Intra-Household Welfare Inequality and Household Public Goods*

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Abstract

We develop a money metric welfare index for individuals within households, allowing for public goods, work, and heterogeneous preferences for men and women. Using Japanese data, we estimate a collective model of labor supply, private consumption, and expenditures on children and other public goods. We find that women have stronger preference for spending on children and other public goods than men. Within-household inequality is larger than between-household inequality, but has been declining across cohorts, reflecting improvements in women's position. This is driven by the increase in women's college graduation, improvement in their relative wages, and the increase in childcare availability.

Keywords: Economics of the family, collective model, gender gap, childcare, investments in children, household public goods, welfare inequality

JEL Codes: D1,D11,D13,J16

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1 Introduction

When studying gender disparities in standards of living, the literature has appropriately focused on the pay gap and on differences in educational and professional opportunities. However, an often-overlooked but key element for understanding the gap between men and women is the way resources are distributed within the household, and how this determines the distribution of welfare.

The collective model with private goods (Chiappori, 1988, 1992) addresses questions of intra-household distribution by defining a sharing rule, which allocates income (from both husband and wife) to individual consumption, based on Pareto weights reflecting their relative bargaining power. In this simple context, the distribution of the resulting private consumption also reflects the distribution of welfare. However, a large proportion of household expenditure is public and non-excludable and is one of the key reasons why people form households.[1] Furthermore, each member of the household may have very different preferences for both public and private goods. These are key factors that must be taken into account when measuring the distribution of welfare and the relative position of women and men.

We build on the collective approach of Chiappori (1988, 1992) and its extension to public goods in Blundell, Chiappori, and Meghir (2005) and Chiappori and Ekeland (2009a). We specify a collective household model that includes both private and public consumption and labor supply, and we provide a money metric of individual welfare allowing for public goods and preference heterogeneity.

We then use this framework to better understand the welfare distribution within households in Japan, a country that lags significantly behind other industrialized nations in terms of economic gender equality, with one of the largest pay gaps and most rigid glass ceilings among OECD countries.[2] Correspondingly, the gender gap in consumption appears dire: the Japanese Panel Survey of Consumers that uniquely records private consumption (see also Lise and Yamada, 2019) reveals

[1] In Appendix D, we provide detailed documentation of the average percentage breakdown of household expenses by category, based on data from the Japan Panel Survey of Consumers.

[2] To provide additional context, Appendix B compares key metrics of economic gender disparities, including the percentage of female managers, the gender wage gap, and maternal labor supply, between Japan and OECD countries.

that married women with children consume only about half the private goods that men do.

Whether accounting for public goods changes the picture one gets from the distribution of private consumption and time allocations rests on whether preferences for the household public goods are aligned within the couple and on the relative bargaining power and the way it varies with external conditions.

Our model includes private consumption, labor supply, and two public goods, namely expenditures on children and expenditures on other household-related public goods. The distinction between the two is important because preferences may be aligned for one public good but not for the other. For example, mothers may place a greater weight on children than fathers, and consequently, an increase in expenditure on children may increase her relative welfare. Our paper thus speaks to the literature that focuses on how parental decisions are made about allocations to children, with implications for child development (see, for example, Dahl and Lochner, 2012; DelBoca, Flinn, and Wiswall, 2014; Attanasio, Cattan, Fitzsimons *et al.*, 2020). By using a collective model, we define the mechanism that can explain how allocations to child investments are related to the relative bargaining power of women and men and how this interacts with their preferences. It also provides a way of understanding the effects of policy, such as child benefits that are designed in part to enhance child development (see Lundberg, Pollak, and Wales, 1997).

To quantify welfare, we introduce the concept of the *Money Metric Welfare Index* (MMWI). The MMWI represents the income level an individual would need to achieve the same level of welfare they currently experience within a household if they were to live alone with unchanged preferences. The idea is related to the notion of "indifference scale" (see Browning, Chiappori, and Lewbel, 2013). What distinguishes MMWI from the indifference scales is its explicit consideration of the welfare derived from public consumption. In the hypothetical scenario of singlehood, individuals would have to pay the full market price for their chosen public consumption. In contrast, within a household, each individual only contributes to public consumption based on their own Lindahl price (Lindahl, 1958; Samuelson, 1954), which is the key to understanding the anatomy of individual welfare. This Lindahl price is individual-specific, depending on two key factors. First,

it reflects personal preferences for public goods: as one prefers more public goods, their personal Lindahl price becomes higher. Second, it accounts for intra-household bargaining power: as one's bargaining power weakens, their Lindahl price becomes lower. Consequently, the MMWI approach captures these two effects of public consumption that would not be accounted for by analyzing private consumption alone.

Our focus is on Japan, where gender inequality is one of the highest in the OECD (see, for example, online appendix B and table B.1 therein). Our model can be used to explore inequality within the household and the way it has changed between cohorts. For this purpose, we use the Japanese Panel Survey of Consumers (JPSC). This is a panel over the years 1993-2020. The panel includes detailed information on household consumption, labor supply, income, and demographic characteristics. Detailed demographic and earnings information allows the estimation of wage equations, which are crucial to identifying the effects of labor supply.[3] A specific feature of this panel is that it allocates expenditures to private goods to each adult in the household and to public goods. We use this feature to identify individual preferences as in Lise and Yamada (2019).

We find that the ratio of male to female MMWI in Japanese households is 0.28, well below 0.5 (for equality), revealing substantial inequality of welfare within households. However, compared to measures based on private consumption or other welfare measures inspired by the collective model without fully accounting for public goods, the MMWI-based measure indicates a lower inequality. This difference highlights the importance of incorporating public goods into welfare calculations, as we do, which reduces the measured extent of inequality. Two key channels explain this result, which the MMWI approach brings to light. First, our estimates show that women value public goods more highly than men, leading them to benefit more from public expenditures. Although women also pay more for these public goods through higher Lindahl prices, the net gain remains positive. Second, the estimated Pareto weight of the wife, which reflects her bargaining power in

[3]Necessary and sufficient conditions for a demand function to stem from a collective framework are in (Chiappori and Ekeland, 2006); Identification is discussed in (Chiappori and Ekeland, 2009b). To the best of our knowledge, the collective model is the only model of the household for which such results have been derived. Browning, Chiappori, and Lechène (2010), Lechène and Preston (2011) and Chiappori and Naidoo (2020) provide a set of necessary conditions for non-cooperative models. However, whether these conditions are sufficient is not known; moreover, no general identification result has been derived so far.

the home, is lower than that of the husband. This lower bargaining power results in a "cheaper" Lindahl price for the wife, allowing her to gain even more from household public goods than she would with equal bargaining power.

Our next key finding is that over our entire sample period the within-household inequality is higher than the between-household one, reflecting the large gender gaps in Japanese society. A key determinant is the wage gap between husband and wife. However, when we look at how inequality has evolved across cohorts, we find a dramatic decline in within-household inequality, which in our youngest cohort born in the 1980s is equal to between-household inequality.[4] We document various factors driving this, a key one being the massive increase in women's college attainment, rising from 8% in the 1960s cohort to 37% in the 1980's one. Although marital sorting declined for the 1960s to 1970s, due to the few college women almost all marrying college men in the 1960s, leading to maximal sorting (Chiappori, Costa Dias, Meghir *et al.*, 2025), assortative matching increased thereafter. All of these factors have compressed the marital wage gap. In addition, the increasing availability of childcare has improved women's outside option and further increased their bargaining power.

Although the Japanese context is important in itself, given the manifest gender inequality, our findings offer insights beyond this context and highlight the importance of allowing for public goods when assessing gender inequalities. In cases of unequal power distribution between households, public goods play a crucial role in understanding welfare, providing a broader perspective than focusing solely on personal consumption. This has important policy implications, such as informing fair compensation in marital dissolution and designing more effective poverty alleviation programs. Our MMWI approach provides the tool for assessing how external factors, including policy interventions or economic shocks, affect the distribution of intra-household welfare.

Our paper is at the intersection of two strands of literature. On the one hand, a recent literature analyzes intra-household allocation of welfare. Browning, Chiappori, and Lewbel (2013) introduced the notion of indifference scales. Empirical applications thus far include Dunbar, Lew-

[4] Lise and Seitz (2011) also present a similar finding for the UK.

bel, and Pendakur (2013), Calvi, Penglase, Tommasi *et al.* (2023), Lechène, Pendakur, and Wolf (2022) and Calvi (2020), among many others. A crucial feature of the existing indifference scales, however, is that it relies on the assumption that each commodity is privately consumed within the household – although some consumption may display economies of scale, that the approach allows to identify.

In a related paper Lise and Yamada (2019) specify a dynamic model of labor supply, private consumption, and a public good, produced by expenditure on a market good and by time inputs. Intra-household allocations are governed by a dynamic collective limited commitment model (see Mazzocco, 2007; Voena, 2015). The authors also use the JPSC and as mentioned above they exploit the unique feature of this data that reports how much each household spends on each of its members. This provides researchers with direct observation of intra-household resource allocation, which would not otherwise be observed allowing for direct identification of the sharing rule and the way it changes with external shocks.

Relative to Lise and Yamada (2019), we place more emphasis on public goods, distinguishing expenditures on children from those on other public goods in the household, and identifying individual preferences over both these goods, consumption, and leisure. Our focus is on measuring within and between household welfare inequality and changes thereof across cohorts based on our money metric welfare index (MMWI). The MMWI provides a measure of relative welfare among partners, allowing labor supply, housework, public, and private goods. This turns out to be key to assessing the relative welfare of men and women in Japan. A key feature of understanding the welfare distribution is the derivation of Lindahl prices, which are at the core of our approach and a novel aspect in this context. On the other hand, our model is static, ignoring dynamic aspects of marriage but relying only on an ex post efficiency assumption; we are therefore agnostic about commitment issues. Our focus is to understand how consumption of public goods changes our view of intra-household inequality. More specifically, how expenditures on children and other public goods are valued differently by the mother and the father, and the implications this may have on intra-household allocations and welfare, and on the targeting of policies intended to affect, among other

things, the welfare of women and children.

The remainder of the paper is organized as follows. Section 2 provides definitions for the basic collective household model, concepts, and axioms that we use throughout the paper. Building on these, we further discuss individual welfare measurements and introduce the Money Metric Welfare Index (MMWI). Then in Section 3, we take the MMWI to the data. Section 4 describes our data sources. In Section 5, we explain our empirical design and some estimation issues that we address. Section 6 presents and discusses our findings. Finally, Section 8 concludes.

2 Intra-Household Welfare: Basic Issues

Our basic structure draws upon the collective model for households developed in Chiappori (1988, 1992) and extended by Blundell, Chiappori, and Meghir (2005) to allow the consumption of public goods. The key defining characteristic of the collective model is that intra-household allocations are efficient. And while individuals can have caring preferences, in the sense that they value their partner's welfare overall, they do not derive utility from the patterns of consumption of their partner, i.e. they do not have paternalistic preferences. We refer the reader to the above articles for a full theoretical analysis of the collective model and its empirical content. Here, we consider individual welfare issues. We first consider a special case in which all commodities are privately consumed, then move to the general case.

2.1 The Case of Private Goods

When all commodities are consumed privately, the household can be considered as a small economy without externalities or public goods. From the second welfare theorem, any Pareto efficient allocation can be decentralized by adequate transfers.

Hence, in a private goods setting, any efficient decision can be described as a two-stage process. In the first stage, household members (say the two cohabiting partners) jointly decide on the allocation of household aggregate full income y between them (and member a gets ρ^a). Since the vector of private goods includes leisure, full income for each person is defined as $w^a T + y^a$ where

w^a is the individual hourly wage, T is total time available and y^a is the person's a non-labor income. In stage two, agents freely spend the share they have received. The decision process (bargaining, for instance) takes place in the first stage.

From a welfare perspective, the crucial point is that there exists a one-to-one, increasing correspondence between Pareto weights and the sharing rule (at least for any cardinal representation of individual preferences such that the Pareto set is strictly convex). When prices and incomes are constant, increasing the weight of one individual (reducing the other's weight proportionally in order to maintain the normalization) always results in a larger share for that individual and conversely.

This result has two consequences. First, given each person's preferences, the sharing rule is a sufficient statistic for the entire decision process. Indeed, since all agents face the same prices, the sharing rule fully summarizes intra-household allocation of resources. As such, it is directly relevant for intra-household inequality. Second, and more importantly for our present purpose, the sharing rule is a money metric measure of individual utility. For given prices, ρ^a is an increasing transform of the collective indirect utility of person a; moreover, and unlike the indirect utility V^a, it is always measured in monetary units.

2.2 Public and Private Commodities

Convenient as the previous notions may be, they still rely on a strong assumption - namely that all commodities are privately consumed. Relaxing this assumption is indispensable; after all, the existence of public consumption is one of the main motives for household formation. So now we address the question of defining individual welfare within a collective household, in the presence of public goods. In what follows we denote by K the vector of public goods and by q^a the vector of private goods consumed by individual a in the household. In general there may be any number S of decision makers within the household, although in our empirical context there will always be two (husband and wife).

2.2.1 Public Goods and Lindahl Prices

Blundell, Chiappori, and Meghir (2005) define the notion of the conditional sharing rule, which reflects the allocation of resources made to each household member for their *private* consumption, given public goods expenditure. Contrary to the case with just private goods, this measure does not reflect the intra-household allocation of welfare because it does not take into account that the choices over public goods also affect the distribution of welfare, particularly if preferences over public goods differ across partners. In the approach below, we address this issue, which leads us to a money-metric measure of the overall distribution of welfare.

One approach to public consumption relies on the notion of Lindahl prices. A key result in public economics states that, in the presence of public goods, Pareto efficient allocations can be decentralized using personal (Lindahl) prices that add up to the market price of the commodity (Lindahl, 1958; Samuelson, 1954). Formally, we have the following result:

Proposition 1. *Assume an allocation* $\left(\bar{K}, \bar{q}^1, ..., \bar{q}^S\right)$ *is Pareto efficient. Then there exist* S *non-negative functions* $\left(\rho^{*1}, ..., \rho^{*S}\right)$*, with* $\sum_k \rho^{*k} = y$*, and for each* $a = 1, ..., S$*,* N *non-negative functions* $\left(P_j^a\right), j = 1, ..., N$ *(where* P^a *is* a*'s N-vector of personal prices), with* $\sum_a P_j^a = P_j$ *for all* j*, such that for all* a *the vector* $\left(\bar{K}, \bar{q}^a\right)$ *solves:*

$$\max_{K, q^a} u^a\left(K, q^a\right) \tag{DP}$$

under the budget constraint

$$\sum_{i=1}^{n} p_i q_i^a + \sum_{j=1}^{N} P_j^a K_j = \rho^{*a}$$

Conversely, for any non-negative functions $\left(\rho^1, ..., \rho^S\right)$ *such that* $\sum_a \rho^a = y$ *and* P_j^a *such that* $\sum_a P_j^a = P_j$ *for all* j*, an allocation that solves (DP) for all* a *is Pareto efficient.*

The vector $\rho^* = \left(\rho^{*1}, ..., \rho^{*S}\right)$ defines a generalized sharing rule (GSR). From an inequality perspective, this notion raises interesting issues. One could choose to adopt ρ^* as a description of intra-household welfare allocation; indeed, agents now maximize utility under a budget constraint

in which ρ^* describes available income. In particular, ρ^* is a much better indicator of the distribution of resources than the conditional sharing rule $\tilde{\rho}$, because it takes into account both private and public consumptions.

