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Provision of Household Public Goods and the Household Income Distribution

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Abstract

Several theoretical models have been proposed to explain household behavior, such as the unitary model, non-cooperative model, and cooperative model. These three models make different predictions about the provision of household public goods. By using both the Japanese tax reforms conducted in the 1990s as a quasi-natural experiment and Japanese panel data on household expenditure, I study how the within-household income distribution affects household public goods and discuss which model is most relevant. I find that the neutrality of the effect of the income distribution on household public goods does not hold, which shows the failure of the unitary model. I also find evidence that the non-cooperative model does not hold either. Finally, I argue that the observed data are consistent with the cooperative bargaining model.

Keywords: public goods, household behavior, income distribution

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1 Introduction

When a couple starts a family, one of the family's functions in society is to share household public goods such as basic housing services, children's welfare, and household chores. For example, Becker (1981) pointed out that children have the characteristics of classical public goods within a family in the sense that both the husband and the wife obtain utility from their children's happiness and it is difficult to exclude the husband's (wife's) enjoyment of their children's happiness when the wife (husband) is enjoying it, too.

Models that explain household behavior can be divided into three categories: the unitary model, non-cooperative model, and cooperative model. The unitary model is based on the hypothesis that a family will behave as if it is a single agent (Samuelson, (1954; Becker, 1974, 1981). In this model, the within-household income distribution does not affect the resource allocation.

In the non-cooperative model, each member of the household determines his/her contribution to household public goods given the contribution of the other members of the household, and the total amount of public goods is determined as the Nash equilibrium of this non-cooperative game. In the non-cooperative game literature, Warr (1983) and Bergstrom, Blume, and Varian (1986) proved that an exogenous income redistribution does not affect the resource allocation as long as income is redistributed among public goods contributors.

The cooperative model is based on the hypothesis that the household allocation is chosen among Pareto-efficient allocations. Several types of cooperative models exist. The collective model developed by Chiappori (1988, 1992) assumes only Pareto efficiency for the household allocation and shows that the allocation implied by Pareto efficiency must satisfy a certain sharing rule. Other types of cooperative models specify more detailed structures. For example, McElroy and Horney (1981) and Manser and Brown (1980) assumed that the household allocation is determined as Nash bargaining where the threat point is the outcome when a couple become divorced. In the so-called separate spheres bargaining model, Lundberg and Pollak (1993) suggested that the final household allocation is determined by Nash bargaining but the threat point is the equilibrium of the non-cooperative game. In this case, how an exogenous income redistribution within household members affects the resource allocation depends on how the non-cooperative bargaining solution is affected by the income redistribution.

The question of how expenditure on household public goods is determined is important for several reasons. First, government policies are often targeted to household public goods such as housing services, children's health, nutrition, and human capital accumulation. Second, to design the basic principle of both the tax and the public expenditure systems, information on how the household resource allocation is determined is necessary. In the tax system, some countries use individual income as the basic unit, while others use household income (the sum of the incomes of the husband and wife). One might ask which system is more efficient and how the difference between these two systems, household income base or individual income base, affects economic behavior such as labor supply, retirement, savings, and the provision of household public goods.

In this study, I first show theoretically how an exogenous variation in income share affects the level of public goods in the unitary model, non-cooperative model, and cooperative bargaining model with a non-cooperative threat point. Second, I empirically examine how an exogenous change in the income distribution affects the level of household public goods and discuss which model is consistent with this observed data.

The contribution of this study is twofold. First, it uses detailed household data taken from the Japanese Panel Survey of Consumers (JPSC). Using the JPSC has several advantages. First, this dataset not only collects data on expenditure for the husband, wife, and children, but also asks about how much is saved. For most couples, some income is saved. Focusing on only current expenditure can thus be misleading for the analysis of the effect of the income distribution on the household allocation. In this data, I can observe how household income is used not only for current expenditure but also for savings for different members of the household and public goods. Thus, these data are more comprehensive than those used in previous studies.

Second, the JPSC asks about the detailed use of time by the husband and wife. For example, it asks how much time each spends on child-rearing, work, housework, leisure, and sleeping. When the wife's income share increases because of an increase in her hours of work, she is often forced to spend less time with the children; as a result, expenditure on children rises. Thus, to assess the effect of the income distribution between the husband and wife on expenditure on children, it is important to control for the time spent child-rearing. In the JPSC, it is possible to control for such an effect.

Third, the years that the JPSC covers includes the 1990s. During the 1990s, the Japanese government conducted several reforms of the income tax system and I use those reforms for identification, as discussed below.

The second contribution of this study is offering an empirical strategy that generates a quasi-experimental exogenous income distribution between the husband and wife. To generate such a quasi-experimental exogenous income distribution, I use the changes in Japanese tax policies. The Japanese tax system is based on individual income, not on family income, and the exemption level is quite high. This fact implies that many secondary earners whose income is low are exempt from the tax system. Thus, when the Japanese government introduced its income tax credit, few secondary earners received it. As a result, the income distribution between the husband and wife changed substantially. I use this tax policy change to generate the exogenous income distribution between the husband and wife. To use the tax policy change as the instrumental variable (IV), I adopt the method initially used by Gruber and Saez (2002) to analyze the effect of labor supply.

Several studies are related to this study. This work rests on the previous advancement of the theoretical description of household behavior including Becker, Horney, and McElroy (1981), Manser and Brown (1980), Lundberg and Pollak (1993), and Chiappori (1988, 1992). In terms of more recent work, Blundell, Chiappori, and Meghir (2005) analyzed the household labor supply with household public goods. They proposed a responsiveness condition of the marginal rate of substitution (MRS) between public and private goods. They showed that if this condition is satisfied, it is possible to map the income distribution and level of household public goods in a cooperative model. More specifically, they showed that if member i's MRS between public goods and private goods is more responsive than that of member j, the shift in bargaining power from j to i will increase the provision of the public good in a cooperative model. In this study, I use a similar responsive condition but formulate it differently to Blundell, Chiappori, and Meghir (2005).

Empirically, Browning and Lechene (2001) and Cherchye, De Rock, and Vermeulen (2012) are the most closely related works to this study. Browning and Lechene (2001) theoretically and empirically analyzed several models including the non-cooperative model and cooperative model with a non-cooperative threat point. Cherchye, De Rock, and Vermeulen (2012) conducted a structural estimation of the model developed by Blundell, Chiappori, and Meghir (2005). Interestingly, they found that a change in empowerment from the husband to wife has little effect on a child's consumption and welfare contrary to the results of previous studies. In this study, by contrast, I use the reduced-form estimation of the effect of the income distribution on the provision of public goods and pay more attention to the exogeneity of the income distribution between the husband and wife. Although conducting the structural estimation is useful for ex-ante policy simulation, assumptions on the functional form and error terms are quite strong. In addition, implementing the IV or GMM estimation in the structural model is difficult. In a non-linear model, the moment conditions do not hold even if the explanatory variable is exogenous. In contrast, the reduced-form estimation places less restriction on the functional form. Thus, I believe that this empirical strategy complements the structural estimation approach.[1]

I employ the reduced-form estimation for two reasons. First, I have an exogenous tax policy change that could generate an exogenous variation in the income distribution. By employing the method proposed by Gruber and Saez (2002), I apply the

[1] In this study, I do not examine the relevance of the bargaining model where the threat point is the divorce. In the long run, such a model might be relevant. However, in this data, the exogenous income redistribution is a tax reform. Given the change in income implied by the tax reform, it is unclear how each individual negotiates the resource allocation using the divorce as the potential threat point.

