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Intensive Margins, Extensive Margins, and Spousal Allowances in the Japanese System of Personal Income Taxes: A Discrete Choice Analysis

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Intensive Margins, Extensive Margins, and Spousal Allowances in the Japanese System of Personal Income Taxes: A Discrete Choice Analysis[*]

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Abstract: This study explores the effects of spousal allowances (SAs) in the Japanese system of personal income taxes, using the micro-simulation method based on the discrete choice model of labor supply. Our simulations show that the complete abolishment of SAs would increase the average annual working hours of all wives by 1.6% only, which is smaller than previous findings in the Japanese literature. If we focus on households benefiting from SAs, the rate of increase in the wife's working hours is even smaller (.1%). In addition, one particular case of SA reduction leads to a *decrease* in the labor supply of wives. We argue that these unexpected results are due to our explicit consideration of the fixed cost of labor market participations, which has been previously ignored in the Japanese studies.

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1. Introduction

The treatment of incomes of household members, typically husband and wife, has been an important factor in designing the system of income taxes (Apps and Rees 2009). There are two archetype tax treatments of personal income: joint taxation and individual taxation. In their pure forms, joint taxation uses the combined earnings of household members to assess tax liability, while individual taxation regards each of the household members as a tax unit and assesses his/her tax liability using individual earnings. While a majority of member countries of the Organisation for Economic Co-operation and Development (OECD) has moved from joint to individual taxation over the decades, their tax systems have retained some degree of "jointness" among family members' incomes. Since such jointness affects the incentives to work for family members, several studies have examined its effects in different countries. Examples include studies on tax reforms in Ireland (Callan et al. 2009), Canada (Crossley and Jeon 2007), Belgium (Ghysels et al. 2011), and the UK (Stephens and Ward-Batts 2004).

Japan is no exception. While its system of personal income taxes is based on individual taxation in principle, it includes the property of jointness between spousal earnings through a set of spousal allowances (SAs). SAs allow the primary earner (usually, the husband) in the pair to reduce his/her taxable income by a specified amount if the secondary earner (usually, the wife) earns less than a certain income threshold. In other words, households can save taxes if their secondary earners earn income that is less than a specified amount. Indeed, an observation of their earning distribution shows that a noticeable proportion of married part-time female workers fall just below this particular threshold income (Abe 2009, Yokoyama 2013). Regarding such labor income adjustment by secondary earners in response to the tax saving incentives created by the SAs, several Japanese studies have criticized the system of SAs as distorting the labor supply decisions of married women. Such studies have typically estimated the effects of the SA on secondary income by focusing on the labor responses of married women (Abe and Otake 1995, Kantani 1997, Oishi 2003, Sakata and McKenzie 2005, Yokoyama 2013). However, these only provide reduced-form

estimates that do not allow simulations of tax policy. A policy simulation requires structural estimates that at least characterize households' preferences.

To the best of our knowledge, only Akabayashi (2006) and Takahashi (2010) explored the effects of SAs through the structural (static) estimation of female labor supply.[1] Nonetheless, these two studies have several shortcomings. First, they focused on female labor supply responses only along the intensive margins. However, we should also be interested in the labor market participations (extensive margin responses) of married women, since the majority of them are out of the labor market. Second, they did not consider local taxes in their budget data. However, since local governments in Japan levy personal income taxes after allowing their own SAs, ignoring them misidentifies the piece-wise linear budget sets of consumers. In addition, their use of the Hausman method (Hausman 1979, 1980, 1985) exacerbated this problem, as it is not robust to measurement errors (Blomquist 1996, Ericson and Flood 1997, Eklöf and Sacklén 2000). Third, their linear specification of labor supply may impose too many restrictions on consumer preferences. The linearity assumes the Slutsky condition *a priori* (MaCurdy et al. 1990, Blomquist 1995) and further renders a unique form of individual utility that does not allow for a backward-bending labor supply curve (Stern 1986, Flood and Islam 2005). Lastly, the labor supply of husbands is assumed to be exogenously fixed. This is understandable since the Japanese system of personal income taxes indeed creates quite complex budget sets if husbands are allowed to adjust their labor supply. However, in fact, they might also be able to adjust their labor supply to changes in SAs.

In this study, we improve on the Japanese literature to explore the effects of SAs on family labor supply. For that purpose, we take advantage of the discrete choice model (DCM) of labor supply, which is now a widely accepted method for labor supply analysis.[2] Indeed, the method has advantages that allow for the shortcomings mentioned

[1] Bessho and Hayashi (1995, 2011) conducted static structural estimations for male labor supply. For a review of the Japanese literature, see Hayashi (2009).

[2] See for example, Blundell et al. (1999, 2000), Van Soest and Das (2001), Van Soest et al. (2002), Duncan and Harris (2002), Aaberge et al. (2004), Steiner and Wrohlich (2004, 2005), Bargain and Orsini (2006), Brewer et al. (2006), Creedy et al. (2006), Haan (2006, 2010), Mych et al. (2006), Vermeulen (2006), Brink et al. (2007), Gerfin and Leu (2007), Baldini and Pacifico (2009), Bargain (2009), Callan et

above. First, the DCM allows us to consider labor responses along both extensive and intensive margins, as it formulates the labor supply decision in terms of discrete choices that include labor market participation. Second, we do not have to fully specify the budget constraints, and the estimates are robust to measurement errors in wages and labor hours (Flood and Islam 2005). Third, we can easily set up a model where both husband and wife adjust their labor supply, and the fixed costs of labor market participations are incorporated. In addition, it is demonstrated that the DCM estimates are robust to the non-convexities of budget sets (Blundell and MaCurdy 1999), changes in the number of discrete choices (Flood and Islam 2005), and some forms of unobserved heterogeneity in preference parameters (Haan 2006). As done in Akabayashi (2006) and Takahashi (2010), we quantify the effects of SAs by simulating the labor supply of individual households in hypothetical tax reforms. We consider three tax reforms where SAs are reduced, using a micro-simulation method especially developed for the DCM analysis (Creedy and Kalb 2005, 2006).

