cash transfer programs and wage subsidies at increasing mothers' bargaining power, control over household monetary resources, and domestic output.

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

JEL Classification: D13, I32, J16, J22

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1 Introduction

Placing monetary resources in the hands of a specific household member significantly affects the way in which those resources will be ultimately spent. Substantial empirical evidence shows that targeting monetary resources to women tend to generate household allocations that are more favorable to children (Duflo (2003), Duflo and Udry (2004), Doss (2013), Armand et al. (2020)). Considering that an increasing number of policies tend to place monetary benefits in the hands of women, disentangling the extent to which observed household responses to these gender-targeted policies are driven by changes in intrahousehold decision-making and are not only the byproduct of income and substitution effects generated by their eligibility criteria and benefits scheme can yield valuable insights regarding the optimal design of social welfare programs and taxation policies.

The aforementioned evidence has constituted a systematic rejection of the standard unitary model of the household.[1] Alternatively, non-unitary models posit that household decisions reflect its members' individual preferences and relative decision-making power. Specifically, the collective model (Chiappori (1988), Apps and Rees (1988), Chiappori (1992)) formalizes the decision-making structure of the household through the concept of the Pareto weight. The model assumes that households behave as if they maximized a weighted sum of its decision-makers' individual utilities, with the Pareto weight being the relative weight attached to an individual's set of preferences.[2] Therefore, this framework is suitable for studying how gender-targeted benefits af-

[1]The unitary model characterizes household behavior as stemming from the maximization of a common utility function, implying that a common set of preferences supersedes household members' individual preferences. A main implication of this framework is that the identity of the recipient of a monetary benefit is irrelevant for decision-making purposes since resources are pooled at the household level.

[2]The model's core assumption is that household outcomes are Pareto efficient. 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* beneficiary households in Mexico, thus providing evidence in favor of collective rationality in this paper's relevant context.

fect household time and consumption allocations by altering the intrahousehold distribution of decision-making power and income.

This paper combines the structural estimation of a collective labor supply model that accounts for home production with a causal reduced-form analysis to quantify the impact of Mexico's *Oportunidades* conditional cash transfer (CCT) program (formerly *Progresa*) on mothers' Pareto weight, intra-household income inequality and investments in children in urban two-parent households. An important feature of the estimated model is that it follows the framework developed in Blundell, Chiappori and Meghir (2005) by considering both time and consumption allocation decisions where time is allocated not only to market work and leisure but also to home production, while also extending the model to account for the endogenous decision of parents regarding the time allocation of children. Within my context, home production plays a crucial role given that domestic output serves as a proxy for the production of child quality by taking both time and monetary investments in children as inputs of production. My causal reduced-form analysis showing that mothers' home production and leisure hours respond strongly to *Oportunidades* provide further motivation for the inclusion of home production.

In providing an empirical application and extension of the Blundell, Chiappori and Meghir (2005) with home production for the ex-ante and ex-post evaluation of a social assistance program like *Oportunidades*, I complement two main strands of the relevant literature. On the one hand, my structural estimation approach builds upon existing literature that uses structural models for policy evaluation. In this way, the paper departs from existing work relating the evaluation of policies like *Oportunidades* by focusing on using the program as a rich source of identifying variation to disentangle the role of intrahousehold decision-making and income inequality in generating the documented effects of the program on household consumption and on children's outcomes.[3] This

[3]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

paper also departs from existing studies in the literature that have used policies like CCTs for ex-ante policy evaluation (Todd and Wolpin (2006), Attanasio, Meghir and Santiago (2012)) by exploring the extent to which intrahousehold gender gaps can be used as policy levers to induce responses aligned with key policy objectives.

By studying the effects of gender-targeted policies through the lens of a collective household model that features both time and consumption, my approach differs from existing collective model applications that have assessed the impact of *Progresa/Oportunidades* on female empowerment through a consumption-based characterization of the model that does not consider the time allocation decisions made by individuals (Tommasi and Wolf (2016), Tommasi (2019), Sokullu and Valente (2021)).[4] This distinction allows me to fully exploit the richness of the information obtained in the *Oportunidades* evaluation survey regarding the allocation of consumption to multiple types of consumption and of time to market work, home production, and leisure.[5] Moreover, the implementation of my analysis through this approach also allows me to derive individual welfare measures that fully capture economies of scale not only in consumption but also in production generated by living in collectivity in a way that is attuned to the arguments raised by Apps and

that participation in *Progresa* improved mothers' reported bargaining position.

[4]Dunbar, Lewbel and Pendakur (2013) (DLP hereafter) proposed a consumption-based characterization of the collective household model focusing on children that differs from the characterization of the model adopted in this paper by focusing only on the intra-household allocation of expenditures. The DLP framework has been central in the application of the collective household model within the context of developing countries as it requires information on household expenditures on clothing which tends to be available in numerous expenditures services and does not impose considerable data requirements regarding the availability of information on time spent on several time use categories (see Calvi (2020), Tommasi (2019), Calvi et al. (2023)) and it has been validated by Bargain, Lacroix and Tiberti (2022) and eased in implementation by Lechene, Pendakur and Wolf (2022).

[5]Within my context, where expenditures on all observable clothing items constitute less than 2% of total expenditures incurred by households included in my the urban evaluation sample, the implementation of a consumption-based collective model that often leverages variation in clothing expenditures could easily run into problems of weak identification faced by this type of structural models that have been raised by Tommasi and Wolf (2018).

Rees (1996) and Chiappori (1997).

Unfortunately, empirical applications of the model featuring both time and consumption allocations in which the Pareto weight is structurally estimated remain relatively scarce, especially when focusing on the context of developing countries. In general, these papers often rely on highly detailed survey data containing time use and consumption information, both reported at the individual level and are predominantly focused on developed countries.[6] Instead, the identification results I present allow me to (non-parametrically) recover the household's production technology, parental preferences, and the Pareto weight when observing the allocation of time at the individual level but only having household-level information on consumption. I, thus, propose an approach for estimating this class of models within the context of developing countries, which often face considerable data limitations that tend to thwart applications of this model but feature rich policy variation like the one I leverage here.

My approach relies on two sources of heterogeneity in the impact of *Oportunidades* on parent's time use that allows my estimation strategy to rely less on assumptions relating the similarity of parental preferences across household structure and more on these causal effects. The first source exploits the role of the wife's share of non-labor income as a distribution factor, capturing shifts in the decision-making process of beneficiary households generated by the program's gender-based targeting.[7] The second source exploits the substitution effect generated by the program as its education-related transfers alter the opportunity cost of school-aged children's time spent at home. I find that these two sources of heterogeneous effects on parental time allocation are crucial in the identification of the Pareto weight. In this way, the complexity of the benefits and requirement

[6] 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 to identify the Pareto weight.

[7] Distribution factors are variables affecting household allocations only through their impact on the Pareto weight while leaving preferences and the budget constraint unchanged.

schemes of development policies like *Oportunidades* can serve as a valuable source of exogenous variation for identification purposes.

Using my structural estimates for the Pareto weight, I show that participation in *Oportunidades* increased mothers' bargaining power by almost 13% within beneficiary households with two working parents.[8] 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 effects of the rural implementation of *Progresa/Oportunidades*, this is mixed with no consistent evidence of a link between monetary benefits targeted to women and improvements in their decision-making power, potentially explained by the challenges presented in Adato et al. (2000) relating the measurement of intrahousehold decision-making.

For instance, Rubalcava, Teruel and Thomas (2009) find that *Progresa* increases the amount of resources allocated to consumption and investments associated with women, suggesting a shift in their bargaining power. More recently, Tommasi (2019) finds that the program increased women's resource share, commonly used as a measure of bargaining power within a consumption-based collective framework, by almost 12%, with the results of Sokullu and Valente (2021) indicating a more modest increase in women's consumption that could be rationalized either by their resource shares either being unresponsive to the cash transfer or negatively affected by it. 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

[8]While my analysis restricts the evaluation to two-working parent households as it requires observing the price of parental time (namely, wages), I adopt a similar semi-structural approach as the one in Chiappori, Meghir and Okuyama (2024) by estimating wages for non-working mothers outside the model using a Heckman two-step procedure. I find that extending my estimation sample following this approach yields similar results. Nonetheless, an ideal approach to deal with the non-participation decision would involve endogenizing it within the model, which would pose significant identification challenges.

women's bargaining power and targeted benefits within a framework that rationalizes both time and consumption responses to these policies.

