Neutrality Theorem Revisited: An Empirical Examination of Household Public Goods Provision*

Hisahiro Naito [†‡] and Ken Yamada [§]

Current version July 13, 2004

Abstract

Households have many economic roles in society. One of such roles is to share household-level public goods that are jointly consumed by members of the household. Several theoretical models have been proposed in the literature: the unitary model, the non-cooperative game theoretical model and the bargaining model. Identifying those models is important due to implications for public policy. The unitary model predicts the amount of household public goods is neutral with respect to income distribution between husband and wife, and the non-cooperative game theoretical model predicts the neutrality of public goods when both the husband and the wife contribute household public goods. Using both the information on Japanese Tax reforms conducted in the 1990s as natural experiments and Japanese panel data that has information on household expenditures in detail, we examine the relevance of the unitary model and the non-cooperative game theoretical model. We found that the neutrality result does not hold in our data. This suggests that we need another economic theory since the unitary model, the non-cooperative game model and the bargaining model also imply some types of neutrality.

Keywords: public goods, household behavior, income distribution

*We are very grateful to the Institute for Research on Household Economics for giving us the permission to use the Japanese Panel Survey of Consumers, data which has been collected by the Institute. We are also thankful to the participants of the workshops held at the Institute for Research on Household Economics, the TCER Macro Conference, the University of Tsukuba and Hitotsubashi University for their helpful comments. Especially, comments from the discussant of our paper at the TCER conference, professor Fumio Hayashi, were very useful. Hisahiro Naito appreciates the financial grant from the Ministry of Education, Science, Sports and Culture, and the faculty research fund from the Institute of Social and Economic Research at Osaka University.

[†]Corresponding author

[‡]Institute of Social and Economic Research, Osaka University and Graduate School of Humanities and Social Sciences, the University of Tsukuba, Phone:81-29-853-7431; fax: 81-29-853-7440; address: Tennodai 1-1-1, Tsukuba City, Ibaraki, Japan 305-8573; Email:naito@iser.osaka-u.ac.jp

[§]Institute of Social and Economic Research, Osaka University, Phone:81-6-6879-9168 Fax: 81-6-6878-2766; address: Mihogaoka 6-1, Ibaraki, Osaka, Japan 567-0047;Email:kyamada@iser.osaka-u.ac.jp

1 Introduction

When a couple begins to form a family, the family will start to have many functions in society and one of such functions is to share household public goods. Such household public goods include basic housing service, children's welfare and sharing household level chores. For example, Becker (1981) pointed out that children have characteristics of classical public goods within a family: both husband and 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. In such a situation, the question of how the expenditures on such household public goods are 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. For example, when the government increases a tax credit or income deduction for a family having children to improve the welfare of children, one might wonder whether the government should give tax preference to the husband, wife or both. Secondly, in order to design the basic principle of both the tax and the public expenditure system, information on how the household resource allocation is determined is necessary. When many countries' tax and public expenditure systems are compared, one would immediately notice that the basic unit of those systems are different for different countries: some countries use individual income as the basic unit and other countries use household income (the sum of the incomes of the husband and the wife) as the basic unit. One might ask which system is more efficient and how the difference between those 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. Also, recently in Japan, the appropriate size of the non-working spouse's benefits such as the pension benefit and the tax allowance for a spouse are becoming important policy issues. Although the Japanese tax and the public pension system are based on individual income, there are some exceptions. For example, in the Japanese public pension system, the spouse whose annual earning is less than 1.3 million yen can receive the basic pension benefit without paying the pension premium at all. Some critics argue that such a system is unfair and inefficient. To answer those questions, information regarding whether a household behaves as if it is a single unit or whether each member of the household behaves individually is necessary.

There are three major hypotheses that could explain the resource allocation within a household including household public goods. The first hypothesis is a family will behave as if it is a single agent. In this case, it is straightforward to show that the amount of household public goods is Pareto-efficient within the household and that income distribution between husband and wife does not affect the allocation of public goods and private goods once they are conditioned by the household income.

The second hypothesis is the amount of public goods provided in the family is determined as the equilibrium of the non-cooperative game (the Nash equilibrium). In this case, each member of the household determines his/her contribution to household public goods given the contribution of the other members of the household to public goods and the total amount of public goods is determined as the Nash equilibrium of this non-cooperative game. As Samuelson (1954) first demonstrated, it is well-known that in this non-cooperative game the total amount of public goods provided within a household is smaller than the efficient level because of the free-rider problem. In addition, in this non-cooperative game, Warr (1982) and

Bergstrom, Blume and Varian (1986) proved that when the government redistributes income among public goods contributors, the total amount of public goods provided is not affected by this government income redistribution. Bergstrom, Blume and Varian (1986) also showed that when the government redistributes income from a public goods contributor to a non-contributor, the level of public goods is not neutral regarding this government redistribution. Thus, whether the exogenous income redistribution affects the resource allocation or not depends on the initial condition.[1]

The third hypothesis is that the household allocation is chosen among Pareto-efficient allocations, but the final allocation among Pareto-efficient allocations is determined as the equilibrium of the bargaining game between the wife and the husband with appropriate threat points.[2] In this case, the neutrality of the allocation with respect to income distribution depends on the threat point in the bargaining model. If the threat points are the non-cooperative Nash equilibrium, the neutral and non-neutral results of the non-cooperative game theoretical model hold in the bargaining model. On the other hand, if the threats points are different from the non-cooperative Nash equilibrium allocation, the neutrality of private goods would not hold. On the other hand, the amount of public goods provision can be neutral with respect to income distribution between wife and husband. Bergstrom and Cornes (1981) and Bergstrom (1983) found that when the preference of each member has the Gorman form, the Pareto-efficient level of public goods is independent of income distribution.

[1]However, applying a simple non-cooperative game theoretical model to the data has a problem; a simple non-cooperative game theoretical model implies that the consumption of the non-working spouse is zero in a single earner couple. To fix this obvious inconsistency of the theoretical prediction of the simple non-cooperative game model with the empirical fact, we introduce a small altruism in the non-cooperative game theoretical model. As we show in the next section, a non-cooperative game theoretical model with a small altruism have rich implications for the effect of income restitution on the household resource allocation.

[2]We include the exchange model in this category. As Cox (1987) correctly pointed out, the bargaining model becomes the standard exchange model when the bargaining power of the service provider becomes equal to zero.

Since the bargaining model assumes that the allocation is Pareto-efficient, it implies that the level of household public goods is neutral with respect to income redistribution between the husband and the wife.

Finding the relevant model among those three hypotheses is important since those three hypotheses have different implications for public policy. For example, if the unitary model is true, the income tax system should be based on household income, not individual income from the point of equity. In addition, since the level of public goods supplied within the household is Pareto-efficient, no government intervention is needed to increase the level household public goods. In the case of the non-cooperative game theoretical model, it is not clear whether the fundamental unit of tax and public expenditure system should be based on family income. Also, since the level of public goods is under-supplied, some government intervention can improve efficiency. In addition, the non-cooperative game theoretical model suggests that different generations can be linked through public goods such as the utility of grand children.

In this paper, we use the Japanese panel data (the Japanese Panel of Survey of Consumers) and information on Japanese tax reforms conducted during the 1990s to examine those hypotheses. The unitary model was denied in many previous studies, but the other two hypotheses are not well examined in the literature and the non-cooperative game theoretical model has not been tested in the literature of the household resource allocation to the best of our knowledge. Although the unitary model and the non-cooperative Nash equilibrium model make similar predictions, there are some differences. In the non-cooperative Nash equilibrium model, if the redistribution occurs between contributors and non-contributors, the neutrality result does not hold. Thus, it is possible that empirical findings of the non-neutrality of the household resource allocation mainly occurs through the redistribution between the

contributors and the non-contributors.