The construction of our analysis is as follows. Section 2 introduces the system of personal income taxes in Japan. Section 3 explicates the DCM of labor supply, specifies the model to be estimated, describes the data, and presents the estimation results. Section 4 implements policy simulations. Our result shows that labor supply responses are rather small, and that the effects of SAs are not as large as the proponents of their abolishment would like to expect. Section 5 concludes.

2. Institutions and Mechanisms

2.1. Personal Income Tax System in Japan

The Japanese system of personal income taxes consists of (i) the Income Tax (a national tax) and (ii) the Inhabitant's Taxes (prefectural and municipal taxes). We also include in the system of personal income taxes the set of social insurance premiums (i.e., payroll taxes), since their payments are compulsory and roughly proportional to wages

al. (2009), Decoster et al. (2010), Dagsvik et al. (2011), Shalhoub (2011), Peichl and Siegloch (2012), and Aaberge and Colombino (2013).

and salaries and their benefits are unfunded and redistributive. In what follows, as we are interested in labor supply responses of employees, we limit our discussion to taxes on labor income.

Employment income deduction The Japanese system of personal income taxes has multiple layers of deductions and allowances. Let Y represent gross income before any tax treatments. The Japanese tax code calls Y "revenue (*shu-nyu*)." First, we deduct the Employment Income Deduction (EID), which we express as D, from the gross income Y. We then obtain "earnings (*shotoku*)" as $E = Y - D$. EID was established to allow for what would be considered "the costs of being employed." From 1995 to 2012, the amount of EID, D, depends on Y, according to the following formula (in thousand yen):

$$D = D(Y) = \begin{cases} Y & Y \le 1,625 \\ 0.4Y & 1,625 < Y \le 1,800 \\ 180 + 0.3Y & 1,800 < Y \le 3,600 \\ 540 + 0.2Y & 3,600 < Y \le 6,600 \\ 1,200 + 0.1Y & 6,600 < Y \le 10,000 \\ 1,700 + 0.05Y & 10,000 < Y \end{cases} \quad for \quad . \tag{1}$$

The EID thus adds kinks to individual budget lines in addition to those created by the progressive schedules of the statutory national and local income tax rates.

Spousal allowances If applicable, the tax system subtracts a variety of allowances from earnings E to yield "taxable income." Such allowances include SAs, which worked as follows in the period up to 2004. Assume that the primary earner within a married couple was the husband, and the secondary earner, his wife. Then, SAs allowed the husband to deduct amount A from his earnings E for tax purposes if his wife's earnings E_w were less than the threshold E_H *and* his annual earnings E were less than ten million yen. The amount A was phased out according to the following decreasing step function of E_w. It started with S for $E_w < E^*$. As E_w exceeded E^*, A was reduced by 50 thousand yen for every 50 thousand-yen increase in E_w, until A approached zero at E_H. Both national and local taxes include SAs in terms of the national spousal allowance (NSA) and the local spousal allowance (LSA), respectively. While the mechanisms of

both NSA and LSA are analogous, their parameters (all in thousand yen) were somewhat different, as seen in **Table 1**: S = 760, E^* = 50, and E_H = 760 for the NSA, and S = 660, E^* = 100, and E_H = 760 for the LSA.[3]

Table 1

Other allowances In addition to the SAs, if applicable, there are other types of allowances (A_k) to be subtracted from E to arrive at the taxable income ($I = E - \sum_k A_k$). **Table 2** lists the major allowances in 1997.[4] The Basic Allowance applied to all earners, with different amounts for national and local taxes. There were also allowances for dependents, including allowances for children aged 15 and below (Child Allowance) and those for nonworking children aged between 16 and 23 (Special Dependent Allowance). In addition, the Social Insurance Premium Allowances reduce the taxable income by an amount that equals contributions to the unemployment insurance, public health insurance, and public pension programs. In addition to the listings in **Table 2**, other types of allowances were available for specific types of expenditures, such as the costs of commercial insurance and medical treatments.

Table 2

Statutory tax rates The schedules for both national and local tax liabilities are defined over the taxable income ($I = E - \sum_k A_k$). In 1997, both the national and local taxes were progressive, as shown in **Table 3**. The former had five brackets with marginal tax rates of 10%, 20%, 30%, 40%, and 50% over the national taxable income, while the latter had three brackets with marginal tax rates of 5%, 10%, and 15% over the local taxable income. Note that since some of the allowances between the national and local taxes differed (as with the SAs), the national and local personal income taxes had different taxable incomes even if the earnings were the same.

Table 3

Social insurance contributions Before 2000, social insurance contributions consisted of contributions to the public pension program, public health insurance, and

[3] In fact, the NSA and LSA each consist of two sub-schemes, one of which is called Special Spousal Allowance. Table 1 lists the amounts of allowances by aggregating them.
[4] Most of the allowances have continued to apply as of 2014 except Child Allowance.

public unemployment insurance. While the premium contributions for unemployment insurance were proportional to actual salaries, those for public pension and public health programs were proportional to a *surrogate* income measure called Standard Monthly Remuneration (SMR), which approximated the monthly gross income of an employee, using his average salaries in the three-month period from April to June. While the specifics varied depending on individual programs, the social insurance programs set out more than 40 values of SMR, ψ_j, and corresponding intervals, such that $\psi_j \in [y_j, y_{j+1})$. If an employee's average salary y fell in the interval $[y_j, y_{j+1})$, he was assigned ψ_j as his SMR. If his monthly salary changed substantially during September to August, the SMR could be updated.

2.2. The effects of SAs and fixed costs of labor market participation

We consider a unitary household whose utility U is a function of after-tax household income c, the husband's leisure l^m, and the wife's leisure l^f; that is, $U(c, l^m, l^f)$. While the Japanese system of personal income taxes discussed in subsection 2.1 complicates the household's budget set, we make the following assumptions to characterize the effects of SAs in a simple diagram. First, we fix the choice of leisure by the husband at $l^m = l^*$ in order to map the household indifference curves over the (l^f, c) space. Second, we assume that the wife's earnings are not taxed, since they are less than the lowest taxable income. Third, we focus on NSA and do not consider local personal income taxes, social security contributions[5], and the other types of allowances (except the EID for the wife's income). We then express the household budget line as $c = (1-t)\cdot Y + tS + W^f\cdot(T - l^f)$ where t is tax rate (assumed to be proportional), $Y = W^m\cdot(T - l^*)$ is the husband's (fixed) labor income, W^m and W^f are the husband's and wife's gross wage rates, and S is the amount of SAs. The amount of S depends on the wife's labor supply $h^f = T - l^f$ or, more precisely, her "earnings" that are $W^f\cdot h^f$ net of her EID.