I consider alternative designs of cash transfer programs in terms of their targeting strategies, as well as changes in other sources of income, such as wages. I find that *Oportunidades* is as effective as alternative cash transfer programs and wage subsidies at empowering mothers, improving their control of monetary resources, and increasing the domestic production of the public good associated with children. As expected, monetary resources targeted to fathers have a contrasting impact on mothers' bargaining power and on the intrahousehold allocation of monetary resources. I also assess the extent to which the targeting strategy of the program could be improved by measuring poverty in a way that is in line with recent literature 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)). I find that upon accounting for the unequal sharing of resources within the household by computing individual poverty rates using the money metric index of individual welfare I develop from extending the index proposed by Chiappori and Meghir (2015), I find that almost 54% of mothers living in two-parent non-poor households are individually poor. I further show that targeting a cash transfer to these mothers improves yields similar effects on intrahousehold inequality as those documented among poor households.

The remainder of the paper is organized as follows. Section 2 describes Mexico's *Oportunidades* program and its evaluation data. Section 3 describes the theoretical framework used to analyze the behavior of two-parent and single-parent households with children. Section 4 describes the identification and estimation strategy implemented. Section 5 describes the analysis of intrahousehold bargaining power and individual welfare used to evaluate the program's effect on beneficiary households' decision-making structure and individual welfare and conducts the counterfactual exercises used to explore alternative policy designs. Section 6 concludes.

2 *Oportunidades*: Data and Evaluation

I exploit the quasi-exogenous variation induced by the 2002 urban expansion of *Progresa* to semi-urban and urban areas. The program intervenes simultaneously in the three focal areas of education, nutrition and health. The benefits and conditionalities scheme of the program provides two main channels through which the program can affect consumption patterns and parental time allocation within beneficiary households. First, the program's gender-based targeting strategy under which once households are deemed eligible, the program administration assigns female household heads as transfer holders; thereby, altering women's contribution to total household non-labor income and, potentially, her say in the decision-making process within the household. Second, 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, could potentially affect the amount of time and money households devote to children's human capital accumulation.

2.1 *Oportunidades*' Urban Evaluation Survey

This paper uses a novel mix of survey and administrative data collected from the urban implementation of *Oportunidades*. I obtain the survey data from the 2002-2004 waves of the program's sociodemographic module of the Urban Evaluation Survey, ENCELURB (PROSPERA (2018)), yielding a short panel of *Oportunidades*' beneficiary and non-beneficiary households. The survey contains rich information on household structure, income and consumption patterns in addition to individual information on labor supply, education, and time use. The availability of individual time use information motivates this paper's focus in the program's urban implementation. 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.

I combine information on households' eligibility with administrative records on the bi-monthly transfers made to households that have been incorporated into the program to construct the program participation indicator. Importantly, the data is detailed enough to distinguish between the educational and non-educational components of the disbursements. This allows me to use the non-educational component of the transfer to construct the wife's share of non-labor income affected by participation in *Oportunidades* and using the educational component as part of the price of keeping school-aged children at home, 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 4.4 is further discussed in the Online Appendix.

2.2 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. I conduct a causal analysis that addresses the potential selection into treatment by explicitly modeling the participation decision using a matching difference-in-differences strategy (MDID), thereby implementing the following longitudinal estimator presented in Blundell and Dias (2009)

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

where N_1 denotes the number of treated households in the common support region. Throughout the analysis, I leverage the design of the program to define two potential comparison groups: (i) units in intervention zones, are eligible and do not sign up for the program and (ii) units in non-intervention zones that are eligible to the program. Following Behrman et al. (2012), I use group (i) to estimate the choice of program participation and, thus, to estimate the propensity to sign up for the program if it would have been available to those in group (i), but use (ii) as the control group

in the difference-in-differences strategy. 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 using their propensity to participate in the program, captured by $\tilde{\omega}_{ij}$.

I implement the estimator in two stages. The first stage involves the computation of the propensity score, $P(X)$, at the household level using a probit model. I present further details on the estimation of the propensity scores in Section F of the Online Appendix. I use a kernel-based algorithm to generate the weights $\tilde{\omega}_{ij}$ which serve to construct the counterfactual for each participant household using information obtained from non-participant households. The second stage consists on estimating a DID regression over the matched sample of households:

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

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

2.3 Estimation Sample and Program Evaluation

Estimation Sample. 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, it serves as a sample for estimation that has all the components of the model described in Section 3. 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 framework involving both discrete and continuous choices. As mentioned in 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 3 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 4.4. Table 1 presents relevant descriptive statistics for the sample of households used in the estimation of the model.[9]

***Oportunidades*' Impact on Time Use and Consumption.** I proceed to investigate the extent to which the *Oportunidades* program affected the allocation of time within two-parent households and of single mothers.[10] Panel (a) in Table 2 presents the overall impact of the program on the intrahousehold time allocation and public expenditures of two-parent households. The results show that 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 program significantly increased yearly public expenditures in participant two-parent households relative to non-participants.[11]

Panel (b) in Table 2 presents the estimates of the program's impact on the allocation of time and consumption related to children in single-mother households. 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 yields a statistically insignificant decrease in leisure hours. In contrast with two-parent households, participation in the program significantly decreases single-mother households' child-related expenditures.

The heterogeneous impact of the program on mothers' time allocation by household structure

[9]For time allocation, the table distinguishes between time spent in home production and time spent in child care. In the estimation described in subsection 4.4, I consolidate these two time use categories into a single measure of home production, thereby capturing these two dimensions of housework.

[10]I do not implement this causal analysis among single-father households since less than 5% of them report participating in the program, inline with the program's targeting strategy prioritizing mothers.

[11]I provide evidence of a similar impact of the program within two-parent households in which mothers are not working in the market. The results are included in the Online Appendix.

can be rationalized within the framework presented in Section 3. While a pure income effect of the cash transfer would imply an increase in mothers' leisure hours, differences in the intrahousehold allocation of leisure – or private consumption, broadly speaking – across household types implies that potential substitution effects triggered by the program could reflect the extent to which mothers in two-parent households benefit from economies of scale in the production and consumption of the public good.

3 Model Setup

In this section, I describe a labor supply model with home production that considers the behavior of both single-parent and two-parent households. Through the lens of this framework, I quantify the response of two-parent households' bargaining structure to the receipt of the *Oportunidades* cash transfer using the contrasting impact of the program on household consumption and time allocations between single-parent and two-parent households as both a motivation and source of identification and validation.

Mothers and fathers are indexed by $i = A$ and $i = B$, respectively. Within each household, parents decide how to allocate their total time endowment $\bar{T}$ in leisure activities (l^i), in home production activities (h_D^i) and in market work (h_M^i). Parents have preferences, described by the utility function in (2), over their own leisure and private market consumption (l^i, q^i) and a good Q that is publicly consumed within the household and domestically produced using parental time h_D^i, children's time at home h_D^C, and market purchases q^D. Parental utility functions are strictly concave, twice continuously differentiable and strictly increasing in (l^i, q^i, Q). I introduce observed preference heterogeneity through the inclusion of a set of taste shifters, $\mathbf{X}^i$, which include parents' age, completed years of education and the number of children in the household as in Cherchye, De Rock and Vermeulen (2012) and Lise and Yamada (2019).

Parents also decide how to allocate their children's time to school h_S^C, market work h_M^C, and

home h_D^C. I assume that the production function of both types of households are twice continuously differentiable, and strictly increasing and concave on all production inputs. Furthermore, following related literature, I allow for the production technology of the household to be affected by a production shifter, here being the number of children younger than 5 living in the household.

I introduce the exogenous variation of the *Oportunidades* cash transfer through two main channels. First, by letting non-labor income be a function of the size of the non-educational component of the transfer received from the program, $y^i = y_C^i + dy_{CCT}$, where d is an indicator of program participation, y_C^i denotes non-labor income in the case of non-participation and y_{CCT} denotes the cash transfer amount assigned. Second, I allow for the relative price of keeping children at home (p^C) to be a function of (i) the wage a school-aged child could earn in the labor market, and (ii) the educational component of the transfers received from *Oportunidades*.