The data we use in this paper is the Japanese Panel of Survey of Consumers (JPSC) from 1993 to 1999. The JPSC has several advantages compared to the data used in the previous research for testing the household resource allocations. First, the JPSC asks not only about the expenditures on each family member (private goods) but about the common expenditures used for all family members and the expenditures for children (household public goods). Second, the JPSC asks about the amount of savings for different purposes, i.e., for the husband, for the wife, for the children and for common expenditures. Thus, we can observe how the household income is used not only for current expenditure but also for savings for different members of the household and public goods. Moreover, the JPSC asks about a detailed use of time by the husband and the wife. For example, the JPSC asks how much time the wife and the husband use for work, housework, their own sleeping hours, and their leisure. Third, the years that the JPSC covers are also useful for identifying three hypotheses in this paper. During the 1990s, the Japanese government conducted several reforms of the income tax system. Those reforms changed the income distribution between the husband and the wife since the income tax liability in the Japanese tax system is calculated based on individual income rather than family income. Thus, the Japanese tax reforms provide us ideal exogenous changes of income distribution between the husband and the wife.

2 Literature Review

Warr (1982) is the first paper that claimed that voluntary provision of public goods is independent of income distribution. Bergstrom, Blume and Varian (1986) analyzed this issue fully and examined under what conditions this theorem is valid. More specifically, they showed

that the neutrality holds as long as 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 the public goods, the total level of public goods will decrease. For the empirical analysis of the voluntary public goods provision and the income distribution, Brunner (1997) and Murdoch and Sandler (1997) are the first papers to analyze this issue. Brunner analyzes the contribution on national level public goods, and Murdoch and Sandler examine the voluntary provision of international public goods. To the best of our knowledge, there is no paper that attempts to apply the non-cooperative model to empirically examine the household public goods allocation.

There are many papers that study the relationship between income distribution and household public goods provision. Among them are Thomas (1990), Hadda and Hoddinot (1995), Schultz (1990). Thomas (1990) finds that in Brazilian families, unearned income of the mother has a stronger positive effect on child welfare. Hadda and Hoddinot (1995) find that in Cote d'Ivoire children's height for their age is positively related with the share of family wealth controlled by mother. However, as Bergstrom (1995) pointed out in his well-organized survey on economics of family, it is still possible that the non-cooperative Nash equilibrium model applies. For example, in the studies by Thomas (1990), Hoddinot and Hadda (1995) and Schultz (1990), the non-neutrality of household public goods can be explained by the redistribution from non-contributors to contributor.

Some researchers also examined the bargaining model regarding household resource allocation. The earlier theoretical works are Manser and Brown (1980) and McElory and Horney (1981). Recently, several authors estimated those bargaining models(Browning and Chiappori 1998; Browning Bourguignon Chiappori Lechene 1994).

As for the neutrality of the private goods, many studies already exist in the literature. Among them are Hayashi (1995), Altonji, Hayashi and Kotlikoff (1992), Browning, Bourguignon Chiappori and Valerie (1994), and Hoddinot and Haddad (1995). Hayashi (1995) and Altonji, Hayashi and Kotlikoff (1992) examined the neutrality within the extended families while Browning, Chiappori and Valerie (1994) and Hoddinot and Haddad (1995) examined the neutrality within a household. The results in those papers consistently showed that the non-neutrality of private goods within extended families or within a family. However, note that those results do not necessarily imply the non-neutrality of public goods for two reasons. First, it is possible that the non-neutrality results on private goods in the previous research were caused by income redistribution from the non-contributors to the contributors of public goods, the mechanism first demonstrated by Bergstrom, Blume and Varian (1986). Second, when the household resource allocation is determined as the cooperative bargaining model with the utility functions that have the Gorman form, the allocation of private goods is not neutral with respect to income redistribution while the provision of public goods is independent of income redistribution because the bargaining model assumes that the allocation of public goods is Pareto-efficient and because the Pareto-efficient level of public goods is independent of income distribution.

3 Data and Exogenous Variations

The data that we use in this paper is the Japanese Panel Study of Consumers (JPSC). The Institute for Research on Household Economics has surveyed 1500 women aged twenty four to thirty four since 1993. These individuals are national representatives of this demographic group. The institute added 500 women aged twenty four to thirty four in 1997 to the original

1500 women to increase the sample size. Since then, the institute surveyed them annually. The women interviewed by the JPSC were asked on many dimensions of their economic and social lives. They are asked about labor market outcome, education, savings, housing, the relationship between their parents and husbands, and the household expenditures.

The JPSC is an appropriate data for testing the neutrality theorem because it surveys the composition of consumption expenditures and savings in September and husband's and wife's after tax incomes separately for the married. The JPSC also asks about the hours of housework and childcare of the husband and the wife in addition to labor supply. In the questionnaire, the consumption expenditures and savings are respectively divided into the following five categories: common expenditures (savings) for family, expenditures (savings) for wife, expenditures (savings) for husband, expenditures (savings) for children, and expenditures (savings) for others.[3] The availability of detailed information on consumption expenditures and savings for each family member and labor supply and the hours of housework and childcare has several advantages in testing the neutrality theorem. First, it is possible to analyze the provision of public goods because common expenditures and savings for family and expenditures and savings for children are classified as the provisions of public goods and expenditures and savings for husband or wife are classified as the consumption of private goods. Second, it is possible to comprehensively examine the consumption of private goods because the exclusive goods are comprehensively included in the private goods and because savings and consumption for the husband (wife) can be included in private goods of the husband (wife). Third, the availability of the hours of housework and childcare enables us to examine the non-separability of the expenditure for children and family from the hours

[3]The share of the expenditure and savings for others are very small. Thus, we ignore this category for our analysis.

of housework and childcare.

We use the JPSC from 1993 to 1999 and focus mainly on two samples. The first sample is 906 single-dual earner households with at least one child. The second sample is 376 dual-earner households with at least one child. The 376 dual-earner households sample is the subset of the 906 single-dual earner households sample. Those two samples are unbalanced panel data. We select those two samples based on the following selection rule; (i) they are married; (ii) they have at least one child; (iii) two earners are salaried workers for at least more than two years in the dual-earner sample and all earners (one or two) are salaried workers in the single and dual earner sample; (iv) they have necessary information for at least more than two years. We use the selection rule (ii) because the neutrality could be more likely to be reached in the couples with children because they share more public goods than the couple with no children, the sample used by Browning, Bourguignon, Chiappori, and Lechene (1994) and Browning and Chiappori (1998). In the case of dual-earner couples with at least one child, the neutrality through the voluntary provision of public goods as well as through income pooling can be reached. Moreover, Japanese couples share the family budget, and the wife typically manages it even in dual-earner households, as shown in Table 1.

The key exogenous variations that we utilize in this paper are the two major permanent income tax reforms conducted in 1995 and 1999 and the characteristics of the Japanese income tax system itself. In the Japanese income tax system, the fundamental units of income tax are not family income, but individual income. In addition, the sum of the level of basic allowance, which is similar to the exemption in the US, and the allowance for salaried worker, which is similar to the standard deduction in the US, is quite high in the Japanese

income tax system (1 million yen in 1993). As a result, there are many individuals who do not have to pay the 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 because the basic unit of the Japanese income tax system is individual income, not family income. Moreover, when the spouse income is less than a certain level, the primary earner, not the spouse, can receive the spouse allowance and the special allowance for the spouse.

As for two tax reforms in Japan, in 1993 the tax brackets and the marginal rate of income tax are changed, and various types of allowance, such as the basic allowance, the allowance for spouses, the allowance for salaried workers, the special allowance for spouses, and the allowance for dependents are expanded by thirty thousand yen, respectively. In the 1999 tax reform, the top marginal rate of income tax is changed, and a 20% fixed rate of income tax cut is conducted after the revision of tax law. Thus, when the Japanese government introduced two permanent tax reforms in the 1990s, many secondary earners who did not pay the income tax did not receive the benefit from those tax reforms. In addition, the expansion of the allowance for the spouse and the special allowance for the spouse benefited the primary earners, not the secondary earners, due to the nature of the Japanese income tax system. Since the initial income distribution between the husband and the wife are different, those two tax reforms in the 1990s changed income distribution between the husband and the wife differently for different households. We utilize those cross-sectional variations of the effects of two tax reforms on income distribution among different households as the key exogenous variations.