However, the welfare of agent a is not fully described by ρ^{*a}; one also needs to know the vector P^a of a's personal prices. Technically, the collective indirect utility of a is:

$$V^a(p, P, y) = v^a(p, P^a, \rho^{*a}(p, P, y))$$

which depends on both ρ^{*a} and P^a. This implies that the sole knowledge of the GSR is not sufficient to recover the welfare level reached by a given agent, even if her preferences are known; indeed, one also needs to know the prices, which depend on all preferences and on the decision process and hence differ in general between members of the household.

In particular, welfare within the household cannot be analyzed from the sole knowledge of the generalized sharing rule. Agents now face different personal prices, and this should be taken into account. This simply reflects a basic but crucial insight - namely that if agents 'care differently' about the public goods (as indicated by personal prices, which reflect individual marginal willingnesses to pay), then variations in the quantity of these public goods have an impact on the intra-household distribution of welfare.

2.2.2 The Money Metric Welfare Index

This leads us to the basic concept of Money Metric Welfare Index (MMWI) of agent a. Formally:

Definition 2. *The Money Metric Welfare Index (MMWI) of agent a, $m^a(p, P, y, z)$, is defined by:*

$$v^a(p, P, m^a(p, P, y)) = V^a(p, P, y) \tag{1}$$

Equivalently, if c^a denotes the expenditure function of agent a, then:

$$m^a(p, P, y) = c^a(p, P, V^a(p, P, y)) \tag{2}$$

In words, m^a is the monetary amount that agent a would need to reach the utility level $V^a(p, P, y)$, if she was to pay the full price of each public good (i.e., if she faced the price vector P instead of the personalized prices P^a). Unlike the GSR, the Money Metric Welfare Index fully characterizes the utility level reached by the agent. That is, knowing an agent's preferences, there is a one-to-one relationship between her utility and her MMWI, and this relationship does not depend on the partner's characteristics.

Some remarks can be made at this point. First, in the absence of public goods, the MMWI coincides with the sharing rule. In other words, the MMWI is a fully general measure of individual welfare, which coincides with the natural concept (i.e. the sharing rule) in the (largely explored) case of private consumptions, and extends it to allow for public expenditures within the household.

A second remark is that in the presence of public goods, the MMWI depends on the price vector used as a reference. While using the market price as a benchmark is a natural solution, it is by no means the only one. Even more striking is the fact that even the direction of intra-household inequality may be affected by this choice; i.e., one can easily construct examples in which the MMWI of member A is larger than B's for some prices but smaller for others.[5]

Third, the previous definition compares the utility currently reached by a married individual with the utility the *same* individual (i.e., with the *same preferences*) would reach in the hypothetical situation where she would have to purchase the public goods at market prices (in which case the chosen consumption bundle would obviously be quite different). It is tempting to think of this hypothetical situation as the individual being single. But this interpretation is by no means needed, and may sometimes be misleading: it requires the assumption that marriage does not change preferences, which is far from obvious.

Lastly, there is a direct relationship between the MMWI and the standard notion of *equivalent*

[5] We thank Frederic Vermeulen for pointing out this result.

income.[6] Both approaches rely on the notion that referring to a common price vector can facilitate interpersonal comparisons of welfare. However, to the best of our knowledge, equivalent income has exclusively been applied so far to private goods. Our point, here, is that using the concept of Lindahl prices allows us to extend it to the case of public consumption, thus providing a natural solution to a recurrent and somewhat difficult problem.

Finally, the previous construct can readily be extended to domestic production — although we do not consider it in the empirical application below.

2.2.3 An Example

As an illustration of the previous concepts, we consider a two-person household, each with Cobb-Douglas preferences over a private good, leisure, and a public good. In what follows γ^1 (resp. γ^2) is the preference weight for the public good for person 1 (resp. 2). Moreover, $1-\mu$ is the Pareto weight of individual 1 and μ that of individual 2. In Appendix A we provide all the calculations for this case. Here we summarize the key insights from this.

The Lindahl prices for the public good take the form

$$P^1 = \frac{(1-\mu)\,\gamma^1}{(1-\mu)\,\gamma^1 + \mu\gamma^2} P, \quad P^2 = \frac{\mu\gamma^2}{(1-\mu)\,\gamma^1 + \mu\gamma^2} P$$

and are increasing in the preference for the public good, reflecting an increased willingness to pay. This results in the Generalized Sharing Rules:

$$\rho^{*1} = q^1 + w^1 L^1 + P^1 K = (1-\mu)\,X$$
$$\rho^{*2} = q^2 + w^2 L^2 + P^2 K = \mu X$$

where X is the aggregate full income of the household. In this case the ratio of 2's to total GSR is

$$r_{GSR} = \frac{\rho^{*2}}{\rho^{*1} + \rho^{*2}} = \mu$$

[6] See for instance Fleurbaey, Kanbur, and Snower (2023) for a recent survey.

We can now derive the the MMWI for each member which are given by

$$\bar{y}^1 = \left(\frac{(1-\mu)\,\gamma^1 + \mu\gamma^2}{(1-\mu)\,\gamma^1}\right)^{\gamma^1} (1-\mu)\,X \text{ and similarly } \bar{y}^2 = \left(\frac{(1-\mu)\,\gamma^1 + \mu\gamma^2}{\mu\gamma^2}\right)^{\gamma^2} \mu X$$

leading to an index of relative welfare for person 2

$$I = \frac{\bar{y}^2}{\bar{y}^1 + \bar{y}^2} = \frac{\mu\left(\frac{(1-\mu)\gamma^1+\mu\gamma^2}{\mu\gamma^2}\right)^{\gamma^2}}{(1-\mu)\left(\frac{(1-\mu)\gamma^1+\mu\gamma^2}{(1-\mu)\gamma^1}\right)^{\gamma^1} + \mu\left(\frac{(1-\mu)\gamma^1+\mu\gamma^2}{\mu\gamma^2}\right)^{\gamma^2}}$$

This ratio is our preferred measure of welfare allocation within the household. Unlike r_{GSR}, it depends not only on the Pareto weight μ, but also on individual preferences for the public good.

The case of identical preferences To better understand the underlying mechanisms, it is useful to consider the particular case of identical preferences, where $\gamma^1 = \gamma^2$. For our Cobb-Douglas preferences, this results in all sharing rules (private goods only r_p, conditional sharing rule r_{CSR}, and Generalized sharing rule r_{GSR}) being identical

$$r_p = r_{CSR} = r_{GSR} = \mu \tag{3}$$

whereas the ratio of the MMWIs I is different

$$I = \frac{\bar{y}^2}{\bar{y}^1 + \bar{y}^2} = \frac{\mu^{1-\gamma}}{(1-\mu)^{1-\gamma} + \mu^{1-\gamma}}$$

which coincides with the previous measures only when $\gamma = 0$. In other words the MMWI depends on the presence of the the public good, even when the various alternative definitions of the sharing rule do not, because the expenditure on the public good is equalizing in this case.

Thus, taking public consumption into account reduces the measure of intra-household inequality; the larger the share of expenditures devoted to public goods, the more important the dampening effect. Figure 1 plots the MMWI μ for various values of γ, from $\gamma = 0$ (which corresponds

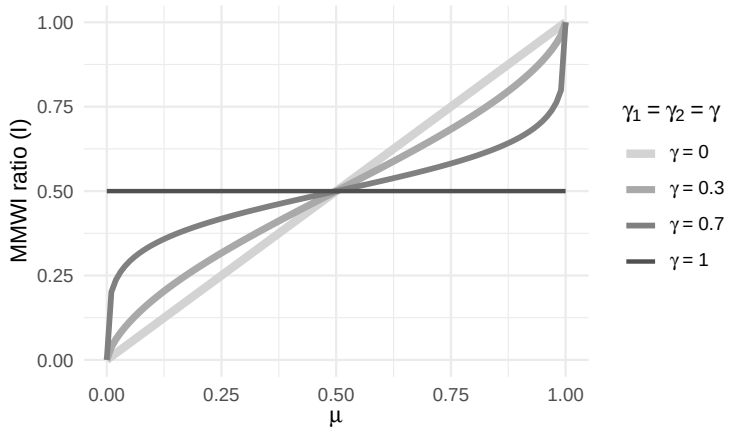


Figure 1: Pareto Weight and MMWI Ratio Under $\gamma^1 = \gamma^2 = \gamma$

Notes: This figure plots a person 2's MMWI ratio as a function of her Pareto weight under three different values of γ: $\gamma = 0$ (thick gray), $\gamma = .3$, $\gamma = 7$, and $\gamma = 1$ (thin black).

to the various ratios in (3)) to $\gamma = 1$. All ratios coincide and equal 0.5 for $\mu = 0.5$, in which case the allocation is perfectly egalitarian. When $\mu \neq 0.5$, inequality, as measured using individual MMWIs, decreases with the coefficient γ.[7] Note that even the Generalized Sharing Rule fails to detect this impact; only the MMWI ratio provides an effective measure of actual intra-household inequality. Technically, access to (implicitly) cheaper public goods benefits both spouses. Even with identical preferences, the corresponding gain is added to both welfare measures, thus reducing welfare inequality. In addition, an individual's Lindahl price of the public good increases with the individual's Pareto weight; unequal distribution is therefore partly compensated by an even 'cheaper' access to public consumption for the disadvantaged party.[8]

An important point is that individual MMWIs add up to more than total household income, precisely because public consumption generates an economic gain. It is therefore interesting to consider the ratio

$$S = \frac{\bar{y}^1 + \bar{y}^2}{X} \tag{4}$$

[7]For instance, in the extreme case where consumption is exclusively public ($\gamma = 1$), our index indicates equal allocation of welfare, which is the only economically meaningful conclusion.

[8]All these ideas generalize to the case where some of the private goods carry individual specific prices, such as the (opportunity cost of) leisure.

which provides a measure of the benefits generated by public consumption. Here:

$$S = (1-\mu)\left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{(1-\mu)\gamma^1}\right)^{\gamma^1} + \mu\left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{\mu\gamma^2}\right)^{\gamma^2}$$

Interestingly, when the bargaining power of the wife is less than that of the husband ($\mu < 0.5$), this benefit reaches its maximum for some $\gamma^2 > \gamma^1$, i.e. when her preference for the public good is stronger than his

Finally, this simple example does not take into account domestic work. In the empirical estimation, given the characteristics of most Japanese households (in which domestic work is almost entirely female), we consider it as a fixed imposition on the wife's time that (also) benefits the husband; de facto, there is thus a transfer of resources from the wife to the husband that should also be taken into account. Another interpretation of our empirical work is that we condition on the amount of housework we observe, very much like Browning and Meghir (1991). In other words, we acknowledge that housework is a choice that we do not explicitly model, but on which we condition.

2.3 Indifference Scales

A related approach to these issues, initially introduced by Browning, Chiappori, and Lewbel (2013, from now on BCL) and then extended by Dunbar, Lewbel, and Pendakur (2013), is based on the notion of *Indifference Scales (IS)*. It posits that agents, when they get married, keep the same preferences but can access a different (and generally more productive) technology. That is, while the basic rates of substitution between consumed commodities remain unaffected by marriage (or cohabitation), the relationship between purchases and consumption does not; therefore, the structure of demand, including for exclusive commodities (consumed only by one member), is different from what it would be for singles. In practice, the technology available to singles is normalized to be the identity in the sense that single individuals consume exactly their market purchase. Within households, commodities are assumed to be consumed privately, time inputs are ignored, and technology is assumed to be linear, so that the n-vector of consumption q can be produced given a

n-vector of market purchases x if:

$$x = A \cdot q \tag{5}$$

where A is a $n \times n$ matrix. Moreover, the matrix is taken to be diagonal, so that (5) becomes:

$$x_i = \lambda_i q_i \quad \forall \text{ goods indexed by } \ i$$

Here, parameters λ_i represent economies of scale generated by the household technology; in particular, $\lambda_i < 1$ means that the amount purchased to provide the household with a total consumption in good i equal to q_i is less, by a factor λ_i, than the sum of purchases that would be needed to provide an equal number of singles with the same total consumption. As a result, household members de facto face different prices than singles; technically, the *within household* price of commodity i becomes $\pi_i = \lambda_i p_i$ for all i. Indifference scales refer precisely to the income that an individual would, as a single (i.e. facing the market prices π), need to achieve the same utility level as he or she does within the couple.

The basic intuition of the MMWI is, in many respects, close to that of the indifference scale literature. In both cases, the household generates an economic gain by enlarging the consumption space available to agents; and in both cases the practical translation is that intra-household prices differ from market prices. However, the main difference is that commodities, in the IS setting, are consumed privately. In particular, while intra-household prices may differ from market prices, *they are identical for all agents within the household* : the price 'rebate simply reflects the more efficient consumption technology in marriage. In contrast, the MMWI approach relies on Lindahl prices that are individual-specific (and add up to market prices). In other words, both models capture a fundamental, economic intuition behind marital gains, namely that the household provides its members with access to the same commodities as if they were alone, but at a lower price. However, the indifference scale additionally assumes that intra-household prices are identical across individuals, while the MMWI setting allows for individual-specific valuations.

All in all, the two approaches are complementary, and their respective scope depends on the

question under consideration. If the goal is to analyze individual poverty in a context where most of the budget is spent on essential goods (food, basic clothing) that are privately consumed, such as might be the case in developing countries, the indifference scale method is convenient and highly tractable; moreover, it allows identification of economies of scale for private consumptions, which raises specific difficulties in the MMWI context, at least if one exclusively considers multiperson families. Conversely, the MMWI technology introduces an additional dimension, namely that individuals may value differently the same amount of public good, a fact that should be taken into account when assessing intra-household inequality if a significant fraction of household expenditures relates to publicly consumed commodities. And of course, in whatever context if the focus is on child investments, the potential divergence in preferences between the parents is of first-order importance. Our approach captures this but the IS approach does not.

2.4 Identifiability

The identifiability of the collective model with private goods, when we only observe aggregate household consumption for most private goods, has been developed in Chiappori (1988, 1992).[9] In this paper we rely on data for individual private consumptions that are reported in the JPSC, which obviously weakens the assumptions required for identification.

This leaves us with the question of identification of individual preferences for the public goods, which is central to our research question. Blundell, Chiappori, and Meghir (2005) (BCM) addresses explicitly this issue. They distinguish two cases. First, in the presence of a distribution factor, namely a variable that affects bargaining power but does not affect preferences, identification is obtained, in the sense that at most one structural model can rationalize the data. In the absence of such a distribution factor, as in our case, BCM show that there is *at most* one set of *weakly separable preferences* that can rationalize the data.[10] However, there is also a continuum of nonseparable

[9]For a detailed presentation, the reader is referred to Chiappori and Ekeland (2009a) and Browning, Chiappori, and Weiss (2014).

[10]More precisely, the private goods need to be weakly separable from the public good. This weak separability property means that the marginal rate of substitution between any two private goods does not depend on public consumption. This is weaker than additive or strong separability.

preferences that can equally well rationalize the data. Hence, in the absence of a distribution factor (as in our case here) identification requires the assumption that preferences over private goods are weakly separable from public goods. We maintain this assumption here.