3.1 Single-Parent Households

The model allows for the domestic production technology to differ by gender as the domestic good Q is assumed to be produced using the technology described by $Q = F_Q^{s,i}$. Thus, the behavior of single-parent households can be described as the solution to

$$\max_{l^i, h_D^i, q^i, q^D} U^i(l^i, q^i, Q; \mathbf{X}^i) \tag{2}$$

$$\text{s.t. } q^i + q^D + p^C h_D^C = y^i + w^i h_M^i;\ \ y^i = y_C^i + dy_{CCT};\ \ p^C = w^C + d_i(edu\_transfer_i)$$
$$Q = F_Q^{s,i}(h_D^i, h_D^C, q^D; \mathbf{S});\ \ \bar{T} = h_D^C + h_M^C + h_S^C;\ \ l^i + h_M^i + h_D^i = \bar{T}$$

In this case, the optimality conditions governing household behavior are

$$\frac{\partial U^i/\partial l^i}{\partial U^i/\partial q^i} = w^i;\ \ \frac{\partial F_Q^{s,i}}{\partial h_D^i}\frac{\partial U^i}{\partial Q} = \frac{\partial U^i}{\partial l^i};\ \ \frac{\partial F_Q^{s,i}}{\partial q^D}\frac{\partial U^i}{\partial Q} = \frac{\partial U^i}{\partial q^i};\ \ \frac{\partial F_Q^{s,i}/\partial h_D^i}{\partial F_Q^{s,i}/\partial q^D} = w^i \tag{3}$$

3.2 Two-Parent Households

In two-parent households, as in Blundell, Chiappori and Meghir (2005), I assume that children have no bargaining power of their own, but are rather accounted for in the production of the public good Q. Within these households, Q is domestically produced using the production technology F_Q^M. I introduce the exogenous variation of the *Oportunidades* cash transfer into this household type's economic environment by assigning the cash transfer amount, y_{CCT}, to the wife's non-labor income if the household is participating in the program. Under the assumption of Pareto efficient household outcomes, household behavior can be described as the solution to

$$\max_{l^A,l^B,h_D^A,h_D^B,h_D^C,q^A,q^B,q^D} \lambda(w^A,w^B,y,\mathbf{z})U^A(l^A,q^A,Q;\mathbf{X}^A)+(1-\lambda(w^A,w^B,y,\mathbf{z}))U^B(l^B,q^B,Q;\mathbf{X}^B) \tag{4}$$

$$\text{s.t.} \quad q^A+q^B+q^D+p^Ch_D^C=y^A+y^B+w^Ah_M^A+w^Bh_M^B;\;\; Q=F_Q^M(h_D^A,h_D^B,h_D^C,q^D;\mathbf{S})$$

$$\bar{T}=l^i+h_M^i+h_D^i;\;\; \bar{T}=h_D^C+h_M^C+h_S^C;\;\; y^A=y_C^A+dy_{CCT};\;\; y^A=z^Ay\;\; p^C=w^C+d_i(edu\_transfer_i)$$

The Pareto weight is a differentiable and zero-homogeneous function on $(w^A,w^B,y,\mathbf{z})$. Importantly, the collective framework highlights the importance of the variables including in the vector $\mathbf{z}$, called distribution factors as it includes those that trace movements along the Pareto frontier. Specifically, distribution factors allow for exogenous factors to affect household behavior only through their effect on the decision-making process.[12] The results in Browning and Chiappori (1998) and Chiappori and Ekeland (2009) highlight the role of the vector of distribution factors, $\mathbf{z}$, in identifying the model since they serve as exclusion restrictions needed to separately identify individual preferences from the Pareto weight by generating shifts in intrahousehold behavior only through changes in the Pareto weight while leaving preferences unaltered.

In the estimation of the model, I allow for the *Oportunidades* program to serve as an exogenous

[12] 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.

source of identifying variation through changes induced by the program on mothers' share of non-labor income, z^A, a common distribution factor used in the literature. I break down z^A into a non-CCT component and a CCT-specific component:

$$z^A = \frac{y^A}{y^A + y^B} = \frac{y_0^A + d_{it} y_{CCT}}{y^A + y^B} = \frac{y_0^A}{y^A + y^B} + d_{it} \frac{y_{CCT}}{y^A + y^B} = z_0^A + d_{it} z_1^A \tag{5}$$

Thus, z_0^A captures the baseline effect of mothers' share of non-labor income on the Pareto weight, while z_1^A captures the effect of *Oportunidades* on mothers' bargaining power through the change induced in mothers' contribution to non-labor income within beneficiary households.

At an interior solution to (4), I derive three sets of optimality conditions that govern the intra-household allocation of time and consumption. The first set relates to productive efficiency

$$\frac{\partial F_Q^M / \partial h_D^A}{\partial F_Q^M / \partial h_D^B} = \frac{w^A}{w^B}; \;\; \frac{\partial F_Q^M / \partial h_D^i}{\partial F_Q^M / \partial q^D} = w^A; \;\; \frac{\partial F_Q^M / \partial h_D^C}{\partial F_Q^M / \partial q^D} = p^C; \;\; \frac{\partial F_Q^M / \partial h_D^i}{\partial F_Q^M / \partial h_D^C} = \frac{w^i}{p^C} \tag{6}$$

The second set relates to the spouses' private consumption of leisure and a market good,

$$\frac{\partial U^A / \partial l^A}{\partial U^A / \partial q^A} = w^A; \;\; \frac{\partial U^B / \partial l^B}{\partial U^B / \partial q^B} = w^B; \;\; \frac{\partial U^A / \partial l^A}{\partial U^B / \partial l^B} = \frac{w^A}{w^B} \frac{1-\lambda}{\lambda}; \;\; \frac{\partial U^A / \partial q^A}{\partial U^B / \partial q^B} = \frac{1-\lambda}{\lambda} \tag{7}$$

Lastly, the third set relates to the spouses' public consumption.

$$\frac{\partial F_Q^M}{\partial h_D^A} \left[\lambda \frac{\partial U^A}{\partial Q} + (1-\lambda) \frac{\partial U^B}{\partial Q} \right] = \lambda \frac{\partial U^A}{\partial l^A}; \;\; \frac{\partial F_Q^M}{\partial h_D^B} \left[\lambda \frac{\partial U^A}{\partial Q} + (1-\lambda) \frac{\partial U^B}{\partial Q} \right] = (1-\lambda) \frac{\partial U^B}{\partial l^B} \tag{8}$$

$$\frac{\partial F_Q^M}{\partial h_D^C} \left[\lambda \frac{\partial U^A}{\partial Q} + (1-\lambda) \frac{\partial U^B}{\partial Q} \right] = \frac{p^C}{w^A} \lambda \frac{\partial U^A}{\partial l^A} = \frac{p^C}{w^B} (1-\lambda) \frac{\partial U^B}{\partial l^B} \tag{9}$$

$$\frac{\partial F_Q^M}{\partial q^D} \left[\lambda \frac{\partial U^A}{\partial Q} + (1-\lambda) \frac{\partial U^B}{\partial Q} \right] = \lambda \frac{\partial U^A}{\partial q^A} (1-\lambda) \frac{\partial U^B}{\partial q^B} \tag{10}$$

The partitioning of these optimality conditions into three groups feeds directly into the identification strategy adopted in Section 4.1. Since the optimality conditions related to productive efficiency do not involve individual preferences or the Pareto weight, identification of the produc-

tion 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 the household's marginal rates of substitution of private for public consumption and the marginal rates of substitution of spouses' private consumption of leisure and market goods.

4 Identification and Estimation

This section describes the identification and structural estimation procedure of the model presented in Section 3. While the model is parametrically estimated, I explore the non-parametric identification of parental preferences, the production technology of both household types and the Pareto weight, which fully characterizes the decision-making structure of two-parent households.

4.1 Identification

Proposition 1. (Identification of Single-Parent Households' Production Technology).
Let (h_D^i, h_D^C, q^D) *be observed functions of* $(w^i, p^C, y^i, \boldsymbol{S})$ *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,* $F_Q^{S,i}(h_D^i, h_D^C, q^D, \boldsymbol{s})$ *is identified up to a strictly monotone (thus, invertible) transformation* G_S *so that* $F_Q^{S,i}(h_D^i, h_D^C, q^D, \boldsymbol{s}) = G_S^{-1}[\bar{F}_Q^{S,i}(h_D^i, h_D^C, q^D; \boldsymbol{s})]$.

Proof: See C.1 in Appendix C.

This follows from the identification result presented in Blundell, Chiappori and Meghir (2005). Intuitively, the optimality conditions derived from productive efficiency in (3) provide a direct relationship between the marginal rates of technical substitution of the three inputs of production, h_D^i, h_D^C, and q^D and their respective prices w^i and p^C for $i = (A, B)$. By exploiting the observability of these inputs of production and their reduced-form relationship with wages and the continuous differentiability of the production function, $F_Q^{S,i}$, additional conditions can be derived to separately

identify the marginal productivity of each input, which can then be integrated to recover $F_Q^{S,i}$ up to an increasing transformation.