We calculate the amount of income tax based on permanent income, that is the weighted average of after tax income per month over time, in order to avoid the endogeneity of tax

brackets. By applying the permanent income to the table for the monthly amount of withholding income tax, we calculate the amount of income tax.

4 Analysis

4.1 Unitary model

Consider a family that is composed of a husband, a wife and their child. In this family, both the husband and the wife have non-labor income and labor income. Let h, w, and k be the index of the husband, wife and the child. We use index j to indicate the wife or the husband.($j = h, w$). Let K_j,$\overline{L}_j$,l_{jk}, l_{jj} and $\overline{W}_j$ be the non-labor income, time endowment, housework, leisure and the wage rate of the member j of the family where j=h,w. By definition, the labor supply of the member j is $\overline{L}_j - l_{jk} - l_{jj}$. This family spends their income for the husband, the wife and the child. We assume that the husband's (wife's) utility consists of the consumption of his (her) own private goods and the utility of their child as follows: $u^h(c_h) + f^h(l_{hh}) + \alpha^{hk}u^k(g_h + g_w, l_{hk}, l_{wk})$ and $u^w(c_w) + f^h(l_{ww}) + \alpha^{wk}u^k(g_h + g_w, l_{hk}, l_{wk})$. $u^k(c_k, l_{hk}, l_{sk})$ is the utility function of their child; $f^j(l_{jj})$ is the utility from active leisure of member j. For the utility of child, we assume that the husband and the wife's time are imperfect substitutes. In the unitary model, the household maximizes the weighted sum of the utility of two persons subject to the household budget constraint. Let Ψ_j be the weight on the member j within the household. Then, the household solves the following maximization problem:

$$\begin{aligned} &\max \sum_{j=h,w} \Psi_j \left\{ u^j(c_j) + f^j(l_{jj}) + \alpha^{jk}u^k(G, l_{hk}, l_{wk}) \right\} \\ &\text{s.t.} \sum_{j=h,w} c_j + G = \sum_{j=h,w} \{K_j + \overline{W}_j(\overline{L}_j - l_{jk} - l_{jj})\} \end{aligned} \tag{1}$$

The above optimization program has several implications. First, it shows that the lump-sum income transfer between the husband and the 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 $\Gamma(l_{hh}, l_{hk}, l_{ww}, l_{wk})$. This implies that at the first stage, the conditional demand of c_h, c_w and G are functions of l_{jj}, l_{jk} and the total income, $\sum_{j=h,w}\{K_j + \overline{W}_j(\overline{L}_j - l_{jk} - l_{jj})\}$, which is equal to $\sum_{j=h,w} c_j + G$. Thus, once c_h, c_w and G are conditioned by l_{jj}, l_{jk} and the total expenditure, $\sum_{j=h,w} c_j + G$, they are independent from the income distribution between the husband and the wife.[4] This is the empirical strategy that many previous studies have employed to test the unitary model.

4.2 Non-cooperative game theoretical model

In the non-cooperative game theoretical model (hereafter we simply call the non-cooperative model to save the space), the husband chooses his private consumption, his contribution to household public goods, the 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, the cash transfer from the husband and the housework by the husband. In this model, we assume that husband is the primary earner and the wife is the secondary earner. The husband (primary earner) has some altruism to the wife (the secondary earner). We need this

[4] In fact, in the above formulation, we assumed that the time for active leisure, l_{jj}, is additively separable. In this case, we can drop the l_{jj} from the conditional demand function. If l_{jj} and l_{jk} are weakly separable from c_h,c_w and G, we can drop l_{jk} and l_{jj} from the conditional demand function of c_h,c_w and G.

assumption; otherwise the consumption of the spouse in the single earner couple becomes zero, which is inconsistent with the empirical fact that the consumption of the spouse in the single earner couple is not zero. Let g_h, g_w and m be the contribution of the household public goods by the husband and the wife and the cash transfer from the husband to wife, respectively. Let τ be the lump tax imposed on the husband by the government and $-\tau$ is the lump sum subsidy to the wife. To simplify the notation, denote the total income of the member j, $K_j + \overline{W}^j(\overline{L}_j - l_{jk} - l_{jj})$, by I_j.

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

$$
\begin{aligned}
(c_h^*, g_h^*, m^*, l_{hh}^*, l_{hk}^*) = \arg \max_{\{c_h, g_h, l_{hh}, l_{hk}, m\}} & u^h(c_h) + f^h(l_{hh}) + \alpha^{hk} u^k(g_h + g_w^*, l_{hk}, l_{wk}^*) \qquad (2) \\
& + \alpha^{hw}\{u^w(c_w^* + m) + \alpha^{wk} u^k(g_h + g_w^*)\} \\
\text{s.t. } & c_h + g_h + m = K_h + \overline{W}^h(\overline{L}_h - l_{hk} - l_{hk}) + \tau \\
& m \geq 0, \ g_h \geq 0 \\
(c_w^*, g_w^*, l_{ww}^*, l_{wk}^*) = \arg \max_{\{c_w, g_w, l_{ww}, l_{wk}\}} & u^w(c_w + m^*) + f^w(l_{ww}) + \alpha^{wk} u^k(g_h^* + g_w, l_{hk}^*, l_{wk}) \\
\text{s.t. } & c_w + g_w = K_w + \overline{W}^w(\overline{L}_w - l_{wk} - l_{ww}) - \tau \\
& g_w \geq 0
\end{aligned}
$$

Before conducting a comparative static analysis, let us fix m and τ at zero and assume that there is a Nash equilibrium where both husband and wife contribute to public goods. In this case, there are two cases. In the first case, $u^{h\prime}(c_h^*) < \alpha^{hw} u^{w\prime}(c_w^*)$ hold and the second case $u^{h\prime}(c_h^*) \geq \alpha^{hw} u^{w\prime}(c_w^*)$ holds. In the first case, since the marginal utility from increasing the consumption of the wife is greater than the marginal utility of his own consumption, the husband will have incentive to make a transfer to the wife. In the second case, the husband

does not have any incentive to make such a transfer.

Now assume that m can be chosen freely with $m \geq 0$. In the first case where $u^{h\prime}(c_h^*) < \alpha^{hw} u^{w\prime}(c_w^*)$ at $m = 0$, the husband makes a transfer to the wife when he can choose m freely with $m \geq 0$. In the second case where $u^{h\prime}(c_h^*) \geq \alpha^{hw} u^{w\prime}(c_w^*)$ at $m = 0$, the husband will not make a transfer even if m can be chosen freely with $m \geq 0$.

Based on those two cases, we can conduct comparative static analysis regarding τ. Consider the Nash equilibrium with $m \geq 0$ and fix $\{l_{jj}, l_{jk}; h = h, w\}$ at the equilibrium point. Assume that the government redistributes income exogenously between the husband and the wife for the fixed levels of $\{l_{jj}, l_{jk}; h = h, w\}$ when both husband and the wife contribute to public goods. In the first case, since the husband is making a transfer to the wife, it is obvious that such exogenous income redistribution does not affect the equilibrium value. On the other hand, in the second case, the comparative static analysis shows the following results:

$$\frac{\partial(g_h^* + g_w^*)}{\partial \tau} = 0, \frac{\partial g_h^*}{\partial \tau} = 1, \frac{\partial g_s^*}{\partial \tau} = -1, \frac{\partial c_h^*}{\partial \tau} = \frac{\partial c_w^*}{\partial \tau} = 0 \tag{3}$$

$$\text{as long as } g_h > 0 \text{ and } g_w > 0 \text{ for given } \{l_{jj}, l_{jk}; j = h, w\}$$

In other words, the exogenous income redistribution does not affect either the level of public goods nor the 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 to one dollar. Thus, the exogenous income redistribution is completely offset by the changes of voluntary contribution to public goods by the husband and the wife.

