The Distribution of Household Income in Marriage

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Abstract
This paper deals with three topics which have been neglected in the economics of the family literature. First, how is the distribution of household income endogenously determined within a marriage? Second, what is the desirable allocation of authority to determine the sharing rule of household income? Third, does free negotiation between wife and husband contribute to achieving a desirable outcome? We analyze these topics within a non-cooperative game model of the family where either the husband or wife decides the share of total household income for private consumption. One of our findings is that the allocation of authority can be determined by examining the relative efficiency of the partners in earning salary, and varies in a non-monotonic way.

1. Introduction
According to the income-pooling hypothesis, only total income and not the individual incomes of members of a household matters for allocation decisions within a household.1 However, a large body of empirical evidence suggests the data are not consistent with this Ricardian-equivalence type hypothesis. For instance, the studies of Grossbard-Shechtmans and Neuman (1986), Browning et al. (1994) and Phipps and Burton (1998) show that the sharing rule for total income allocation among spouses significantly affects the final expenditure allocation decisions made by the household. These studies tend to argue that the sharing rule in a family is established as a result of exogenous factors such as differences between the wife’s and the husband’s age, ethnicity, social norms in respect of gender and other factors.

Our focus is different from that of earlier studies in the area. Whereas previous empirical studies have sought to identify the factors that affect the allocation of total household income, our interest centres on how the sharing rule is determined endogenously within marriages. In 60 to 70 percent of Japanese couples, the husband hands all of his income to his wife, so that she decides the distribution rule of the household income (Institute for Household Economy, 1999). This fact cannot be explained by exogenous variables such as age differentials. Furthermore, we develop an efficient sharing rule and examine whether the husband and wife can

1 There are two standard models of distribution within the family. Becker’s altruist model (1974,1981), (See Pollak, 1985, for the a discussion of this model) and the cooperative, usually Nash bargaining models of Manser and Brown (1980) and McElroy and Horney (1981). These are extended by Chiappori (1988), Lundberg and Pollak (1995), Konrad and Lommerud (2000), and Gugl (2004) and others. See also Bergstrom (1996) and Lundberg and Pollak (1996) for general reviews of this theory.

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achieve it through negotiation. Theoretical analysis of these issues is important but is somewhat neglected in the economics of the family literature.

In studying sharing rules determined endogenously within marriages, we use the framework of the non-cooperative game model of the family developed by Lundberg and Pollak (1994, 2003), Konrad and Lommerud (1995), and Browning (2000). Assuming that both spouses contribute to the supply of household public goods, such as well-educated children, a clean house etc., Lundberg and Pollak (1994) examine the possibility of ensuring Pareto optimal outcomes in families under the repeated game setting. They extend the model in Lundberg and Pollak (2003) to a non-stationary multi game setting to account for the situation that players cannot make a costless enforcement agreement. Konrad and Lommerud (1995) study the effect of family policies on welfare improvement within a similar framework. Developing a simple two period model, Browning (2000) studies the saving behaviour in a non-cooperative family. Our model is rather different from those mentioned, except in that it uses the notion of the non-cooperative family.

Critical to our analysis are the marriage partners’ incentives for contributing to household income, which are affected by which partner has authority to determine the sharing rule within the family. Household income is defined as the total salary earned by both marriage partners. While they contribute to the household income, partners compete for their share of household income to use for private consumption. Under this simple assumption, we examine, first, how the share of household income will be determined in an equilibrium. Second we characterise what the desirable allocation of authority is that would enable us to determine the sharing rule of household income within a marriage. Third, we look at whether free negotiation between wife and husband contributes to achieving the desirable outcome.

The organisation of this paper is as follows. In section 2, we set out the basic model for payoff maximising spouses. In section 3, we discuss their optimisation behaviour. Section 4 is devoted to deriving the payoffs in equilibrium. The condition that determines the optimal allocation of authority between wife and husband is derived in section 5. In section 6, negotiation between them over the right to decide the share of household income is addressed. We conclude in section 7.

2. Model

Consider a two-person, husband and wife family. In the following analysis, we describe two partners as, $j = h, w$ where $h$ and $w$ indicate husband and wife, respectively. Each partner can work and earn a salary. The sum of their salaries is equal to the total household income.