Proposition 2. (Identification of Two-Parent Households' Production Technology).
Let $(h_D^A, h_D^B, h_D^C, q^D)$ *be observed functions of* $(w^A, w^B, p^C, y, \boldsymbol{S}, \boldsymbol{z})$ *for two-parent households. The production function for two-parent households,* $F_Q^M(h_D^A, h_D^B, h_D^C, q^D, \boldsymbol{s})$ *is identified up to a strictly monotone (thus, invertible) transformation* G_M *so that* $F_Q^M(h_D^A, h_D^B, h_D^C, q^D, \boldsymbol{s}) = G_M^{-1}[\bar{F}_Q^M(h_D^A, h_D^B, h_D^C, q^D; \boldsymbol{s})]$.

Proof: See C.1 in Appendix C.

This follows a similar intuition to the one followed in the proof of Proposition 1. The identification result stems from a straightforward extension of the identification singles' production technology to include one more input of production (since we have the time input of both parents) for which we observe its price (i.e. the wage rate of both parents).

Proposition 3. (Identification of Individual Preferences and the Pareto Weight).
Let l^i *be an observed function of* $(w^i, p^C, y^i, \boldsymbol{S})$ *for* $i = (A, B)$ *for single-parent households and let* (l^A, l^B) *be observed functions of* $(w^A, w^B, p^C, y, \boldsymbol{S}, \boldsymbol{z})$ *for two-parent households. The Pareto weight and parental preferences are identified, if (1) the Pareto weight is responsive to changes in the distribution factor* z^A*, (2) married mothers' time allocation is responsive to exogenous changes in a distribution such as* z^A*, ultimately translating into changes in the intra-household allocation of leisure, and (3) parental time allocation is responsive to changes in* p^C.

Proof: See C.2 in Appendix C.

Once the production technology of the household has been identified, the intuition behind the identification result presented in this proposition is based on the role of leisure as an exclusive good (Chiappori and Ekeland, 2009). Specifically, the optimality conditions of the model shows that the allocation of leisure and housework hours between spouses in two-parent households is governed by their bargaining power, preferences, and domestic production technology; the latter having been

separately identified from the productivity conditions in Proposition 2. It is then possible to map these optimality conditions to the observed responses of parental time allocation to participation in *Oportunidades* as a way to separately identify the Pareto weight from preferences and labor market returns.

On one hand, capturing the heterogeneous responses of the intrahousehold allocation of leisure hours between spouses as we vary the size of the non-educational component of the *Oportunidades* cash transfer which affects mothers' share of non-labor income (z_1^A), I can trace changes in the Pareto weight, allowing us to pin it down using this quasi-experimental variation. On the other hand, capturing the heterogeneous responses of the intrahousehold allocation of time (both in terms of leisure and home production) between spouses as I vary the size of the educational component of the *Oportunidades* cash transfer, I pin down how the program affects the household's factor demands of production as it alters the price of one of the inputs (school-aged children at home).

4.2 Parametrization

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 in Appendix D.

Preferences. I assume that preferences are strongly separable on leisure, private consumption and the public domestic good, allowing for an additively separable representation. I let each sub-utility be 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 $\alpha_1^i(\mathbf{X}^i) = \frac{\exp(\alpha_1^{i'}\mathbf{X}^i)}{1+\exp(\alpha_1^{i'}\mathbf{X}^i)+\exp(\alpha_2^{i'}\mathbf{X}^i)}$, $\alpha_2^i(\mathbf{X}^i) = \frac{\exp(\alpha_2^{i'}\mathbf{X}^i)}{1+\exp(\alpha_1^{i'}\mathbf{X}^i)+\exp(\alpha_2^{i'}\mathbf{X}^i)}$, and $\mathbf{X}^i$ 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.

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

$$F_Q^M(h_D^A, h_D^B, h_D^C, q^D; \mathbf{S}) = [\psi^A(\mathbf{S})(h_D^A)^\gamma + \psi^B(\mathbf{S})(h_D^B)^\gamma + (1 - \psi^A(\mathbf{S}) - \psi^B(\mathbf{S}))(h_D^C)^\gamma]^{\frac{\rho_M}{\gamma}}(q^D)^{1-\rho_M}$$

For households headed by a single parent, I assume that the production function can be characterized by a similar nested CES technology:

$$F_Q^{S,i}(h_D^i, , h_D^C, q^D; \mathbf{S}) = [\phi^i(\mathbf{S})(h_D^i)^{\beta^i} + (1 - \phi^i(\mathbf{S}))(h_D^C)^{\beta^i}]^{\frac{\rho_S^i}{\beta^i}}(q^D)^{1-\rho_S^i} \text{ for } i = (A, B)$$

To distinguish between single men and women, I estimate this separately for single mothers and for single fathers to allow ϕ^i and β^i to vary by gender.

For both types of households, I let $\mathbf{S}$ denote a vector of production shifters including a constant and the number of children younger than 5 living in the household. Furthermore, as in Lise and Yamada (2019), I let $\rho_M, \rho_S^A, \rho_S^B \in [0, 1]$, $\gamma, \beta^A, \beta^B \leq 1$.

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

$$\lambda(w^A, w^B, y, \mathbf{z}) = \frac{\exp(\lambda_0 + \lambda_1(w^A/w^B) + \lambda_2 z_0^A + \lambda_3 z_1^A + \lambda_4 z_s)}{1 + \exp(\lambda_0 + \lambda_1(w^A/w^B) + \lambda_2 z_0^A + \lambda_3 z_1^A + \lambda_4 z_s)}$$

where I will denote $\lambda(w^A, w^B, y, \mathbf{z})$ 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 are in $\mathbf{z}$. As mentioned in Section 3, I use the CCT-related and non-CCT related wife's share of non-labor income, z_1^A and z_0^A, respectively as distribution factors. I also use state-level, age-specific sex ratios as additional distribution factors as a way to benchmark their role to .

4.3 Estimating Equations

The estimating equations used in the method of moments estimator can be broken down into two sets, one relating the theoretical conditions – or moments – implied by the first-order conditions derived from the model presented in Section 3; the other set involves approximating the intrahousehold responses to participation in the *Oportunidades* program.

Model's First-Order Conditions. There is a natural partition within the model's first-order conditions that feeds into the two-step nature of the identification analysis. (i) On one hand, I obtain the moment conditions for the estimation of the production technology using the optimality conditions relating to productive efficiency, captured in the last three conditions presented in (3) for single-parent households and in (6) for two-parent households. (ii) On the other hand, the second step of the identification involves the optimality conditions relating the marginal rates of substitution of private and public consumption. Thus, for this stage, I derive these moments from the first condition presented in (3) and for the conditions presented in (7) and (10). I present the parametric form of these conditions in Section B.1 of the Online Appendix.

Quasi-Experimental Moments. The non-parametric proof presented in Appendix C shows that two of the conditions necessary for the identification of parental preferences and the Pareto Weight involve capturing the empowerment and substitution effects of the program inferred from the response of parental time to participation in the program. Specifically, the main quasi-experimental moments necessary for identification involve (i) taking the derivative of the marginal rate of substitution of mothers' leisure for fathers' leisure presented in the third condition in (7) with respect to z^A, which captures the empowerment effect of *Oportunidades*; and (ii) the marginal rate of substitution of parental leisure hours for the public good presented in (9) with respect to p^C, which captures the substitution effect of the program. I present the parametric form of these moments in Section B.1 of the Online Appendix.

4.4 Estimation

Step 1. Given the breakdown of the *Oportunidades* cash disbursement into an educational and a non-educational component, to estimate the quasi-experimental moments used in estimation, I estimate these using the MDID framework presented in (1) and exploiting the heterogeneity of the program's effect by the size of its educational and non-educational components

$$y_{it} = \beta_0 + \beta_1 CCT_{it} + \beta_2 d_i + \beta_3 Post_t + \beta_4 (d_i \times Post_t) + \underbrace{\beta_5}_{\approx \Delta^y_{CCT}} (d_i \times Post_t \times CCT_{it}) + \epsilon_{it} \quad (11)$$

where CCT_{it} captures the monetary measure affected by one of the components of the transfer, namely, z^A_{it} or p^C_{it} with respect to which I capture the heterogeneity of the *Oportunidades* effect. Thus, the regression coefficient β_5 is used as an approximation of the quasi-experimental moments relating the derivatives of the corresponding marginal rates of substitution of private and public consumption described in the previous section. Specifically, based on the identification analysis outlined above, the specific moments focus on the effects on parental leisure as well as on all domestic production inputs with respect to z^A and p^C. Given the parametrization of the model, the outcomes y_{it} in this case are ratios involving: $[l^A, l^B, h^A_D, h^B_D, q^D, h^C_D]$.