Now what will happen if the government keeps redistributing income from the wife to the husband? The above argument shows that as long as the contribution of the wife is strictly positive, the husband increases his contribution and the wife decrease her contribution by the exact amount of the exogenous income redistribution and the neutrality of public goods and the private goods keeps holding. However, as the government keeps redistributing income, the contribution of the wife to public goods becomes smaller and smaller and at some point it reaches zero. From that point, the neutrality does not hold any more. But as the government keeps redistributing further, the amount of public goods would start to increase. This is because the husband becomes the sole contributor to public goods and because the husband's income increases as the government keeps redistribution. Since public goods is usually normal goods, the level of public goods will increase. On the other hand, the wife spends her income only for her private consumption and her private consumption keeps decreasing as the government keeps redistributing income from the wife to the husband. This process will continue as long as the marginal utility of the husband's consumption is greater than the discounted marginal utility of the wife's consumption. When the marginal utility of the husband's consumption becomes smaller than the wife's marginal utility of the consumption, the husband starts to makes a transfer. From this point, further income redistribution does not affect the equilibrium allocation since the transfer from the husband to the wife offset the redistribution from the wife to the husband.

Figure 1(a) shows the case 1 and Figure 1(b) shows the case 2. G indicates the level of public goods and θ indicates the share of the husband's income. In the Figure 1(a), voluntary transfer occurs even when both husband and wife contribute to public goods. In this case, income redistribution does not affect the level of public goods provided in this household.

In Figure 1(b), initially only the wife provides public goods (between A and B). As the income share of the wife decreases, the level of public goods will decrease. As the income redistribution from the wife to the husband continues, both the husband and the wife start to contribute public goods (point B). While both the husband and the wife contribute public goods, income redistribution does not affect the level of public goods. As the government keep redistribution from the wife to the husband, the wife's contribution becomes smaller and the husband's contribution becomes larger. At some point, the wife's contribution reaches zero (point C). Further redistribution from the wife to the husband increases the level of public goods in this household. At point D, the marginal utility of the husband's consumption becomes equal to the discounted marginal utility of the wife's consumption. From point D, the husband starts to make a positive cash transfer to the wife. Between point D and E, income redistribution does not affect the level of public goods because a cash transfer complectly offsets income redistribution. Figure 1(c) shows the graph of the consumption of the husband.

This result has several empirical implications for the data. First, this result suggests that income distribution between husband and wife does not affect the resource allocation as long as both the husband and the wife contribute to household public goods. Second, it provides the case that the effect of income redistribution in the non-cooperative model is different from the effect in the unitary model. In the unitary model, income redistribution does not matter whether both husband and the wife contribute to household public goods or only one of them contributes to household public goods. On the other hand, in the non-cooperative model, the neutrality result is valid only when both the husband and the wife contribute. This is the strategy that we use in this paper to discriminate two models.

4.3 Pareto-efficient Bargaining model

Since we do not test the Pareto-Bargaining model explicitly in this paper, we summarize it briefly. In the Pareto-efficient Bargaining model the equilibrium allocation is determined from the following optimization program:

$$\begin{aligned} \max \ & \left\{u^h(c_h) + \alpha^{hk} u^k(G, l_{hk}, l_{wk}) + f^h(l_{hh}) - V_{h0}(X, \overline{W}_h, K_h)\right\} \\ & \times \left\{u^w(c_w) + \alpha^{wk} u^w(G, l_{hk}, l_{wk}) + f^h(l_{hh}) - V_{h0}(X, \overline{W}_w, K_w)\right\} \\ \text{st.} \ & \sum_{j=h,w} c_j + G = K_h + \overline{W}_h(\overline{L}_h - l_{hk} - l_{hh}) + K_w + \overline{W}_w(\overline{L}_w - l_{wk} - l_{ww}) \end{aligned} \tag{4}$$

where $V_{h0}(X, \overline{W}_h, K_h, \tau)$ and $V_{w0}(X, \overline{W}_w, K_w, \tau)$ are the threat points of the husband and the wife within the couple. The neutrality of private goods depends on the choice of the threat points. If the utility levels at the non-cooperative equilibrium are used as the threat points, we obtain similar neutrality and non-neutrality results. When other threat points such as the utility level at divorce are used, the neutrality of the private goods does not hold since the income transfer will change threat points.

As for the effect of income distribution on the level of public goods, there are two cases. If the utility function is of the Gorman form with respect to public goods, the Pareto-efficient level of public goods is independent from the income distribution. Thus, as for the level of public goods, the implication is the same as the unitary model. On the other hand, as for the level of private goods, the Pareto-efficient bargaining model implies that the private consumption is not independent of income distribution between husband and wife. Thus, by focusing on both private goods and public goods, it is possible to distinguish the unitary model and Pareto-efficient bargaining model when the utility function is of the Gorman form. When the utility function is not of Gorman form regarding public goods, neither private goods

nor public goods are independent from income distribution.

4.4 Empirical Strategy

Let i be the index to denote the household and n be the index to indicate the category of the expenditure and savings, respectively. In this data, the expenditure and savings are classified as for husband (h), wife (w), family (f) and children (k). For each category, we use subscript h, w, f and k. Let E_{int} ,S_{int} and Y_{int} be the current expenditure, savings and the sum of the current expenditure and saving for category n and let E_{it}, S_{it} and Y_{it} be the total current expenditure, total savings and the sum of the total current expenditure and the saving of the household i. By definition, $Y_{int} = E_{int} + S_{int}$, $E_{it} = \sum_n E_{int}$, $S_{it} = \sum_n S_{int}$, and $Y_{it} = E_{it} + S_{it}$. Let $\theta_{it}, I_{hit}, I_{wit}, I_{it}$ and $\mathbf{X}_{it}$ be the income share of the husband, the total income of the husband, the total income of the wife, the total income of the household and the vector of demographic variables, respectively. Let h^E_{int} ,h^S_{int} , h^Y_{int} be the share of E_{int} in the total expenditure, the share of S_{int} in total savings and the share of Y_{int} of the household i, respectively, i.e., $h^E_{int} = E_{int}/E_{it}$, $h^S_{int} = S_{int}/S_{it}$ and $h^Y_{int} = Y_{int}/Y_{it}$. In the unitary model, for given level of l_{wkit} and l_{hkit}, we can consider the following Engel curve:

$$h^b_{int} = \beta_{1nb}\theta_{it} + \beta_{2nb} \ln b_{it} + \beta_{3nb} l_{hkit} + \beta_{4nb} l_{wkit} + \mathbf{X}_{it}\delta_{bn} + a_{inb} + \varepsilon_{inbt} \tag{5}$$

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

Several comments would be useful for (5). First, $\mathbf{X}_{it}$ includes the age of the husband, the wife and the number of children of the household i at the period t. a_{inb} represents time-invariant preference shocks. Second, (5) is based on the conditional demand curve in which l_{hkit} and l_{wkit} are conditioned. The first-order condition for given level of l_{hkit} and l_{wkit} in the unitary model reveals that once the equation is conditioned by the total expenditure, the

equation should not include the wage rates of the husband and the wife but should include the housework of the husband and the wife due to possible non-weak separability between housework and h^b_{int} in (5).[5] Third, we can derive (5) from the non-cooperative model given $\{l_{jj}, l_{jk}; j = h, w\}$. Fourth, in the case of $b = E$, the model assumes additive separability between the current consumption and future consumption. If this additive separability assumption fails, but if the unitary model is still true, (5) is valid only for $b = Y$.

The parameter of our interest is β_{1nb} and it measures how an increase of the husband's income will increase the level of household public goods (or the consumption of private goods) when the total household income is held constant. In the unitary model, β_{1nb} is equal to zero. β_{3nb} and β_{4nb} indicate the degree of non-separability between the expenditure share of category n with housework of the husband and the wife, respectively. For estimating the above equation, previous studies use the total income for the instrumental variable of $\ln E_{it}$ and $\ln Y_{it}$. However, there are still several problems. The first problem is the correlation between the time-invariant preference shock 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 spouse's time-invariant preference shock for public goods is correlated with the spouse's time invariant preferences for housework.