IV estimation. To use the IV estimation, employing the reduced-form estimation is quite natural. In contrast, in a structural estimation, the model becomes non-linear regarding the error term. In such a case, conducting the IV estimation is challenging.

2 Literature Review

Since the literature on household behavior is large, this literature review is restricted to static analyses. Even in static analysis, the literature is nevertheless large. In this static analysis literature, several works have studied the relationship between the income distribution and household public goods provision.[2]

Warr (1983) was the first study to claim that the income distribution is neutral regarding the resource allocation when public goods are voluntarily provided in the non-cooperative model. Bergstrom, Blume, and Varian (1986) analyzed this issue fully and examined the conditions under which this theorem is valid. More specifically, they showed that neutrality holds as long as the income redistribution is conducted among the contributors to public goods. In addition, they showed that if the income redistribution is conducted from the contributors to the non-contributors to public goods, total public goods will decrease.[3] In the context of household behavior, non-cooperative models have been presented by Ulph (1988) and Konrad and Lommerud (1995). These models have been applied to the division of housework (Bragstad, 1989), domestic violence (Tauchen et al., 1991), and expenditure on children by divorced parents (Del Boca and Flinn, 1994; Welling, 2000).[4]

The cooperative household model was developed Manser and Brown (1980) and McElroy and Horney (1981). Lundberg and Pollak (1993) developed a separate spheres model where the threat point is the equilibrium allocation of the non-cooperative

[2] Among them are Thomas (1990), Hoddinott and Haddad (1995), and Schultz (1990). Thomas (1990) found that in Brazilian families, the unearned income of the mother has a stronger positive effect on child welfare. Haddad and Hoddinott (1995) found that in Cote d'Ivoire, children's height for their age is positively related to the share of family wealth controlled by the mother.

[3] For the empirical analysis of the voluntary provision of public goods and income distribution, Brunner (1997) and Murdoch and Sandler (1997) were the first studies to analyze this issue. Brunner (1997) analyzed the contribution to national public goods and Murdoch and Sandler (1997) examined the voluntary provision of international public goods.

[4] Naito and Yamada (2004) examine the household public goods in a non-cooperative model.

equilibrium. Haddad and Kanbur (1994), Konrad and Lommerud (2000), Chen and Woolley (2001), and Browning, Chiappori, and Lechene (2011) are also along this line of research.

For collective models, as discussed in the Introduction, seminal works are Chiappori (1988, 1992) and subsequent extensions (Bourguignon, Browning, Chiappori, and Lechene, 1993, 1994; Chiappori, 1997). Recently, collective models have included both labor supply and household public goods (Blundell, Chiappori, and Meghir, 2005; Cherchye, De Rock, and Vermeulen, 2012).

Finally, many studies have examined the neutrality of the effect of the income distribution on private goods consumption, such as Hayashi (1995), Altonji, Hayashi, and Kotlikoff (1992), Bourguignon, Browning, Chiappori, and Lechene (1994), and Hoddinott and Haddad (1995). Hayashi (1995) and Altonji, Hayashi, and Kotlikoff (1992) examined neutrality within extended families, while Bourguignon, Browning, Chiappori, and Lechene (1994) and Hoddinott and Haddad (1995) investigated neutrality within a household. The results of those studies consistently showed the non-neutrality of private goods within extended families or within a family.

3 Dataset

The dataset that I use in this study is the JPSC. Since 1993, the Institute for Research on Household Economics has surveyed 1500 women aged 24 to 34. These individuals are national representatives of this demographic group. The institute added another 500 women aged 24 to 34 in 1997 to increase the sample size. Since then, the institute has surveyed them annually. The women interviewed by the JPSC are asked about their economic and social lives, such as labor market outcomes, education, savings, housing, the relationship between their parents and husbands, and household expenditure.

The JPSC is an appropriate dataset for testing the neutrality of the effect of the income distribution on the provision of household public goods because it surveys the composition of consumption expenditure and savings in September and assesses the husband's and wife's after tax incomes separately for married couples. The JPSC also asks about hours of housework, leisure, sleeping, and child-rearing for the husband and wife in addition to labor supply. In the questionnaire, consumption expenditure is divided into the following five categories: common expenditure, family expenditure (savings), expenditure on wife, expenditure on husband, expenditure on children, and expenditure on others. Savings are divided similarly. However, the JPSC has several disadvantages. First, the sample size is small compared with other panel datasets such as PSID. Although the JPSC initially includes approximately 2000 households, after cleaning the dataset, the number of households that have at least one child is approximately 1000. Second, for expenditure on each item, the JPSC only asks women. This implies that the information of the consumption of the husband could have a lot of noise.[5] Hence, for the estimation, I need to take special account of those variables. To solve this issue, I thus use the IV estimation.

I use the JPSC from 1993 to 1999 and focus on two samples for the reasons explained in the section on empirical strategies. The first sample comprises 906 single- and dual-earner households with at least one child. The second sample is composed of 376 dual-earner households with at least one child. The dual-earner households sample is a subset of the 906 single- and dual-earner households sample. These two samples are unbalanced panel data. I select participants based on the following selection rules: (i) they are married; (ii) they have at least one child; (iii) the two earners have been salaried workers for at least two years in the dual-earner sample and all earners (one or both) are salaried workers in the single- and dual-earner sample; and (iv) they have the necessary information for more than two years. I use selection rule (ii) because neutrality is more likely to be reached in the couples with children because they share more public goods than those with no children (see the samples used by Bourguignon, Browning, Chiappori, and Lechene, 1994; Browning and Chiappori, 1998). In the case of dual-earner couples with at least one child, neutrality through the voluntary provision of public goods as well as through income pooling can be

[5]For the single- and dual-earner sample, among the 4225 observations, the wife manages the home budget in 3855 observations. In the 2780 dual-earner observations, the wife manages the home budget in 1505 observations.

reached. Moreover, Japanese couples share the family budget, and the wife typically manages it even in dual-earner households, as shown in Table 1.

4 Tax Reforms

In the Japanese income tax system, the fundamental units of income tax are not family income, but individual income. The amount of the tax is calculated by subtracting the basic allowance, which is similar to the exemption in the United States, and the allowance for salaried workers, which is similar to the standard deduction in the United States, from gross income. The sum of the basic allowance and the allowance for salaried workers is quite high in the Japanese income tax system (1 million yen in 1993). As a result, many individuals do not have to pay income tax. Even if they pay, the amount of tax liability is quite small and those whose tax liability is small are often the secondary earners in the family. Moreover, when the wife's income is below a certain level, the primary earner can receive a spouse allowance and a special allowance for the spouse.

The key exogenous variations that I use in this study are the two major income tax reforms conducted in 1995 and 1999 and the characteristics of the Japanese income tax system itself.[6] In 1993, the tax brackets and marginal rate of income tax changed and various types of allowances, such as the basic allowance, the allowance for wives, the allowance for salaried workers, the special allowance for wives, and the allowance for dependents, were expanded by 30,000 yen. In the 1999 tax reform effective in 1999, 20% of the tax payment was deducted regardless of the marginal tax rate. The top marginal rate was also reduced. Thus, when the Japanese government introduced two tax reforms in the 1990s, many secondary earners who did not pay income tax did not receive the benefit from those tax reforms. In addition, the expansion of the allowance for the wife and the special allowance for the wife benefited primary earners, not secondary earners, because of the nature of the Japanese income tax system. Since the initial income distribution between the husband and wife is different, those two

[6]The tax reform 1999 was planned in 1998 and implemented in 1999. Thus, using the 1999 data does not cause a problem.

tax reforms in the 1990s changed the income distribution between the husband and wife differently for different households. I thus use the two tax reforms on the income distribution among different households as the key exogenous variations.