A crucial remark is that what is identified (up to an increasing transformation) is the indirect collective utility of each member. From a welfare perspective, this is the only relevant concept, since it fully characterizes the utility reached by each agent. However, its implications for the previous discussion must be carefully considered. The case where all goods are public is the easiest: Chiappori and Ekeland (2009b) show that when all commodities are publicly consumed, recovering a person's indirect collective utility is equivalent to recovering their direct utility. It follows that all the concepts previously defined (in particular the MMWI) are exactly identified under either the exclusion condition or the assignable and distribution factor case.

Private goods, however, raise specific difficulties. Remember that, in the absence of public goods, the various concepts (conditional sharing rule, generalized sharing rule, money metric welfare index) coincide with the sharing rule, and the collective indirect utility takes the form:

$$V^a(p, y) = v^a(p, \rho^a(p, y))$$

where, as above, v^a is a's indirect utility and ρ is the sharing rule. Under assumptions stated above, the function V^a is identified. The sharing rule, however, is not; identification only obtains up to an additive function of the prices of the non-exclusive private goods. The corresponding indeterminacy is not welfare relevant, since the different solutions correspond to the same collective indirect utilities for each agent. In that case, and somewhat paradoxically, one can identify the intra-household distribution of *welfare* (although only up to the usual restrictions: one can only identify individual utilities in an ordinal sense), but not the intra-household distribution of *income*.

It is important to remark, however, that this non-identification result is only local. In particular, it disregards additional, global restrictions such as non-negativity constraints. Adding non-negativity restrictions (reflecting the fact that if household income goes to zero then all consump-

tions should go to zero as well) typically pins down the sharing rule in general. This result should be related to recent work on the estimation of the sharing rules based on a revealed preference approach (see for instance Cherchye, De Rock, Lewbel *et al.*, 2015). Since the revealed preference approach is global by nature, it can generate bounds on the sharing rule, which can actually be quite narrow.[11] In the 'differentiable' case, such as the one below, the specific functional forms generally used implicitly impose non-negativity restrictions on individual consumptions (which enter through their log), which leads to full identification.[12]

3 Empirical Model

We now use the MMWI to characterize the distribution of welfare in Japanese households. We draw data from the Japan Panel Survey of Consumers (JPSC), which we explain in detail in Section 4. JPSC makes it necessary to accommodate certain features of observed household decisions. First, a substantial share of 48.1 percent of wives do not work. Second, husbands contribute little to house work. 55 percent of husbands do not do housework at all on a typical weekday and the median hours that husbands spend on house work is 0.5 hours per day. Given these observations, we assume all housework is performed by the woman and we condition on the observed amount (Browning and Meghir, 1991).

The setting. We consider a two-person household, consisting of person 1 (primary earner) and person 2 (secondary earner or household manager) who jointly make decisions about consumption

[11] In all cases, the global restrictions are generated at one end of the distribution of expenditures, so their use for identifying the sharing rule outside this range should be submitted to the usual caution.

[12] Alternatively, one may assume that individual preferences remain (partly) unchanged after marriage, and use information about the demand of single individuals - a line followed by Bargain, Beblo, Beninger *et al.* (2006), Vermeulen, Bargain, Beblo *et al.* (2006) and Lise and Seitz (2011) for labor supply, and by the Indifference Scale literature initiated by Browning, Chiappori, and Lewbel (2013) for consumption. Additional constraints on intra-household allocations can also be derived from the equilibrium conditions on the marriage market. These approaches refer either to frictionless, matching models (Choo and Siow, 2006; Chiappori, Iyigun, and Weiss, 2009; Chiappori, Salanié, and Weiss, 2017; Chiappori, Costa-Dias, and Meghir, 2018) or to a search framework (Jacquemet and Robin, 2013; Goussé, Jacquemet, and Robin, 2017). In all these cases, complete identification of the sharing rule is obtained.

as well as labor force participation. Their individual preferences are Cobb-Douglas:

$$U^a = \alpha^a \ln L^a + \beta^a \ln C^a + \gamma_1^a \ln K_1 + \gamma_2^a \ln K_2 \quad \text{for } a = 1, 2 \text{ and } \alpha^a + \beta^a + \gamma_1^a + \gamma_2^a = 1 \quad (6)$$

Here, L^a denotes person a's leisure, C^a their consumption of some Hicksian composite good that is privately consumed, and K_1 and K_2 are two household public goods, one represents child-related expenditures (K_1) and the other a general public good defined in the data section (K_2). Note that these utilities are (strongly) separable; in particular, individual demands for private goods, as functions of the sharing rule, do not depend on the level of public consumption. All coefficients in the utility function are assumed random allowing for substantial heterogeneity. This is discussed further in the estimation section.

The time constraint on person $i = 1, 2$ is $T = L^i + H^i + h^i$, where H^i is hours worked and h^i is hours spent on household chores respectively. The collective household optimization problem under efficiency is

$$\max \quad V = (1 - \mu)U^1 + \mu U^2 \quad (7)$$

subject to the budget constraint

$$C^1 + C^2 + w_1 L^1 + w_2 L^2 + P_1 K_1 + P_2 K_2 = \hat{y}^1 + \hat{y}^2 + Y \equiv X \quad (8)$$

where $\hat{y}^1 = w_1 T$ and $\hat{y}^2 = w_2(T - h)$ are the maximum potential income of the primary earner and the household manager, respectively, which in the context of Japan is almost always the woman, and we take that to be the case from now on. Moreover, we assume the male (member 1), always works.

The solution depends on whether the woman works or not, which is determined by

$$\text{Works} \Leftrightarrow \mu \leq \frac{\hat{y}^2}{\alpha^2 X} \quad (9)$$

For the case where the woman does work, the resulting demands for the private goods (consumption

and leisure) are

$$w_a L^a = \zeta_\mu^a \alpha^a X; \qquad C^a = \zeta_\mu^a \beta^a X, \quad a = 1, 2 \tag{10}$$

where $\zeta_\mu^1 = 1 - \mu$ for person 1 and $\zeta_\mu^2 = \mu$ for person 2. The collective demand for the public goods is

$$P_j K_j = (\zeta_\mu^1 \gamma_j^1 + \zeta_\mu^2 \gamma_j^2) X \quad \text{for public goods } j = 1, 2 \tag{11}$$

which shows how the individual preference for the public good (γ_j^a) is weighed by their relative bargaining power (ζ_μ^a). The elasticity of collective demand for each public good with respect to the wife's bargaining power is:

$$\epsilon_{\zeta^2}^{K^j} = \frac{1}{1 + \frac{\gamma_j^1}{\zeta^2(\gamma_j^2 - \gamma_j^1)}} \qquad (j = 1, 2). \tag{12}$$

This elasticity is positive if the wife places more weight on the respective public good than the husband does ($\gamma_j^2 > \gamma_j^1$). For a given ζ^2 (or equivalently μ), the elasticity increases with the disparity between the wife's and husband's preferences for the good.

In the case where she does not work, the structure of the demands is the same. However total income X is replaced by $\tilde{X} \equiv X - \hat{y}_2$ and the relative bargaining power of the man ζ_μ^1 is replaced by $\tilde{\zeta}_\mu^1 \equiv (1-\mu)/((1-\mu) + \mu(1-\alpha^2))$, while that of the women by $\tilde{\zeta}_\mu^2 \equiv \mu/((1-\mu) + \mu(1-\alpha^2))$.

Money Metric Welfare Index. We define the Money Metric Welfare Index (MMWI) to be the minimal expenditure needed as a single to achieve the level of utility implied by the efficient allocations as a married couple:

$$\begin{aligned} &\text{Working when single:} && MMWI_p^a = E_p^a(U_m^a, P_1, P_2, w_a) \quad a = 1, 2 \\ &\text{Not working when single:} && MMWI_{np}^a = E_{np}^a(U_m^a, P_1, P_2) \quad a = 1, 2 \end{aligned} \tag{13}$$

where U_m^a is the indirect utility of person a when living with their partner and the intra-household allocations are efficient as described above.[13]

[13] We provide the exact formulae for the indirect utility functions and the expenditure functions corresponding to

Preference heterogeneity. We assume that the preference parameters $(\alpha^a, \beta^a, \gamma_1^a, \gamma_2^a, a = 1, 2)$ depend on a vector of characteristics $(\boldsymbol{x}_i)$, which includes their educational attainment (an indicator variable taking one if one has some college degree or above), the age of the youngest child, and the number of children as well as on a random term. Hence we have that:

$$\begin{aligned} \alpha^a &= \frac{1}{1 + exp(-\boldsymbol{x}_i'\boldsymbol{\alpha}^a - \epsilon_{i\alpha}^a)}, \quad \gamma_1^a = \frac{1}{1 + exp(-\boldsymbol{x}_i'\boldsymbol{\gamma_1}^a - \epsilon_{i\gamma 1}^a)}, \\ \gamma_2^a &= \frac{1}{1 + exp(-\boldsymbol{x}_i'\boldsymbol{\gamma_2}^a - \epsilon_{i\gamma 2}^a)}, \quad \beta^a = 1 - \alpha^a - \gamma_1^a - \gamma_2^a \end{aligned} \tag{14}$$

The additive errors, ϵ_α^a, ϵ_β^a, $\epsilon_{\gamma 1}^a$ and $\epsilon_{\gamma 2}^a$ $(a \in 1, 2)$, are specified to be normally distributed, but must add up to zero for the husband and the wife respectively. Hence there are just three variances that are free in each case. We denote these by ς_k^a, where k indicates the corresponding parameter.[14]

Pareto weight. We assume that the wife's Pareto weight μ depends on the couple's log wage gap $(ln(wage\ wife/wage\ husband))$, on childcare availability, and on household unearned income. Childcare availability is important because it can improve women's labor market opportunities and consequently her outside opportunities if she happens to be divorced.

$$\mu = \frac{1}{1 + exp(-z_h'\boldsymbol{\mu})} \tag{15}$$

4 Data

Our main data come from the Japanese Panel Survey of Consumers (hereafter JPSC), the longest-running nationwide panel survey of individuals in Japan.

We restrict our sample to heterosexual,[15] legally married couples with at least one child under the age of 15[16] between 1998 and 2020 (0.3% of households in the original married sample

our specification in the appendix.

[14]Normality is an approximation since it allows the remote possibility of coefficients occasionally turning negative.

[15]During the period of our study, same-sex marriage was not yet legalized in Japan and thus was not captured in our data. Our focus on heterosexual couples does not diminish the scholarly importance of studying same-sex marriages in Japan. We leave it for future studies.

[16]In Japan, out-of-wedlock births still account for a very small portion of all births. In 2020, only 2.4 percent of all

Table 1: Descriptive Statistics

	Mean	Std.dev.
Demographic characteristics		
Wife's actual market experience	8.36	6.19
Wife some college	0.23	0.42
Wife 4yr+ university	0.16	0.37
Husband 4yr+ university	0.37	0.48
No. of children	2.01	0.80
Dummy = 1 if the youngest child age 0-6	0.56	0.50
Dummy = 1 if the youngest child age 7-12 (primary school)	0.32	0.47
Dummy = 1 if the youngest child age 13-15 (middle school)	0.12	0.32
Childcare availability per child	0.41	0.15
Household income		
Dummy = 1 if wife participates	0.53	0.50
Dummy = 1 if husband participates	1.00	0.00
Wife's hourly rate of pay (real, JPY)	1,158.59	577.47
Husband's hourly rate of pay (real, JPY)	1,879.19	877.72
Household labor income per week (real, JPY)	111,992.36	46,280.21
Wife's labor income per week (real, JPY, including zeroes)	37,660.92	25,362.90
Husband's labor income per week (real, JPY)	92,351.12	38,836.31
Nonlabor income per week (real, JPY)	-49,801.14	40,970.40
Household expenditure		
Weekly total household expenditure (real, JPY)	62,191.22	26,793.58
Weekly expenditure on nonchild public goods (real, JPY)	39,772.25	19,255.03
Weekly expenditure on child public goods (real, JPY)	10,303.36	11,230.03
Weekly expenditure on private goods (real, JPY)	12,115.61	9,706.36
Weekly expenditure share of private goods	0.20	0.13
Weekly expenditure share of nonchild public goods	0.64	0.16
Weekly expenditure share of child public goods	0.16	0.11
Weekly expenditure share of wife's private goods	0.06	0.06
Weekly expenditure share of husband's private goods	0.14	0.10
Wife's relaive private expenditure per week	0.30	0.22
Time use		
Wife's hrs worked per week	18.38	18.66
Wife's hrs leisure per week	18.11	13.81
Wife's hrs housework per week	53.07	24.82
Husband's hrs worked per week	51.92	11.06
Husband's hrs leisure per week	22.72	13.76
Husband's hrs housework per week	10.62	10.35
Dummy = 1 for husband's zero housework	0.16	0.37

dropped).[17] We also exclude households where a husband is not gainfully employed (6% dropped), and households that did not complete reporting monthly expenses, income (1% dropped), and time use (1% dropped). Finally, we omit households that did not provide a comprehensive history of the wife's employment since she completed school (0.4% dropped). The resulting sample consists of 2,080 households each observed for an average of 7 years and 14,648 observations in total.[18] Key summary statistics are shown in Table 1.

For our empirical analysis, JPSC provides necessary information on household expenditure, household expenditure on children (which corresponds to public good 1), household expenditure on common use (which corresponds to public good 2),[19] time use, income, homeownership, housing characteristics, prefecture of residence, and individual characteristics such as highest educational attainment.

5 Estimation

Our estimation method proceeds in steps. We first deal with missing wages for non-working women. We then use the simulated method of moments to estimate the parameters that characterize preferences and the Pareto weight.

5.1 Wife's Wage Process

We take wages as exogenous, in the sense that unobserved components of wages are assumed independent of preference heterogeneity for both men and women. While all men in our sample are working and hence their wages are observed, this is not true for the high proportion of women

births were out of marriage

[17] Although the JPSC starts in 1993, some key variables exist only after 1998.

[18] See Table C.2 in the Online Appendix for the number of households dropped to meet each criteria.

[19] The Japanese Panel Survey of Consumers asks about monthly household expenses for common resources and personal use by the wife, husband, children, and other household members. These breakdowns are mutually exclusive and should add up to the total household monthly expenses. The survey question does not aim to identify which commodities each household member consumes. Instead, it leaves the interpretation of what constitutes a common resource or personal use to the respondents. This survey question was originally motivated by sociological studies on the control and allocation of money within families, particularly Jan Pahl's (1989) "Money and Marriage" published by MacMillan. In our study, we use expenses for children as public good 1 and expenses for common resources as public good 2.

who do not work and whose wages are missing and have to be integrated out. We thus estimate the distribution of women's wages outside of the main model using a wage equation of the form

$$\ln w_{it} = \boldsymbol{z}'_{w,it}\boldsymbol{\gamma}_w + \epsilon_{it}, \qquad \epsilon_{it} \sim N(0, \sigma^2) \tag{16}$$

where $\boldsymbol{z}_{w,it}$ represents individual characteristics, including her actual labor market experience since completing her schooling, its square, and education. We estimate equation (16) correcting for selection based on the Heckman (1979) estimator and assuming joint normality. The participation equation, used to correct for selection, additionally includes dummies for the number of children (1-3 children), dummies for the age of the youngest child (0-6 years old, 7-12 years old, and 13-15 years old), childcare availability, and its interaction with the age of the youngest child. Childcare availability is defined as the ratio of daycare slots to the population aged 0-4, and is reported by prefecture level and rural-urban status (i.e. two measures per prefecture). Childcare availability is measured as the ratio of public childcare capacity to the population aged 0-4. Across prefectures, the supply of childcare increased during the studied period, but timing varied, giving us the variation we need, beyond aggregate and prefecture effects. Both the wage equation and the participation equation include time, prefecture, and rural/urban dummies. Table 2 shows the results of the estimate of this wage equation. As our results show, greater access to childcare increases mothers' participation in market work. This, together with the demographic composition of the household, is a strong instrument for selection correction.