The standard way to solve the correlation between the time-invariant preference shocks and the income distribution between the husband and the wife is to rewrite (1) in terms of

[5] If the leisure is not weakly separable from c_j and G, labor supply should also be included as the explanatory variable.

time-demeaning form:

$$\ddot{h}^b_{int} = \beta_{1nb}\ddot{\theta}_{it} + \beta_{2nb}\ddot{\ln}b_{it} + \beta_{3nb}\ddot{l}_{hkit} + \beta_{4nb}\ddot{l}_{wkit} + \ddot{\mathbf{X}}_{it}\delta_{nb} + \ddot{\varepsilon}_{inbt} \tag{6}$$

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

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

On the other hand, the fixed effect estimation can have a problem, too. It is widely recognized that the fixed effect estimation aggravates the measurement error problem. To alleviate this measurement error problem, we use the instrumental variable estimation. For constructing the instrumental variables, we use the information on the Japanese tax system and the Japanese tax reforms in the 1990s. During the 1990s, the Japanese government introduced two permanent tax reforms and those tax changes affected income distribution between the husband and the wife differently for different household because of the nonlinearity of the income tax system and the tax reforms. This suggests that the cross-sectional variations of 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 the wife at period t when the husband's and the wife's incomes are I_h and I_h and the number of dependents of the husband and the wife are D_h and D_w, respectively. For a function τ_t, there is a subscript t because there are two tax reforms during the 1990s. τ_t is a function of the husband's (wife's) labor income and the spouse's labor income and 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 spouse allowance and the special spouse allowance whose eligibility

depends on spouse's income. Thus, the tax liability of the husband (wife) also depends on the spouse's income. Also let I^p_{hi} and I^p_{wi} be the permanent income of the husband and the wife of the household i. We calculate the permanent income of I^p_{hi} and I^p_{wi} as the average of I_{hit} and I_{wit} for all observed periods. Then we can calculate

$$tax1_{it} = \tau_t(I^p_{hi}, I^p_{wi}, D_{hit}) + \tau_t(I^p_{wi}, I^p_{hi}, D_{wit}) - \frac{\sum_t \{\tau_t(I^p_{hi}, I^p_{wi}, D_{hit}) + \tau_t(I^p_{wi}, I^p_{hi}, D_{wit})\}}{\#(t)} \quad (7)$$

$$tax2_{it} = \frac{\tau_t(I^p_{hi}, I^p_{wt}, D_{hit})}{\tau_t(I^p_{hi}, I^p_{wt}, D_{hit}) + \tau_t(I^p_{wi}, I^p_{hi}, D_{wit})} - \frac{1}{\#(t)}\{\sum_t \frac{\tau_t(I^p_{hi}, I^p_{wi}, D_{hit})}{\tau_t(I^p_{hi}, I^p_{wi}, D_{hit}) + \tau_t(I^p_{wi}, I^p_{hi}, D_{wit})}\}$$

where $\#(t)$ is the number of periods that the income are observed. Note that when calculating $tax1_{it}$ and $tax2_{it}$, the tax liabilities are evaluated at the permanent income of the husband and the wife. Also notice that D_{hit} and D_{wit} are the function of I^p_{hi}, I^p_{wi} and the demographic variable X_{it}. Thus, $tax1_{it}$ and $tax2_{it}$ are the change of the total tax liability and the change of the share of the husband's tax liability caused by the tax reform alone after controlled by $\mathbf{X}_{it}$. Thus, by the construction, it is uncorrelated with $\ddot{\varepsilon}_{it}$. As for $\ddot{l}_{hkit}$ and $\ddot{l}_{wkit}$, if they are correlated with time-variant preference shock, we also need to use the instrumental variables for them. However, we could not find good instrumental variables that are correlated with $\ddot{l}_{hkit}$ and $\ddot{l}_{wkit}$ sufficiently in the first stage. Many variables including the wage rates and marginal tax rates turn out to be uncorrelated with $\ddot{l}_{wkit}$ and $\ddot{l}_{hkit}$. Thus, we are forced to assume that the $\ddot{l}_{hkit}$ and $\ddot{l}_{wkit}$ are uncorrelated with the time-variant preference shocks.

So far, our test of the unitary model is based on the Engel curves. With additional assumptions, we can test the unitary model in a different way as well. Assume that the utility of the husband's (wife's) consumption is additively separable with the other variables and that the utility function of the husband's consumption is the same as that of the wife within the same household. The first order conditions of the husband's (wife's) consumption

are $\Psi_h u'(c_{hit}) = \Psi_w u'(c_{wit}) = \lambda_{it}$ where λ_{it} is the Lagrangian multiplier of the budget constraint of the household i at period t. In addition, assume that the utility function of the husband's (wife's) consumption is of the iso-elastic form. This implies that we can write the current expenditure or the sum of the current expenditure and savings of the husband and the wife as follows:

$$b_{jit} = \gamma_1 I_{jit} + \mathbf{X}_{jit}\gamma_2 + a_{it} + a_j + u_{jit} \quad b = E, Y \text{ and } j = h, w$$

where a_j captures Ψ_j, the weight on the utility function of the member j of the household in the unitary model. a_{it} captures the Lagrangian multiplier of the household i at the period t. If the unitary model is true, γ_1, the coefficient of individual income I_{jit}, should be equal to zero. After a first-differencing transformation, an unobserved individual heterogeneity is removed, and we have

$$\Delta b_{jit} = \gamma_1 \, \Delta I_{jit} + \Delta \mathbf{X}_{jit} \, \gamma_2 + \Delta a_{it} + \Delta u_{jit}, \qquad b = E, Y; \; j = h, w \tag{8}$$

where $\Delta b_{jit} = b_{jit} - b_{ji,t-1}$, $\Delta I_{jit} = I_{jit} - I_{ji,t-1}$, $\Delta X_{it} = X_{it} - X_{i,t-1}$, $\Delta a_{it} = a_{it} - a_{i,t-1}$, and $\Delta u_{jit} = u_{jit} - u_{ji,t-1}$. Then, after a fixed effects transformation, family background variables are removed, and we have

$$\ddot{\Delta} b_{jit} = \gamma_1 \, \ddot{\Delta} I_{jit} + \ddot{\Delta} X_{jit} \, \gamma_2 + \ddot{\Delta} u_{jit} \quad b = E, Y \text{ and } j = h, w \tag{9}$$

where $\ddot{\Delta} b_{jit} = \Delta b_{jit} - \bar{\Delta b}_{it}$, $\ddot{\Delta} I_{jit} = \Delta I_{jit} - \bar{\Delta I}_{it}$, $\ddot{\Delta} \mathbf{X}_{jit} = \Delta \mathbf{X}_{jit} - \bar{\Delta \mathbf{X}}_{it}$, $\ddot{\Delta} u_{jit} = \Delta u_{jit} - \bar{\Delta u}_{it}$, $\bar{\Delta b}_{it} = (\Delta b_{hit} + \Delta b_{wit})/2$, $\bar{\Delta I}_{it} = (\Delta I_{hit} + \Delta I_{wit})/2$, $\bar{\Delta \mathbf{X}}_{jit} = (\Delta \mathbf{X}_{hit} + \Delta \mathbf{X}_{wit})/2$, and $\bar{\Delta u}_{it} = (\Delta u_{hit} + \Delta u_{wit})/2$. This first-differencing fixed effects estimation is equivalent to dynamic test in Altonji, Hayashi, and Kotlikoff (1992).

Up to this point, our discussion has been restricted to the examination of the unitary

model. In this paper, we will also discriminate between the unitary model and the non-cooperative model since the welfare implications of the two models are quite different.