[5] Considering social security premiums (contributions) creates additional non-linearity in the household budget line. See, for example, Yokoyama (2014, Figure 2.4b, page 65). Although we ignore these in the diagrammatic expositions in this paper, our actual estimation and simulations of course allow for the effects of such contributions.

We then express this budget line as a twice-kinked line **abef** in **Figure 1**. The segment **ef** runs parallel to the original line **ak**, and the length of the segment **ef** corresponds to the amount of this household's EID. Recall that SAs are scheduled over "earnings (*shotoku*)" as "revenue (*shu-nyu*)" net of the EID, and not over the revenue (i.e., before-tax personal income) itself. The adjacent segment **be** is a linear approximation of the SA schedules, which is in fact a step function, as described in **Table 1**.

Figure 1.

We then turn to fixed costs of labor market participation, an important factor in making individual labor supply decisions (Hausman 1980, Cogan 1981). The fixed costs may be time-related, monetary, or psychological. For example, finding a job usually costs time and sometimes money. After obtaining a job, one usually commutes to the place of work, which costs a certain amount of time and money. Furthermore, if a couple works full time, they may make alternative household arrangements, especially when they have small children who need care. Such arrangements would not only entail large expenses but may also have psychological consequences: working parents may feel qualms if they cannot take care of their small children but instead put them in day care. Furthermore, individuals find some types of work as "unattractive," and when they take such jobs, it costs them additional non-monetary discomforts independent of their hours worked.

The literature conceptualizes these fixed costs as a fixed reduction in (i) either income (Blundell et al. 1999, Callan et al. 2009) or (ii) utility level (e.g., Van Soest 1995, Peichl and Siegloch 2013). We express the former as Fs in $U(y - F_m \cdot 1\{l^m > 0\} - F_f \cdot 1\{l^f > 0\}, l^m, l^f)$ with $c = y - F_m \cdot 1\{l^m > 0\} - F_f \cdot 1\{l^f > 0\}$ and the latter as ϕs in $U(c, l^m, l^f) - \phi_m \cdot 1\{l^m > 0\} - \phi_f \cdot 1\{l^f > 0\}$. While the choice between the two is a matter of preference (Van Soest et al. 2002), we opt for the second formulation mainly because of the existence of *non-monetary* costs, which may not legitimately be *fixed* if they are measured in the unit of income. For example, if the fixed costs were of leisure forgone, they would hardly be fixed if the standard assumptions for consumer preferences apply.

Furthermore, when the costs are psychological, it should be more natural to consider them fixed when they are measured in utility rather than income. Another reason is our choice of preferences specification. As we see in the next section, we use a log-quadratic specification. If we take the first formulation with this specification, we may not define the utility, because $y - F_m - F_f$ in $\ln(y - F_m - F_f)$ may take a non-positive value.

The presence of fixed costs creates a discontinuity in individual labor supply responses to the changing after-tax wage rate since it requires an additionally higher wage to induce an individual to participate in the labor market. To see such a discontinuity, let us combine the budget set in **Figure 1** with the indifference curves with fixed costs as illustrated in **Figures 2a** and **2b**. As shown in the two figures, with the fixed costs of the second type ϕs, indifference curves are "vertically sliced down" at the time endowment level T. The vertical distance Q of the "sliced-down" part is defined implicitly[6] as $U(y - Q, l^*, T) = U(y, l^*, T) - \phi$, where $y = (1 - t)Y + S$ is measured by distance Tf. **Figure 2a** shows a case where the wife does not work at all. As seen from the figure, a small increase in the wage rate cannot induce her to participate in the labor market. By contrast, if the fixed costs are small enough, the wife actually works, as shown in **Figure 2b**.

Figures 2a and 2b.

3. Estimation

3.1. The model

We utilize the unitary household model often utilized in the DCM literature (e.g., Van Soest, 1995). Married couple i faces $J \times J$ pairs of discretized labor supply (h_{ij}^m, h_{is}^f) with choices $j = 1, \ldots, J$ and $s = 1, \ldots, J$. This couple has a common utility function,

[6] While the costs are fixed when measured as ϕ, they are not so when measured as Q. In particular, if the marginal utility of income ($\partial U/\partial c$) is decreasing in c, Q is increasing in y: $dQ/dy = [\partial U(y - Q, l^*, T)/\partial c - \partial U(y, l^*, T)/\partial c]/[\partial U(y - Q, l^*, T)/\partial c] > 0$. This can be obtained by totally differentiating $U(y - Q, l^*, T) = U(y, l^*, T) - \phi$ with respect to Q and y and rearranging the resultant terms.

$$U_{ijs} = U(c_i, l_{ij}^m, l_{is}^f \mid \boldsymbol{Z}_i) + \varepsilon_{ijs}. \tag{2}$$

Utility (2) increases in after-tax income c_i, and leisure of the husband $l_{ij}^m \equiv T - h_{ij}^m$ and that of the wife $l_{is}^f \equiv T - h_{ij}^f$, where T is time endowment. It also depends on household characteristics $\boldsymbol{Z}_i$, and a choice-specific unobservable $\varepsilon_{ijs} \equiv e(h_{ij}^m, h_{is}^f)$. This couple's tax liability is

$$R_i = R(W_i^m h_{ij}^m, W_i^f h_{is}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}) \tag{3}$$

where W_i^m and W_i^f are the husband's and wife's gross wage rates respectively, and $\boldsymbol{\tau}$ refers to tax parameters. Then, the household's after-tax income is

$$c_i = W_{ij}^m h_{ij}^m + W_{ij}^f h_{is}^f - R(W_i^m h_{ij}^m, W_i^f h_{is}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}). \tag{4}$$