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2 Since the purpose of this paper is to examine the sharing rule within married couples, we do not consider divorce by implicitly assuming that the cost of divorce is sufficiently high not to separate. Specifically, as we can derive from the analysis below, the cost of divorce for husband and wife is assumed to be at least greater than $\frac{a}{\varepsilon}$ and $\frac{1}{\varepsilon \theta}$, respectively. These amounts are greater than the payoff achieved even with a zero share for each of the spouses, respectively.
where $y$ is the total household income and $x_j$ is the amount of time partner $j$ spends working. The (given) wage rates of partner $h$ and $w$ are $a(\geq 0)$ and $1$, respectively. A part of household income, $(1 - b)y$, $(0 \leq b \leq 1)$ is used for the necessary outlays of the family, such as housing, savings, food expenses, lighting expenses and so on. The remainder of the income, $by$, is distributed to the husband and wife as money for private consumption. Without any loss of generality, we assume $b = 1$ in the following analysis.

The two partners conflict over the distribution of household income, which is divided between the two partners according to a sharing rule. Distributed income is used for private consumption. We represent $\lambda$ as the share distributed to the husband out of the total household income $(0 \leq \lambda \leq 1)$. Hence, the private consumption of husband and wife is given by $\lambda y$ and $(1 - \lambda)y$, respectively. The share of total household income, $\lambda$, is chosen by the partner ($h$ or $w$) who has authority to determine the sharing rule in the family.

Grossbard-Shechtman and Neuman (1986) consider that $\lambda$ is established as a result of exogenous factors, such as differences between the wife and husband’s age, ethnicity and so on. Browning et al. (1994) assume that $\lambda$ is given by the function of various exogenous variables and the total household income. In this paper, however, we consider that $\lambda$ is determined endogenously in each family.$^3$

The partners work and earn salary to contribute to household income. We assume that the cost of working (or cost of efforts) for the husband is $(\varepsilon/2)x_h^2$, where $\varepsilon$ is a given parameter. The cost of working for the wife is assumed to be $(\varepsilon\theta/2)x_w^2$, where $\theta$ reflects a cost differential parameter. When the cost of working one hour is relatively lower for the husband than the wife, $\theta > 1$. We do not, however, exclude $\theta \leq 1$.

In our model, we assume that there is no love or altruism in the sense of interdependent preferences.$^4$ Under this situation, we assume that partners will derive payoffs from the difference between money for private consumption and the minimum cost of earning salaries. The payoff functions are given by

$$U_h = \lambda y - \varepsilon x_h^2/2$$  \hspace{1cm} (2)

and

$$U_w = (1 - \lambda)y - \varepsilon\theta x_w^2/2$$  \hspace{1cm} (3)

$^3$ Such an implication is supported by findings in the field of rent seeking and team production, where some studies have found an endogenous sharing rule determined through individuals’ optimising behaviour. See, for instance, Lee (1995), Ganguli (1996), and Noh (1999).

$^4$ As Konrad and Lommerud (2000, p.472) hope, fully non-cooperative behaviour within families is rare. However, non-cooperative family models are useful as an alternative benchmark in modelling the behaviour of married couples. The truth seems to lie somewhere between the non-cooperative and cooperative behaviour models.
### 3. Optimisation Problem

Turning to the optimisation problems for both partners. The timing of the decision-making is:

1. Either the husband or wife decides the share of total household income, $\lambda$.
2. $\lambda$ having been decided at the first stage, husband chooses $x_h$ and wife chooses $x_w$.
3. The household income is distributed to husband and wife according to the sharing rule, by which they obtain $U_h$ and $U_w$.

To decide $\lambda$ at the first stage brings about a higher profit to the person who decides the share of household income since he (she) can have an influence on the labour decision of the companion by revealing $\lambda$.\(^5\)

The equilibrium concept used is the backward induction outcome. Thus, we start by examining the second stage of the game.

**Decisions on $x_j$**

*Wife*. Suppose that either the husband or wife has chosen the share, $\lambda$, at the first stage. Then, taking $\lambda$ as given, the wife chooses $x_w$ to maximise her payoff, $U_w = (1 - \lambda)y - \varepsilon\theta x_w^2/2$, subject to (1). The solution is given by

$$x_w = \frac{1 - \lambda}{\varepsilon\theta} \quad (4)$$

The wife does not change her contribution to the household income, $x_w$, as husband changes $x_h$, since the household income is just a linear function of the sum of each partner’s contribution. However, it is influenced by the share of household income; $\partial x_w / \partial \lambda < 0$ The more money the wife gets, the more she contributes to the household income.