5.2 Estimation of the Main Model

We estimate 32 preference parameters, the coefficients defining the Pareto weight, and the variances of the random coefficients in preferences. The full set of parameters is given by

$$\theta = \left(\boldsymbol{\alpha}^a, \boldsymbol{\beta}^a, \boldsymbol{\gamma}_1^a, \boldsymbol{\gamma}_2^a, \boldsymbol{\mu}, \varsigma_\alpha^a, \varsigma_{\gamma 1}^a, \varsigma_{\gamma 2}^a\right) \qquad a = 1, 2$$

by using the simulated method of moments (McFadden, 1989; Pakes and Pollard, 1989). Specifically, we maximize the following criterion function

$$L(\theta) = -\sqrt{n}(g_n(\theta))' W_n(\theta) g_n(\theta) \tag{17}$$

where $g_n(\theta)$ is a vector whose elements are defined by $g_{n,j}(\theta) = \dfrac{m_j^D - m_j^S(\theta)}{m_j^D}$. In the above, m_n^D are the moments estimated from the data and $m_s^S(\theta)$ the simulated moments from the model, produced by S simulations. The errors that are drawn for these s simulations of the model are drawn only once and held the same throughout the optimization problem. The subscript n emphasizes the dependence of the data moments on the sample size.

The moments include the mean and variance of leisure, private consumption and public goods interacted with the four pairs of education of couples,[20] the three categories of the number of children (one child, two children and three or more children), the three categories of the age of the youngest child (age 0-6, 7-12, and 13-15), and the work status of the wife. We use observed wages for working women and draw wages from the pre-estimated wage model for nonworking women, assuming the error term is normally distributed. We set the weighting matrix $W_n(\theta)$ to be an identity matrix instead of an optimal weighting matrix. This is to address small-sample biases in GMM covariance estimation that Altonji and Segal (1996) point out.

Model Identifiability In our empirical setting, the underlying preferences and Pareto weights are exactly identified. First, our data provide direct observations of private good consumption (C^a) for each individual. This allows us to pin down the exact level of an individual's resource share within the household, and consequently, the Pareto weight (μ). Second, each person in the household consumes one commodity exclusively, which in our case is leisure. Third, in our model, individual utility is strongly separable for private consumption, leisure, and public goods. Although we use a Cobb-Douglas specification, the essential feature is separability of private goods and leisure from

[20]The four pairs are (husband's educational attainment, wife's educational attainment) = ((high school or below, high school or below), (high school or below, some college or above), (some college, some college or above), (some college, some college or above)).

Table 2: Labor Force Participation and the Wage Equation

	Estimate	(Std.err.)	Estimate	(Std.err.)
Participation equation				
Intercept	-2.078	(0.057)	-2.276	(0.117)
Wife's actual market experience (years)	0.203	(0.007)	0.211	(0.007)
Wife's actual experience squared	-0.003	(0.000)	-0.003	(0.000)
Wife some college	0.139	(0.029)	0.160	(0.031)
Wife 4yr+ university	0.273	(0.034)	0.274	(0.036)
Dummy = 1 if the youngest child age 7-12 (primary school)	0.475	(0.070)	0.431	(0.070)
Dummy = 1 if the youngest child age 13-15 (middle school)	0.692	(0.107)	0.628	(0.107)
Childcare availability	1.389	(0.103)	1.307	(0.309)
Availability x primary school dummy	-0.517	(0.167)	-0.386	(0.167)
Availability x middle school dummy	-1.307	(0.245)	-1.134	(0.244)
No. of children = 2	0.079	(0.026)	0.066	(0.026)
No. of children $\geq$3	0.036	(0.031)	0.017	(0.032)
Log wage equation				
Intercept	6.231	(0.025)	5.961	(0.042)
Wife's actual market experience (years)	0.048	(0.003)	0.049	(0.003)
Wife's actual experience squared	-0.001	(0.000)	-0.001	(0.000)
Wife some college	0.157	(0.012)	0.144	(0.012)
Wife 4yr+ university	0.393	(0.014)	0.341	(0.014)
Selection				
sigma	0.433	(0.005)	0.420	(0.005)
rho	0.787	(0.015)	0.812	(0.012)
Prefecture FE	NO		YES	
Year FE	NO		YES	

Notes: This table presents the estimated coefficients for women's participation equation and log wage equation. The first pair of columns does not include prefecture and year fixed effects whereas the second pair includes them both in the participation and wage equations. Asymptotic standard errors in parentheses.

public goods, rather than the particular specification. In the absence of distribution factors (factors that affect Pareto weights but not preferences or budget constraints), this is the condition required to identify each person's preferences over public goods. The theoretical foundations for these identification strategies are established in Blundell, Chiappori, and Meghir (2005) who provided the identifiability result for a model with two private goods and one public good, while Chiappori and Ekeland (2009a) extended this to a more general case.

6 Results

In this section, we discuss the estimation results, beginning with the wife's wage and participation equations, followed by the preference parameters, Pareto's weight parameters, Lindahl prices, and finally the Money Metric Welfare Index. As demonstrated in Section F.2, the model fits the data very well, despite the relatively parsimonious specification of preferences.

Wage and participation equations. Table 2 presents the parameter estimates for the participation equation and the wage equation described in Section 5.1. The estimates indicate that wives are more likely to participate as their experience and education increase, in particular having a four-year university degree or above (*Wife 4yr+ university*). Their participation increases non-linearly in the number of children. Most importantly, the availability of childcare increases female participation, particularly for those with pre-school children. However, it also seems to increase female labor supply more generally, likely because the childcare availability proxies the area's generosity of family-friendly policies, such as after-school childcare.

We use the estimated wage equation presented in the second pair of columns to predict those who do not work, and therefore their wages are not observed. Appendix F Figure F.3 shows the distribution of the log wage gap in couples. The mean wage gap is -0.78 log points (std. dev. = 0.55). This wage gap feeds into the wife's Pareto weight equation in the main estimation.

6.1 Parameter Estimates

Preferences. Table 3 presents the estimated preference parameters and Table 4 presents the mean and standard deviation of the resulting utility weights across the sample, allowing also for unobserved heterogeneity. Our results indicate significant differences between spouses' valuations of public goods. On average, women value public goods substantially more than their husbands. In particular, husbands place very low weight on child-related expenditures relative to their wives. These differences are reflected in the preferences ratios. For wives, the ratio of their weight on children relative to her consumption (γ_1/β) is 3.66 and the ratio between non-child public goods

Table 3: Preference Parameter Estimates

	Husband		Wife	
Estimate	Estimate	(Std.err.)	Estimate	(Std.err.)
Leisure (α^a)				
Constant	1.634	(0.153)	-0.242	(0.096)
University	0.003	(0.039)	0.086	(0.016)
No. of children >= 2	0.052	(0.087)	-0.003	(0.088)
Any child aged < 7	0.438	(0.243)	0.093	(0.106)
Child care availability	-1.387	(0.426)	-0.512	(0.110)
Child care x Child age < 7	-0.169	(0.321)	-0.084	(0.090)
Std.dev. of random preference ς^a_α	0.004	(0.158)	0.000	—
Preference for Child Expenditures (γ^a_1)				
Constant	-5.132	(0.845)	-2.784	(0.346)
No. of children >= 2	-1.292	(1.140)	1.484	(0.345)
Any child aged < 7	0.495	(0.184)	-0.167	(0.078)
Std.dev. of random preference $\varsigma^a_{\gamma 1}$	1.206	(0.304)	0.000	—
Preference for Other Public Goods (γ^a_2)				
Constant	-2.152	(0.173)	-0.313	(0.095)
No. of children >= 2	0.084	(0.142)	-0.461	(0.105)
Any child aged < 7	0.048	(0.176)	0.209	(0.091)
Std.dev. of random preference $\varsigma^a_{\gamma 2}$	0.277	(0.032)	0.029	(0.026)

Notes: This table presents estimates for preference parameters. Standard errors are shown in parentheses. Each of the preference weights on leisure and the two public goods is a function of the characteristics reported in the panel and a random error. To constrain the range of each preference weight to be between 0 and 1 it is modeled as a logistic of the form $a = 1/(1 + exp(-x'b + \varepsilon))$, where a is one of α, γ_1 and γ_2. The preference weight on consumption is then calculated as $1 - \alpha - \gamma_1 - \gamma_2$. This is always within the range of 0/1 so no further restrictions were required. Whenever the variance of the preference heterogeneity is estimated at the boundary of zero we do not report the standard error.

and their consumption (γ_2/β) is 8.43. In contrast, for husbands, these ratios are 0.15 and 2.11, respectively. While husbands place slightly more weight on non-child public goods than on their own consumption, they value child-related expenditures less than their personal consumption.[21] These findings align with previous literature suggesting that mothers tend to prioritize children more than fathers (see, e.g., Lundberg, Pollak, and Wales, 1997; Dunbar, Lewbel, and Pendakur, 2013).

[21] As equation shows, the household expenditure share of children is weighted sum of the wife's and the husband's preferences where the weight equals the wife's Pareto weight: $P_j K_j / X = \zeta^1_\mu \gamma_1 + \zeta^2_\mu \gamma_2$ where $\zeta^1_\mu = 1 - \mu$ and $\zeta^2_\mu = \mu$.

Table 4: Mean Preference Parameters

	Husband		Wife	
	Mean	[Std.dev.]	Mean	[Std.dev.]
α^a leisure	0.821	[0.031]	0.424	[0.023]
β^a private consumption	0.055	[0.044]	0.044	[0.025]
γ_1^a preference for child expenditures	0.008	[0.017]	0.161	[0.066]
γ_2^a preference for other public goods	0.116	[0.029]	0.371	[0.057]

Note: This table presents wife's and husband's mean preference parameters, as well as their sample standard deviation, including the effect of unobserved heterogeneity. Underlying parameter estimates are presented in Table 3.

There is some heterogeneity around these results, as reflected by the standard deviation reported in the table. However, the only significant (and substantial) unobserved heterogeneity is in the husband's preference for the two public goods, with some men having a strong preference for both child expenditures and other public goods. The difference in preferences for public goods becomes more pronounced as the number of children increases. Appendix F Table F.3 demonstrates that with more children, wives shift additional weight to children and away from personal consumption, while husbands' preferences remain largely unchanged. It's worth noting, however, that the wife's increasing preference for child expenditures as family size grows could also reflect a selection effect, where women who value child-related spending more tend to have larger families.[22]

Pareto weight. Table 5 presents parameter estimates of the wife's Pareto weight. The estimated coefficient on the couple wage gap is positive and significant, suggesting that as the couple wage gap closes (becoming less negative), the wife's Pareto weight improves: when the couple pay gap closes

[22]The stark gender gap in preferences over children may partly reflect Japan's specific circumstances regarding child custody, which tend to favor mothers. In Japan, married parents typically share custody and responsibility for their children, unless a court order states otherwise. However, in cases of divorce, parents must agree on who will have sole custody and responsibility for their children. Japan's legal system does not allow for shared custody. When custody disputes are brought to family courts, it is now common for the mother to receive full custody. According to Vital Statistics, between 2000 and 2020, 83 percent of newly divorced mothers received custody of all their children.

Table 5: The Pareto Weight of the Wife (μ)

	Estimate	(Std.err.)
m^0 constant	-1.805	(0.178)
m^{12} couple pay gap	0.344	(0.085)
m^y unearned income (10,000 JPY)	0.094	(0.010)
m^{cc} child care availability	3.745	(0.210)

Notes: This table presents the estimated coefficients for Pareto weights. Standard errors are shown in parentheses. In the cases where the standard deviation of random preferences hit the boundary of zero, we do not report a standard error.

from the bottom quartile to the top quartile, while keeping other variables at the data mean, the Pareto weight increases by about 0.05 percentage points. It confirms that relative earnings capacity matters for intra-household allocations. It also suggests that women's economic empowerment translates into intra-household bargaining power. If we completely close the couple wage gap, the wife's Pareto weight improves to 0.32 at the sample means for the other variables, but still does not reach parity. This implies that other socioeconomic conditions beyond earnings power could potentially be at play in shaping women's weak bargaining positions in this context.

Consistent with what we observe in existing studies in family economics, higher household unearned income also increases the wife's bargaining power. Lastly, the availability of child care increases the wife's bargaining power and also reduces her preference for leisure (as seen in Table 3). These two forces act to increase her labor market participation and on net more child care availability increases her welfare. This speaks to the growing literature on the effects of child care on women's economic empowerment (Goldberg and Meghir, 2024).

Considering the mean household observables, the average Pareto weight for the wife is 0.283. However, it varies significantly between households. In the top fifth percentile, the wife's Pareto weight is 0.56. At the bottom fifth percentile, it decreases to 0.11.

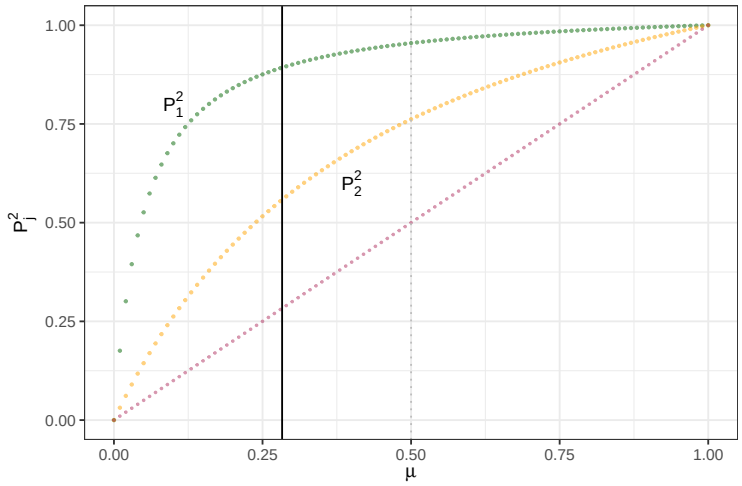


Figure 2: Wife's Lindahl Price and Her Pareto Weight

Notes: This figure shows wife's Lindahl price as a function of her Pareto weight μ. Her personal Lindahl price is given by $P_j^2 = \mu\gamma_j^2/((1-\mu)\gamma_j^1+\mu\gamma_j^2)$. P_1^2 refers to the wife's Lindahl price for child expenditures and P_2^2 to her Lindahl price for other public goods. When computing Lindahl price of each public good, we employ mean preferences presented in Table 4 ($\gamma_1^1 = 0.008$, $\gamma_1^2 = 0.116$, $\gamma_2^1 = 0.161$, $\gamma_2^2 = 0.371$). In case the wife and the husband have identical preferences ($\gamma_j^1 = \gamma_j^2$), her Lindahl price equals her Pareto weight μ, which is shown as a 45 degree line. Two vertical lines show two different Pareto weights. The gray line equals to the case $\mu = 0.5$, which represents equal power between the wife and the husband.