Step 2. This step consists of implementing a two-step estimator, which closely follows the parametric identification analysis presented in Appendix D. I partition the parameter vector into one set containing only the home production parameters, denoted by θ_1 and another set containing the preference and Pareto weight parameters, denoted by θ_2. In the first stage, Step 2A, I implement the following GMM estimator for the production function of the two types of households considered

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

where $\boldsymbol{\theta}_1 = \boldsymbol{\theta}_1^M = (\rho_M, \gamma, \boldsymbol{\psi}^A, \boldsymbol{\psi}^B)$ for two-parent households, $\boldsymbol{\theta}_1 = \boldsymbol{\theta}_1^{S,A} = (\rho_S^A, \beta^A, \boldsymbol{\phi}^A)$ and $\boldsymbol{\theta}_1 = \boldsymbol{\theta}_1^{S,B} = (\rho_S^B, \beta^B, \boldsymbol{\phi}^B)$ for single-mother and single-father households, respectively. Furthermore, $\mathbf{g}(\cdot)$ contains the orthogonality conditions derived from the productive efficiency first order conditions for single-parent and two-parent households, respectively. In the second stage (Step 2B), I 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 $\hat{\boldsymbol{\theta}}_1 = [\boldsymbol{\theta}_1^M; \boldsymbol{\theta}_1^S] = (\hat{\rho}_M, \hat{\gamma}, \hat{\boldsymbol{\psi}}^A, \hat{\boldsymbol{\psi}}^B, \rho_S^A, \beta^A, \boldsymbol{\phi}^A, \rho_S^B, \beta^B, \boldsymbol{\phi}^B)$ are the estimates obtained in Step 2A. Furthermore, $\mathbf{h}(\cdot)$ contains the orthogonality conditions derived from the optimality conditions derived from the first-order conditions relating the marginal rates of substitution of private and public consumption within both household types, $\boldsymbol{\Delta}$ denotes the vector of quasi-experimental moments to target in this step of the estimation procedure, and $\mathbf{W}_N$ is a symmetric positive definite weighting matrix for which I use an optimal weight matrix.

4.5 Results

Parameter Estimates. Table 3 presents the results obtained from the two-step GMM estimator described above. With respect to parental preferences, I find that mothers, on average, have a lower utility weight on leisure than fathers and that the utility weight attached to private market consumption is slightly higher for mothers than for fathers. I 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, I define the utility weight attached to the public domestic good is as $1 - \alpha_1^i(\mathbf{X}) - \alpha_2^i(\mathbf{X})$ for $(i = A, B)$. I find that mothers do assign a higher utility weight to the consumption of the public good Q. Regarding the Pareto weight, I find that

both relative market returns (w^A/w^B) and women's contribution to total household non-labor income derived from non-CCT income and CCT-related income (z_0^A and z_1^A) significantly increase mothers' bargaining power. Moreover, I find that the sex ratio I use in the estimation (defined as the number of women per men for different age groups) decreases women's bargaining power. In this way, I 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).

Model Fit. Table 4 and Figure 1 present how well the model is able to fit the data moments used in estimation. The model seems to hit the theoretical moments relatively well.[13] The model also does a reasonable job at hitting the quasi-experimental moments needed for identification.

A further test of the model's fit involves checking how well the model is able to replicate the intrahousehold time allocation responses to participation in the program. Panels (b)-(c) in Table 4 presents the equivalent of the reduced-form results presented in Table 2 using the model to simulate parental time and household consumption. The model predicts well the documented effects of *Oportunidades* on parental time allocation, though some of the effects lose statistical significance, potentially attributed to the fact that these are constructed using the parameter estimates.

5 Intrahousehold Inequality and Gendered Policies

Throughout this section, I quantify bargaining power and individual welfare within two-parent households as described in Section 3 using the estimates presented in Section 4.5. To measure individual welfare, I develop an extension of the money metric welfare index (MMWI) proposed by Chiappori and Meghir (2015). The MMWI describes the minimum amount of expenditures an

[13]The model seems to over-predict single fathers' leisure hours and private market consumption. This might be expected given that these households represent a small share (8%) of the estimation sample, so that most of the estimation of fathers' preferences could be driven by the sample of married fathers.

individual would need to incur in order to reach the same level of intrahousehold utility reached in collectivity in the case in which she were to become single, thereby considering how the change in living arrangement will ultimately affect both their private and public consumption.

Since the model features the time allocation of children as a choice variable for the household, it is necessary to adjust the way in which we were defining the minimization problem used to derive the money metric welfare index (MMWI) to account for the fact that the domestic good can take an additional input of production even in the counterfactual environment of singlehood. I then define the MMWI for mothers in the following way

$$MMWI^A = \min_{h_D^A, l^A, q^A, h_D^C, q^D} \Big[w^A l^A + q^A + w^A h_D^A + q^D + p^C h_D^C \Big| \\ u^i(l^i, q^i, Q; \mathbf{X}^i) \geq u^i(l^{i*}, q^{i*}, Q^*; \mathbf{X}^i), Q = F_Q^{S,A}(h_D^A, h_D^C, q^D; \mathbf{S}) \Big] \tag{12}$$

Since in less than 10% of divorce settlements recorded during this period are fathers granted custody (based on statistics from the administrative divorce records), I set the time spent at home for children in the singlehood counterfactual for fathers to 0. Thus, I define their MMWI in the following way

$$MMWI^B = \min_{h_D^B, l^B, q^B, q^D} \Big[w^B l^B + q^B + w^B h_D^B + q^D \Big| \\ u^i(l^i, q^i, Q; \mathbf{X}^i) \geq u^i(l^{i*}, q^{i*}, Q^*; \mathbf{X}^i); Q = F_Q^{S,B}(h_D^B, 0, q^D; \mathbf{S}) \Big] \tag{13}$$

where (l^{i*}, q^{i*}, Q^*) denotes the optimal choices when living in collectivity.

5.1 *Oportunidades* and Intrahousehold Inequality

Using the estimates presented in Table 3, I compute the Pareto weight and MMWI 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. Table 5 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 approximately 13% (of almost 13 percentage points) in mothers' bargaining power which translates into a significant 1% increase in their individual welfare characterized by the MMWI. Fathers' individual welfare increases by almost 0.5% as characterized by their MMWI.

Given the significant empowerment effect documented in favor of mothers, I now investigate whether such empowerment effect is consistent with a higher production of the public good Q. Notably, I find that participation in *Oportunidades* can also be associated with a significant increase of almost 14% in the production of the public good Q, suggesting that by empowering mothers, who tend to have a higher preference for the public good Q, the program effectively increases domestic production by allowing households to substitute parental time investments with monetary investments in children. Given that the public good Q in the model serves as a way to capture investments in children's human capital, 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). Furthermore, part of the reason why the program increases the individual welfare of both parents can be rationalized by the benefits generated by the economies of scale in consumption within the household as the production of the public good increases with participation in the program.

5.2 Counterfactual Policies and Intrahousehold Inequality

I now quantify the impact of counterfactual gender-targeted policies on women's bargaining power, individual welfare, and domestic production to assess the extent to which these exacerbate or mitigate existing patterns of gender inequality within the household. In particular, I consider targeted benefits in the form of cash transfers and wage subsidies. I take the documented *Oportunidades* effects as the benchmark against which I compare these counterfactual policies' effects. Throughout each of these exercises, I 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.

Alternative Cash Transfer Designs. In these counterfactual exercises, we assess how changing the identity of the cash transfer recipient affects different measures of intrahousehold gender inequality. The first change to the targeting strategy involves giving the cash transfer to the father rather than the father. The other change involves randomizing who gets to receive the cash transfer. The first row of Figure 2 shows the results of these exercises. These show that targeting the transfers to fathers generates contrasting effects on the Pareto weight and a slightly negative effect on the production of the public good, but improves fathers' individual welfare significantly more. Furthermore, randomizing the identity of the recipient generates a more modest increase in mothers' Pareto weight. The relatively higher increase in individual welfare of parents can be rationalized by the fact that in this exercise, I compare only the effect of targeting these transfers without generating any increase in p^C which affects the singlehood counterfactual, and thus, the effect on individual welfare.