I calculate the amount of income tax based on permanent income, which is the weighted average of after tax income per month over time, in order to avoid the endogeneity of tax brackets. By applying permanent income to the table for the monthly amount of withholding income tax, I calculate the amount of income tax.

5 Analysis

5.1 Preferences

Consider a family composed of a husband, a wife, and their child. In this family, both the husband (primary earner) and the wife (secondary earner) have non-labor income and labor income. I denote the husband as h, the wife as w, and the child as k. Let j be the index denoting the husband, $j = h$, and the wife, $j = w$. Let $\overline{K}_j$, $\overline{L}_j, L_j$, l_{jk} l_{jj}, and $\overline{w}_j$ be the non-labor income, time endowment, labor supply, housework/time spent child-rearing, leisure (including hours for sleeping), and market wage rate of the husband and wife. By definition, the labor supply of member j, L_j, is equal to $\overline{L}_j - l_{jk} - l_{jj}$. This family spends its income on the husband, wife, and child. Let $u_h(c_k, l_{hk}, l_{wk})$ be the utility of the child. I assume that the husband's utility consists of the consumption of his own private goods and the utility of his child as follows:

$$V_h = u_h(c_h) + f_h(l_{hh}) + \alpha_{hk} u_k(c_k, l_{hk}, l_{wk})$$

I assume that the wife's utility function is represented as follows:

$$V_w = u_w(c_w) + f_w(l_{ww}) + \alpha_{wk} u_k(c_k, l_{hk}, l_{wk})$$

where α_{hk} and α_{wk} are the degrees of altruism. $f_j(l_{jj})$ is the utility from the active leisure of member j. For the utility of the child, I assume that the husband and wife's time are imperfect substitutes.[7]

5.2 Unitary model

Let Ψ_j be the weight of member j in the household. Then, the household solves the following maximization problem:

$$\sum_{j=h,w} \Psi_j V_j \tag{1}$$

$$\text{s.t.} \sum_{j=h,w} c_j + c_k = \sum_{j=h,w} \left\{ \overline{K}_j + \overline{w}_j (\overline{L}_j - l_{jj} - l_{jk}) \right\}$$

The above optimization problem has several implications. First, it shows that the lump-sum income transfer between the husband and wife does not affect the allocation. Second, it shows that the optimal allocation can be solved in two steps. In the first stage, the household maximizes the objective function given l_{jj} and l_{jk} and obtains the conditional indirect utility function $\Gamma(l_{hh},\ l_{hk}, l_{ww},\ l_{wk})$. In the second stage, the household chooses l_{jj} and l_{jk} to maximize $\Gamma(l_{hh},\ l_{hk}, l_{ww},$ and $l_{wk})$. This implies that in the first stage, the conditional demand of c_h, c_w, and c_k are functions of l_{jj}, l_{jk}, and total income $\sum_{j=h,w} \left\{ \overline{K}_j + \overline{w}_j (\overline{L}_j - l_{jj} - l_{jk}) \right\}$. Thus, as long as l_{jk} and l_{kk} are fixed, c_j and c_k are independent of the income distribution between the husband and wife. Many previous studies have employed this empirical strategy to test the unitary model.[8]

5.3 Non-cooperative model and cooperative model with a non-cooperative threat point

Characterizing the Threat Point

[7] In this formula, I do not include caring preferences, where the husband also cares about the utility of the wife. Conducting an empirical study that includes public goods, labor supply, and caring preferences in a cooperative model is challenging. To the best of my knowledge, no such empirical study has yet been conducted. This is left to future work.

[8] In fact, in the above formulation, I assume that the time for active leisure, l_{jj}, is additively separable. In this case, I can drop l_{jj} from the conditional demand function.

The separate spheres bargaining model is a cooperative model where the threat point is the non-cooperative Nash equilibrium. In this model, how the income redistribution affects the resource allocation critically depends on the non-cooperative equilibrium. Thus, I first characterize the non-cooperative equilibrium. In the non-cooperative game theoretical model (I simply call this the non-cooperative model hereafter to save space), the husband chooses his private consumption, contribution to household public goods, cash transfer to the wife, housework, and labor supply given the wife's private consumption, her contribution to household public goods, and her housework. Similarly, the wife determines her private goods consumption, contribution to public goods, housework, and labor supply given the husband's contribution to household public goods, cash transfer from the husband, and housework by the husband. In this model, I assume that the husband is the primary earner and wife is the secondary earner. Let g_h and g_w be the contribution of household public goods by the husband and wife. To conduct the comparative statics needed for empirical studies, let τ be the exogenous transfer from the wife to the husband.

The Nash equilibrium of this non-cooperative game $\{c_j^*, g_j^*, l_{jj}^*, l_{jk}^*;\ j = h, w\}$ is determined as the solution of the following fixed point problem:

$$\begin{aligned}
(c_h^*, g_h^*, m^*, l_{hh}^*, l_{hk}^*) &= \arg \max_{\{c^h, l_{hh}, l_{hk}, g^h\}} \; u_h(c_h) + f_h(l_{hh}) + \alpha_{hk} u_k(g_h + g_w^*, l_{hk}, l_{wk}^*) \\
\text{s.t. } & c_h + g_h + m = \overline{K}_h + \overline{w}_h\{\overline{L}_h - l_{hh} - l_{hk}\} + \tau \\
& \text{where } g^h \geq 0 \qquad (2) \\
(c_w^*, g_w^*, l_{ww}^*, l_{wk}^*) &= \arg \max_{\{c^w, l_{ww}, l_{wk}, g^w\}} \; u_w(c_w) + f_w(l_{ww}) + \alpha_{wk} u_k(g_h^* + g_w, l_{hk}^*, l_{wk}) \\
\text{s.t. } & c_w + g_w = \overline{K}_w + m + \overline{w}_w\{\overline{L}_w - l_{ww} - l_{wk}\} - \tau \\
& \text{where } g_w \geq 0 \qquad (3)
\end{aligned}$$

Now, I can conduct a comparative static analysis by increasing τ. Consider increasing τ, holding (l_{jj}^*, l_{jk}^*) fixed. The comparative static analysis shows the following results:

$$\frac{\partial(g_h^* + g_w^*)}{\partial\tau} = 0, \frac{\partial g_h^*}{\partial\tau} = -1, \frac{\partial g_w^*}{\partial\tau} = 1, \frac{\partial c_h^*}{\partial\tau} = 0 \text{ and } \frac{\partial c_w^*}{\partial\tau} = 0$$

$$\text{as long as } g_h^* > 0 \text{ and } g_w^* > 0 \text{ for a fixed level of } \{l_{jj}^*, l_{jk}^*; j = h, w\}$$

In other words, the exogenous income redistribution does not affect the level of public or private goods. When the income of the husband increases by one dollar and the income of the wife decreases by one dollar, the husband increases his contribution to public goods by one dollar and the wife decreases her contribution by one dollar. Thus, the exogenous income redistribution is completely offset by the changes in voluntary contribution to public goods by the husband and wife.

Now, what would happen if I keep increasing τ? The above argument shows that as long as the contribution of the wife is strictly positive, the husband increases his contribution and the wife decreases her contribution by the same amount of the exogenous income redistribution and the neutrality of public and private goods continues to hold. However, as I keep increasing τ, the contribution of the wife to public goods becomes smaller and at some point reaches zero. From that point, neutrality no longer holds. However, as τ increases further, the amount of public goods starts to increase because the husband becomes the sole contributor to public goods. Since public goods are usually normal goods, the level of public goods will increase. On the contrary, the wife spends her income only on her private consumption, which keeps decreasing as τ increases.