*Husband*. Given $\lambda$, the husband maximises his payoff, $U_h = \lambda y - \varepsilon x_h^2/2$, with respect to $x_h$. The solution is obtained by

$$x_h = \frac{a \lambda}{\varepsilon} \quad (5)$$

Note that the husband contributes to the household income more as he receives more money for private consumption, $\partial x_h / \partial \lambda < 0$.

### Decisions on $\lambda$

In the following discussion, we analyse the equilibrium share of household income distributed to each member of a family, $\lambda$, by dividing the analysis into two types of family structure. In the first family, the husband has the authority to determine the share of household income allocated to each partner. We refer to these families as *husband predominance* (H-type) families.

In contrast, the second type of family, *wife predominance* (W-type) family, involves the wife having authority to decide the family members’ share of household income.

\(^5\)To decide $\lambda$ and $x_i$ at the same time yields the result which is the same as the case where the partners divorce.
From equations (4) and (5), the total household income becomes

\[ y = ax_h + x_w = [\lambda \theta a^2 + 1 - \lambda] / \epsilon \theta \]  

(6)

Substituting equations (4), (5), and (6) into (2) and (3), we obtain the payoffs for the two partners as a function of \( \lambda \):

\[ U_h = \frac{\lambda [2 + (\theta a^2 - 2) \lambda]}{2 \epsilon \theta} \]  

(7)

\[ U_w = \frac{(1 - \lambda) [1 + (2 \theta a^2 - 1) \lambda]}{2 \epsilon \theta} \]  

(8)

**H-type family**

Where the husband holds the authority to determine the distribution of household income, he chooses the share, \( \lambda \), so as to maximise his payoff. The problem is to maximise (7) with respect to \( \lambda \). The share of household income in the H-type family, \( \lambda^h \), is given by

\[ \lambda^h = \begin{cases} 
1 & \text{if } \theta a^2 \geq 1 \\
(2 - \theta a^2)^\lambda < 1 & \text{if } 0 < \theta a^2 < 1 
\end{cases} \]

where \( \theta a^2 \) can be considered as the husband’s relative efficiency of earning salary.

Two remarks can be made about this solution. First, the husband does not always choose to get all the household income, even though there is no love and altruism, since the wife will contribute no salary to the household income if he chooses \( \lambda^h = 1 \). If the wife’s cost of working, \( \theta \), and the husband’s wage rate, \( a \) are so small as to satisfy \( 0 < \theta a^2 < 1 \), it is better for the husband to have his wife contribute to the household income. In doing so, the husband must give his wife an incentive to contribute, so he chooses to distribute a share of household income to her that is greater than zero. On the other hand, when \( \theta a^2 \geq 1 \), there is no need for the wife to contribute to the household income. The husband obtains a higher payoff by contributing the entire household income and choosing to get all the household income, \( \lambda^h = 1 \).

Second, \( \lambda^h \) is increasing in \( \theta \) and \( a \) when \( 0 < \theta a^2 < 1 \). This implies that the husband is more likely to choose a share parameter favourable to his wife, the lower is his wage rate and the lower is his wife’s relative cost of working. To utilise wife’s relative efficiency, he must make a decision attractive to his wife. Thus, even in a family where the husband holds the majority of power, the wife’s ability to earn salary will give her some influence over the allocation of total household income.

**W-type family**

Where the wife holds the authority to determine the share of household income, the problem for the wife is to maximise (8) with respect to \( \lambda \). The solution in the W-type family, \( \lambda^w \), becomes as follows:
\[ \lambda^w = \begin{cases} 0 & \text{if } 0 < \theta \alpha^2 \leq 1 \\ (1-\theta\alpha^2)(1-2\theta\alpha^2)^{-1} > 0 & \text{if } \theta \alpha^2 > 1 \end{cases} \]

We have two remarks similar to the case where the husband holds authority. First, the wife does not always choose to keep all of household income such that \( \lambda^w = 0 \). This is because if she sets \( \lambda^w \) at zero, her husband contributes no salary to the household income. To make him contribute, she must distribute the income so that \( \lambda^w \) is greater than zero.

Second, when \( \theta \alpha^2 < 1 \) the wife is likely to depend on husband’s contribution as \( \theta \) and \( \alpha \) increase, \( \partial \lambda^w / \partial \theta > 0, \partial \lambda^w / \partial \alpha > 0 \).