Wage Subsidies. One of the intrahousehold gender gaps in income that could also be targeted through viable policies involve the provision of wage subsidies to either mothers or fathers. I explore the effect of setting these subsidies at 25% and at 40%.[14] The results of these exercises are presented in the second and third row of Figure 2. When setting the subsidy to 25%, the results show that the Pareto weight increases to 7.57% (which constitutes around 60% of the *Oportunidades* effect). The results show that setting $\tau = 40\%$ yields an effect on the Pareto weight com-

[14]The 40% subsidy serves as a benchmark to a well-known policy, the U.S. Earned Income Tax Credit. I obtain this rate from the EITC parameters provided in https://taxpolicycenter.org/statistics/eitc-parameters, taking the credit rate (as a percent) of the program for 2002 (my baseline year), and for a household with 2 children (considering that the average number of kids per household in my estimation sample is between 2-3 children).

parable to the one generated by *Oportunidades* (11.73% while the effect of *Oportunidades* is of 13.02%). As with the cash transfers, there is a negative effect on the Pareto weight when targeting these subsidies to fathers. Nonetheless, increasing wage subsidies for both parents also increases the production of the public good (though relatively smaller than the *Oportunidades* effect), but the increase is larger when targeted to mothers.

5.3 Targeting Intrahousehold Poverty

I use the MMWI to revisit the original targeting strategy of *Oportunidades*. The motivation for this exercise 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 2 excludes mothers living in non-poor households who could have benefited from participating in the program. I first investigate whether the MMWI can help identify these individually poor mothers. I then assess whether a cash transfer can effectively translate into improvements in these mothers' bargaining position and a higher production of the domestic public good Q.

I start by including non-poor households (as classified by the program administration) in the estimation sample used in the GMM estimator described in Section 4.4. The parameter estimates are presented in Table A.1 in Section E of the Online Appendix. I then use the parameter estimates to compute the MMWI and compare these monetary measures with what would be an individual poverty line below which a parent would be deemed as poor. 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.[15] For fathers, I define their poverty line

[15]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 This agency's poverty line for 2000 was

as the poverty line obtained from the CONEVAL for a 1-person household.

Table 6 presents the individual poverty rates obtained under this poverty line definition. I find that around 54% of mothers in two-parent non-poor households can be classified as individually poor when measuring poverty based on their MMWI respectively.[16] The results highlight a sharp pattern of intrahousehold gender inequality that pervades among non-poor households. This relates to my finding that in at almost 90% of households in which I can categorize only one of the parents as individually poor, such parent is the mother.

Figure 3 presents the percentage changes in the main outcomes of interest associated with targeting a cash transfer constituting 30% of these households' non-labor income to parents living in two-parent non-poor households deemed as poor within the individual poverty analysis here presented.[17] The results show that targeting transfers to individually poor parents in non-poor households yields comparable effects on parents' bargaining power, domestic production, and individual welfare as *Oportunidades*.

While *Oportunidades* has been as effective as alternative cash transfer designs and 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 program misses mothers living in non-poor two-parent households who would benefit from participating in the program.

used to determine the eligibility for *Oportunidades* was originally defined.

[16] 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.

[17] 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.

6 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 4.5, 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.

The analysis here presented could be extended in multiple ways to yield more generalizable results. On one hand, the model would benefit from explicitly modeling women's labor force participation decision. 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). Given the strong effects on different measures of intrahousehold gender inequality, the analysis here developed would also benefit from extending it to a dynamic setting that accounts for (i) endogenous marital dissolution and formation, as evidence presented in Bobonis (2011) indicate that the program's rural implementation had a significant effect on marital turnover, and (ii) savings as Gertler, Martinez and Rubio-Codina (2012) find that the program affected the investment decisions of rural households. Besides involving novel identification results, these extensions 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.

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Tables and Figures

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

	Two Parent		*Single Woman*		*Single Man*	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**
Household Characteristics:						
Household Size	5.13	5.00	3.89	4.00	1.98	1.00
Number of children	3.04	3.00	2.71	3.00	0.93	0.00
Mean Age of Children in Household	8.56	8.50	10.06	10.17	11.61	11.67
Household Consumption:						
Public Expenditures, Yearly	7,133.26	6,262.31	5,389.30	4,757.04	3,314.59	2,567.27
Private Consumption	22,064.96	20,846.34	16,246.73	14,718.75	16,949.58	14,990.40
Food Expenditures	17,838.17	16,484.00	13,478.18	12,246.00	10,412.40	8,840.00
Income						
Total Household Nonlabor Income	7,856.30	4,906.89	7,198.88	3,713.89	4,778.60	1,578.24
Wife's Share	0.29	0.00	.	.	.	.
Total Household Earnings	38,214.11	34,816.91	16,457.04	14,511.20	23,208.37	23,642.79
Parental Characteristics:						
Age, Mother	32.71	32.00	37.92	36.00	.	.
Age, Father	36.32	35.00	.	.	46.79	46.00
Years of Education, Mother	6.22	6.00	5.66	6.00	.	.
Years of Education, Father	6.81	6.00	.	.	5.18	6.00
Market Work Hours, Mother	1,133.43	832.00	1,490.95	1,456.00	.	.
Market Work Hours, Father	2,265.40	2,496.00	.	.	2,146.45	2,366.00
Child Care Hours, Mother	573.71	416.00	380.31	208.00	.	.
Child Care Hours, Father	141.06	0.00	.	.	98.20	0.00
Home Production Hours, Mother	1,686.41	1,664.00	1,427.33	1,352.00	.	.
Home Production Hours, Father	213.22	130.00	.	.	692.80	598.00
Real Wage, Mother	13.01	9.52	15.39	9.57	.	.
Real Wage, Father	14.29	11.42	.	.	14.64	11.14

Notes: Monetary values reported in 2002 MXN pesos. 1USD = 10.43 MXN pesos. All measures are annualized. *Two Parent* corresponds to characteristics of households headed by two parents (N=661). *Single Woman* corresponds to households headed by a single mother (N=848). *Single Men* corresponds to characteristics headed by a single man (N=130).

Table 2: Overall Impact of *Oportunidades*

(a) Two-Parent 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

(b) Single-Mother 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

Notes: Monetary values reported in 2002 MXN pesos. 1USD = 10.43 MXN pesos. All measures are annualized. *Two Parent* corresponds to characteristics of households headed by two parents (*N*=661). *Single Woman* corresponds to households headed by a single mother (*N*=848). *Single Men* corresponds to characteristics headed by a single man (*N*=130).

Table 3: Structural Estimation Results

	Estimate	SE
Home Production Function, Two-Parent Households:		
ψ_0^A	-0.693	0.0009
ψ_1^A	1.080	0.0015
ψ_0^B	-0.693	0.0005
ψ_1^B	-0.971	0.0006
γ	0.588	0.0002
ρ	0.893	0.0006
Sample mean $\psi^A(S)$	0.510	-
Sample mean $\psi^B(S)$	0.224	-
Sample mean $(1 - \psi^A(S) - \psi^B(S))$	0.266	-
Home Production Function, Single-Mother Households:		
ϕ_0^A	0.002	0.0000
ϕ_1^A	1.299	0.0001
β^A	0.164	0.0004
ρ_S^A	0.859	0.0007
Sample mean $\phi^A(S)$	0.631	-
Sample mean $(1 - \phi^A(S))$	0.369	-
Home Production Function, Single-Father Households:		
ϕ_0^B	-0.026	0.0000
ϕ_1^B	0.470	0.0001
β^B	0.175	0.0009
ρ_S^B	0.743	0.0025
Sample mean $\phi^B(S)$	0.508	-
Sample mean $(1 - \phi^B(S))$	0.492	-
Pareto Weight, Two-Parent Households:		
λ_0 [Constant]	1.208	0.0213
λ_1 [w^A/w^B]	0.749	0.0166
λ_2 [z_0^A]	0.693	0.0055
λ_3 [z_1^A]	0.838	0.0117
λ_4 [Sex ratio]	-2.336	0.0200
Sample mean $\lambda(\mathbf{z})$	0.541	-