The couple chooses a set of after-tax income and labor supply (c_i, h_{ij}^m,h_{is}^f) to maximize (2) given (4). Note that (4) allows us to express (2) as

$$U_{ijs} = V(h_{ij}^m, h_{is}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}) + \varepsilon_{ijs} \tag{2'}$$

where $V(h_{ij}^m,h_{is}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}) \equiv U(W_i^m h_{ij}^m + W_i^f h_{is}^w - R(h_{ij}^m,h_{is}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}), T - h_{ij}^m, T - h_{is}^f \mid \boldsymbol{Z}_i)$, so that the choice is simply among $J \times J$ pairs of labor supply (h_{ij}^m,h_{is}^f) that maximize (2'). We then specify the deterministic part of (2) in a log-quadratic form as

$$\begin{aligned} U(c_i, l_{ij}^m, l_{is}^f \mid \boldsymbol{Z}_i) &= U(c_i, T - h_{ij}^m, T - h_{is}^f \mid \boldsymbol{Z}_i) = \\ &\alpha_{ci} \cdot \ln(c_i) + \alpha_{mi} \cdot \ln(T - h_{ij}^m) + \alpha_{fi} \cdot \ln(T - h_{is}^f) \\ &+ \gamma_{cc}[\ln(c_i)]^2 + \gamma_{mm}[\ln(T - h_{ij}^m)]^2 + \gamma_{ff}[\ln(T - h_{is}^f)]^2 \\ &+ \gamma_{cm} \ln(c_i) \cdot \ln(T - h_{ij}^m) + \gamma_{cf} \ln(c_i) \cdot \ln(T - h_{is}^f) + \gamma_{mf} \ln(T - h_{ij}^m) \cdot \ln(T - h_{is}^f) \\ &- \phi_{mi} \cdot 1\{h_i^m > 0\} - \phi_{fi} \cdot 1\{h_i^f > 0\} \end{aligned} \tag{5a}$$

where the αs and γs are parameters. The ϕs in the last line refer to the fixed costs of labor-market participation. We allow some of the items in $\boldsymbol{Z}$ to affect the three linear term coefficients αs as

$$\alpha_{ni} = \alpha_{n0} + \boldsymbol{\alpha}_n' \boldsymbol{Z}_{ni}. \tag{5b}$$

for $n = c$, m, and f where $\boldsymbol{\alpha}_n$ are coefficient vectors on the terms in the second line of (5a). We also allow the fixed costs ϕs to vary across households depending on household characteristics $\boldsymbol{Z}_{gi}$

$$\phi_{gi} = \phi_{g0} + \boldsymbol{\phi}_g' \boldsymbol{Z}_{gi} \qquad (5c)$$

for $g = m$ and f where $\boldsymbol{\phi}_g$ are coefficient vectors.

Finally, we assume that ε_{ijs} follows the type I extreme value distribution that is identically and independently distributed. This distributional assumption allows us to estimate parameters in (5a-c) as the multinomial logit model using the maximum likelihood method.

3.2. Sample and data

Our sample draws from the 1997 Employment Status Survey (ESS, *Syugyo Kozo Kihon Chosa*). The ESS is the most comprehensive labor survey in Japan, offering us approximately 11 million observations of individuals along with a variety of household characteristics. Since we are interested in the effects of SAs, we focus on married couples, with or without children, whose heads are prime-age (25-55) males. In addition, since SAs apply to employees, we exclude from the sample (a) self-employed workers, (b) board members of private companies and non-profit organizations, (c) family workers in small- and medium-sized enterprises, and (d) those unemployed due to illness. In addition, since our data are annual data, we exclude (e) those who changed residence or job within one year of the date of the survey, and (f) those who had children within one year of the date of the survey. These exclusions reduce the sample size to 43,011.

We then construct the following variables. First, the ESS codes hours worked as interval data. Using the midpoints of these intervals, we set up eight choices of annual hours worked for husbands and wives. The choices thus consist of $8 \times 8 = 64$ alternatives. **Table 4** shows the distribution of husbands and wives over the eight choices. We set $T = 16 \times 356 = 5{,}840$ hours.

Table 4

Second, we use the following household characteristics for $\boldsymbol{Z}_i$ in (5b) and (5c). For $n = c$ in (5b), we use (a) the numbers of children aged 6 and below, between 7 and 14, and 15 and above, (b) dummies for five age intervals (30-34, 35-39, 40-44, 45-49,

and 50-54) for husbands (b-1) and wives (b-2), (c) a dummy for residence in one of the three major urban areas (Tokyo, Chukyo, and Kinki), and (d) three education dummies (graduates from junior high school, junior college, and university or graduate school) for husbands (d-1) and wives (d-2). For $n = m$ in (5b), we use (a), (b-1), (c), and (d-1), whereas we use (a), (b-2), (c), and (d-2) for $n = f$ in (5b). Lastly, for both $g = m$ and f in (5c), we employ (a). **Table 5** lists the sample statistics for these household characteristics.

Table 5

Third, since the ESS does not provide the point data for before-tax wage rates, we estimate their values as follows. Using the interval data for days worked and labor income from the ESS, we construct intervals for the before-tax wage rate. We then estimate two wage equations for husbands and wives that regress the log of the midpoints of their intervals on the dummies for age, residence, education, and their cross terms. Since 42% of the wives in our sample do not work in labor markets (see **Table 4**), we estimate the wage equations as sample selection models, where excluded instruments are quadratic terms of residuals obtained from a regression for their nonlabor income (family income minus husband's labor income). We use the fitted values from these wage equations as the gross wage rates.

Lastly, we obtain after-tax income c_i by calculating the tax liabilities of couple i, whose values depend on a given choice of the $J \times J$ pairs of its labor supply. We calculate the national and local taxes using the schedules listed in **Table 3** and the allowances listed in **Table 2**. We ignore the other minor allowances since information on them is not obtainable from the ESS and their effects on the budget set are likely to be negligible. In addition, we approximate the social insurance premiums as proportional taxes with rates that differ by the size and type of employers, as all the necessary information to calculate the social insurance premiums are not available either. Based on the relevant data in 1997, we assume that the combined premium rates were 13.325% for firms with less than 1000 employees, 14.306% for the other firms, and 12.9395% for public sector employment.