### 4. Equilibrium and Payoffs

#### Total Household Income

In the family described above, the equilibrium values of \( x_h^*, x_w^*, \) and \( y \) depend on the cost differential parameter, \( \theta \), the relative wage rate \( \alpha \), and the type of family structure in which either husband or wife controls money in marriage. The equilibrium values, \( x_h^*, x_w^*, \) and \( y^* \) are represented in table 1, where \( i = H, W \) stands for the H-type and W-type family.\(^6\)

#### Table 1 Equilibrium Values

<table>
<thead>
<tr>
<th>( \theta \alpha^2 )</th>
<th>( x_h^{Hi} )</th>
<th>( x_w^{Hi} )</th>
<th>( y^{Hi} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \theta \alpha^2 &gt; 1 )</td>
<td>( \frac{a}{\epsilon} )</td>
<td>0</td>
<td>( \frac{a^2}{\epsilon} )</td>
</tr>
<tr>
<td>( 0 &lt; \theta \alpha^2 &lt; 1 )</td>
<td>( \frac{a}{\epsilon(2-\theta \alpha^2)} )</td>
<td>( \frac{1-\theta \alpha^2}{\epsilon \theta(2-\theta \alpha^2)} )</td>
<td>( \frac{1}{\epsilon \theta(2-\theta \alpha^2)} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( \theta \alpha^2 )</th>
<th>( x_h^{Wi} )</th>
<th>( x_w^{Wi} )</th>
<th>( y^{Wi} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \theta \alpha^2 &gt; 1 )</td>
<td>( \frac{a(\theta \alpha^2 - 1)}{\epsilon(2 \theta \alpha^2 - 1)} )</td>
<td>( \frac{a^2}{\epsilon(2 \theta \alpha^2 - 1)} )</td>
<td>( \frac{\theta \alpha^4}{\epsilon(2 \theta \alpha^2 - 1)} )</td>
</tr>
<tr>
<td>( 0 &lt; \theta \alpha^2 &lt; 1 )</td>
<td>0</td>
<td>( \frac{1}{\epsilon \theta} )</td>
<td>( \frac{1}{\epsilon \theta} )</td>
</tr>
</tbody>
</table>

Table 1 shows the amount of total household income. When \( \theta \alpha^2 < 1 \), the household income in the H-type family, \( y^{Hi} \), is greater than the household income in the W-type family, \( y^{Wi} \). On the other hand, the result is reversed when \( 0 < \theta \alpha^2 < 1 \), where the household income in the H-type family is smaller than the income in the W-type family. The total household income varies with the location of authority within a family.

\(^6\) Notice that we omit the case \( \theta \alpha^2 = 1 \) in the following analysis.
**Payoffs**

We can now use the equilibrium values of $\lambda$, $x_h$, $x_w$, and $y$ to derive the payoffs for both partners. Substituting them into equations (2) and (3), we summarise the payoffs in table 2.

Table 2 Payoffs

<table>
<thead>
<tr>
<th></th>
<th>H-type family</th>
<th>W-type family</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$U^H_h$</td>
<td>$U^H_w$</td>
</tr>
<tr>
<td>$\theta a^2 &gt; 1$</td>
<td>$\frac{a^2}{2\varepsilon}$</td>
<td>$0$</td>
</tr>
<tr>
<td>$0 &lt; \theta a^2 &lt; 1$</td>
<td>$\frac{1}{2\varepsilon\theta(2 - \theta a^2)}$</td>
<td>$(1 - \theta a^2)(1 + \theta a^2)$</td>
</tr>
</tbody>
</table>

5. Who Should Distribute the Household Income?

In considering which partner should have authority to decide the allocation of household income, we define the utilitarian total payoff function, $TP_i$, as follows:

$$TP_i = U^H_i + U^W_i \quad i = H, W$$

(9)

The intrahousehold optimum is achieved when $\lambda = (1 + \theta a^2)/(1 + 2\theta a^2)$. However, under both H-type and W-type families, contributions diverge from the optimum, which suggests that it cannot be achieved within these family structures due to the conflicting interests of the partners.

To analyse how authority should be allocated between the two partners, we compare family structures of H-type and W-type on the basis of the total payoff obtained by (9).

The total payoff is summarised in table 3.