Lindahl prices. Now we are ready to compute personal Lindahl prices for the public goods. Two curves in Figure 2 show the wife's Lindahl prices P_j^2 ($j = 1$ for child expenditures and $j = 2$ for other public goods) as a function of her Pareto weight μ while holding her preference parameters at the data mean. The black vertical line shows μ evaluated at the data mean. The prices of the public good are normalized to one. Hence, husband's Lindahl price P_j^1 is $1 - P_j^2$. Evaluated at the data mean, the wife's Lindahl price for public good 1 is 0.89 whereas the husband's is 0.11. Similarly, the average wife's Lindahl price for public good 2 is 0.56 whereas the husband's is 0.44. The wife's higher Lindahl prices reflect her higher preference weights on children and non-child public good.

Conditional on preferences, the wife's Lindahl price monotonically increases with her Pareto weight. As her Pareto weight increases, her private consumption also increases. This creates an upward pressure on the marginal rate of substitution between her private consumption and the public good, leading to a higher willingness to pay for public goods.

If wife and husband had equal power within a household, then her prices for public goods would have been even higher. Setting $\mu = 0.5$, her price for expenditures on children would have

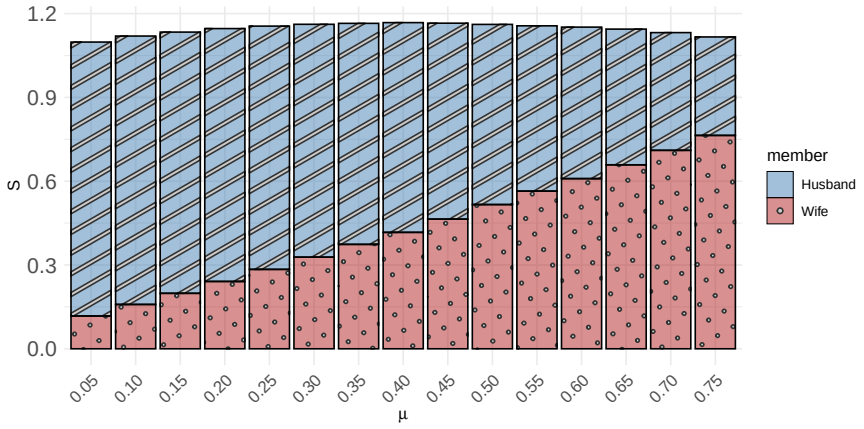


Figure 3: Benefits Generated by Public Consumption

Notes: This figure illustrates the monetary evaluation of benefits generated by public consumption, or economies of scale, as a function of the wife's Pareto weight, μ. The x-axis displays μ binned between 0.025 and 0.775 in increments of 0.05, with the midpoint of each bin shown. Each bar represents the average economy of scale within each bin, calculated as the sum of the husband's and wife's Money Metric Welfare Index (MMWI), divided by the household's full income. The total value is further decomposed into the husband's MMWI (blue, stripe-shaded) and the wife's MMWI (red, dot-shaded).

been 0.95 and her price for expenditures on the nonchild public good would have been 0.76. The discrepancy arises precisely because, on average, the wife has weaker power than her husband, that is, $\mu = 0.283 < 0.5$. When the wife is at the weaker side of the intra-household power equation, she gets her personal price discounted and, therefore, benefits more from the shared household goods.

Alternatively, if both the wife and the husband assigned equal preference weight to public goods, then the wife's personal Lindahl price would be equal to her Pareto weight μ, which is shown by a 45 degree line in Figure 2. It is interesting to note that household demand for public goods is unaffected by μ if the wife's and husband's preferences are symmetric. Even so, the Pareto weight, or distribution of power, matters for personal Lindahl prices, and therefore it has an important welfare implication. Within a household, welfare is redistributed through public goods.

Money Metric Welfare Index (MMWI). Finally, we examine the distribution of welfare within households using our estimated Money Metric Welfare Index (MMWI). On average, husbands' MMWI is 169,824 JPY/week while wives' MMWI is 63,256 JPY/week. These values represent the monetary amount that each spouse would need as a single person to achieve their level of utility

within the marriage.[23] The ratio of the total household MMWI to the full household income captures economies of scale from public consumption, averaging 1.15 in our sample. As shown in Figure 3, these scale economies peak when wives have relatively low bargaining power ($\mu < 0.5$), consistent with our finding that wives have stronger preferences for public goods. The key point here is that with increased equality within the couple, the size of the pie grows, as well as being more equally distributed. This is an insight obtained because of the inclusion of public goods.

To assess intra-household welfare inequality, we calculate the wife's MMWI ratio, defined as her MMWI divided by the sum of both spouses' MMWIs. The average ratio of 0.28 reveals substantial welfare inequality hidden within households. Figure 4 compares the distribution of the MMWI ratio to three alternative measures discussed in Section 2: relative private consumption of the wife r_p (mean 0.22), the ratio of the conditional sharing rule r_{CSR} (mean 0.18) and the ratio of the generalized sharing rule r_{GSR} (mean 0.28). The MMWI ratio distribution first-order stochastically dominates both r_p and r_{CSR}, indicating systematically higher welfare shares for wives when accounting for public consumption. Although the MMWI and GSR distributions cross, MMWI shows higher ratios particularly among households with the most unequal distributions, suggesting that this measure better captures welfare redistribution through public goods in cases of extreme inequality.

The implications of intra-household inequality extend beyond individual households, influencing the aggregate welfare measurement. Table 6 presents Theil's T index for various metrics of consumption and welfare, along with its decomposition into within-household and between-household components.[24] Under the standard unitary household approach, which assumes equal sharing and applies the OECD equivalence scales, Theil's T index is 0.1. By definition, the inequality within the household is set to zero and all inequality is attributed to differences between households. In contrast, measures based on the collective household model yield higher Theil's T

[23] These estimates condition on wives' observed housework time, which represents an implicit transfer to husbands that is not explicitly valued in our analysis.

[24] Theil's T index of inequality in y (Theil, 1967) is given by $T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\ln\frac{y_i}{\bar{y}}\right)$, where $\bar{y}$ is average y. It is part of the generalized entropy measures of inequality and has the advantage that it is decomposable in within and between group inequality (in our case within and between households).

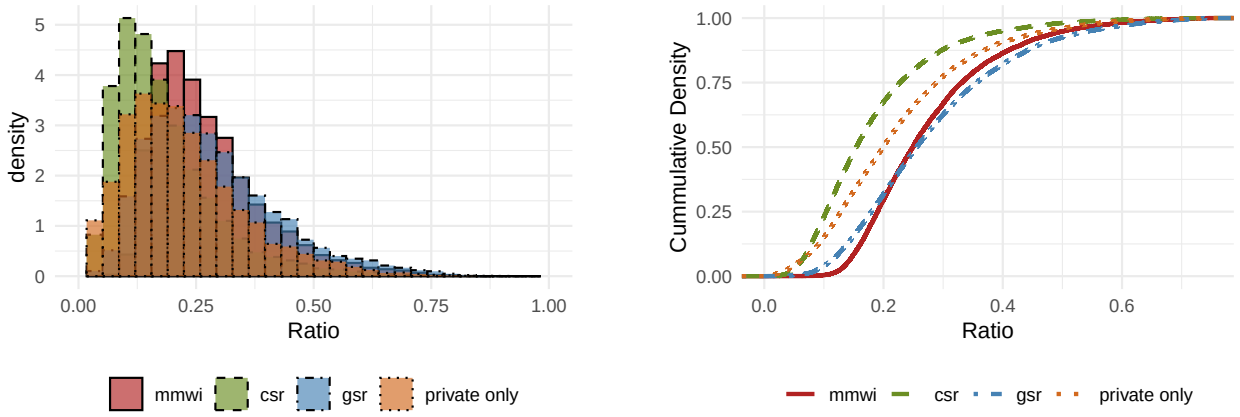


Figure 4: Wife's MMWI Ratio and Other Inequality Measures

Notes: This figure presents the distributions (left) and cumulative distributions (right) of the wife's MMWI ratio (maroon bars and solid line), her ratio of the conditional sharing rule (green bars and dashed line), the generalized conditional sharing rule (blue bars and dot-dash line), and private consumption only (orange bars and dotted line). Each ratio represents the share of the wife's welfare metric relative to the combined welfare metrics of both spouses. The conditional sharing rule is calculated as the sum of the wife's predicted private consumption and the monetary value of her leisure, expressed as $\rho_{csr} = \hat{c}^a + \hat{l}^a w^a$. The generalized conditional sharing rule extends this calculation by including the product of her valuation (Lindahl price) of public goods and public goods consumption, expressed as $\rho_{gsr} = \hat{c}^a + \hat{l}^a w^a + \hat{P}_1^a \hat{K}_1 + \hat{P}_2^a \hat{K}_2$.

indices, ranging from 0.22 to 0.35, reflecting the significant role of within-household inequality. Regardless of the metric used, inequality within the household accounts for a larger share than inequality between households. This highlights that unitary approaches significantly underestimate societal inequality by ignoring welfare disparities within households. Notably, the Money Metric Welfare Index (MMWI) produces the lowest Theil's T coefficient (0.22) among collective measures, emphasizing the role of public consumption as a redistributive mechanism within households.

The lower inequality measured by MMWI compared to other collective approaches stems from two key factors: the wives' higher valuation of public consumption and the discounting of their personal Lindahl prices due to weaker bargaining power. These findings highlight the dual role of households in welfare distribution: they can hide significant inequality while simultaneously providing a mechanism for welfare redistribution through public consumption. This has important policy implications. First, divorce settlements should account for both the direct loss of consumption and the loss of scale economies from public goods. Second, poverty alleviation programs might be more effective if they target household public goods that are highly valued by

Table 6: Consumption and Welfare Inequality

Metric	Within Couples Inequality	Between Couples Inequality	Overall Inequality
Unitary Household Model			
Total Consumption	0.00	0.10	0.10
Collective Household Model			
Private consumption Only	0.19	0.14	0.32
Conditional sharing rule (CSR)	0.27	0.09	0.35
Generalized sharing rule (GSR)	0.15	0.08	0.23
Money Metric Welfare Index (MMWI)	0.14	0.08	0.22

Notes: Inequality is measured using Theil's T Index for various metrics of consumption or welfare among married individuals. The index, which is decomposable in within and between inequality, ranges from zero (indicating perfect equality) to higher positive values, with larger values indicating greater inequality. The 'Unitary household approach' assumes equal sharing of resources within households. Per-person consumption is calculated by multiplying total household expenses (including private and shared consumption) by the OECD equivalent scale ($1.5 + 0.3 \times$ No. of children) and dividing by two. The 'Collective household approach' incorporates individual-level differences in resource allocation and welfare, applying collective household models to measure private consumption, Conditional Sharing Rules (CSR and GSR), and the Money Metric Welfare Index (MMWI).

disadvantaged members. Future research could further explore how these welfare patterns vary across household types and how they respond to changes in institutional and economic conditions.

Changes in Inequality across cohorts Inequality within the household is actually greater than across households, revealing a weak position of women in Japan. However, this hides quite dramatic changes across cohorts, showing the changes in gender gaps across cohorts.

Figure 5 illustrates trends and sources of welfare inequality in three birth cohorts of wives (born between 1960-1969, 1970-1979, and 1980-1989). For each cohort, Theil's T indices are averaged over the ages of 30 and 40 for wives, which avoids any age-composition effects in the comparison. Overall, welfare inequality has declined: Theil's T indices for the three cohorts, starting with the older one, are 0.24, 0.21, and 0.16, respectively. This decline is entirely driven by a reduction in inequality within the household, which dropped from 0.17 to 0.14 and then to 0.08. In contrast, the inequality between households has remained stable, with a slight increase observed in the most recent cohort.[25]

This change reflects a large improvement in the position of women in Japan and, at the same time, illustrates the power of the collective approach for the analysis of inequality (see also Chi-

[25] Lise and Seitz (2011) also estimate a large decline in inequality within households in the UK based on private consumption allocations.

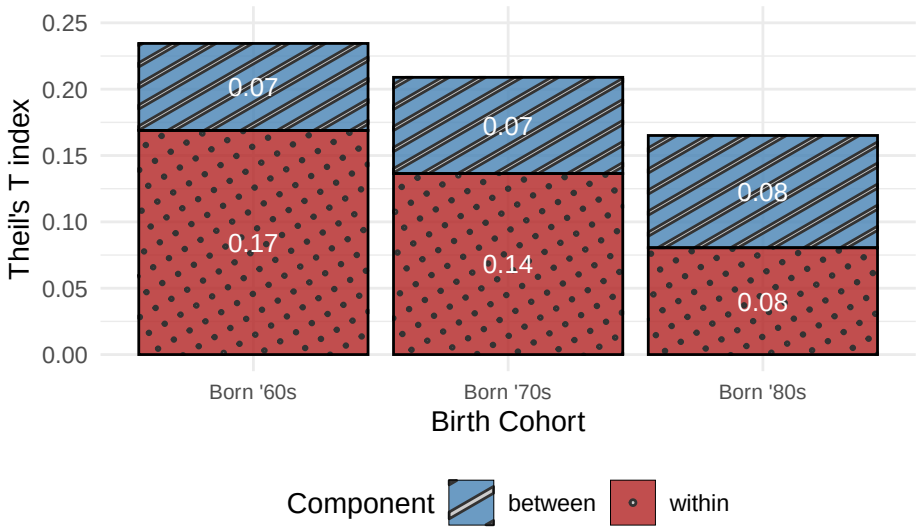


Figure 5: Welfare Inequality Decomposition by Cohorts

Notes: This figure shows the trends and sources of welfare inequality across birth cohorts. Welfare inequality is measured using the Money Metric Welfare Index (MMWI) and Theil's T indices, which are decomposed into within-household and between-household components. For each cohort, Theil's T indices are averaged over the ages of 30 and 40 for wives.

appori and Meghir, 2015). To provide some context, we show key differences between cohorts in Table 7. The striking feature is the substantial increase in college enrollment by women, from 6% to 37% in two 10-year cohorts. In 1960 there was effectively maximal marital sorting, with nearly all college-educated women marrying college-educated men. In the 1980s cohort, men's college attainment rose to 50% (after a small decline in the 1970s birth cohort). Sorting increased relative to the 1970's cohort after declining from the 1960s, based on the odds ratio (see Chiappori, Costa Dias, Meghir *et al.*, 2025, for a definition and properties). Finally, women's wages caught up somewhat with men's, with the within-couple wage gap, while still large, narrowing from -0.92 to -0.61. The overall implications of all these changes have been a large increase in the women's Pareto weight, particularly from the 1970s to the 1980s cohort, which underlies the decline in within-household inequality.