	Estimate	SE
Wife's Preferences for Leisure:		
$\alpha_{1,1}^A$ [Constant]	-0.960	0.0390
$\alpha_{1,2}^A$ [Age]	0.000	0.2332
$\alpha_{1,3}^A$ [Education]	-0.029	0.0957
$\alpha_{1,4}^A$ [Number of Children]	-0.828	0.0662
Sample mean $\alpha_1^A(\mathbf{X})$ (Married)	0.266	-
Sample mean $\alpha_1^A(\mathbf{X})$ (Single)	0.291	-
Wife's Preferences for Private Market Consumption:		
$\alpha_{2,1}^A$ [Constant]	-22.590	0.0484
$\alpha_{2,2}^A$ [Age]	0.667	0.2772
$\alpha_{2,3}^A$ [Education]	-0.404	0.1249
$\alpha_{2,4}^A$ [Number of Children]	0.120	0.0866
Sample mean $\alpha_2^A(\mathbf{X})$ (Married)	0.145	-
Sample mean $\alpha_2^A(\mathbf{X})$ (Single)	0.257	-
Husband's Preferences for Leisure:		
$\alpha_{1,1}^B$ [Constant]	-5.062	0.0467
$\alpha_{1,2}^B$ [Age]	0.019	0.3174
$\alpha_{1,3}^B$ [Education]	1.776	0.0623
$\alpha_{1,4}^B$ [Number of Children]	-1.033	0.0846
Sample mean $\alpha_1^B(\mathbf{X})$ (Married)	0.459	-
Sample mean $\alpha_1^B(\mathbf{X})$ (Single)	0.429	-
Husband's Preferences for Private Market Consumption:		
$\alpha_{2,1}^B$ [Constant]	2.036	0.1308
$\alpha_{2,2}^B$ [Age]	0.001	0.8620
$\alpha_{2,3}^B$ [Education]	-0.044	0.3384
$\alpha_{2,4}^B$ [Number of Children]	-0.552	0.1949
Sample mean $\alpha_2^B(\mathbf{X})$ (Married)	0.375	-
Sample mean $\alpha_2^B(\mathbf{X})$ (Single)	0.379	-

Notes: The tables present the parameter estimates obtained in the two-step GMM procedure implemented. The first table relates to the home production parameters estimated separately for each type of household. The second table relates to the parameters of the Pareto weight and parental preferences for leisure and private market consumption.

Table 4: Model Fit

(a) Moments Used in GMM Estimator

Two-Parent Households			Single-Parent Households		
	Data	**Model**		**Data**	**Model**
h_D^A/h_D^B [M]	9.3149	9.3149	h_D^A/h_D^C [S]	0.3465	0.3465
h_D^A/h_D^C [M]	0.4563	0.4563	$w^A h_D^A/q^D$ [S]	3.4389	3.4389
h_D^B/h_D^C [M]	0.0490	0.0490	$p^C h_D^C/q^D$ [SM]	2.1997	2.1997
$w^A h_D^A/q^D$ [M]	3.8857	3.8857	$w^A l^A/q^A$ [S]	0.0960	0.0960
$w^B h_D^B/q^D$ [M]	0.4210	0.4210	l^A/h_D^A [S]	1.1707	1.1706
$p^C h_D^C/q^D$ [M]	3.2384	3.2383	$p^C h_D^C/q^A$ [S]	1.6993	1.6992
$w^A l^A/w^B l^B$	1.5337	1.4128	q^A/q^D [S]	1.5196	1.2877
$w^A l^A/q$ [M]	1.1010	1.0124	h_D^B/h_D^C [S]	1.4222	0.6692
$w^B l^B/q$ [M]	1.6885	1.3955	$w^B h_D^B/q^D$ [S]	0.6835	0.5512
l^A/h_D^A [M]	0.9518	0.9616	$p^C h_D^C/q^D$ [SF]	3.2183	3.9908
l^B/h_D^B [M]	13.4736	13.5611	$w^B l^B/q^B$ [S]	1.8853	1.9722
q/q^D [M]	3.3592	3.3634	l^B/h_D^B [S]	0.1443	0.1142
$p^C h_D^C/q$ [M]	0.9641	0.7916	$p^C h_D^C/q^B$ [S]	0.3948	0.3191
$p^C h_D^C/w^A l^A$ [M]	0.8757	0.8014	q^B/q^D [S]	4.3045	4.8890
$p^C h_D^C/w^B l^B$ [M]	0.5709	0.5673			
$\Delta_z^l(d)$	0.8302	0.7991			

(b) Model-Simulated Impact of *Oportunidades* on Two-Parent Beneficiary Households

	Leisure		Home Production		Market Work		
	Mother	Father	Mother	Father	Mother	Father	Public Exp.
MDID	290.387**	-182.081	-419.623	-144.243	129.236	326.324	1240.723*
	(138.935)	(133.681)	(519.936)	(128.188)	(470.814)	(200.528)	(721.590)
N	478	478	478	478	478	478	478

(c) Model-Simulated Impact of *Oportunidades* on Single-Parent Beneficiary Households

	Leisure	Home Prod.	Market Work	Public Exp.
MDID	-139.023	-288.308	427.331	-2155.108*
	(186.135)	(271.996)	(391.667)	(1197.359)
N	632	632	632	632

Notes: The table presented in Panel (a) presents the empirical and simulated values of the moments used in the GMM estimator presented in Section 4.4. [M] denotes moments pertaining two-parent (married) households, [S] denotes moments relating single-parent households, further distinguishing between single-father [SF] and single-mother [SM] moments when superscripts do not specify the gender of the parent. Panels (b) and (c) present the results from implementing the matching difference-in-differences estimator on the simulated time and consumption allocations of parents obtained using the estimated model for two-parent and single-mother households.

Table 5: Overall Impact of *Oportunidades* on Beneficiary Households, Percentage Change

	Two-Parent Households					
		Conditional Sharing Rule		**MMWI**		
	Pareto Weight	Mother	Father	Mother	Father	Domestic Output
MDID	13.017***	27.699***	-11.674*	1.042***	0.535*	14.391*
	(1.853)	(6.048)	(6.202)	(0.353)	(0.253)	(7.983)

Notes: Tables present the MDID estimates (in percentage changes) of the impact of *Oportunidades* on outcomes derived from the model that quantify the degree of gender inequality within the household. *Money Metric Welfare Index* computes the money metric welfare index described as the solution to (S37) and (S38) for mothers and fathers, respectively. *Domestic Output* corresponds to the predicted production of the public good Q associated with children.

Table 6: MMWI-Based Individual Poverty Rates (as a % of Households) among Non-Poor Households

	All Households	**HHs with 1 Child**	**HHs with 2+ Children**
All	28.16	24.02	30.49
Mothers	53.72	42.16	60.00
Only Mothers	53.07	41.18	59.51
Both	0.65	0.98	0.49
Fathers	2.59	5.88	0.98
Only Fathers	1.94	4.90	0.49
Both	0.65	0.98	0.49
Intrahousehold Pov. Ineq.	96.47	89.36	99.19

Notes: The table presents the percentage of non-poor households in which either the mother or the father could be categorized as individually poor when comparing their money metric welfare index (MMWI) to the individual poverty line established by the CONEVAL. The table also shows hoe this poverty rate varies with the number of children in the household. The MMWI used is computed using the estimates obtained from implementing the GMM estimator on the sample including both poor and non-poor households. *Intrahousehold Pov. Ineq.* captures the percentage of households with at most one individually poor decision-maker in which the only individually poor parent is the mother.

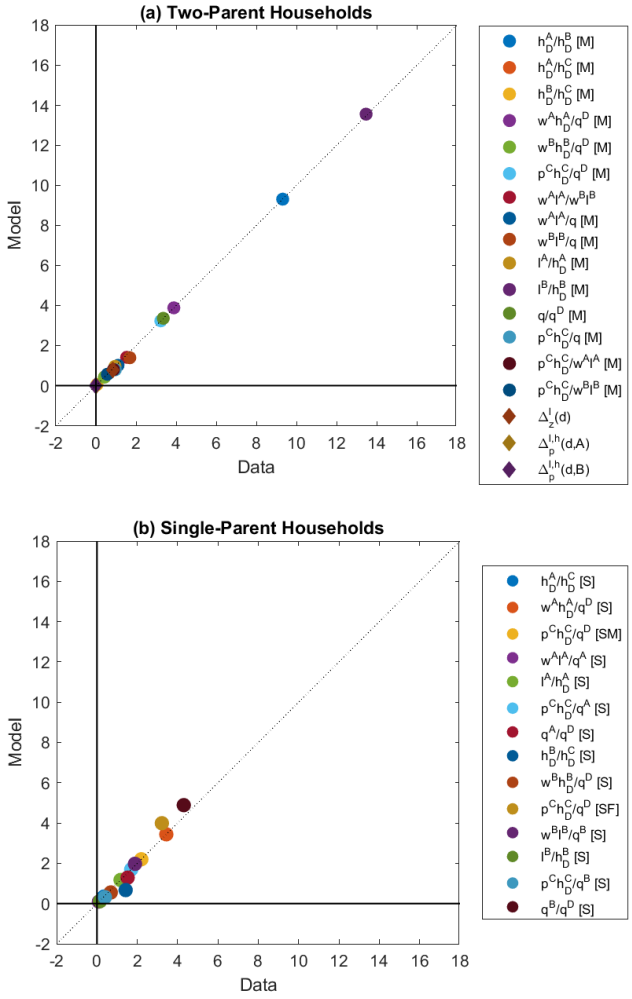

Figure 1: Model Fit of Estimation with Quasi-Experimental Moments

Notes: The figure shows empirical (data) and predicted (model) moments by household type. Two sets of moments are displayed: those derived from the first order conditions of the model solution (theoretical moments) and those related to the causal effect of *Oportunidades* on the time and consumption allocation of households (quasi-experimental moments).