Table 3 Total Payoffs

<table>
<thead>
<tr>
<th></th>
<th>H-type family</th>
<th>W-type family</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\frac{a^2}{2\varepsilon}$</td>
<td>$\frac{a^2(3\theta^2 a^4 - \theta a^2 - 1)}{2\varepsilon(2\theta a^2 - 1)^2}$</td>
</tr>
<tr>
<td>$0 &lt; \theta a^2 &lt; 1$</td>
<td>$\frac{(3 - \theta a^2 - \theta^2 a^4)}{2\varepsilon\theta(2 - \theta a^2)^2}$</td>
<td>$\frac{1}{2\varepsilon\theta}$</td>
</tr>
</tbody>
</table>

7 $\lambda = (1 + \theta a^2)/(1 + 2\theta a^2)$ is derived by the maximization of the sum of $U_h$ and $U_w$ given by (7) and (8).
Consider the case of $\theta r^2 > 1$. Comparing the total payoff in the W-type family, $TP^W$, with the payoff in the H-type family, $TP^H$, we have

$$TP^H - TP^W = \frac{a^2}{2e} - \frac{a^2(3\theta^2a^4 - 2\theta^2a^2 - 1)}{2e(2\theta^2a^2 - 1)^3} = \frac{a^2(\theta^2 - 2)(\theta^2 - 1)}{2e(2\theta^2a^2 - 1)^3}$$

(10)

Since $\theta r^2 > 1$, it becomes $TP^H - TP^W > (\langle)0$ for $\theta r^2 > (\langle)2$. Hence, we obtain the result that where $\theta r^2$ is larger than 2, it is preferable for the husband to have authority (H-type family) and where $\theta r^2$ is smaller than 2, it is preferable for the wife to have authority (W-type family).

This result is confirmed in figure 1(a), where the utility possibility frontier (UPF) is depicted assuming $\theta r^2 > 2$. The first-best optimum is represented by point $A$, which is achieved when $\lambda = (1 + \theta r^2)/(1 + 2\theta r^2)$, though neither W-type nor H-type family achieves it. $H$ represents the H-type equilibrium, where the husband chooses $\lambda = 1$, and $W$ represents W-type equilibrium, where the wife selects $\lambda$ as $\lambda = (1 + \theta r^2)/(1 + 2\theta r^2)^{-1} > 0$. The utilitarian total payoff is given by the line $TP^W$ attained at W-type equilibrium, which is strictly greater than that attained at H-type equilibrium. Hence, in this case, it is preferable for the wife to have the power to control the distribution of household income. The ranking of total payoff is changed in Figure 1(b), where UPF is drawn by assuming $1 < \theta r^2 < 2$.

**Figure 1 (a) Utility Possibility Frontier ($\theta r^2 > 2$). $TP^W > TP^H$**

![Utility Possibility Frontier](image)
In the case of \( 0 < \theta \sigma^2 < 1 \), we obtain

\[
TP^H - TP^W = \frac{3 - \theta \sigma^2 - \theta^2 \sigma^4}{2 \varepsilon \theta (2 - \theta \sigma^2)^3} - \frac{1}{2 \varepsilon \theta} = \frac{(2 \theta \sigma^2 - 1)(1 - \theta \sigma^2)}{2 \varepsilon \theta (2 - \theta \sigma^2)^3}
\]  (11)

If we proceed as before, then \( TP^H - TP^W > (\leq)0 \) for \( \theta \sigma^2 > (\leq)0.5 \), since \( 0 < \theta \sigma^2 < 1 \).

We obtain the result that the H-type family is more desirable than the W-type family for \( \theta \sigma^2 \) larger than 0.5 and undesirable where \( \theta \sigma^2 \) is smaller than 0.5.