Table 7: Mean Characteristics by Wife's Birth Cohort

	Born in '60s	Born in '70s	Born in '80s
Demographics			
Wife's average age	35.0	35.0	35.0
Husband's average age	37.6	37.1	36.9
Wife with university degree	0.08	0.16	0.37
Husband with a university degree	0.37	0.35	0.50
Marital Sorting			
High school graduate couples (a)	0.61	0.60	0.42
High school graduate wife and university graduate husband (b)	0.30	0.23	0.21
University graduate wife and high school graduate husband (c)	0.01	0.05	0.08
University educated couples (d)	0.08	0.12	0.29
Assortative matching index: odds ratio (ad/bc)	16.27	6.26	7.25
Bargaining Power			
Couple log wage gap (wife- husband)	-0.92	-0.80	-0.60
Wife's Pareto weight (μ)	0.23	0.28	0.41

Notes: Numbers relating to education and marital sorting are proportions. The degree of assortative matching (measured by the odds ratio), the mean log wage gap between wives and husbands, and the mean Pareto weight of wives, represent averages at the time when the wives are age 35, grouped by the wife's birth cohort. For women whose wages are unobserved due to non-participation, wages are imputed based on wage regressions estimated in Section 5.1. The wife's Pareto weights are computed based on the estimated parameters shown in Table 5. 'University graduates' refers to individuals who completed a four-year university program, while all others are categorized as high school graduates.

7 Simulating Effects of a Child Allowance

Finally, we consider the welfare implications of a universal child allowance, which is ¥ 10,000 per child per week. This government-provided financial support to families with children is widely implemented around the world, often without a means test (universal; see, for example, the UK). For illustrative purposes, we focus only on couples with two children.

The allowance increases household unearned income, which enters both the budget constraint and the Pareto weight, providing these two channels for the effect of the allowance: a direct income effect for the household and a redistribution of bargaining power. Given our estimates, the allowance will increase women's bargaining power.

We present a simulation result where child allowance is externally funded and consequently it will have a strong income effect and an impact on bargaining power.[26] The results are shown in

[26]Japan introduced a similar universal child allowance policy (*Jido Teate* in Japanese) in October 2024, after the period covered by our study. The policy provides a monthly allowance of ¥15,000 per child 0-2 years old and ¥10,000 per child 3-15 years old. For the third child and beyond, the allowance increases to 30,000 JPY per child. Payments

Table 8. Column 1 displays the baseline intra-household allocations, welfare, and inequality in the absence of the child allowance, while column 2 shows the effect of the child allowance.

Household spending on children increases by 17.2% on average. This change can be decomposed into two channels:[27] an income effect that contributes 48.4 % of the total effect, and a bargaining power effect contributing 51.6 %. Similarly, expenses for general public goods increase by 12.8%, with the income effect accounting for 66.1 % of the total effect, and the bargaining power effect contributing 33.9 %. The bargaining power channel is more pronounced for child expenses than for general public goods. This distinction arises because, as shown in equation (12), the elasticity of collective demand for a public good is greater when there is a larger discrepancy between the wife's and husband's preferences. According to our preference estimates, this discrepancy is significantly larger for child-related expenses.

The policy also has distributional consequences for welfare within households. Wives' MMWI increases by 15.6% with an income effect contributing 54.2 % of the total effect, and a bargaining power effect contributing 45.8 %.[28] In contrast, husbands' MMWI increases by a smaller 2.5%, with a positive income effect and a negative bargaining power effect partially offsetting the income effect. This differential welfare impact reduces inequality of welfare within the household. The policy also reduces inequality of welfare between households, leading to a general decrease in Theil's T index from 0.15 to 0.13.

This counterfactual simulation offers two key insights. First, it highlights how the bargaining power channel amplifies the positive impact of the allowance on child investments, surpassing the effects predicted by income changes alone. Second, it demonstrates the value of the MMWI measure in policy evaluation by uncovering distributional effects both within and between households in response to unconditional cash transfers.

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are made to the household's primary earner.

[27] The household demand for child expenses is given by $P_1 K_1 = (\zeta_\mu^1 \gamma_j^1 + \zeta_\mu^2 \gamma_j^2) X$. This allows us to decompose the change in log expenses into two channels: $\Delta \log P_1 K_1 = \Delta \log (\zeta_\mu^1 \gamma_j^1 + \zeta_\mu^2 \gamma_j^2) + \Delta \log X$.

[28] One's MMWI is $\zeta_\mu^a \left(\left(\zeta_\mu^1 \gamma_1^1 + \zeta_\mu^2 \gamma_1^2 \right) / \left(\zeta_\mu^a \gamma_1^a \right) \right)^{\gamma_1^a} \left(\left(\zeta_\mu^1 \gamma_2^1 + \zeta_\mu^2 \gamma_2^2 \right) / \left(\zeta_\mu^a \gamma_2^a \right) \right)^{\gamma_2^a} X \quad (a = 1, 2)$. This formula allows us decompose the change in log MMWI into two channels: $\Delta \log MMWI^a = \Delta \log \left(\zeta_\mu^a \right) + \gamma_1^a \Delta \log \left(\left(\zeta_\mu^1 \gamma_1^1 + \zeta_\mu^2 \gamma_1^2 \right) / \left(\zeta_\mu^a \gamma_1^a \right) \right) + \gamma_2^a \Delta \log \left(\left(\zeta_\mu^1 \gamma_2^1 + \zeta_\mu^2 \gamma_2^2 \right) / \left(\zeta_\mu^a \gamma_2^a \right) \right) + \Delta \log (X)$. The sum of the first three terms represents a bargaining power effect while the last term represents an income effect.

Table 8: Simulated Effects of Child Allowance (Families with 2 Children)

	Baseline	Counterfactual
Wife's Pareto Weight	0.437	0.474
Wife's Consumption	4,830	5,729
Wife's Leisure	43	51
Husband's Consumption	10,802	10,966
Husband's Leisure	54	55
Expenses for Children	20,739	24,418
Expenses for General Public Goods	49,567	55,925
Wife's MMWI	103,414	119,593
Husband's MMWI	161,123	165,200
Household MMWI	264,538	284,792
Economy of Scale	1.146	1.145
Wife's MMWI Ratio	0.407	0.436
Theil's T index (within)	0.07	0.061
Theil's T index (between)	0.082	0.07
Theil's T index (overall)	0.151	0.131

Notes: All monetary units in ¥. Baseline relates to the actual circumstances. Unfunded provides the child allowance of ¥10,000 per child per week. Revenue neutral imposes a proportional tax on earnings of 12.4% that ensures revenue neutrality.

8 Conclusion

A large fraction of inequality is hidden in the household, particularly in countries with large gender gaps and low women's empowerment such as in Japan. However, measuring inequality poses two key challenges. First, we need to account for the role of public goods. These are a very large part of household expenditures, but are potentially valued differently by household members. Second, we need to estimate individual preferences over private and public consumption, as well as the way households allocate expenditures to each of these.

In this paper, we introduce the notion of the money metric welfare index that allows us to define individual welfare for each decision-making member of the household in the presence of both public and private goods. We then estimate a collective model with public goods built on ideas in Blundell, Chiappori, and Meghir (2005) using Japanese survey data, a particularly interesting case because of the relatively unequal position of women.

Our empirical analysis reveals several important results. First, allowing for public goods mitigates the large inequality implied by observed private consumption. In contrast to men, women have a much stronger preference for public goods in general and for child expenditures in particular. And this preference is even stronger for women with 2 or more children. Overall, within-household inequality is larger than between households, as measured by the decomposable Theil inequality index. However, within-household inequality has declined dramatically across cohorts, and for our youngest cohort, born in the 1980s, it is equal to the between-household one. This change is associated with a large increase in the number of college educated women and with an increase in assortative matching for our last two cohorts. A simple simulation also shows that an unfunded child allowance increases women's welfare in equal parts because of an income effect and an improvement in her bargaining position. On the other hand the transfer leaves male welfare almost unchanged, once both channels have been accounted for.

The next step in this research line would be to better understand how the marriage market is changing and how this has contributed to the large changes in inequality that we document.

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Online Appendix

Intra-household Welfare Inequality and Household Public Goods

Pierre-André Chiappori, Costas Meghir and Yoko Okuyama

A Theory Appendix

An example with Cobb-Douglas Preferences. The previous concepts can be illustrated on a very simple example, which will be directly generalized in the empirical section. Assume two individuals 1 and 2, four commodities - one private consumption good q, one public consumption good Q and two leisures L^1 and L^2 - and Cobb-Douglas preferences:

$$U^n\left(L^n, q^n, Q\right) = \alpha^n \ln L^n + \gamma^n \ln Q + \left(1 - \alpha^n - \gamma^n\right) \ln q^n, \;\; n = 1, 2$$

The couple's aggregate budget constraint is given by

$$w^1 L^1 + w^2 L^2 + q^1 + q^2 + PQ = \hat{y}^1 + \hat{y}^2 = Y$$

where w^n denotes n's wage, P is the price of the public good (the price of the private good being normalized to 1), and $\hat{y}^n = w^n T$ denotes n's maximum labor income (T being the total time available for leisure and work)[29]; for simplicity, we disregard non labor income. Finally, let μ be the Pareto weight of individual 2 (then the weight of individual 1 is normalized to be $1 - \mu$ to keep the sum constant and equal to 1).

Assume, for the time being, that the wife has a positive market labor supply.[30] The individuals'

[29] Domestic work is not considered in this example, although it will be taken into account in the empirical estimation.
[30] The case of a non participating wife is considered in the online Appendix.

private consumptions and demand for leisure are given by:

$$q^1 = (1-\mu)\left(1-\alpha^1-\gamma^1\right)Y,\;\; q^2 = \mu\left(1-\alpha^2-\gamma^2\right)Y \tag{18}$$

$$L^1 = \alpha^1(1-\mu)\frac{Y}{w^1},\;\; L^2 = \alpha^2\mu\frac{Y}{w^2} < T \tag{19}$$

while the demand for public good is:

$$Q = \left((1-\mu)\gamma^1 + \mu\gamma^2\right)\frac{Y}{P}$$

giving individual utilities

$$U_M^1 = \ln Y - \ln w^1 - \ln P + \ln(1-\mu) + K^1 \tag{20}$$

$$U_M^2 = \ln Y - \ln w^2 - \ln P + \ln(1-\mu) + \left(1-\gamma^2\right)\ln\frac{\mu}{1-\mu} + K^2$$

where

$$K^1 = \alpha^1\ln\alpha^1 + \gamma^1\ln\left(\frac{(1-\mu)\gamma^1+\mu\gamma^2}{1-\mu}\right) + \left(1-\alpha^1-\gamma^1\right)\ln\left(1-\alpha^1-\gamma^1\right)$$

$$K^2 = \alpha^2\ln\alpha^2 + \gamma^2\ln\left(\frac{(1-\mu)\gamma^1+\mu\gamma^2}{1-\mu}\right) + \left(1-\alpha^2-\gamma^2\right)\ln\left(1-\alpha^2-\gamma^2\right)$$

It follows that:

- The ratio of private consumptions is

$$r_p = \frac{q^2}{q^1+q^2} = \frac{\mu\left(1-\alpha^2-\gamma^2\right)}{(1-\mu)\left(1-\alpha^1-\gamma^1\right)+\mu\left(1-\alpha^2-\gamma^2\right)}$$

- The conditional sharing rules are:

$$\tilde{\rho}^1 = q^1 + w^1L^1 = (1-\mu)\left(1-\gamma^1\right)Y$$

$$\tilde{\rho}^2 = q^2 + w^2L^2 = \mu\left(1-\gamma^2\right)Y$$

hence the ratio

$$r_{CSR} = \frac{\tilde{\rho}^2}{\tilde{\rho}^1 + \tilde{\rho}^2} = \frac{\mu\left(1-\gamma^2\right)}{(1-\mu)\left(1-\gamma^1\right) + \mu\left(1-\gamma^2\right)}$$

- The Lindahl prices for the public good are

$$P^1 = \frac{(1-\mu)\gamma^1}{(1-\mu)\gamma^1 + \mu\gamma^2} P,\ P^2 = \frac{\mu\gamma^2}{(1-\mu)\gamma^1 + \mu\gamma^2} P$$

giving the Generalized Sharing Rules:

$$\rho^{*1} = q^1 + w^1 L^1 + P^1 Q = (1-\mu) Y$$
$$\rho^{*2} = q^2 + w^2 L^2 + P^2 Q = \mu Y$$

so that the ratio of 2's to total GSR is

$$r_{GSR} = \frac{\rho^{*2}}{\rho^{*1} + \rho^{*2}} = \mu$$

- Finally, the MMWI requires estimating, for each individual, the utility they would reach for some given income if they had to purchase the public good at market price. Individual n if endowed with an income $\bar{y}^n$, would then choose

$$w^n L_S^n = \alpha^n \bar{y}^n,\ \ PQ_S^n = \gamma^n \bar{y}^n,\ \ q_S^n = \left(1-\alpha^n-\gamma^n\right)\bar{y}^n,$$

therefore reach the utility level

$$U_S^n = \ln \bar{y}^n - \ln w^n - \ln P + \alpha^n \ln \alpha^n + \gamma^n \ln \gamma^n + \left(1-\alpha^n-\gamma^n\right)\ln\left(1-\alpha^n-\gamma^n\right)$$

Attaining in this context the utility levels given by (20) would require incomes given by:

$$U_S^1 = U_M^1 \Rightarrow \ln \bar{y}^1 = \ln Y + \ln(1-\mu) + \gamma^1 \ln\left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{(1-\mu)\gamma^1}\right)$$

or

$$\bar{y}^1 = (1-\mu)\, Y \left(\frac{(1-\mu)\,\gamma^1 + \mu\gamma^2}{(1-\mu)\,\gamma^1} \right)^{\gamma^1}$$

and similarly

$$\bar{y}^2 = \mu Y \left(\frac{(1-\mu)\,\gamma^1 + \mu\gamma^2}{\mu\gamma^2} \right)^{\gamma^2}$$

giving an index

$$I = \frac{\bar{y}^2}{\bar{y}^1 + \bar{y}^2} = \frac{\mu \left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{\mu\gamma^2} \right)^{\gamma^2}}{(1-\mu) \left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{(1-\mu)\gamma^1} \right)^{\gamma^1} + \mu \left(\frac{(1-\mu)\gamma^1 + \mu\gamma^2}{\mu\gamma^2} \right)^{\gamma^2}}$$

This ratio of 2's to total MMWI is our preferred measure of welfare allocation within the household. Note that, unlike r_{GSR}, it depends not only on the Pareto weight μ, but also on individual preferences for the public good.

B Institutional Background Appendix

Women's Economic Position in Japan and OECD countries. Japan is one of the most developed nations economically, but one of the most under-developed in terms of gender equality in political and economic opportunities. While Japan ranks among the top three countries in terms of the GDP per capita, it lags far behind its peer nations in gender equality. In 2022, it ranked 121 out of 153 countries in the Global Gender Gap Report 2022 (World Economic Forum, 2022). Especially, among four arenas that the World Economic Forum analyses (health, education, workplaces and politics), workplaces and politics are skewed in favor of men in Japan.

At workplace, Japanese women face a thicker glass ceiling than women in the peer nations. The top panel of Table B.1 shows the gender gap in the labor market outcomes. At the median, Japanese women earn 78 cents while Japanese men earn one dollar. The gap, 22 percent relative to men's median earnings, is twice as large as the OECD median (11 percent). The proportion of female managers is only 13 percent, which puts Japan as the worst among all OECD countries. While more women are employed than before, nearly 40 percent of them work part time. From the intra-household bargaining perspective, weak economic opportunities put women at a weaker position in the household bargaining.