3.3. Estimation results

Table 6 shows the estimated parameters along with their standard errors. Since the log-quadratic specification (5a) does not impose a priori restrictions, to yield the positive marginal utility of income and the quasi-concavity of preferences, we check these properties by calculating *HC* and d*U*/d*c* as defined by Van Soest (1995). If *HC* is positive, the preferences are quasi-concave. If d*U*/d*c* is positive, utility increases with income. Only .34% of couples displayed at least one negative value for the two indicators. In other words, more than 99% of couples displayed quasi-concave utility functions that increase with income.

Table 6

4. Simulations

We base our micro-simulations on a method specially designed for DCM analysis (Creedy and Kalb 2006). With the parameter estimates in **Table 6**, we can calibrate the random component ε_{ijs} in (2') as follows.

- For each household *i*, draw a vector of $J \times J$ random numbers that follows the type I extreme value (I-EV) distribution. Let $\boldsymbol{\varepsilon}_i^q \equiv [\varepsilon_{i11}{}^q, \ldots, \varepsilon_{i1J}{}^q, \varepsilon_{i21}{}^q, \ldots, \varepsilon_{i2J}{}^q, \ldots, \varepsilon_{iJ1}{}^q, \ldots, \varepsilon_{iJJ}{}^q]'$ be the *q*-th draw. This yields a set of $J \times J$ utility levels, $\boldsymbol{U}_{ijs}{}^q \equiv [U_{i11}{}^q, \ldots, U_{i1J}{}^q, U_{i21}{}^q, \ldots, U_{i2J}{}^q, \ldots, U_{iJ1}{}^q, \ldots, U_{iJJ}{}^q]'$ where $U_{ijs}{}^q \equiv V(h_{ij}{}^m, h_{is}{}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}) + \varepsilon_{ijs}{}^q$. For given $\boldsymbol{\varepsilon}_i^q$, find the optimal choice among the $J \times J$ alternatives that selects the maximum value in $\boldsymbol{U}_{ij}{}^q$. If the optimal choice equals the observed choice $\{h_i{}^m, h_i{}^f\}$, then store $\boldsymbol{\varepsilon}_i^q$ as a "successful" draw $\boldsymbol{\varepsilon}_i^{*l}$. We repeat this process to obtain *K* successful draws $\{\boldsymbol{\varepsilon}_i^{*1}, \ldots, \boldsymbol{\varepsilon}_i^{*k}, \ldots, \boldsymbol{\varepsilon}_i^{*K}\}$.
- Change the tax parameters from $\boldsymbol{\tau}$ to $\boldsymbol{\tau}^1$. This changes the deterministic part of utility in (2') from $V(h_{ij}{}^m, h_{is}{}^f, \boldsymbol{Z}_i, \boldsymbol{\tau})$ to $V(h_{ij}{}^m, h_{is}{}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}^1)$. Using $\boldsymbol{\varepsilon}_i^{*k}$ obtained above, select a choice $\{h_{i*}{}^{mk}, h_{i*}{}^{fk}\}$ that yields the maximum values among $\{V(h_{ij}{}^m, h_{is}{}^f, \boldsymbol{Z}_i, \boldsymbol{\tau}^1) + \varepsilon_{ijs}{}^{*k}\}_{js}$ for $j = 1, \ldots, J$ and $s = 1, \ldots, J$. Note that since there are *K* successful draws,

there are K pairs of $\{h_{i*}^{mk}, h_{i*}^{fk}\}$ for each household. [7]

These K pairs constitute the simulated distribution of the labor supply of husbands and wives after the tax change.

4.1. Labor supply elasticities

Following the procedure described above, we first calculate labor supply elasticity by simulating labor responses to a 1% rise in the before-tax wage rates. We express the elasticity as an average quantity in terms of the fraction P of individuals who participate in labor markets (i.e., aggregate responses along the extensive margins), and the average hours L worked by labor market participants (i.e., aggregate responses along the intensive margins). The 1% raise in the before-tax wage rates yields K pairs of $\{h_{i*}^{mk}, h_{i*}^{fk}\}$ for each couple, which are then aggregated to calculate P^* and L^*, the simulated values of P and L after the increase. Note that since there are K = 100 sets of simulated values, we obtain 100 sets of relevant elasticities accordingly.

Table 7 shows the averages values of 100 simulated elasticities with their standard deviations in parentheses. The average total elasticity is .041 for husbands and .087 for wives. The difference originates in the labor responses along the extensive margins, as they are larger for wives (.055) than for husbands (.009). The responses along the intensive margins are similar (.032 for husbands and .031 for wives). We note that these elasticities are rather smaller than those provided by comparable studies. As Bargain et al. (2012) show, the average own-wage elasticity ranges from .08 to .46 for husbands and from .08 to .65 for wives. However, our results still conform to those of previous studies, in that females are more responsive than males to changes in own wages.

Table 7

The current model also allows us to examine the labor responses of the husband (wife) to an increase in his (her) spouse's wage rates. A husband responds to an increase

[7] If we cannot obtain a "successful" draw for a household even after 100 draws, we discard it from the sample.

in his wife's wage rate by reducing his hours worked (–.007), with similar responses along both margins (–.003 and –.004). However, these responses are small with rather large standard deviations, implying that husbands, in fact, respond little to their wives' wage rates. On the other hand, a wife responds to an increase in her husband's wage rate by increasing her hours worked (.169). Her responses along the extensive margins (.105) are larger than those along the intensive margins (.063). Unlike the case of the husband's responses, the case of the wife's responses may seem rather implausible, as it implies that an increase (a decrease) in the husband's wage rate increases (reduces) the wife's labor supply. However, such a case is indeed reported by some of the previous DCM studies (Van Soest 1995, Steiner and Wrohlich 2004, Nyffeler 2005). [8] Furthermore, it is not a theoretical impossibility. In a continuous labor choice model, we may express the wife's leisure demand as $l^f = l^f(w^m, w^f, I)$ where $I = w^m T + w^f T + a$ with a as the virtual income. We could then characterize her labor supply response to her spouse's wage rate as $\partial h^f/\partial w^m = -\partial l^f/\partial w^m = -\partial l_c^f/\partial w^m - h^m \cdot \partial l^f/\partial I$ where l_c^f is the compensated demand for leisure. Therefore, if leisure is a normal good ($\partial l^f/\partial I > 0$), a necessary condition for the positive response ($\partial h^f/\partial w^m > 0$) is that the wife's leisure is complementary to her husband's leisure ($\partial l_c^f/\partial w^m < 0$).