Actual families are not likely to adhere strictly to these principles, but approximate results regarding the desirable allocation of authority are drawn in figure 2. The desirable allocation of authority is characterised by the relative wage rate (\( \sigma \)) and the relative cost of working (\( \theta \)) for the partners, and varies in a non-monotonic way. It is desirable that the authority be given to the wife when she is sufficiently superior to the husband in earning salary, \( 0 < \theta \sigma^2 < 0.5 \). On the other hand, when the husband is sufficiently superior to his wife in earning salary (\( \theta \sigma^2 > 2 \)) the husband should have authority to decide the allocation of total household income. This result is consistent with the conventional wisdom that where the production technology is linear, authority should be assigned to the agent who can raise funds and implement joint projects most efficiently.
However, our results suggest that the partner who is inferior in earning salary should have the authority for an interval of $0.5 < \theta r < 2$. That is, if the husband is only slightly more efficient than the wife at working, the wife should have the authority to make decisions about allocation of household income. Likewise, where the wife is only slightly more efficient than the husband in working, the husband should have the authority. The rationale for this paradoxic result can be understood as follows. When $0.5 < \theta r < 2$, it is better for both partners to make a positive contribution. That is, the total payoff for family in which both partners work is higher than the payoff for family in which only the husband works. This means that the solution requires $x_h > 0$ and $x_w > 0$ to be selected. However, if the husband has the authority when $1 < \theta r < 2$, he chooses the share of household income such that $\lambda h^* = 1$. This choice rules out the wife’s contribution to the household income ($x_w = 0$) and therefore fails to take advantages of her salary earning capacity (however inferior it may be to her husband’s). If however, the wife is given the authority, she would necessarily rely on her husband’s earnings, and would choose the sharing rule as $\lambda w^*$ less than one. As the share of household income is neither zero nor one, both partners are more likely to contribute to household income. That is, giving authority to the less efficient partner generates a positive contribution from both partners.

The same logic applies in the reverse case when wife is slightly more efficient in earning salary, $0.5 < \theta r < 1$. In this case, husband should have the authority to decide the allocation of household income, otherwise he would not contribute at all to the household income.
6. Negotiation

In the previous section, we examined how authority should be allocated between the two partners. The result is represented in figure 2, which shows that the desirable allocation of authority depends on the relative cost differentials between the partners.

In this section, we examine the possibility of achieving the desirable allocation of authority within a family. In general, initial allocation of authority is determined exogenously by such factors as culture, peer group, and relative ages, without partners making their own decision, and therefore it may not be possible to achieve a desirable allocation of authority. However, the result will depend on whether we allow for the trade of authority through negotiation within a family. In the following analysis, we allow partners to trade authority and allow for some endogenous allocation of authority. Then, we examine whether the desirable allocation of authority characterised in figure 2 can be achieved or not through negotiation between the husband and wife.

We assume that there is no negotiation cost. First, we consider the situation where the wife is superior to the husband in earning salary, \(0 < \theta a^2 < 1\). If the husband initially has authority, the process of negotiation becomes as follows: (i) wife asks her husband to transfer the authority to decide \(\lambda\). (ii) In return, she provides transfers that compensate the payoff loss compared with what her husband had obtained before the transfer of authority.

Under this process, husband is indifferent about having and transferring authority. Thus, he accepts this proposal. A problem is whether or not an incentive to make such a proposal exists for the wife. We denote the transfers that the wife must compensate her husband for when \(0 < \theta a^2 < 1\) as \(T_w|_{0 < \theta a^2 < 1}\).

It is equivalent to the difference between the payoff which might be obtained in the H-type family, \(U^H_w = \frac{1}{2} \epsilon \theta (2 - \theta a^2)\), and the payoff which might be obtained in the W-type family, \(U^W_w = 0\). This yields

\[
T_w|_{0 < \theta a^2 < 1} = \frac{1}{2 \epsilon \theta (2 - \theta a^2)}
\]

The wife is constrained to provide transfers characterised by (12). \(T_w|_{0 < \theta a^2 < 1}\) from the level obtained in the W-type family, \(U^W_w = 1/2 \epsilon \theta\), leaves

\[
U_w = \frac{1}{2 \epsilon \theta} - \frac{1}{2 \epsilon \theta (2 - \theta a^2)} = \frac{1 - \theta a^2}{2 \epsilon \theta (2 - \theta a^2)}
\]

From this it can be concluded that the wife will negotiate to be transferred the authority to determine the allocation of household income if and only if the payoff level in (13) is greater than the level which is obtained in the

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8 Notice that in the process of negotiation, we do not pursue the means of attaining the first-best equilibrium represented by point A in figure 1(a). In fact, we find whether players who are at point H in figure 1(a) have incentives to move to point W.