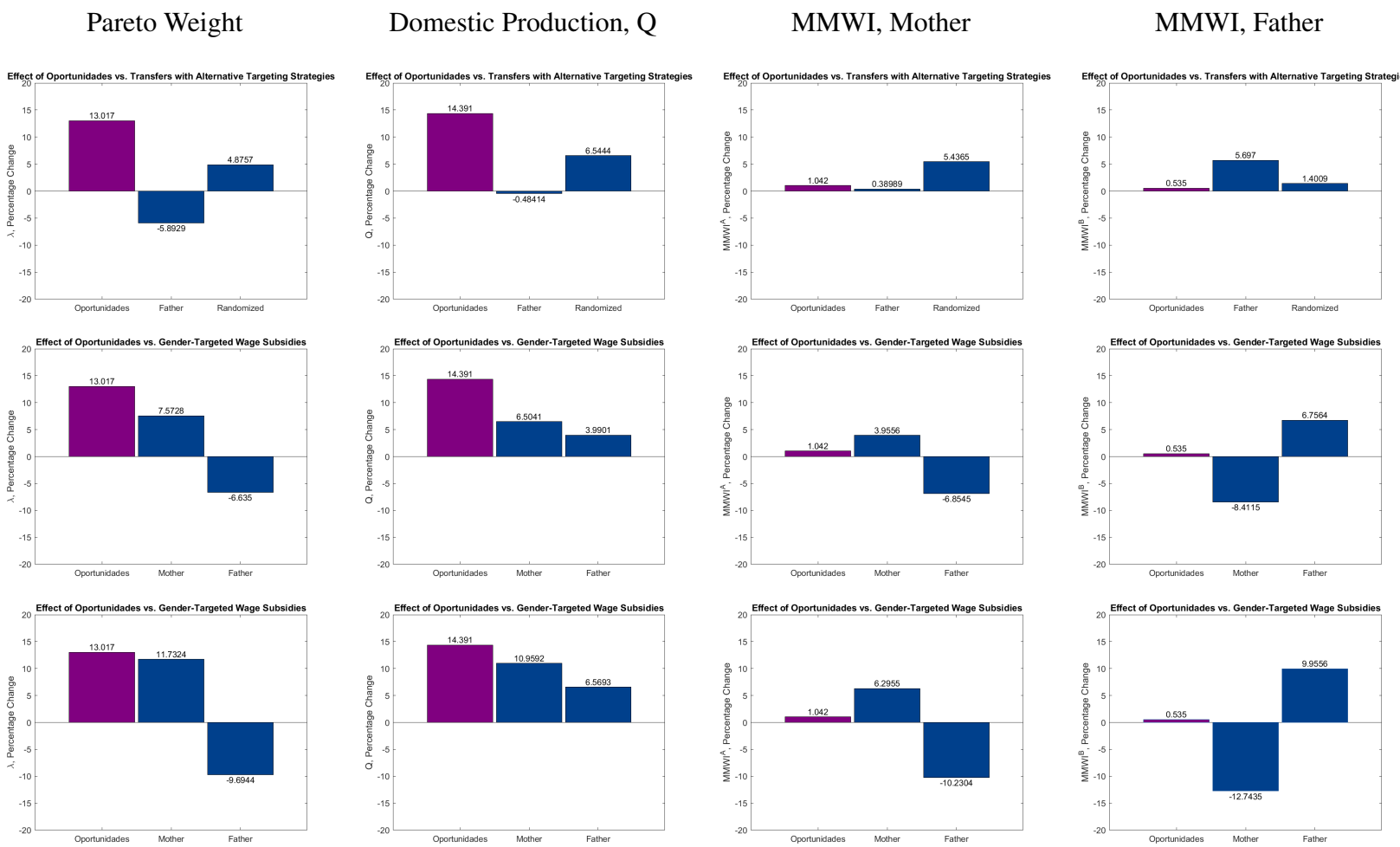

Figure 2: Counterfactual Exercises: Targeting Intrahousehold Gender Gaps in Income

NOTES: This figure compares the effects of *Oportunidades* and alternative counterfactual policies on intrahousehold inequality measures including: the (i) Pareto weight, (ii) domestic production, (iii) mother's welfare (MMWI), and (iv) father's welfare (MMWI). The first row considers counterfactual policies that adopt alternative targeting strategies for cash transfers (targeting to fathers vs. randomizing the identity of the recipient). The second row considers a wage subsidy of 25% targeted to mothers (second bar) and targeted to fathers (third bar). The third row considers a wage subsidy of 40% targeted to mothers (second bar) and targeted to fathers (third bar).

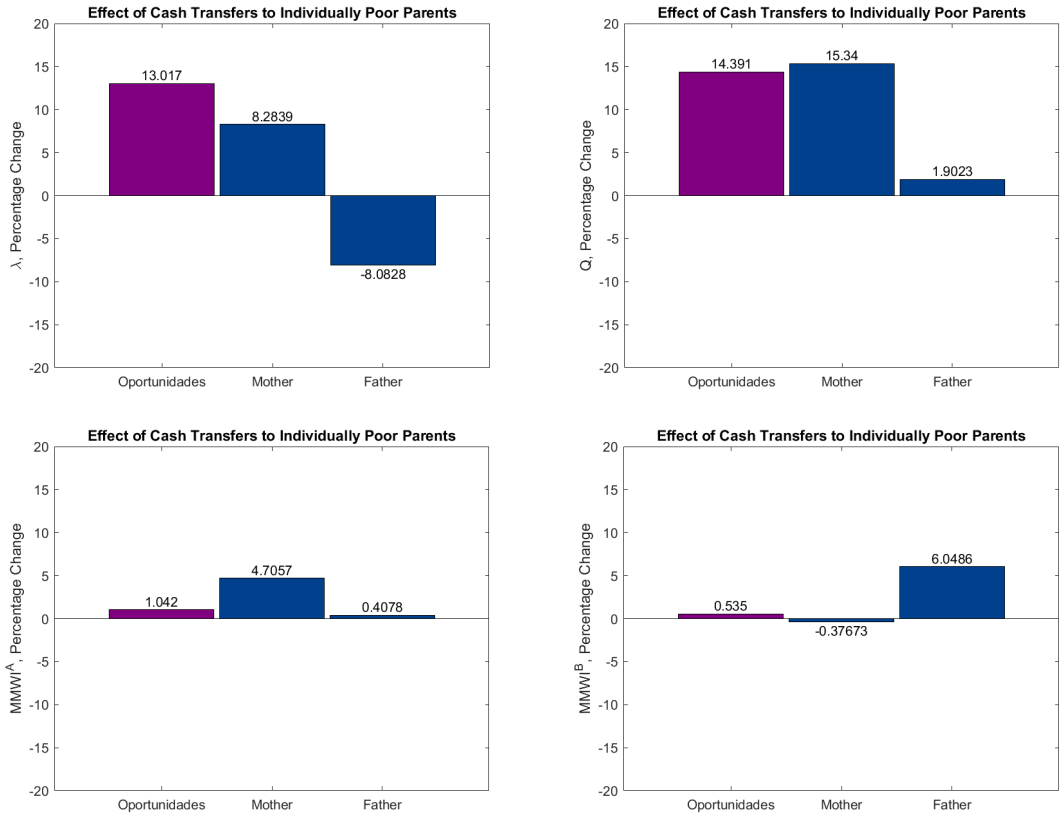

Figure 3: Effects of Counterfactual Cash Transfers Targeted to Individually Poor Households in Non-Poor Households

NOTES: This figure presents the predicted effects of targeting a cash transfer to parents deemed as individually poor in households classified as non-poor by the program administration.