Characterizing Nash Bargaining

Let $\overline{V}^h$ and $\overline{V}^w$ be the utility level determined in the non-cooperative equilibria. Then, the cooperative Nash equilibrium is

$$\max(V^h - \overline{V}^h)(V^w - \overline{V}^w)$$
$$\sum_{j=h,w} c_j + c_k = \sum_{j=h,w} \left\{\overline{K}_j + \overline{w}_j(\overline{L}_j - l_{jj} - l_{jk})\right\} \tag{4}$$

To solve the above problem and conduct the comparative statics, it is useful to consider the following two steps. First, for the given l_{jj} , l_{jk}, and c_k, I choose c_h and c_w. In the next step, I choose c_k to maximize the objective function holding l_{jj} and l_{jk} constant. Moreover, I fix l_{jj} and l_{jk} in this thought experiment since I always control l_{jj} and l_{jk} to run the regression.

Comparative Statics

Now, I increase τ and conduct the comparative statics for a given level of l_{jj} and l_{jk}. First, it becomes clear that a change in τ does not affect the final resource allocation when both the husband and the wife provide public goods at the corresponding threat point. This is because in (4), the threat point does not move when both the husband and the wife provide public goods. In contrast, as τ grows, at one point only the husband provides public goods. Thus, from that point, an increase in τ will increase $\overline{V}^h$ and decrease $\overline{V}^w$. As I show in the Appendix, this finding implies that the consumption of the husband increases and the consumption of the wife decreases. A natural question in this case is what would happen to the public goods provision when $\overline{V}^h$ increases and $\overline{V}^w$ decreases. Here, I modify the responsiveness condition initially used by Blundell, Chiappori, and Meghir (2005) and introduce c_k-constant responsiveness condition. Define MRS_j as the MRS of private goods and the household public goods of member j as follows:

$$MRS_j \equiv \frac{\alpha_{jk}\frac{\partial u_k}{\partial c_k}}{\frac{\partial u_j}{\partial c_j}}, \qquad j = h, w$$

The optimal amount of public goods is determined at the point where the MRS of the husband and wife is equal to the marginal cost of providing one unit of public goods, which is one in this case:

$$\sum_{j=h,w} MRS_j = 1 \tag{5}$$

The c_k-constant responsiveness condition can be summarized as follows:

$$c_k\text{-constant responsiveness condition:} \tag{6}$$

$$\left.\frac{\partial MRS_h}{\partial c_h}\right|_{c_k, l_{hk}, l_{wk}=\text{constant}} < \left.\frac{\partial MRS_w}{\partial c_w}\right|_{c_k, l_{hk}, l_{wk}=\text{constant}} \tag{7}$$

Note that in the above c_k-constant responsiveness condition, c_k is held fixed. Thus, this condition is much easier to check than the responsiveness condition that is defined by Blundell, Chiappori and Meghir(2005).

Proposition 1

Consider a cooperative equilibrium where its threat point is the outcome of the non-cooperative game. Assume that for the given τ,only the husband supplies household public goods at the corresponding threat point. If the c_k-constant *responsiveness condition holds, then an increase in τ will decrease c_k at the cooperative equilibria holding $l_{ww}, l_{hh}, l_{hk}, l_{wk}$ constant. (Proof is in Naito (2015))*

The usefulness of the c_k-constant responsiveness condition can be seen as follows:

Proposition 2

The c_k-constant responsiveness condition is satisfied when

$$-\frac{u_h''(c_h)}{\left(\frac{\partial u_h}{\partial c_h}\right)^2}\alpha_{hk}\frac{\partial u_k}{\partial c_k} < -\frac{u_w''(c_w)}{\left(\frac{\partial u_w}{\partial c_w}\right)^2}\alpha_{wk}\frac{\partial u_k}{\partial c_k}$$

where $u_h''(c_h)$ and $u_w''(c_w)$ are the second derivative of $u_h(c_h)$ and $u_w(c_w)$.

One obvious case that the above condition is satisfied is $u_h''(c_h) = 0$ and $u_w''(c_w) < 0$. Thus, we have the following proposition.

Proposition 3

If the utility functions of the husband is quasi linear with respect to private goods and if the marginal utility of the consumption of the wife is diminishing, then the c_k-constant *responsiveness condition is satisfied.*

Combining Proposition 1-3, we have the following useful result.

Proposition 4

Consider a cooperative equilibrium where its threat point is the outcome of the *non-cooperative game. Assume that for the given τ,only the husband supplies household public goods at the corresponding threat point. If the utility functions of the husband is quasi linear with respect to private goods and if the marginal utility of the consumption of the wife is diminishing, then an increase in τ will decrease c_k at the cooperative equilibria holding $l_{ww}, l_{hh}, l_{hk}, l_{wk}$ constant.*

In many empirical studies, it is observed that when the bargaining power of the husband increases, the expenditure for children decreases. The Proposition 4 implies that, assuming that the household resource allocation is Pareto-efficient, this observation is explained when the utility function of the husband's consumption is linear and the marginal utility of the wife's consumption is diminishing.

5.4 Empirical strategy

The above theoretical analysis has an important implication. First, in the non-cooperative model, as long as both the husband and the wife provide public goods, the income distribution does not affect the resource allocation. If only the husband provides public goods, then an increase in the income share of the husband will increase the level of public goods since he will become the only contributor of public goods and the free rider problem does not exist. In a cooperative model with a non-cooperative threat point, if both parties provide public goods at the non-cooperative threat point, then the income distribution is neutral regarding the resource allocation. If only the husband provides public goods at the non-cooperative threat point and if the responsiveness condition is satisfied, then the level of public goods will increase.

This finding suggests that if I select only dual earners, it is likely that the neutrality of the resource allocation would hold in both the non-cooperative and the cooperative models. If I select both dual- and single-earner couples, then an increase in the husband's income distribution would increase the level of public goods in a non-cooperative model and decrease the level of public goods in a cooperative model. In the unitary model, the resource allocation would be neutral regarding the income distribution.

Let i be the index denoting the household and n the index indicating the category of expenditure and savings, respectively. t is the index of time. In this dataset, expenditure and savings are classified as husband (h), wife (w), family (f), and children (k). For each category, I use the subscripts h, w, f, and k. Let E_{int}, S_{int}, and Y_{int} be expenditure, savings, and the sum of expenditure and savings for category n at time t for household i. Let E_{it}, S_{it}, and Y_{it} be total expenditure, total savings, and the sum of total expenditure and total savings for household i. By definition, $E_{it} = \sum_{n=h,w,f,k} E_{int}, S_{it} = \sum_{n=h,w,f,k} S_{int}, Y_{it} = E_{it} + S_{it}$ and $Y_{int} = E_{int} + S_{int}$. Let $\theta_{it}, I_{hit}, I_{wit}, I_{it}$, and X_{it} be the income share of the husband, total income of the husband, total income of the wife, total income of the household, and vector of the demographic variables, respectively. Let $q^E_{int}, q^S_{int}, q^Y_{int}$ be the share of E_{int} in total expenditure, the share of S_{int} in total savings, and the share of Y_{int} in total income, namely $q^E_{int} = E_{int}/E_{it}, q^S_{int} = S_{int}/S_{it}, q^Y_{int} = Y_{int}/Y_{it}$. In the unitary model, for the given level of l_{jjit} and l_{jkit}, I can consider the following Engel curve:

$$q^b_{int} = \beta_{1nb}\theta_{it} + \beta_{2nb} \ln b_{it} + \beta_{3nb} l_{hkit} + \beta_{4nb} l_{wkit} + X_{it}\delta_{bn} + a_{inb} + \varepsilon_{inbt} \qquad (8)$$

where $b = E, Y; n = h, w, f, k; t = 1993, 1994, ..., 1999$

Several comments would be useful for (8). First, X_{it} includes the age of the husband, that of the wife, and the number of children in household i in period t. a_{inb} represents time-invariant preference shocks. Second, (8) is based on the conditional demand curve on which l_{hkit} and l_{wkit} are conditioned. The first-order conditions of all three models reveal the relationship between the consumption of each member for the given level of l_{hkit} and l_{wkit} as well as total expenditure. Thus, I need to condition on l_{hkit} and l_{wkit}. In addition, the IV, which is the change in the tax rate, affects the amount of labor used for child-rearing since the change in the tax rate affects the marginal price of housework. Thus, it is necessary to control for l_{hkit} and l_{wkit}. Although l_{hkit} and l_{wkit} are endogenous, I do not apply the IVs on l_{hkit} and l_{wkit} since I are not interested in the coefficient on l_{hkit} and l_{wkit}. In other words, I assume that the IVs are independent given X_{it} ,l_{hkit}, l_{wkit}, and the other conditioning variables such as labor supply. Third, in the case of $b = E$, the model assumes additive separability between current and future consumption. If this additive separability assumption fails, but if the unitary model is still true, (8) is valid only for $b = Y$

The parameter of interest is β_{1nb}, which measures how an increase in the husband's income share will increase the level of household public goods (or the consumption of private goods) when total household income is held constant. In the unitary model, β_{1nb} is equal to zero. For the non-cooperative model, if both the husband and the wife supply public goods, it is equal to zero. If only the husband provides public goods, it is positive. For the cooperative model, if the responsiveness condition is satisfied, it is negative. To estimate the above equation, previous studies use total income for the IV of ln E_{it} and ln Y_{it}. Using the IV of E_{it} and Y_{it} is needed since the JPSC asks for information on the husband's income and expenditure on the wife, which may include measurement errors.

Even if I use total income as the IV, however, several problems remain. The first problem is the correlation between the time-invariant preference shocks a_{inb} and explanatory variables. Because of the definition of θ_{it}, θ_{it} is likely to be correlated with a_{inb}. This is possible when the wife's time-invariant preference shocks for public goods are correlated with her preference for labor supply.

The standard way in which to solve the correlation between the time-invariant preference shocks and income distribution between the husband and wife is to rewrite (1) in a time-demeaning form:

$$\ddot{h}^{b}{}_{int} = \beta_{1nb}\ddot{\theta}_{it} + \beta_{2nb}\ddot{\ln} b_{it} + \beta_{3nb}\ddot{l}_{hkit} + \beta_{4nb}\ddot{l}_{wkit} + \ddot{X}_{hkit}\delta_{bn} + \ddot{\varepsilon}_{hkit} \qquad (9)$$
$$\text{where } b = E, Y; n = h, w, f, k; t = 1993, 1994, ..., 1999$$

In the above equation, $\cdot\cdot$ is an operator that calculates the time-demeaning mean. For example, where θ_{it} is observed, in $\#(t)$ periods, $\ddot{\theta}_{it}$ is calculated as $\ddot{\theta}_{it} = \theta_{it} - (1/\#(t))\sum_t \theta_{it}$. Similarly, the other variables can be calculated in the same fashion.

The fixed effect estimation may aggravate the measurement error problem. To alleviate this issue, I use the IV estimation. To construct the IVs, I use information on the Japanese tax system and Japanese tax reforms in the 1990s. As noted earlier, during the 1990s, the Japanese government introduced two tax reforms and those tax changes affected the income distribution between the husband and wife differently for different households. This finding suggests that the cross-sectional variations in the effect of the two tax reforms can be good instruments. Let $\tau_t(I_h, I_w, D_h)$ and $\tau_t(I_w, I_h, D_w)$ be the labor income tax function of the husband and wife in period t when the husband and wife's incomes are I_h and I_h and the number of dependents of the husband and wife are D_h and D_w, respectively. For the function τ_t, there is a subscript t because there were two tax reforms during the 1990s. τ_t is a function of the husband's (wife's) labor income and the wife's labor income as well as the number of the husband's (wife's) dependents. Although the Japanese income tax system is based on individual income in principle, there are some exceptions such as the wife allowance and the special wife allowance whose eligibility depends on the wife's income. Thus, the tax liability of the husband (wife) also depends on the wife's income. Further, let I^p and I^p be the permanent income of the husband and wife of household i. I calculate the permanent income of I^p and I^p as the average of I_{hit} and I_{wit} for all the observed periods. Then, I can calculate

$$
\begin{aligned}
tax1_{it} &= \tau_t(I_{hi}^p, I_{wi}^p, D_{hit}) + \tau_t(I_{wi}^p, I_{hi}^p, D_{wit}) - \frac{\sum_t \{\tau_t(I_{hi}^p, I_{wi}^p, D_{hit}) + \tau_t(I_{wi}, I_{hi}, D_{wit})\}}{\#(t)} \\
tax2_{it} &= \frac{\tau_t(I_{hi}^p, I_{wi}^p, D_{hit})}{\tau_t(I_{hi}^p, I_{wi}^p, D_{hit}) + \tau_t(I_{wi}^p, I_{hi}^p, D_{wit})} - \frac{1}{\#(t)}\{\sum_t \frac{\tau_t(I_{hi}^p, I_{wi}^p, D_{hit})}{\tau_t(I_{hi}^p, I_{wi}^p, D_{hit}) + \tau_t(I_{wi}^p, I_{hi}^p, D_{wit})}\}
\end{aligned}
\tag{10}
$$

where $\#(t)$ is the number of periods in which income is observed. $tax1_{it}$ is the time-demeaning mean of the sum of the tax liability of both the husband and wife. $tax2_{it}$ is the time-demeaning mean of the share of the tax liability of the husband. Note that when calculating $tax1_{it}$ and $tax2_{it}$, the tax liabilities are evaluated based on the permanent income of the husband and wife. Further, D_{hit} and D_{wit} are the functions of I^p, I^p, and the demographic variable X_{it}. Thus, $tax\ 1it$ and $tax2it$ are the change in the total tax liability and change in the share of the husband's tax liability caused by the tax reform alone after being controlled by X_{it}. Therefore, by construction, it is uncorrelated with $\ddot{\varepsilon}_{hkit}$.

6 Results

Table 1 shows the number of households that share the budget with the wife. More than 95% of the households (4055/4226=0.96) share the family budget with the wife to some degree. This finding provides indirect evidence that the neutrality result is very likely to hold for the households in this dataset. Table 2 shows the descriptive statistics of the variables used in this study. In this data, I have 907 households and 4226 observations for single- and dual-earner couples. Among the 907 households, 376 households are dual-earner couples for which I have 1505 observations. One noticeable feature in Table 2 is the similarity of the expenditure patterns between the single-earner sample (the first column) and the dual-earner sample (the second column). Another noticeable characteristic in Table 2 is that the share of the wife's consumption is quite small (5%) and that 70% of total expenditure is used for household public goods such as on children and family. This finding suggests that in the dual-earner sample, both the husband and the wife are likely to contribute household public goods. Because of these two facts, readers might conjecture that neutrality is likely to hold in the dataset under all three models (unitary model, non-cooperative model, cooperative model). However, the following regression analysis shows that such a conjecture is not correct.