In the household sphere, the bulk of unpaid work and childcare responsibilities still fall on women's shoulders. The bottom panel of Table B.1 focuses on women and men who are partnered and have at least one child at the age of 0-14. Japanese women work and engage in unpaid care work as likely as other OECD nations. What sets Japan apart from other OECD countries is the disengagement of men from domestic duties. Japanese men devote significantly less time to care work: for example, men with one child spend only 2.5 percent of their time on care work out of all the time they spend on primary activities (paid work, unpaid work, care work, personal care, leisure, and unspecified activities). This is only half the amount that men in other OECD countries spend. As a result, the distribution of care work within households in Japan is skewed toward women.

Table B.1: Women's position in Japan and OECD countries

Variable	Definition	Japan	OECD
Gender wage gap	Gender difference in the median earnings relative to men's median earnings.	22.11	11.31
Share managers (women)	Proportion of managers that are women.	13.20	35.40
Share part time (women)	Women's part-time employment as a proportion of women's employment.	39.02	20.71
Maternal employment rate	Employment rates (%) for women 15-64 yrs old with children (aged 0-14)	70.61	72.96
Care work time (men, 1 child)	% of time dedicated to care work (men with 1 child)	2.50	5.27
Care work time (men, 2 children or more)	% of time dedicated to care work (men with >1 children)	4.10	6.67
Care work time (women, 1 child)	% of time dedicated to care work (women with 1 child)	11.70	11.39
Care work time (women, 2 children or more)	% of time dedicated to care work (women with >1 children)	16.60	16.08

[1] *Source*: OECD Family database (https://www.oecd.org/els/family/database.htm). The column *OECD* shows the median of all OECD countries available in the database.

C Data Appendix

C.1 Sample Construction

Table C.2: Sample Construction

Criteria	No. of households	No. of household-year observations
Original married sample	2,297	26,798
At least one child aged 15 or below	2,291	20,547
Husband is employed and earns positive earnings	2,144	16,319
Complete expenditure and income data	2,115	15,386
Complete time use data	2,089	14,705
Wife's market history	2,080	14,648

We use data from the Japanese Panel Survey of Consumers (hereafter JPSC), the longest-running nationwide panel survey of individuals in Japan. We restrict our sample to heterosexual, legally married couples with at least one child under the age of 15 between 1998 and 2020. Although the JPSC starts in 1993, information on detailed household expenses exist only after 1998. We restrict our sample to households to those with at least one child below the age of 15 (0.3% of households in the original married sample dropped). We further exclude households where a husband is not gainfully employed (6% dropped), and households that did not complete reporting monthly expenses, income (1% dropped), and time use (1% dropped). Finally, we omit households that did not provide a comprehensive history of the wife's employment since she completed school (0.4% dropped). The resulting sample consists of 2,080 households each observed for an average of 7 years and 14,648 observations in total. Table C.2 summarizes the number of households and household-year observations dropped to meet each criteria.

C.2 Construction of Key Variables

Hourly wage. In the employment section of the survey questionnaire, labor earnings are reported based on the payment frequency, while hours worked are reported on a weekly basis. Accordingly, hourly wages are computed as follows: If earnings are paid monthly, the hourly wage is calculated by dividing monthly labor earnings by the product of weekly hours worked and four. If earnings are paid weekly, the hourly wage is obtained by dividing weekly labor earnings by the total weekly hours

worked. For earnings paid daily, the hourly wage is calculated by dividing daily labor earnings by the number of hours worked per day, as reported in the time-use section of the survey. Finally, if earnings are paid hourly, the reported hourly wage is used directly.

Weekly expenses. The Japanese Panel Survey of Consumers collects data on monthly household expenses, categorized by common resources and personal use for the wife, husband, children, and other household members. These categories are mutually exclusive and sum to the total monthly household expenses. The survey does not specify the commodities consumed by each household member but instead allows respondents to interpret what constitutes common resources or personal use. This question was inspired by sociological studies on the control and allocation of money within families, particularly Jan Pahl's (1989) Money and Marriage, published by Macmillan. In our study, we classify expenses for children as public good 1 and expenses for common resources as public good 2 (general public good).

Wife's complete labor market participation history. We use each respondent's complete participation history since the completion of schooling to estimate her wage process. This history is reconstructed using her self-reported retrospective work history, collected during the first wave (i.e., covering her work history prior to entering the longitudinal survey), as well as her employment status observed in subsequent waves. For cases where the initial work history is missing, we impute the data using the following approach:

1. Never worked: If she reported in a separate question that she had never worked before, her initial work history is recorded as zero years.

2. Not currently working, with quit date provided: If she is not currently working but reported the year she quit her last job, her initial work experience is calculated as the year she quit minus the year she completed her highest degree.

3. Not currently working, no quit date provided: If she is not currently working and did not provide any information about her past work history, her initial work experience is recorded

as zero years.

4. Currently working: If she is currently working, her initial work experience is calculated as the year she entered the longitudinal survey minus the year she completed her highest degree.

Our results for the wife's participation and log wage equation are robust even when we exclude imputed initial work histories and rely solely on the sample with observed work history.

D Summary Statistics Appendix

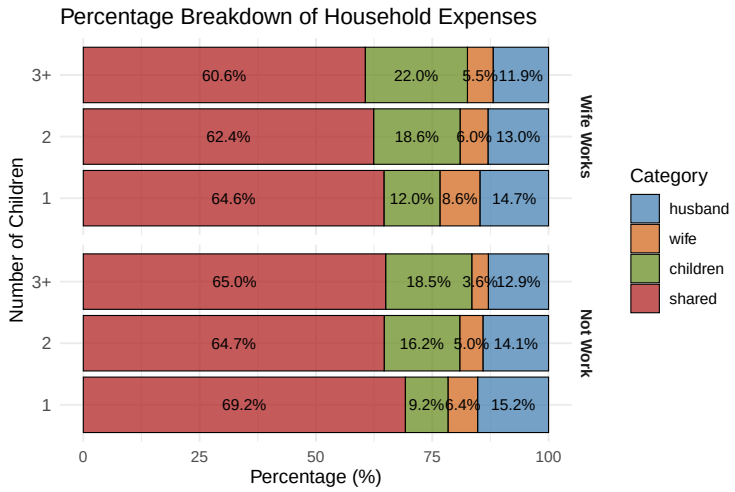


Figure D.1: Average Percentage Breakdown of Household Expenses

Notes: The figure shows the average percentage breakdown of household consumption across four categories: wife's personal consumption, husband's personal consumption, children's consumption, and shared consumption. The data is grouped by the wife's labor participation status (working or not working) and the number of children in the household (1, 2, or 3+). Percentages are calculated as a share of total household consumption. Lines around and within the bars delineate individual categories, and percentage labels indicate the average share within each group. Data source: Japan Panel Survey of Consumers (JPSC) 1998–2020. Details on sample construction are provided in Appendix C.

The analysis of household expenses in our sample reveals significant patterns in the allocation of resources. On average, 64 percent of total household expenses are devoted to general public goods, including housing, utility costs, and shared food consumption. Spending on children constitutes the second largest category at 20 percent, while the remaining 17 percent is allocated to personal consumption. Within this category, husbands account for about two-thirds (14 percent), and wives account for the remaining one-third (6 percent).

Figure D.1 offers additional insights into household expenses, categorized by household type and the number of children. As the number of children increases, spending on children rises, while expenses on general public goods decrease slightly. Nevertheless, the combined spending on public goods (general public goods plus children) grows overall, reflecting the increasing resource demands of larger families. Building on this, Figure D.2 breaks down household expenses by the level of the binned couple wage gap, where 1 represents the largest gap and 5 the smallest. As the

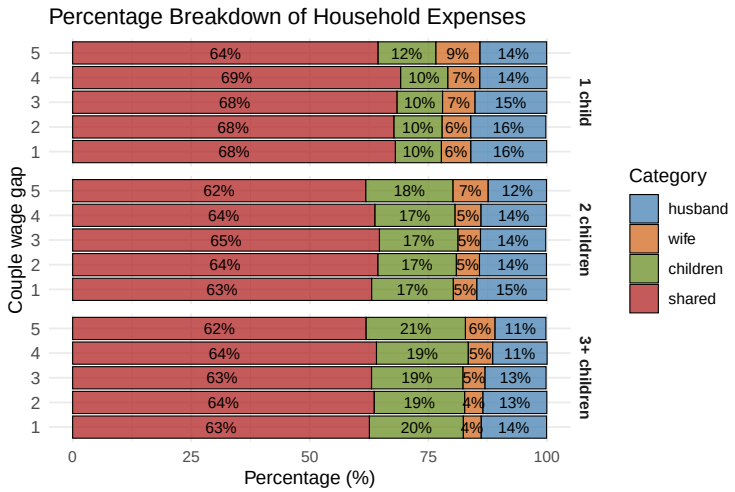


Figure D.2: Average Percentage Breakdown of Household Expenses By Couple Wage Gap

Notes: The figure presents the average percentage breakdown of household consumption across four categories: wife's personal consumption, husband's personal consumption, children's consumption, and general public good consumption (labeled as "shared"). The data is grouped by the number of children in the household (1, 2, or 3+) and the couple log wage gap. The couple log wage gap (wife's log wage minus husband's log wage) is divided into five bins, with 1 representing the largest gap (bottom 20%) and 5 representing the smallest gap (top 20%). For women whose wages are unobserved due to non-participation, wages are imputed based on wage regressions estimated in Section 5.1. Percentages are calculated as shares of total household consumption. Lines around and within the bars delineate individual categories, with percentage labels indicating the average share for each group. Data source: Japan Panel Survey of Consumers (JPSC) 1998-2020. Details on sample construction are provided in Appendix C.

couple wage gap narrows, the wife's personal consumption increases, while the husband's personal consumption decreases, reducing the consumption disparity between partners. Notably, the share of expenses allocated to children also shows a modest increase as the couple wage gap closes.

Two key insights emerge from these observations. First, on average, married women with children consume only half as much in private goods as their male counterparts. This disparity in private consumption is strongly associated with the couple's wage gap, suggesting that labor market inequalities translate into gender differences in consumption. This, in turn, points to the potential existence of a substantial welfare gap within households. Second, while the disparity in private consumption is notable, private consumption accounts for less than 20 percent of total household expenses, with the majority directed toward public goods. This emphasizes the central role of shared consumption in shaping household welfare and underscores the importance of incorporating it into welfare assessments for a more comprehensive understanding of household well-being.

E Empirical Model Appendix

Collective indirect utilities.

1. She works:

$$\begin{aligned} V^1 = \alpha^a \ln\left(\zeta_\mu^a \alpha^a \frac{X}{w_a}\right) + \beta^a \ln\left(\zeta_\mu^a \beta^a X\right) \\ + \gamma_1^a \ln\left((\zeta_\mu^1\gamma_1^1 + \zeta_\mu^2\gamma_1^2)\frac{X}{P_1}\right) + \gamma_2^a \ln\left((\zeta_\mu^1\gamma_1^1 + \zeta_\mu^2\gamma_1^2)\frac{X}{P_2}\right) \qquad a = 1,2 \end{aligned} \tag{21}$$

2. She does not work:

$$\begin{aligned} V_{NP}^1 = \alpha^1 \ln\left(\tilde{\zeta}_\mu^1 \alpha^1 \frac{\tilde{X}}{w_a}\right) + \beta^1 \ln\left(\beta^1 \tilde{\zeta}_\mu^1 \tilde{X}\right) \\ + \gamma_1^1 \ln\left((\tilde{\zeta}_\mu^1\gamma_1^1 + \tilde{\zeta}_\mu^2\gamma_1^2)\frac{\tilde{X}}{P_1}\right) + \gamma_2^1 \ln\left((\tilde{\zeta}_\mu^1\gamma_2^1 + \tilde{\zeta}_\mu^2\gamma_2^2)\frac{\tilde{X}}{P_2}\right) \end{aligned} \tag{22}$$

$$\begin{aligned} V_{NP}^2 = \alpha^2 \ln\left(\bar{L}\right) + \beta^2 \ln\left(\beta^2 \tilde{\zeta}_\mu^2 \tilde{X}\right) \\ + \gamma_1^2 \ln\left((\tilde{\zeta}_\mu^1\gamma_1^1 + \tilde{\zeta}_\mu^2\gamma_1^2)\frac{\tilde{X}}{P_1}\right) + \gamma_2^2 \ln\left((\tilde{\zeta}_\mu^1\gamma_2^1 + \tilde{\zeta}_\mu^2\gamma_2^2)\frac{\tilde{X}}{P_2}\right) \end{aligned} \tag{23}$$

Money Metric Welfare Index.

1. She works:

$$\bar{y}^a = \zeta_\mu^a \left(\frac{\zeta_\mu^1\gamma_1^1 + \zeta_\mu^2\gamma_1^2}{\zeta_\mu^a\gamma_1^a}\right)^{\gamma_1^a} \left(\frac{\zeta_\mu^1\gamma_2^1 + \zeta_\mu^2\gamma_2^2}{\zeta_\mu^a\gamma_2^a}\right)^{\gamma_2^a} X, \qquad a = 1,2 \tag{24}$$

2. She does not work:

$$\bar{y}_{NW}^1 = \tilde{\zeta}_\mu^1 \left(\frac{\tilde{\zeta}_\mu^1\gamma_1^1 + \tilde{\zeta}_\mu^2\gamma_1^2}{\tilde{\zeta}_\mu^1\gamma_1^1}\right)^{\gamma_1^1} \left(\frac{\tilde{\zeta}_\mu^1\gamma_2^1 + \tilde{\zeta}_\mu^2\gamma_2^2}{\tilde{\zeta}_\mu^1\gamma_2^1}\right)^{\gamma_2^1} \tilde{X} \tag{25}$$

$$\bar{y}^2_{NW} = (1-\alpha^2)\tilde{\zeta}^2_\mu \left(\frac{\tilde{\zeta}^1_\mu \gamma^1_1 + \tilde{\zeta}^2_\mu \gamma^2_1}{\tilde{\zeta}^2_\mu \gamma^2_1} \right)^{\frac{\gamma^2_1}{1-\alpha^2}} \left(\frac{\tilde{\zeta}^1_\mu \gamma^1_2 + \tilde{\zeta}^2_\mu \gamma^2_2}{\tilde{\zeta}^2_\mu \gamma^2_2} \right)^{\frac{\gamma^2_2}{1-\alpha^2}} \tilde{X} \tag{26}$$

Theil's T index with MMWI Theil's T index can be decomposed as within- and between- household inequality:

$$T_T = \sum_{i=1}^{m} s_i T_i + \sum_{i=1}^{m} s_i \ln \frac{\bar{y}_i}{\mu}, \quad \text{for } s_i = \frac{\bar{y}_i}{N\mu} \tag{27}$$

where

- s_i is MMWI share of household i,
- N is the number of households,
- T_i is the household-level Theil index,
- $\bar{y}_i$ is the average MMWI in household i, and
- μ is the average MMWI of the population,

The first component indicates within-household inequality, and the second component indicates between-household inequality.

As discussed in Section 6, the Money Metric Welfare Index (MMWI) plays a crucial role in measuring within-household inequality. Interestingly, however, MMWI also has implications for between-household inequality.