4.2. The effects of spousal allowances

We finally simulate the effects of tax reforms, all of which reduce both the NSA and LSA. We consider three patterns of SA reduction, as listed in **Table 8**. We continue to use diagrams that are analogues to **Figures 1, 2a,** and **2b** and illustrate the effects of these reforms on individual budget sets in the upper diagram in **Figure 3**. The lower diagram in **Figure 3** presents four (one current and three reformed) SA schedules over individual leisure consumption. Again, to make the illustrations simpler, the diagrams ignore local personal taxes since the LSA schedule is slightly different from the NSA schedule, as we can see in **Table 8**. Of course, when we conduct the simulations, we

[8] However, these studies do not provide explanations on why the responses are positive.

properly consider all the relevant aspects of the Japanese tax system in place (i.e., both NSA and LSA are considered). The details of the three reforms are as follows:

Figure 3 and Table 8

- **Reform 1** traces the reform actually implemented in 2004. The 2004 reform flattened the NSA to a lump-sum value of 380 thousand yen for secondary earnings (i.e., gross income minus EID) less than 400 thousand yen and also flattened the LSA to another lump-sum value of 330 thousand yen for secondary earnings less than 450 thousand yen. Beyond each of the two thresholds, each of the two allowances starts to phase out and becomes zero at secondary earnings of 760 thousand yen, as shown in the column titled "Reform 1" in **Table 8**. As a rough approximation, this change transforms the budget line from **abef** to **abdg** and the SA schedule from **OBEF** to **OBDG** in **Figure 3**. This new SA schedule is in place since 2004, and the new kink point **d** represents the income threshold (i.e., 1.03 million yen ceiling) we mentioned in the introduction.
- **Reform 2** abolishes both the NSA and LSA altogether. In **Figure 3**, this reform abolishes SA schedule **OBEF** to none (**OK**) and pushes back the budget line from **abef** to the straight original budget line **ak**. The Democratic Party of Japan (DPJ) indeed advocated this plan during the 2009 General Election, although it did not follow up on its promise on winning the election. In addition, as of summer 2014, this plan (i.e., the abolishment of SAs) has again started to receive serious policy attention.
- **Reform 3** replaces SAs with a new allowance schedule that starts to gradually phase out at zero "earning" (i.e., before-tax income minus EID) as labor supply increases. We could roughly approximate this new SA schedule as **OJRG,** which changes the budget line to **ajrg** in **Figure 3**. We might regard this change as a political compromise that falls short of total abolishment (Reform 2). Total abolishment may be a radical reform that causes large political repercussions. Thus, policy makers would want to implement something in between, that is, they would stop short of total abolishment.

Figure 3 and Table 8

Below, we limit our discussion to the effects of SAs on the labor choices of wives.[9] **Table 9a** tabulates the simulated distributions of wives' labor supply. Reforms 1 and 2 generate similar results. After both reforms, the share of nonparticipants (i.e., those with zero labor supply) decreases by .5 points, while that of those with short working hours (Choice 2) decreases very little (less than .1 point). On the other hand, the shares of those who work longer (Choices 4-7) increase from .05 to .18 points. These changes cause the average annual working hours of wives to increase by 1.6% in Reforms 1 and 2. On the other hand, Reform 3 *reduces* the average annual working hours by .02%, as it decreases the shares of Choices 2-4 and increases those of Choice 1 (not working) and Choices 5-7.

While we are utilizing DCM here, we now describe the underlying mechanisms behind these results by approximating the wives' choices with the simple models we used in Figures 2a-b. Reforms 1 and 2 transform the original budget **abef** to **abdg** and **ak** respectively, both keeping the slope of the budget line constant in **Figure 3**. Therefore, unless wives originally supply their labor at point **e** where SAs start to phase out, changes in their labor supply reflect only income effects. If leisure is a normal good, we expect wives' labor supply to increase. Meanwhile, Reform 3 vertically shifts the original budget line down by **ef**. In all of the three reforms, due to the existence of fixed costs of labor market entry, wives who did not work before the reforms are unlikely to start to work after the reforms.

A number of Japanese studies have criticized the system of SAs as distorting the labor supply decisions of married women. In particular, researchers have often argued that wives with earnings less than 380 thousand yen (equivalent to a gross income of 1.03 million yen) are most affected by SAs, which place a "ceiling" on wives' working hours (Abe 2009). Indeed, a noticeable proportion of married part-time female workers are observed to fall just below this ceiling in their earning distribution. However, note

[9] The tables for the other results, including the labor supply choices of husbands, are relegated to the Appendix.

that the 1.03 million yen ceiling refers to the new kink at **d** that reflects the changes realized *after* the 2004 reform.

Meanwhile, our analysis is based on pre-2004 data. In the pre-2004 tax system, a kink analogous to that at **d** would be the kink at **e** in **Figure 3**. We then expect that working wives would adjust their hours worked below the level associated with **e**. Next, we therefore focus on those wives who, before the reform, earned an income around the ceiling associated with **e** (and had husbands with earnings less than 10 million yen). **Table 9b** calls such wives "eligible wives" and lists the results analogous to **Table 9a.**

Tables 9a-b

Table 9b shows that some of the eligible wives quit working after the reforms. More specifically, the post-reform shares of those who opt for relatively short hour choices (Choices 2 and 3) decrease, while those of wives opting for zero hours (Choice 1) and relatively long hours (Choices 4-7) increase. These results conform to our expectation, since the "ceiling" will be placed between Choices 3 and 4 if the hourly wage rate of the part-time worker is, say, 800 yen. On average, Reforms 1 and 2 increase the labor supply of eligible wives (.19% increase due to Reform 1 and .13% increase due to Reform 2), similar to the results in **Table 9a**. In addition, Reform 3 again reduces the labor supply, this time by .23% (i.e., –.23% increase).[10]

Akabayashi (2006) and Takahashi (2010) respectively performed simulations that run parallel to Reform 1. The former study found a 5.53% increase in wives' labor supply, and the latter, a .7% increase. Our result (.19% increase) is smaller than theirs. This smaller response is also reflected in elasticity values. While our elasticity along the intensive margins is .031, the analogous values of Akabayashi (2006) and Takahashi (2010) are .16 and .19 respectively. Note that while these two studies exclude from their samples those wives who did not work, our analysis also excludes from our sample those who worked more than 1,484 hours a year, in addition to the non-workers. As such, if the earning adjustments are as substantial as the Japanese literature claims, our

[10] Note that while these changes are smaller than those in Table 9a, they are not really comparable to each other, since the shares in Table 9a are based on the whole sample we use, whereas the shares in Table 9b are based on a subsample of the whole sample.

selection of the sample would have made our rate of change larger than those in the previous two studies, since our sample roughly excludes those who are not supposed to be seriously affected by the income ceiling (wives who worked more than 1,484 hours a year). Despite this, our result is not as expected.