9 Here we assume that the wife has a perfect bargaining power. The results are not affected by assuming the bargaining power is imperfect, however.
H-type family with no negotiation, \( U^W = (1 - \theta a^2)(1 + \theta a^2)/2\epsilon \theta (2 - \theta a^2) \). With some further derivation, the increase in payoff for wife through negotiation, \( \Delta U^W \mid_{a^2 < 1} \), can be described as follows:

\[
\Delta U^W \mid_{a^2 < 1} = \frac{(1 - \theta a^2)(1 - 2\theta a^2)}{2\epsilon \theta(2 - \theta a^2)^2} \tag{14}
\]

In this part we have considered the case of \( 0 < \theta a^2 < 1 \), and obtained the result that if \( 0 < \theta a^2 < 0.5 \), the wife has an incentive to negotiate with her husband to transfer the authority to determine allocation of household income. She will offer him compensation in return. The proposal must be accepted by her husband for the authority to be transferred to her. In contrast to this, if \( 0.5 < \theta a^2 < 1 \), the wife has no incentive to hold the authority because she must compensate her husband too much. The result is that the husband retains the authority.

Next, we consider the situation where \( \theta a^2 > 1 \), and the husband initially has authority. The wife must compensate her husband for transferring the authority to her. We denote the size of transfers she must provide when \( \theta a^2 > 1 \) as \( T^w \mid_{a^2 > 1} \). It is given by

\[
T^w \mid_{a^2 > 1} = \frac{a^2}{2\epsilon} - \frac{a^2(\theta a^2 - 1)(\theta a^2 + 1)}{2\epsilon(2\theta a^2 - 1)^2} = \frac{a^2(3\theta^2 a^4 - 4\theta a^2 + 2)}{2\epsilon(2\theta a^2 - 1)^2} > 0 \tag{15}
\]

The payoff for the wife is obtained by subtracting \( T^w \mid_{a^2 > 1} \) in (15) from the payoff level obtained in the W-type family, \( U^W = \theta a^4/2\epsilon(2\theta a^2 - 1) \). It follows that

\[
U^w = \frac{(2 - \theta a^2)(\theta a^2 - 1)}{2\epsilon(2\theta a^2 - 1)} \tag{16}
\]

Since the payoff for wife obtained in the H-type family with no negotiation is characterised by \( U^W \mid_{a^2 > 1} = 0 \), we obtain the increase in payoff for the wife under (15), \( \Delta U^w \mid_{a^2 > 1} \), as

\[
\Delta U^w \mid_{a^2 > 1} = \frac{(\theta a^2 - 1)(2 - \theta a^2)}{2\epsilon(2\theta a^2 - 1)} \tag{17}
\]

Since \( \theta a^2 > 1 \), it follows that when \( 1 < \theta a^2 < 2 \), the wife will negotiate with her husband to have the authority to decide the allocation of household income. With the compensation determined in (15), the husband may transfer the authority to his wife. However, there is no incentive for the wife to negotiate if \( \theta a^2 > 2 \). Thus, in this case, the authority will remain with the husband.

The negotiation process that occurs when the wife initially has authority can be examined using the same procedure as above. When \( 1 < \theta a^2 < 2 \) and \( 0 < \theta a^2 < 0.5 \), the wife retains her authority since there is no incentive for the husband to negotiate for it. However, when \( \theta a^2 > 2 \) and \( 0.5 < \theta a^2 < 1 \), the authority is transferred from the wife to the husband with compensation going to the wife.\(^{10}\)

\(^{10}\) See Appendix.
Summarising the above discussion, we can conclude that if some kind of negotiation over possession of the decision right occurs, the authority to decide the share of household income can be optimally allocated between husband and wife. That is, when $1 < \theta a_2 < 2$ and $0 < \theta a_2 < 0.5$, the wife will eventually hold authority. In contrast, when $\theta a_2 > 2$ and $0.5 < \theta a_2 < 1$, the husband holds authority. This is indeed the optimal allocation of authority obtained in the last section (figure 2). Consequently, the optimal allocation of authority will be achieved through negotiation between husband and wife.

7. Conclusion

We have presented a model to examine the allocation of authority (the right to decide each partner’s share of household income) amongst marriage partners and addressed three issues.

First, we demonstrate the distribution of household income in the equilibrium. In addition we study the relationship between total household income and location of power (H-type or W-type family). Second, we derive the condition for desirable allocation of authority. Third, we discuss the possibility of negotiation among partners to achieve the optimal allocation of authority. The main conclusions are as follows.

First, intrahousehold decision making differs according to the location of authority to determine the allocation of household income within a marriage. This raises some fundamental questions about the validity of the income pooling hypothesis. Second, the desirable allocation of authority is determined by the relative wage rate and the relative cost for working for the partners and varies in a non-monotonic way. Third, the desirable allocation of authority can be achieved through negotiation for possession of the authority to decide the allocation of household income.