Columns (1), (2), (5), and (6) in Tables 3 and 4 show the estimates by the standard IV estimation in equation (5), which have been used in many previous studies. In Table 3, the dependent variables are the share of current expenditure on children, family, husband, and wife in total current expenditure. In Table 4, the dependent variables are the share of the sum of current expenditure and savings on children, family, husband, and wife in the sum of total current expenditure and total savings. The after tax income of the husband and wife is used as the IVs for the logarithm of total current expenditure (in Table 3) and the sum of total current expenditure and total savings (in Table 4). Table A1 presents the first stage regression, showing that both variables are good IVs. (The F-statistic is more than 10.) Columns (1) and (2) are the estimates from the single- and dual-earner sample and columns (5) and (6) are the estimates from the dual-earner sample. All the numbers in Tables 3 and 4 show the effect of the share of the husband's income on the dependent variables. The common explanatory variables other than the share of the husband's income in Tables 3 and 4 are the hours spent on housework and child-rearing, the logarithm of total current expenditure (in Table 3), the logarithm of the sum of total current expenditure and total savings (in Table 4), the age of the husband and wife, the number of children, the number of family members, and year dummies. In some specifications, I add the labor supply of the husband and wife in addition to the hours of housework of the husband and wife as additional explanatory variables. The inclusion of the hours of housework and labor supply allows the possibility that labor supply and housework are not weakly separable from the consumption of the wife, the husband, and public goods.

In the standard IV estimates, the two tables show that neutrality is strongly denied in both the single- and dual-earner sample and the dual-earner sample when demand is not conditioned by the labor supply of the husband and the wife. When this is conditioned by labor supply, some coefficients become less significant and small, but overall demand neutrality is denied. For example, column (1) of Table 4 shows that a 10 percentage point change in the income distribution from the wife to the husband decreases the sum of expenditure and savings for children by 0.2 percentage points.

The standard IV estimation is subject to the bias caused by time-invariant preference shocks. The fixed effect estimation can solve this problem. Columns (3), (4), (7), and (8) in Tables 3 and 4 show the fixed effect estimation, which affects many of the estimates of the dual-earner sample. Except for the effect on expenditure on children (column (7) in Tables 3 and 4), the coefficients of the effect of the husband's income share become insignificant. For the single- and dual-earner sample, as long as they are not conditioned by labor supply, many of the coefficients are still significant in the fixed effect estimation and demand neutrality is denied. However, those estimates are not robust to the inclusion of labor supply. Once they are conditioned by labor supply, many become insignificant (columns (4) and (8)). Tables A3 and A4 present the estimates of the other covariances in the fixed effect estimation, showing that the housework of the wife is not weakly separable from the expenditure on children in the single- and dual-earner sample, as one would predict. In contrast, I cannot find such non-separability in the dual-earner sample.

Tables 5 and 6 show the fixed effect IV estimation. As mentioned in the previous section, the fixed effect estimation exacerbates the measurement error problem and IVs can fix this issue if appropriate variables are used. As the IVs, I used $tax1it$ and $tax2it$ defined in (10). Table A2 shows that both these IVs satisfy the rank condition at a reasonably small and significant t level.

As predicted, the fixed effect IV estimation raises the absolute value of the coefficient, which suggests the existence of the measurement error problem. Again, Table 5 assumes additive separability between current and future consumption, while Table 6 does not. I also conduct the Hausman test against the null hypothesis that the error term in (6) is uncorrelated with $\ddot{\theta}_{it}$. The numbers in the square brackets show the Hausman statistic.

In Table 5, which does not assume additive separability between current and future consumption, the effect of the husband's income share on expenditure on children becomes significant in all four specifications in the single- and dual-earner sample. The Hausman statistic shows that the fixed effect IV estimation is better than the fixed effect estimation. In contrast, as for the effect of the husband's income share on the wife's consumption in the same sample, the fixed effect estimation shows significant estimates, while the fixed effect IV estimation shows insignificant estimates. Therefore, the Hausman statistic suggests the fixed effect estimation is preferable to the fixed effect IV estimation.

In the dual-earner sample of Table 6, only the effect of the husband's income share on the husband's consumption becomes significant. For the coefficients on the effect of the husband's income share on the sum of current expenditure and savings on children, which are significant in the single- and dual-earner sample, they become insignificant for all specifications in the fixed effect IV estimation; however, the Hausman statistic indicates that the fixed effect estimation is preferable to the fixed effect IV estimation. In the fixed effect estimation, the coefficient on the effect of the husband's income share on the sum of current expenditure and savings on children is not robust to adding labor supply to the covariances. Once the labor supply of the husband and wife is added, the coefficient becomes insignificant in the fixed effect estimation. In summary in the single- and dual-earner sample, I can conclude that neutrality is denied in many of the specifications. However, in the dual-earner sample, non-neutrality is supported only marginally.

How can I reconcile these estimation results with the economic theory? Clearly, the unitary model is denied. In addition, the non-cooperative model is rejected. Although the evidence in the dual-earner sample is thin, the coefficient on the effect of the husband's income share on public goods in the single- and dual-earner sample is contrary to that predicted by the non-cooperative model. In contrast, the data are consistent with those of the non-cooperative model. If the responsiveness condition is satisfied, it is possible that as the husband's income share increases, the level of public goods decreases.

7 Implications and Conclusions

In this study, by using tax reforms as a quasi-experiment and Japanese panel data, I studied the effect of the within-household income distribution on household public goods. I first examined this topic by using a conventional IV estimation. The estimation results showed the non-neutrality of the income distribution in both the single- and dual-earner sample and the dual-earner sample. Next, I corrected the time-invariant preference shocks by using a fixed effect estimation. With the fixed effect correction, the non-neutrality result was obtained for the single- and dual-earner sample, while non-neutrality became marginal in the dual-earner sample. After applying the fixed effect IV estimation, the non-neutrality result was still valid in the single- and dual-earner sample and it was marginal in the dual-earner sample. Thus, the unitary model was clearly denied. The coefficient of the husband's income share on expenditure on public goods in the single- and dual-earner sample was opposite to that predicted by the non-cooperative model. Thus, the non-cooperative model was rejected. On the other hand, the result was consistent with the cooperative model as long as the responsiveness condition holds.

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Table 1: Types of Family Budget Management

		Single-Earner and Dual-Earner Couples	Dual-Earner Couples
		Number of Observations	
Do you share the family budget with your spouse?	Yes	4054	1398
	No	74	71
	NA.	97	36
	Total	4225	1505
Who manages the family budget?	Wife	3899	1278
	Husband	155	120
	Total	4054	1398
How much do you share the family budeget with your spouse?	The husband gives over all his salary to his wife	3035	964
	The husband gives over some of his salary to his wife	864	314
	The wife gives over all her salary to her husband	52	44
	The wife gives over some of her salary to her husband	103	76
	Total	4054	1398

Table 2: Summary Statistics

	Single-Earner and Dual-Earner Couples	Dual-Earner Couples
	Mean (Standard Deviation)	
Husband's after tax income per month	28.7 (11.0)	26.8 (9.61)
Wife's after tax income	4.33 (7.11)	11.7 (7.26)
Husband's share of family income	0.89 (0.16)	0.73 (0.28)
Husband's hours of housework and child care per week	8.48 (8.77)	7.92 (9.07)
Wife's hours of housework and child care	61.5 (27.3)	39.4 (16.3)
Number of children	1.89 (0.72)	1.92 (0.69)
Number of family members	4.58 (1.27)	4.85 (1.29)
Husband's age	35.2 (5.17)	36.2 (6.13)
Wife's age	32.2 (3.68)	33.3 (3.57)
Total consumption expenditures per month	21.2 (8.99)	22.6 (9.92)
Total consumption expenditures and savings per month	28.3 (11.5)	1.73 (3.63)
Share of consumption expenditures for		
children	0.13 (0.10)	0.15 (0.10)
family	0.60 (0.20)	0.56 (0.20)
husband	0.15 (0.11)	0.16 (0.11)
wife	0.05 (0.08)	0.07 (0.08)
other family members per month	0.05 (0.10)	0.06 (0.11)
Share of consumption expenditures and savings for		
children	0.15 (0.10)	0.16 (0.09)
family	0.57 (0.19)	0.53 (0.19)
husband	0.16 (0.10)	0.16 (0.10)
wife	0.07 (0.07)	0.09 (0.08)
other family members per month	0.05 (0.09)	0.05 (0.09)
Number of Families	906	376
Number of Observations	4225	1505

Notes: The sample includes single-earner and dual-earner couples with at least one child in column 1 and dual-earner couples with at least one child in column 2. The amount of income, consumption, and saving are measured in ten thousand yen.