These differences might be attributed to the estimation methods used. First, the two previous studies utilized the Hausman method and are suspected to be sensitive to measurement errors, which are arguably prevalent in their estimation (Blomquist 1996, Ericson and Flood 1997, Eklöf and Sacklén 2000). In particular, the two studies failed to include local taxes and local SAs in their calculation of tax liabilities, which plausibly constitutes an additional source of measurement errors that exacerbate the problem. On the other hand, the literature shows that our method, the DCM, has advantages as it is robust to the non-convexities of budget sets (Blundell and MaCurdy 1999), changes in the number of choices (Flood and Islam 2005), measurement errors in wages and labor hours (Flood and Islam 2005), and some forms of unobserved heterogeneity in preference parameters (Haan 2006).

Another important source of the differences would be the inclusion of fixed costs in our model. The fixed costs would indeed lead to differences, as they could help explain why the labor supply increase tends to be smaller, or even negative, as follows. First, the existence of the fixed costs may make non-workers continue to be non-workers after the reforms. **Figure 4a** describes the case where a non-working wife stays out of the labor market even after SAs are totally abolished (i.e., Reform 2). The wife in **Figure 4a** does not work both before and after the reform due to the presence of fixed costs Q_0 (at **f**) and Q_1 (at **k**). Second, it is even **possible** that **a wife** stops working even when **she is** facing a rather high wage rate. This may particularly be the case with Reform 3, a possible effect of which is described in **Figure 4b**. Before the reform, the wife was supplying her labor at **e**. However, as the figure shows, she stops working after Reform 3 due to the presence of the fixed costs.

Figures 4a-b

Our simulations indeed show that while the share of movers (i.e., those who changed their choices after the reform) is small, the share of those who quit working among the movers can be large. **Tables 10a** and **10b** tabulate the distributions of the labor choices of eligible wives and the movers among the eligible wives after Reform 3, conditional on their labor choices before the reform. While **Table 10a** shows that the share of the movers is very small (less than 1%), **Table 10b** shows that more than half of such movers quit working after Reform 3: 53.6%, 62.61%, and 60.36% of the movers stopped working (i.e., they switched to Choice 1 from Choices 2, 3, and 4). Based on the figures in **Table 10b**, if we include those who reduced their working hours but did not quit working, the shares increase to 83.69% and 88.55% for the movers from Choices 3 and 4 respectively. The remaining portions of the movers increased their labor supply, which may be interpreted as the "standard" effects of the reduction in the SA. Indeed, as experts have argued in a round table talk on labor management, the reduction in SAs would make some people work longer, and others, shorter (Hirano 2010, p. 63). Our result is not only consistent with this view but it further shows that the share of those who reduce their labor supply is larger than those who increase it.

Tables 10a-b

5. Conclusion

This study investigated the effects of SAs in the Japanese system of personal income taxes, taking advantage of the micro-simulation method based on DCM of labor supply. Our simulations showed that the complete abolishment of SAs would increase the female labor supply by 1.6% for all wives and by .1% for wives who are supposedly largely influenced by the allowances. These effects were found to be rather smaller than those provided by previous studies. We also discovered a case wherein reform in the SA led to a decrease in the female labor supply. We argued that these results were due to our explicit consideration of the fixed cost of labor participation, which have been previously ignored in the Japanese studies. While we consider our analysis an improvement over the previous analyses, it is, of course, not free from limitations. For

example, while we have developed our analysis in a static framework, dynamic decision making may be important (Abe 2009). In addition, while we have assumed unitary decision making in households, household members may, in fact, interact strategically within their household (Bargain et al. 2006). While it is quite difficult to allow for dynamic and/or strategic aspects of household decision making in the estimation of household labor supply, these are nonetheless worth exploring in future research.

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Appendix

Tables A1a, A1b, and A2

Table 1. Schedules for spousal allowances (Before 2004)

(Thousand yen)

Earnings (E)	National SA (NSA)	Local SA (LSA)
< 50	760	660
$50 \leq E < 100$	710	
$100 \leq E < 150$	660	610
$150 \leq E < 200$	610	560
$200 \leq E < 250$	560	510
$250 \leq E < 300$	510	460
$300 \leq E < 350$	460	410
$350 \leq E < 380$	410	360
$380 \leq E < 400$	380	330
$400 \leq E < 450$	360	
$450 \leq E < 500$	310	
$500 \leq E < 550$	260	
$550 \leq E < 600$	210	
$600 \leq E < 650$	160	
$650 \leq E < 700$	110	
$700 \leq E < 750$	60	
$750 \leq E < 760$	30	
$760 \leq E$	0	

Table 2. Major allowances (in 1997)

(Thousand yen)

	Income Tax (national)	Inhabitant's Tax (local)
Basic Allowance	380	330
Spousal Allowance	See Table 1	See Table 1
Dependent/Child Allowance	380	330
Special Dependent Allowance	530	410
Social Insurance Premium Allowances	Equals to the actual premium payments	

Table 3. Personal income taxes in Japan in 1997

(Thousand yen)

Income Tax		Inhabitant's Tax	
Taxable income (I)	Marginal tax rate	Taxable income (I)	Marginal tax rate
$I \leq 3{,}300$	10%	$I \leq 2{,}000$	5%
$3{,}300 < I \leq 9{,}000$	20%	$2{,}000 < I \leq 7{,}000$	10%
$9{,}000 < I \leq 18{,}000$	30%	$7{,}000 < I$	15%
$18{,}000 < I \leq 30{,}000$	40%		
$30{,}000 < I$	50%		