The key observation to empirically distinguish the two models is that in the non-cooperative model, the effect of income redistribution is neutralized through the changes of contribution to public goods. In other words, when the government redistributes one dollar from the husband to the wife, the husband decreases his voluntary contribution exactly by one dollar and the wife increases her public goods contribution exactly by one dollar as long as both the husband and the wife contribute to public goods. However, this mechanism of neutralization does not occur when either the contribution by the husband or the wife is equal to zero. This implies that the neutrality result is less likely to hold when the initial income share between the husband and the wife is already extreme and, as a result, only one person contributes to public goods. On the other hand, in the unitary model, the neutrality theorem holds at any income share. This suggests the following identification strategy to distinguish the unitary model and the non-cooperative Nash equilibrium model. If the non-cooperative model is true and if we estimate (6) for a sample that includes both the single earner couples and the dual-earner couples, in which the single earner couple is headed by the husband, the neutrality result is not likely to hold and the coefficient of the husband's income share on the husband's consumption and public goods should be positive. On the other hand, for another sample with equitable income distribution between the husband and the wife, the neutrality result is likely to hold since both the husband and the wife are likely to contribute to public goods. Thus, in this paper, we make the two samples and test the demand neutrality. The first sample includes both single and dual earner couples in which the single earner is headed by the husband. The second sample includes only the dual earner couples. If the non-cooperative

model is true, we expect that the neutrality is more likely to hold in the dual-earner sample while it does not in the single-dual earner sample. Also in this sample, the coefficient of the husband's income share on public goods and the consumption of the husband (wife) should be positive (negative).

5 Results

Table 1 shows the number of households who share the budget with the spouse. As Table 1 shows, more than 95 percent of the households (4055/4226=0.96) share the family budget with the spouse to some degree. This provides an indirect evidence that the household in our data lives in an environment in which the neutrality result is very likely to hold. Table 2 shows the descriptive statics of the variables that we use in this paper. In our data, we have 907 household and 4226 observations for single and dual earner couples. Among 907 households, 376 households are the dual earner couples. In the 376 dual-earner sample, we have 1505 observations. One noticeable feature in Table 2 is the similarity of the expenditure patterns between the single-dual earner sample (the first column) and the dual-earner sample (the second column). Another noticeable characteristic in Table 2 is the fact that the share of wife's consumption is quite small (5%) and that 70% percent of the total expenditure is used for household public goods such as the expenditure for children and family. This suggests that in the dual-earner sample, both husband and wife are likely to contribute household public goods. Because of those two facts, readers might conjecture that the neutrality is likely to hold in the data due to either unitary model or the non-cooperative game theoretical model. However, the following regression analysis shows that such a conjecture is not correct.

The columns (1), (2), (5) and (6) of Table 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 the current expenditure for children, family, husband or wife in the total current expenditure and in Table 4 the dependent variables are the share of the sum of the current expenditure and saving for children, family, husband or wife in the sum of the total current expenditure and the total savings. The after tax incomes of the husband and the wife are used as the instrumental variables for the logarithm of the total current expenditure (in Table 3) and for logarithm of the sum of the total current expenditure and savings (in Table 4). Table A1 shows the first stage regression and it shows that both variables are good instrumental variables.[6] (The F-statistic is more than 10.) Column (1) and (2) are the estimates from the single and dual earner couple sample and columns (5) and (6) are the estimates from the dual earner couple sample. All numbers in Table 3 and Table 4 show the effect of the share of husband income on dependent variables. Common explanatory variables other than the share of husband's income in Table 3 and Table 4 are the hours for housework and childcare, the logarithm of the total current expenditure (in Table 3), the logarithm of the sum of the total current expenditure and the total savings (in Table 4), the age of husband and the wife, the number of children, the number of family members and year dummies. In some specifications, we add labor supply of the husband and the wife in addition to the hours of housework of the husband and the wife as additional explanatory variables. The inclusion of the hours of housework and labor supply allows a possibility that the labor supply and housework are not weakly separable from the consumption of the wife, the husband and the public goods.

In the standard IV estimates, the two tables show that the demand neutrality is strongly

[6]For discussion showing the necessity to check the first stage regression in the IV estimation, see the paper by Bound, Jaeger and Baker (1995)

denied in both the single-dual earner sample and the dual-earner sample when the demand is not conditioned by the labor supply of the husband and the wife. When they are conditioned by the labor supply, some of the coefficients become less significant and small, but over all the demand neutrality is denied. For example, column (1) of Table 4 shows that a ten percentage point change of income distribution from the wife to the husband will decrease the sum of the expenditure and saving for children by a 0.2 percentage point.

The standard IV estimation is subject to the bias caused by time-invariant preference shocks. The fixed effect estimation can solve this problem and columns (3), (4), (7) and (8) in Table 3 and Table 4 show the fixed effect estimation. The fixed effect estimation affects many estimates of the dual-earner sample. Except the effect on the expenditure on children (column (7) Table 3 and Table 4), the coefficients of the effect of the husband's income share become insignificant. For the single-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 the demand neutrality is denied. However, those estimates are not robust to the inclusion of the labor supply. Once they are conditioned by the labor supply, many of them becomes insignificant (column (4) and column (8)). Table A3 and A4 show the estimates of the other covariates in the fixed effect estimation. It shows that the housework of the wife is not weakly separable from the expenditure for children in the single-dual earner sample, as one would predict. On the other hand, we can not find such a non-separability in the dual-earner sample.

Table 5 and Table 6 show the fixed effect differenced estimation, an estimation strategy suggested by Altonji, Hayashi, and Kotlikoff (1992). Again, Table 5 assumes the additive separability between the current consumption and future consumption while Table 6 does

not. When the dependent variable is the sum of the current expenditure and saving for the husband, wife, children, and family, (i.e. not assuming additive separability of the current consumption and the future consumption), the coefficients of the effect of the husband's income share are all significant at the 10 percent level.

Table 7 and Table 8 show the fixed effect instrumental variable estimation. As we mentioned in the previous section, the fixed effect estimation exacerbates the measurement error problem and the instrumental variable can fix such a problem if appropriate instrumental variables are used. As the instrumental variables, we used $tax1_{it}$ and $tax2_{it}$ defined in (7). Table A2 shows the first stage regression. Table A2 shows that both two instrumental variables satisfy the rank condition with a reasonably small significant level.

As predicted, the fixed effect instrumental variable estimation makes the absolute value of the coefficient larger, which suggests the existence of the measurement error problem. Again, Table 7 assumes that the additive separability between the current consumption and the future consumption while Table 8 does not. We also conduct the Hausman test against the null hypothesis that the error term in (6) is uncorrelated with $\ddot{\theta}_{it}$. The number in the squared bracket show the Hausman statistic.

In Table 8, which does not assume the additive separability between the current consumption and the future consumption, the effect of the husband's income share on the expenditure for children becomes significant at all 4 specifications in the single-dual earner sample and the Hausman statistic shows that the fixed effect IV estimation is better than the fixed effect estimation. On the other hand, as for the effect of the husband's income share on the wife's consumption in the same sample, the fixed effect estimation shows the significant estimates while the fixed effect IV estimation show insignificant estimates. The Hausman statistic

suggests the fixed effect estimation is preferable to the fixed effect IV estimation.

In the dual-earner sample of Table 8, 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 the current expenditure and saving for children, which are significant in the single-dual earner sample for all specifications in the fixed effect IV estimation, they become insignificant but Hausman statistics indicates the fixed effect estimation is preferable to the fixed effect IV estimation. However, in the fixed effect estimation, the coefficient on the effect of the husband's income share on the sum of the current expenditure and saving for children is not robust to adding the labor supply to the covariates. Once the labor supply of the husband and the wife are added, the coefficient becomes insignificant in the fixed effect estimation. In summary, in the single-dual earner sample, we can conclude that the neutrality is denied in many specifications. However, in the dual earner sample, the non-neutrality is supported only marginally.

How can we reconcile those estimation results with the economic theory? The idea to distinguish the unitary model from the non-cooperative model is that in the unitary model the neutrality is likely to hold in any sample but in the non-cooperative model the neutrality is likely to hold only in the dual-earner sample. From that point, the unitary model is strongly rejected. Also, the non-cooperative model is rejected. Although the evidence in the dual-earner sample is thin, the coefficient of the effect of the husband's income share on public goods in the single-dual earner sample is opposite to what the non-cooperative model predicts. As Figure 1(b) shows, the effect of the husband's income share on public goods should be positive in the single-dual earner sample in which the single earner is headed by the husband.