Finally we note two relevant implications. First, we have considered negotiation among partners to show that it is possible to achieve an efficient solution to the problem of total household income maximisation. In our model, negotiation for the right of share allocation is carried out with no costs. This assumption is critical. If there exist negotiation costs within the marriage, a process of negotiation may not generate the most efficient outcome depending on the costs of negotiation.

Second, the cost of the husband earning salary may be relatively small ($\theta a_2 < 1$) because average wages or earnings tend to be substantially lower for women than for men. If this is true, then where $1 < \theta a_2 < 2$, authority to decide the share of household income should be with the wife. In Japan, the evidence shows that women’s average wage as a proportion of men’s ranges from about 69 percent to 96 percent [Ministry of Health, Labour and Welfare (2001)]. These figures may explain a part of the present situation that the wife decides the distribution rule of the household income. As the Japanese male/female wage differential tends to decline, the family structure may change in the direction where the wife possesses a decisive power with household income.
In ending the paper, brief discussion of the limitations of the model may be in order. First, in this paper, we use a specific functional form in the payoff function. Specifically we assume transferable utility and the constant marginal utility of private consumption. Though these restrictions may be allowed in order to obtain explicit results, the robustness of the result should be checked by generalising the basic model. Second, we analyse a somewhat special case of negotiation. Examination of general bargaining might provide other outcomes. However, rather than providing a general analysis, we hope our approach highlights the most important forces at work.

**Appendix**

In this Appendix, we examine whether the husband has an incentive to have the decision right over the allocation of household income. We assume that $T_h$ represents the transfer husband must make to his wife as compensation for transferring the right. Let us consider the options open to husband where $\theta \bar{r} > 1$. He must transfer $T_h |_{\bar{w} \rightarrow 1} = \theta \bar{r}^i / 2\varepsilon(2\theta \bar{r}^2 - 1)$ to his wife in exchange for the right which the wife holds. The wife will accept this proposal, since she is indifferent to the payoff level before and after transferring the right. The husband obtains $U_h = \bar{r}^2 / 2\varepsilon$ before negotiation starts. Hence, the payoff for husband becomes:

$$U_h = \frac{\bar{r}^2}{2\varepsilon} - \frac{\theta \bar{r}^i}{2\varepsilon(2\theta \bar{r}^2 - 1)} = \frac{\theta \bar{r}^2 - 1}{2\varepsilon(2\theta \bar{r}^2 - 1)}$$

If the payoff derived from this equation is greater than $U_h = (\theta \bar{r}^2 - 1)(\theta \bar{r}^2 + 1) / 2\varepsilon(2\theta \bar{r}^2 - 1)^2$, which is the payoff obtained in the W-type family, he has an incentive to negotiate for the transferral of the right. The increment in the payoff with negotiation, $\Delta U_h |_{\bar{w} \rightarrow 1}$, is given by

$$\Delta U_h |_{\bar{w} \rightarrow 1} = \frac{(\theta \bar{r}^2 - 2)(\theta \bar{r}^2 - 1)}{2\varepsilon(2\theta \bar{r}^2 - 1)}$$

As we are considering the case of $\theta \bar{r} > 1$, if $1 < \theta \bar{r} < 2$, the husband does not negotiate, and the wife retains the right. On the other hand, if $\theta \bar{r} > 2$ the husband can improve his payoff level, so that he is transferred the right in exchange for compensation to his wife.

Similarly, when $0 < \theta \bar{r} < 1$, the amount of compensation that the husband must provide is given by $T_h |_{0 < \bar{w} < 1} = (2\theta \bar{r}^2 - 4\theta \bar{r} + 3) / 2\varepsilon(2 - \theta \bar{r})^2$. In this case, the increment in the payoff level of husband by negotiation, $\Delta U_h |_{0 < \bar{w} < 1}$, can be described as follows:

$$\Delta U_h |_{0 < \bar{w} < 1} = \frac{(1 - \theta \bar{r}^2)(2\theta \bar{r} - 1)}{2\varepsilon(2 - \theta \bar{r})^2}$$

It follows that when $0 < \theta \bar{r} < 0.5$, the wife continues to hold the right since her husband does not have any incentive to negotiate. However, when $0.5 < \theta \bar{r} < 1$, the husband would benefit from transferral of the right. Thus, he negotiates with his wife to get the right to determine the allocation of household income and pays appropriate compensation.
References