Table 3: The Effects of Husband's Share of Family Income on
the Budeget Share of Consumption Expenditures for Each Family Member

The Budget Share of Consumption Expenditures for		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Estimation Methods							
		IV		FE		IV		FE	
Public Goods	Children	-0.053	-0.064	-0.047	-0.0079	-0.075	-0.070	-0.11	-0.076
		(0.016)	(0.029)	(0.020)	(0.028)	(0.027)	(0.034)	(0.042)	(0.043)
	Family	0.11	0.069	0.10	0.010	0.075	0.035	0.045	0.011
		(0.030)	(0.055)	(0.041)	(0.056)	(0.052)	(0.065)	(0.084)	(0.086)
Private Goods	Husband	0.026	0.015	-0.012	-0.00061	0.074	0.054	0.054	0.038
		(0.016)	(0.027)	(0.022)	(0.031)	(0.028)	(0.039)	(0.043)	(0.044)
	Wife	-0.056	-0.058	-0.063	-0.030	-0.062	-0.064	0.035	0.045
		(0.011)	(0.021)	(0.014)	(0.018)	(0.022)	(0.026)	(0.031)	(0.032)
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Families		906				376			
Number of Observation		4225				1505			

Notes: Clustering robust standard errors on an individual basis are in parentheses. The sample includes couples with at least one child in columns 1 through 4 and dual-earner couples with at least one child in columns 5 through 8. Other covariates in the estimation models are the number of children, the number of family members, husband's hours of housework and childcare, and wife's hours of housework and childcare. In addition to these covariates, the logarithm of total consumption expenditures, husband's age, wife's age, and year dummies are included in columns 1, 2, 5 and 6, the logarithm of deflated total consumption expenditures are included in columns 3, 4, 7, and 8, and husband's hours of work and wife's hours of work are included in an even number of columns. In columns 1, 2, 5, and 6, husband's after tax income and wife's after tax income are used as the instrumental variables for total consumption expenditures. This notes apply to Table 4.

Table 4: The Effects of Husband's Share of Family Income on
the Budeget Share of Consumption Expenditures and Savings for Each Family Member

The Budget Share of Consumption Expenditures and		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Estimation Methods							
		IV		FE		IV		FE	
Public Goods	Children	-0.026	-0.017	-0.037	0.0083	-0.048	-0.032	-0.086	-0.049
		(0.016)	(0.027)	(0.019)	(0.026)	(0.026)	(0.032)	(0.037)	(0.038)
	Family	0.15	0.10	0.098	0.021	0.13	0.098	0.074	0.041
		(0.031)	(0.055)	(0.038)	(0.052)	(0.054)	(0.050)	(0.077)	(0.079)
Private Goods	Husband	0.0040	-0.0028	-0.0076	0.0013	0.044	0.029	0.058	0.050
		(0.016)	(0.031)	(0.021)	(0.028)	(0.03)	(0.037)	(0.041)	(0.042)
	Wife	-0.10	-0.12	-0.077	-0.058	-0.13	-0.13	-0.013	-0.0089
		(0.014)	(0.023)	(0.013)	(0.017)	(0.025)	(0.029)	(0.030)	(0.031)
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Families		906				376			
Number of Observation		4225				1505			

Notes: The logarithm of total consumption expenditures and savings and the logarithm of deflated total consumption expenditures and savings are included in the covariates in place of the logarithm of total consumption expenditures and the logarithm of deflated total consumption expenditures, respectively.

Table 5: Fixed Effects Instrumental Variable Estimation:
The Effect of Husband's Share of Family Income on The Budeget Share of Consumption Expenditures for Each Family Member

The Budget Share of Consumption Expenditures for		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Estimation Methods							
		Fixed Effects Instrumental Variable Estimation							
Public Goods	Children	-0.46	-0.58	-0.37	-0.51	-0.38	-0.37	-0.30	-0.30
		(0.15)	(0.20)	(0.14)	(0.21)	(0.16)	(0.17)	(0.18)	(0.18)
		[-2.77]	[-2.88]	[-2.33]	[-2.41]	[-1.74]	[-2.20]	[-1.09]	[-1.67]
	Family	0.41	0.47	0.49	0.60	0.22	0.20	0.10	0.096
		(0.28)	(0.38)	(0.27)	(0.39)	(0.32)	(0.33)	(0.34)	(0.30)
		[1.44]	[1.22]	[1.80]	[1.52]	[0.56]	[0.59]	[0.17]	[-0.29]
Private Goods	Husband	-0.060	-0.071	-0.048	-0.059	0.094	0.092	0.23	0.24
		(0.15)	(0.21)	(0.15)	(0.21)	(0.16)	(0.17)	(0.18)	(0.19)
		[-0.40]	[-0.34]	[-0.32]	[-0.28]	[0.26]	[0.33]	[1.01]	[1.10]
	Wife	0.12	0.19	0.037	0.11	0.21	0.22	0.18	0.19
		(0.096)	(0.12)	(0.095)	(0.13)	(0.12)	(0.12)	(0.13)	(0.13)
		[-1.20]	[1.62]	[0.46]	[0.88]	[1.50]	[1.51]	[1.14]	[1.07]
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Instrumental Variables		1		2		1		2	
Number of Families		906				376			
Number of Observations		4225				1505			

Notes: Clustering robust standard errors on individual household basis are in parentheses, and Hausman statistics are in square brackets. The Hausman t statistic has an asymptotic standard normal distribution. The sample includes couples with at least one child in columns 1 through 4 and dual-earner couples with at least one child in columns 5 through 8. Other covariates in the estimation models are the number of children, the number of family members, husband's hours of housework and childcare, and wife's hours of housework and childcare, and the logarithm of deflated total consumption expenditures. Additionally, husband's hours of work and wife's hours of work are included in an even number of columns. In columns 1, 2, 5, and 6, husband's share of the amount of income tax in the family is used as the instrumental variable for husband's share of family income. In columns 3, 4, 7, and 8, husband's share of the amount of income tax in the family and the amount of family income tax are used as the instrumental variables for husband's share of family income and the logarithm of deflated total consumption expenditures. This notes apply to Table 6.