6 Implications and Conclusions

In this paper, by using Japanese panel data, we test the neutrality theorem of public goods and private goods, which is unconditionally implied by the unitary model or which is supported under some circumstances in the non-cooperative game theoretical model. The data is suitable for our analysis since the data includes the expenditure and saving for each family member, the expenditure and saving for household public goods, and the hours of housework and labor supply by the wife and the husband. We first checked the neutrality by using the conventional IV estimation. The estimation results showed the non-neutrality in both the single-dual earner sample and the dual-earner sample. Next, we corrected the time-invariant preference shocks by using fixed effect estimation. With the fixed effect correction, the non-neutrality result was obtained for the single-dual earner sample while the non-neutrality became marginal in the dual-earner sample. After applying the fixed effect instrumental variable estimation, the non-neutrality result was still valid in the single-dual earner sample and it was marginal in the dual-earner sample. However, the coefficient of the husband's income share on the expenditure on public goods in the single-dual earner sample is opposite to what the non-cooperative game theoretical model predicts. Thus, both the unitary model and the non-cooperative game theoretical model are rejected.

In addition, the non-neutrality of public goods in the single-dual earner sample excludes the possibility that the preference for public goods in this sample is of the Gorman form and that the Pareto-efficient public goods is neutral about income distribution in that sample. In the dual-earner couple sample, we obtain the same result when the additive separability between the current consumption and future consumption is assumed. However, the neutrality

of public goods provision is not rejected when the additive separability between the current consumption and future consumption is not assumed and the labor supply of the husband and the wife are included in the explanatory variables.

Apart from the relevancy of those models, the results in this paper have important implications for public policy. For example, in Japan various changes of the income tax system and the public pension system such as the elimination of the allowance of the spouse and the expansion of the basic allowance are currently proposed. Given the current Japanese tax system, those change of the tax law is likely to decrease the income share of the husband and increase the income share of the wife. Suppose that such changes of policy affects the income distribution between the husband and the wife by one percentage point. Then the result in Table 8 shows that, if the preference is additively separable between the current consumption and the future consumption, a one percentage point increase of income share of the wife will increase the expenditure and saving share for children by a 0.48 percentage point other things being constant.

References

[1] Altonji, Joseph, Fumio Yayashi and Laurence Kotlikoff, "Is the Extended Family Altrustically Linked? : Drect Test using Mircro Data," *American Economic Review*, 1992, vol82, pp 1117-1198.

[2] Altonji, Joseph, Fumio Hayashi and Laurence Kotlikoff, "Parental Altruism and Inter Vivos Transfer: Theory and Evidence," *Journal of Political Economy*, 1997, vol 105, pp1121-1166.

[3] Barro, Robert J., "Are Government Bond Net Wealth?", *Journal of Political Economy*, 1974, vol 82, pp1095-117

[4] Becker, Gary S. " A Theory of Social Interactions", *Journal of Political Economy*, 1974,vol 82, pp1063-1094.

[5] Becker, Gary S. *A treatise on the family*, Cambridge, Mass Harvard University Press, 1981

[6] Bergstrom, Theodore, Lawrence Blume and Hal Varian, "On the Private Provision of Public Goods," *Journal of Public Economics* 29(1), February 1986, pages 25-49.

[7] Bergstrom, Theodore, "A Survey of Theories of the Family", in *Handbook of Population and Family Economics* vol 1a, 1997.

[8] Bergstgrom, Theodore and Richard Cornes, "Gorman and Musgrave are Dual: An Antipodean Thoerem on Public Goods", *Economic Letters*, 1981, pp371-378.

[9] Bergstgrom, Theodore and Richard Cornes, "Independence of Allocative Efficiency from Distribution in the Theory of Public Goods", *Econometrica*, 1983, vol51, pp1753-1766.

[10] Bound, J., D. Jaeger and R. Baker, Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak, Journal of the American Statistical Association, 1995, vol. 90, no. 430, pp. 443450.

[11] Brunner, Eric J., "An Empirical Test of Neutrality and the Crowding-Out Hypothesis," *Public Choice*, September 1997, 92(3-4), pp 261-79.

[12] Bouguignon, F. , M. Brwning, P.A. Chiappori and V. Lechene, "Intra-Household Allocation of Consumption: a Model and some Evidence from French Data", *Annales d'Economie et de Statistique*,1993, 29, pp1067-1096.

[13] Bouguignon, F. , M. Brwning, P.A. Chiappori and V. Lechene, "Incomes and Outcomes: A Structural Model of Intra-Household Allocation," *Journal of Political Economy*, 1994, vol 102, pp 1067-1096

[14] Browning M. and P.A. Chiappori, "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests," *Econometrica*, 1998, vol 66, pp 1241- 1278.

[15] Cox, Donald, "Motives for Private Income Transfers", *Journal of Political Economy*, 1987, pp508-546

[16] Haddad, Lawrence and John Hoddinott "Household Expenditures, Child Anthropomorphic Status and the Intrahousehold Division of Income: Evidence from the Cote d' Ivoire," *Oxford Bulletin of Economics and Statistics*", 1995, 57(1): 77-96

[17] Mansser M. and M. Brown "Marriage and Houehold Decisionmaking:A Bargaining Analysis," *International Economic Review*, 1980, 21 pp31-44

[18] McElroy,M.B. and MJ. Horney, "Nash-Bargained Household Decisionis:Toward A Generalization of the Theory of demand", *International Economic Review*, 1981, 22, pp333-340

[19] McElroy, Marjorie B. "The Empirical contenst of Nash Bargained Household Behavior", *Journal of Human Resources*, 25, pp559-583

[20] Murdoch,James, and Todd Sandler "The Voluntary Provision of a Pure Public Good: The Case of Reduced CFC Emissions and the Montreal Protocol", *Journal of Public Economics*. February 1997, 63(3): 331-49.

[21] Samuelson, Paul A., "The Pure Theory of Public Expenditure", *Review of Economics Statistics*, November, 1954.

[22] Warr, Peter G. " The Private provision of a public good is independent from income distribution", Economic Letter, 1983.

[23] Schultz, T. Paul (1990), Testing the Neoclassical Model of Family Labor Supply and Fertility," Journal of Human Resources, 25, 599-634.

[24] Thomas, Duncan (1990) Intra-household Resource Allocation: An Inferential Approach," Journal of Human Resources, 25, 635-696.

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
		[0.0095]	[0.024]	(0.020)	(0.028)	[0.022]	[0.028]	(0.042)	(0.043)
		{0.016}	{0.029}			{0.027}	{0.034}		
	Family	0.11	0.069	0.10	0.010	0.075	0.035	0.045	0.011
		[0.024]	[0.019]	(0.041)	(0.056)	[0.042]	[0.053]	(0.084)	(0.086)
		{0.030}	{0.055}			{0.052}	{0.065}		
Private Goods	Husband	0.026	0.015	-0.012	-0.00061	0.074	0.054	0.054	0.038
		[0.013]	[0.027]	(0.022)	(0.031)	[0.022]	[0.031]	(0.043)	(0.044)
		{0.016}	{0.033}			{0.028}	{0.039}		
	Wife	-0.056	-0.058	-0.063	-0.030	-0.062	-0.064	0.035	0.045
		[0.0089]	[0.0080]	(0.014)	(0.018)	[0.018]	[0.022]	(0.031)	(0.032)
		{0.011}	{0.021}			{0.022}	{0.026}		
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Families		906				376			
Number of Observations		4225				1505			