Between-household inequality is influenced by disparities in household full income and differences in the economy of scale, as captured by MMWI. To illustrate this, note that the average MMWI for household i can be expressed as a function of i's full income and economy of scale:

$$\bar{y}_i = \frac{1}{2}\left(\bar{y}^1_i + \bar{y}^2_i\right) = \frac{1}{2} S_i X_i \tag{28}$$

where X_i is household i's full income, and S_i indicates economy of scale in household i defined as

$S = (\bar{y}_i^1 + \bar{y}_i^2)/X_i$ (See also equation (4)). Then between-household inequality can be rewritten as

$$T_{between} = \frac{1}{N}\sum_{i=1}^{m} \frac{\bar{y}_i}{\mu} \log\left(\frac{\bar{y}_i}{\mu}\right) \tag{29}$$

$$= \frac{1}{N}\sum_{i=1}^{m} \frac{\bar{y}_i}{\mu} \log\left(\bar{y}_i\right) - \log\left(\mu\right) \tag{30}$$

$$= \frac{1}{N}\sum_{i=1}^{m} \frac{\bar{y}_i}{\mu} \log\left(\frac{1}{2}S_i X_i\right) - \log\left(\mu\right) \tag{31}$$

$$= \frac{1}{N}\sum_{i=1}^{m} \frac{\bar{y}_i}{\mu} \log\left(S_i\right) + \frac{1}{N}\sum_{i=1}^{m} \frac{\bar{y}_i}{\mu} \log\left(X_i\right) - \log\left(2\mu\right) \tag{32}$$

The first term indicates dissimilarity in economy of scale, and the second term indicates dissimilarity in household income.

The economy of scale, S, exhibits a hump-shaped relationship with the wife's Pareto weight, μ. Consequently, keeping preferences fixed, the distribution of μ across households influences the distribution of S. μ becomes more equally distributed across households, S also equalizes, leading to a reduction in between-household inequality.

This observation highlights the implications of welfare inequality stemming from changes in marriage matching patterns. The distribution of μ is determined by marriage market matching, meaning that shifts in marriage market outcomes affect between-household inequality not only through the distribution of household income but also through the distribution of scale economies.

F Estimation Results Appendix

F.1 Couple Wage Gap

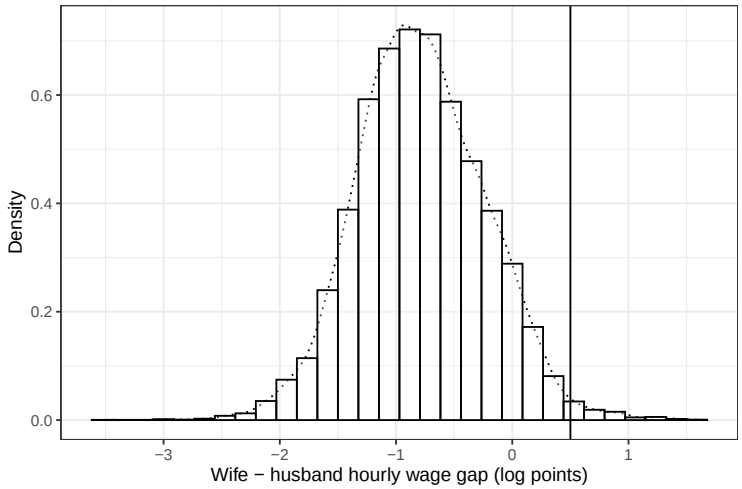


Figure F.3: Distribution of Couple Wage Gap

Notes: This figure plots the distribution of the couple log wage gap (wife's log wage minus husband's log wage). For women whose wages are unobserved due to non-participation, wages are imputed based on wage regressions estimated in Section 5.1.

Table F.3: Mean Preference Parameters by the Number of Children

	One child	Two or more children
Husband		
α leisure	0.817	0.825
β private consumption	0.068	0.058
γ_1 preference for child expenditures	0.008	0.002
γ_2 preference for other public goods	0.107	0.115
Wife		
α leisure	0.424	0.423
β private consumption	0.071	0.036
γ_1 preference for child expenditures	0.053	0.199
γ_2 preference for other public goods	0.451	0.342

Note: This table presents preference parameters by the number of children while holding other household observables constant at the data mean. Underlying parameter estimates are presented in Table 3.

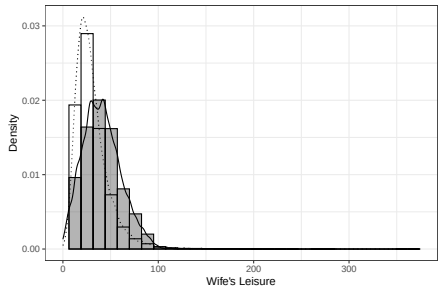
F.2 Goodness of Fit

Table F.4: Comparison of Observed and Predicted Means

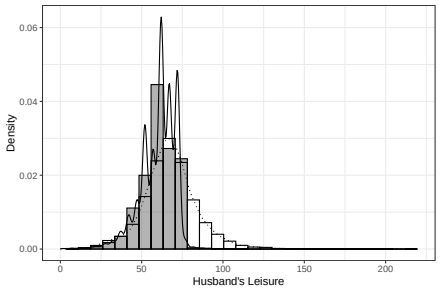
Category	Observed	Predicted
Wife's Consumption	2,817	3,620
Husband's Consumption	8,959	8,415
Wife's Leisure	30.89	40.55
Husband's Leisure	67.55	60.07
Expenses for Children	10,225	10,325
Expenses for General Public Goods	38,904	39,685

Note: This table compares the observed means with the predicted means for various categories of household consumption and leisure. Observed values are calculated from the JPSC data, while predicted values are based on model estimates.

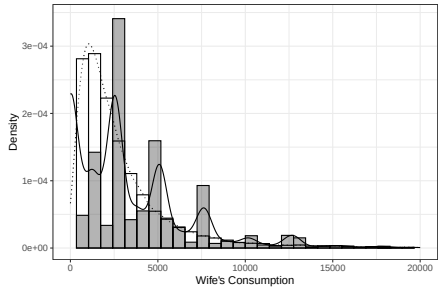
This section presents goodness-of-fit statistics for the model estimates from Section 5. We simulate the model and compare the observed data with the model's predictions. Table F.4 reports the mean values, while Figure F.4 illustrates the distributions of the key variables. Overall, the model demonstrates a good fit with the data.



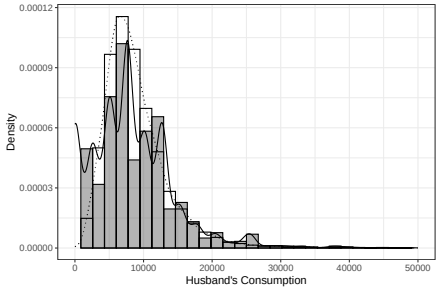
(a) Wife's leisure



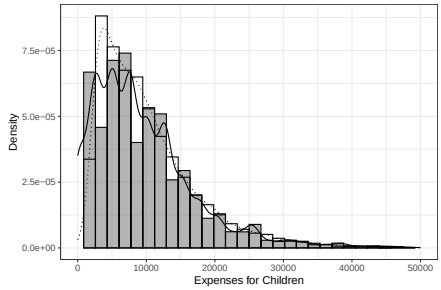
(b) Husband's leisure



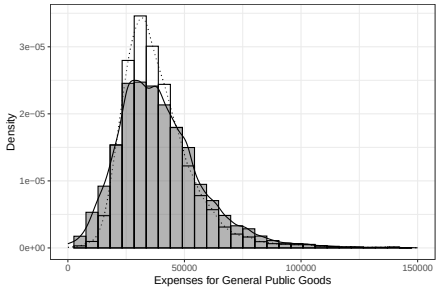
(c) Wife's private consumption



(d) Husband's private consumption



(e) Children



(f) General public goods

Figure F.4: Observed and Predicted Consumption and Leisure

This figure compares the distributions of observed and predicted private, public consumption, and leisure. The white histogram represents the predicted values, while the gray-shaded histogram illustrates the observed data. Predicted consumption and leisure values are calculated using the estimated Pareto weights presented in Table 5 and preference parameters presented in Table 3.

F.3 Welfare Inequality

Table F.5: Consumption and Welfare Inequality Measured by Education Group

Metric	Theil (within)	Theil (between)	Theil (overall) height
Unitary: Total Consumption			
1. Low (wife) & low (husband)	0.00	0.09	0.09
2. High (wife) & low (husband)	0.00	0.10	0.10
3. Low (wife) & high (husband)	0.00	0.09	0.09
4. High (wife) & high (husband)	0.00	0.11	0.11
Collective: Private consumption Only			
1. Low (wife) & low (husband)	0.14	0.13	0.27
2. High (wife) & low (husband)	0.22	0.14	0.36
3. Low (wife) & high (husband)	0.18	0.14	0.32
4. High (wife) & high (husband)	0.26	0.15	0.41
Collective: Conditional sharing rule (CSR)			
1. Low (wife) & low (husband)	0.25	0.08	0.33
2. High (wife) & low (husband)	0.24	0.08	0.32
3. Low (wife) & high (husband)	0.31	0.08	0.39
4. High (wife) & high (husband)	0.29	0.09	0.38
Collective: Generalized sharing rule (GSR)			
1. Low (wife) & low (husband)	0.13	0.07	0.21
2. High (wife) & low (husband)	0.13	0.07	0.20
3. Low (wife) & high (husband)	0.19	0.08	0.26
4. High (wife) & high (husband)	0.17	0.09	0.25
Collective: Money Metric Welfare Index (MMWI)			
1. Low (wife) & low (husband)	0.12	0.08	0.20
2. High (wife) & low (husband)	0.12	0.07	0.20
3. Low (wife) & high (husband)	0.17	0.08	0.25
4. High (wife) & high (husband)	0.15	0.09	0.24

Notes: This table presents Theil's T Indices for various metrics of consumption or welfare inequality among married individuals, separately by the combination of husband's and wife's educational attainment. The index ranges from zero (indicating perfect equality) to higher positive values, with larger values indicating greater inequality. Overall inequality (overall Theil's T index) is decomposed into two components: the average inequality within households, weighted by total household consumption or welfare ('within' component of Theil's T index), and inequality between households ('between' component of Theil's T index). The 'Unitary household approach' assumes equal sharing of resources within households. Per-person consumption is calculated by multiplying total household expenses (including private and shared consumption) by the OECD equivalent scale ($1.5 + 0.3 \times$ No. of children) and dividing by two. The 'Collective household approach' incorporates individual-level differences in resource allocation and welfare, applying collective household models to measure private consumption, Conditional Sharing Rules (CSR and GSR), and the Money Metric Welfare Index (MMWI).

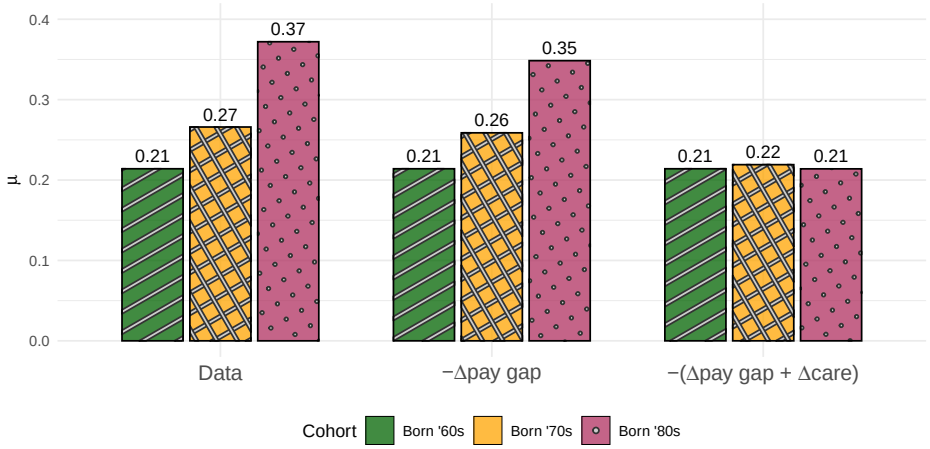


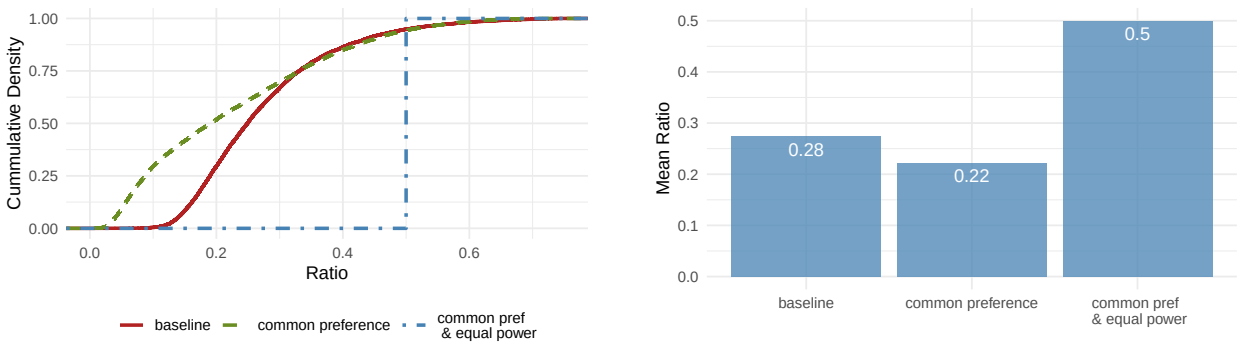
Figure F.5: Decomposition of Wife's Pareto Weight by Cohorts

Notes: This figure illustrates trends in women's Pareto weight (μ) across birth cohorts and highlights the contribution of key constraints. For each cohort, μ is computed using estimated parameters and cohort-specific means of explanatory variables (the couple wage gap, unearned income, and child care availability), averaged over wives aged 30 to 40, following the formula in equation (15). The "Data" bars represent baseline values using observed cohort means. The "Δ pay gap" scenario sets the spousal pay gap to the level observed in the 1960s cohort. The "(Δ pay gap + Δ care)" scenario further sets childcare availability to the 1960s level, holding both factors constant.

Table F.6: Cohort-level Means of Key Variables for Wife's Pareto Weight

Cohort	Child Care Availability	Couple Pay Gap $log(w_{wife}/w_{husb})$	Unearned Income
Born '60s	0.34	-0.90	-50230.46
Born '70s	0.40	-0.79	-47010.18
Born '80s	0.52	-0.60	-50286.55

Notes: This table presents the cohort-specific means of explanatory variables for the wife's Pareto weight (the couple wage gap, unearned income, and child care availability), averaged over wives aged 30 to 40.



(a) Empirical Distributions

(b) Mean MMWI Ratio

Figure F.6: The Wife's MMWI Ratio: The Roles of Preference Heterogeneity and Bargaining Power

Notes: This figure presents the average and empirical distribution of the wife's MMWI ratio and decomposes it into the contributions of two key components: preference heterogeneity and intra-household bargaining power. In the baseline case, both preference heterogeneity and intra-household bargaining power are allowed. In the "common preference" case, we assign both the husband's and wife's preferences to be the weighted average of their estimated preferences (e.g., $\zeta^1\alpha^1 + \zeta^2\alpha^2$), making their preferences identical while leaving the household demand functions unchanged. In the "common preference and equal power" case, we assume both common preferences and equal bargaining power by setting $\zeta^1 = \zeta^2 = 0.5$, effectively reducing the household model to a unitary framework.