Table 6: Fixed Effects Instrumental Variable Estimation:
The Effect of Husband's Share of Family Income on The Budeget Share of Consumption Expenditures and Savings

The Budget Share of Consumption Expenditures and Savings for		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Estimation Methods							
		Fixed Effects Instrumental Variable Estimation							
Public Goods	Children	-0.34	-0.44	-0.36	-0.48	-0.15	-0.13	-0.12	-0.11
		(0.14)	(0.18)	(0.13)	(0.18)	(0.14)	(0.15)	(0.14)	(0.15)
		[-2.18]	[-2.00]	[-2.51]	[-2.22]	[-0.47]	[-0.56]	[-0.25]	[-0.42]
	Family	0.30	0.33	0.30	0.35	-0.037	-0.069	-0.21	-0.23
		(0.26)	(0.35)	(0.24)	(0.33)	(0.29)	(0.31)	(0.31)	(0.31)
		[-0.79]	[0.89]	[0.85]	[1.01]	[-0.40]	[-0.37]	[-0.95]	[-0.90]
Private Goods	Husband	0.048	0.074	0.11	0.15	0.20	0.21	0.35	0.36
		(0.14)	(0.19)	(0.13)	(0.19)	(0.15)	(0.16)	(0.17)	(0.18)
		[0.40]	[0.39]	[0.92]	[0.79]	[0.98]	[1.04]	[1.76]	[1.77]
	Wife	-0.019	0.010	0.0099	0.050	0.060	0.071	0.14	0.14
		(0.089)	(0.12)	(0.083)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)
		[1.09]	[-0.40]	[1.06]	[-0.067]	[0.63]	[0.69]	[1.21]	[1.28]
χ^2 statistic		8.10	6.82	10.63	9.08	3.05	2.77	6.25	6.39
(p-value)		(0.088)	(0.15)	(0.031)	(0.059)	(0.55)	(0.60)	(0.18)	(0.17)
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Instrumental Variables		1		2		1		2	
Number of Families		906				376			
Number of Observations		4225				1505			

Note: The logarithm of deflated total consumption expenditures and savings are included in the covariates in place of the logarithm of total deflated consumption expenditures.

Table A1: First Stage Regressions in the Instrumental Variable Estimation

Instrumental Variables	(1)	(2)	(3)	(4)
	ln(Total Consumption Expenditures)		ln(Total Consumption Expenditures and Savings)	
Husband's After Tax Income	0.011	0.0038	0.012	0.0042
	(0.0021)	(0.0035)	(0.0024)	(0.0044)
Wife's After Tax Income	0.023	0.036	0.027	0.041
	(0.0039)	(0.0066)	(0.0040)	(0.0078)
F statistic	61.6	61.7	76.8	71.2
	[0.00]	[0.00]	[0.00]	[0.00]
Number of Families	906	376	906	376
Number of Observations	4225	1505	4225	1505

Notes: Huber-White standard errors are in parentheses, and p-values are in square brackets. The sample includes couples with at least one child in columns 1 and 3 and dual-earner couples with at least one child in columns 2 and 4. F statistic is a test statistic under the null hypothesis that the coefficients of the two instrumental variables are zero. Other covariates in the estimation models are the number of children, the number of family members, husband's hours of housework and childcare, wife's hours of housework and childcare, husband's hoursof work, wife's hours of work, husband's age, wife's age, and year dummies.

Table A2: First Stage Regressions in the Fixed Effects Instrumental Variable Estimation

Instrumental Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Husband's Share of Family Income		ln(Consumption Expenditures)		ln(Consumption Expenditures and Savings)	
Husband's Share of the Amount of Family Income	-0.078	-0.14	0.15	0.25	0.069	0.16
	(0.0091)	(0.016)	(0.055)	(0.085)	(0.046)	(0.071)
Amount of Family Income Tax	-0.012	-0.032	-0.062	-0.19	-0.044	-0.15
	(0.0037)	(0.011)	(0.022)	(0.060)	(0.019)	(0.50)
F statistic	43.1	45.4	7.10	8.65	3.72	6.24
	[0.00]	[0.00]	[0.00]	[0.00]	[0.02]	[0.00]
Number of Families	906	376	906	376	906	376
Number of Observations	4225	1505	4225	1505	4225	1505

Notes: Standard errors are in parentheses, and p-values are in square brackets. The sample includes couples with at least one child in an odd number of columns and dual-earner couples with at least one child in an even number of columns. F statistic is a test statistic under the null hypothesis that the coefficients of two instrumental variables are zero. Other covariates in the estimation models are the number of children, the number of family members, husband's hours of housework and childcare, wife's hours of housework and childcare, husband's hours of work, and wife's hours of work.

Table A3: Fixed Effects Estimation: The Effects of Husband's Share of Family Income on Consumption Expenditures for Each Family Member

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Consumption				Consumption and Saving			
	Public Goods		Private Goods		Public Goods		Private Goods	
Instrumental Variables	Children	Family	Husband	Wife	Children	Family	Husband	Wife
Husband's Share of Family Income	-0.047	0.10	-0.012	-0.063	-0.11	0.045	0.054	0.035
	(0.020)	(0.041)	(0.022)	(0.014)	(0.042)	(0.084)	(0.043)	(0.031)
ln(Total Consumption Expenditures)	-0.035	0.011	-0.019	0.0079	-0.041	-0.0078	-0.011	0.028
	(0.0057)	(0.011)	(0.0062)	(0.0037)	(0.0099)	(0.020)	(0.010)	(0.0074)
Husband's hours of housework and childcare	0.33	0.27	-0.29	-0.11	0.76	-0.068	-0.88	0.30
	(0.23)	(0.45)	(0.25)	(0.15)	(0.42)	(0.83)	(0.43)	(0.32)
Wife's hours of housework and childcare	-0.28	0.024	0.23	-0.050	0.0017	-0.76	0.71	-0.12
	(0.087)	(0.17)	(0.094)	(0.057)	(0.22)	(0.44)	(0.23)	(0.17)
Number of Families	906				376			
Number of Observations	4225				1506			

Notes: Standard errors are in parentheses. The sample includes couples with at least one child in columns 1 through 4 and dual-earner couples with at least one child in columns 5 through 8. The specification of the estimation models is the same as that in columns 3 and 7 in Table 3. The estimated coefficients of husband's and wife's hours of housework and childcare multiplied by 1000 are reported. The standard errors of the estimated coefficients of husband's and wife's hours of housework and childcare are also mulplied by 1000. This notes apply to Table A5.

Table A4: Fixed Effects Estimation: The Effects of Husband's Share of Family Income on Consumption Expenditures and Savings for Each Family Member

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Public Goods		Private Goods		Public Goods		Private Goods	
Instrumental Variables	Children	Family	Husband	Wife	Children	Family	Husband	Wife
Husband's Share of Family Income	-0.037	0.098	-0.0076	-0.077	-0.086	0.074	0.058	-0.013
	(0.019)	(0.038)	(0.021)	(0.013)	(0.037)	(0.077)	(0.041)	(0.030)
ln(Total Consumption Expenditures and Savings)	-0.036	0.029	-0.026	0.0024	-0.041	-0.00032	-0.012	0.019
	(0.0052)	(0.010)	(0.0056)	(0.0036)	(0.0087)	(0.018)	(0.0095)	(0.0072)
Husband's hours of housework and childcare	0.067	0.055	0.062	0.068	0.48	-0.40	-0.55	0.47
	(0.21)	(0.42)	(0.23)	(0.14)	(0.37)	(0.77)	(0.41)	(0.31)
Wife's hours of housework and childcare	-0.17	0.037	0.11	-0.049	0.042	-0.40	0.39	-0.15
	(0.080)	(0.16)	(0.086)	(0.054)	(0.20)	(0.40)	(0.21)	(0.16)
Number of Families	906				376			
Number of Observations	4225				1506			

Notes: The specification of the estimation models is the same as that in columns 3 and 7 in Table 4.