Notes: Standard errors, Huber-White robust standard errors, and clustering robust standard errors on an individual basis are in parentheses, square brackets, and curly brackets, respectively. 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 Savings for		(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
		[0.012]	[0.022]	(0.019)	(0.026)	[0.020]	[0.026]	(0.037)	(0.038)
		{0.016}	{0.027}			{0.026}	{0.032}		
	Family	0.15	0.10	0.098	0.021	0.13	0.098	0.074	0.041
		[0.023]	[0.044]	(0.038)	(0.052)	[0.041]	[0.050]	(0.077)	(0.079)
		{0.031}	{0.055}			{0.054}	{0.065}		
Private Goods	Husband	0.0040	-0.0028	-0.0076	0.0013	0.044	0.029	0.058	0.050
		[0.012]	[0.025]	(0.021)	(0.028)	[0.022]	[0.028]	(0.041)	(0.042)
		{0.016}	{0.031}			{0.030}	{0.037}		
	Wife	-0.10	-0.12	-0.077	-0.058	-0.13	-0.13	-0.013	-0.0089
		[0.0096]	[0.018]	(0.013)	(0.017)	[0.019]	[0.023]	(0.030)	(0.031)
		{0.014}	{0.023}			{0.025}	{0.029}		
Hours of Work?		No	Yes	No	Yes	No	Yes	No	Yes
Number of Families		906				376			
Number of Observations		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 Estimation: The Effects of One's Income on Consumption Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Estimation Methods							
	FE		FD FE		FE		FD FE	
After Tax Income	0.042	0.037	0.021	0.019	0.045	0.042	0.017	0.015
	(0.0032)	(0.0037)	(0.0056)	(0.0056)	(0.0072)	(0.0079)	(0.011)	(0.011)
Hours of Work?	No	Yes	No	Yes	No	Yes	No	Yes
Number of Individuals	1812		1720		752		692	
Number of Observations	8450		5988		3010		1956	

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. In addition to this sample selection, the sample includes only the observations that have information for at least two years in a row in columns 3, 4, 7, and 8. Other covariates in the estimation models are hours of housework and childcare and year dummies. In addition to these covariates, one's hours of work is included in an even number of columns. This notes apply to Table 6.

Table 6: Fixed Effects Estimation: The Effects of One's Income on Consumption Expenditures and Savings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Estimation Methods							
	FE		FD FE		FE		FD FE	
After Tax Income	0.048	0.041	0.027	0.025	0.064	0.060	0.025	0.023
	(0.0037)	(0.0044)	(0.0066)	(0.0066)	(0.0085)	(0.0092)	(0.013)	(0.013)
Hours of Work?	No	Yes	No	Yes	No	Yes	No	Yes
Number of Individuals	1812		1720		752		692	
Number of Observations	8450		5988		3010		1956	

Table 7: Fixed Effects Instrumental Variable Estimation:
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: Standard errors are in parentheses, and Hausman statistics are in square brackets. Hausman statistic can be computed as $(\hat{\beta}_{FEIV} - \hat{\beta}_{FE}) / \{[se(\hat{\beta}_{FEIV})]^2 - [se(\hat{\beta}_{FE})]^2\}^{1/2}$. 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 8.

Table 8: Fixed Effects Instrumental Variable Estimation:
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]
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: 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 hours of 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	-0.078	-0.14	0.15	0.25	0.069	0.16
Amount of Family Income	(0.0091)	(0.016)	(0.055)	(0.085)	(0.046)	(0.071)
Amount of Family Income	-0.012	-0.032	-0.062	-0.19	-0.044	-0.15
Tax	(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.

Figure 1(a)

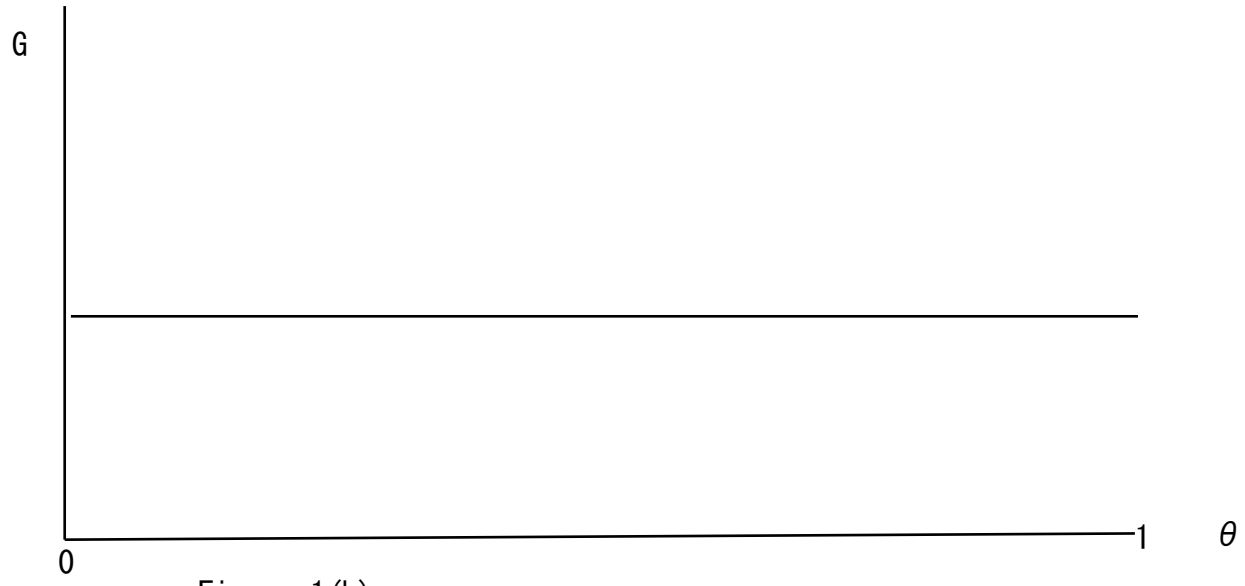

Figure 1(b)

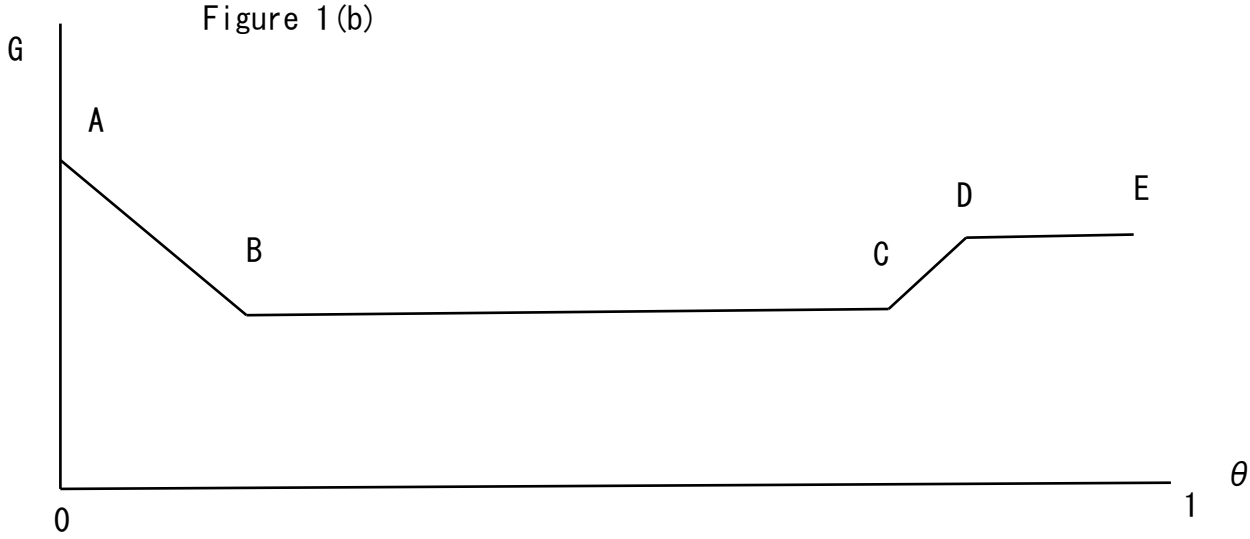

Figure 1(c)