Table 4. Discretized levels of annual hours worked

Choices	Hours worked	Minimum (hours)	Maximum (hours)	Husband (%)	Wife (%)
1	0	0	0	2.14	41.98
2	492	1	900	1.37	16.04
3	1,177	901	1,250	26.63	21.79
4	1,484	1,251	1,550	25.79	10.39
5	1,741	1,551	1,750	13.62	3.85
6	1,849	1,751	2,000	8.53	2.85
7	2,140	2,001	2,200	10.79	1.97
8	2,679	2,201	3,000	11.13	1.13
Total				100.00	100.00

Table 5. Sample statistics

		Mean	S.D.	Min	Median	Max
Husband: Age	1{25 ≤ age ≤ 29}	.028	.164	0	0	1
	1{30 ≤ age ≤ 34}	.044	.206	0	0	1
	1{35 ≤ age ≤ 39}	.075	.263	0	0	1
	1{40 ≤ age ≤ 44}	.182	.386	0	0	1
	1{45 ≤ age ≤ 49}	.349	.477	0	0	1
	1{50 ≤ age ≤ 54}	.322	.467	0	0	1
Husband: Education	1{junior high school}	.144	.351	0	0	1
	1{senior high school}	.451	.498	0	0	1
	1{junior college}	.055	.227	0	0	1
	1{university or higher}	.350	.477	0	0	1
Wife: Age	1{25 ≤ age ≤ 29}	.053	.224	0	0	1
	1{30 ≤ age ≤ 34}	.029	.168	0	0	1
	1{35 ≤ age ≤ 39}	.089	.285	0	0	1
	1{40 ≤ age ≤ 44}	.295	.456	0	0	1
	1{45 ≤ age ≤ 49}	.377	.485	0	0	1
	1{50 ≤ age ≤ 54}	.152	.359	0	0	1
Wife: Education	1{junior high school}	.103	.305	0	0	1
	1{senior high school}	.505	.500	0	1	1
	1{junior college}	.244	.430	0	0	1
	1{university or higher}	.148	.355	0	0	1
Number of children (Age)	age ≤ 6	.153	.448	0	0	4
	7 ≤ age ≤ 14	.474	.776	0	0	5
	15 ≤ age	.777	.854	0	1	4
Residence in major urban areas		.629	.483	0	1	1
Husband's gross wage rate (fitted) (10,000 yen/hour)		.427	.123	.182	.424	.753
Wife's gross wage rate (fitted) (10,000 yen/hour)		.060	.042	.003	.049	.276

The sample size is 43,011.

Table 6. Estimation results

	α_c	α_m	α_f	ϕ_m	ϕ_f
Constant	10.667 (1.866)	61.423 (3.201)	156.546 (3.908)	−.153 (.046)	.961 (.026)
# children age ≤ 6	.042 (.018)	−.458 (.113)	−.738 (.171)	.403 (.142)	.903 (.046)
# children 7 ≤ age ≤ 14	.011 (.009)	−.154 (.065)	.615 (.055)		
# children 15 ≤ age	.017 (.009)	−.192 (.058)	−.097 (.048)		
Husband: 30 ≤ age ≤ 34	−.021 (.045)	−3.467 (.388)			
Husband: 35 ≤ age ≤ 39	−.013 (.042)	−3.094 (.308)			
Husband: 40 ≤ age ≤ 44	−.062 (.031)	−2.963 (.245)			
Husband: 45 ≤ age ≤ 49	−.032 (.020)	−1.294 (.164)			
Husband: 50 ≤ age ≤ 54	−.007 (.016)	−.529 (.112)			
Wife: 30 ≤ age ≤ 34	−.077 (.042)		−.559 (.223)		
Wife: 35 ≤ age ≤ 39	−.106 (.047)		−1.460 (.286)		
Wife: 40 ≤ age ≤ 44	.003 (.037)		−1.282 (.206)		
Wife: 45 ≤ age ≤ 49	−.047 (.022)		−.652 (.128)		
Wife: 50 ≤ age ≤ 54	−.040 (.018)		−.320 (.107)		
Husband: junior high school	−.059 (.016)	−1.201 (.180)			
Husband: junior college	−.013 (.026)	.017 (.198)			
Husband: university	−.007 (.017)	−.134 (.139)			
Wife: junior high school	−.063 (.016)		−.818 (.131)		
Wife: junior college	.014 (.017)		.698 (.103)		
Wife: university	.055 (.028)		.625 (.166)		
Residence in urban areas	.015 (.012)	.386 (.105)	−2.380 (.080)		

γ_{cc}	γ_{mm}	γ_{ff}	γ_{cm}	γ_{cf}	γ_{mf}
.060 (.004)	−9.357 (.289)	−20.775 (.475)	−.573 (.381)	−1.820 (.122)	3.487 (.341)

Note: Standard errors are in parentheses. Log-likelihood is −151399.2. Sample size is 43,011.

Table 7. Elasticities

	Change in own wage rate			Change in spouse's wage rate		
	Total	Intensive	Extensive	Total	Intensive	Extensive
Husband	.041 (.010)	.032 (.009)	.009 (.005)	−.007 (.007)	−.003 (.006)	−.004 (.004)
Wife	.087 (.031)	.031 (.016)	.055 (.021)	.169 (.035)	.063 (.019)	.105 (.024)

Note: The standard deviations are in parentheses.

Table 8. Changes in schedules for spousal allowances

(Thousand yen)

Earnings (E)	National SA (NSA)				Local SA (LSA)			
	Before	Reform 1	Reform 2	Reform 3	Before	Reform 1	Reform 2	Reform 3
< 30	760	380	0	380	660	330	0	330
< 50				360				
$50 \leq E < 100$	710			310				310
$100 \leq E < 150$	660			260	610			260
$150 \leq E < 200$	610			210	560			210
$200 \leq E < 250$	560			160	510			160
$250 \leq E < 300$	510			110	460			110
$300 \leq E < 350$	460			60	410			60
350 $\leq E < 380$	410			30	360			30
$380 \leq E < 400$	380			0	330			0
$400 \leq E < 450$	360	360						
$450 \leq E < 500$	310	310			310	310		
$500 \leq E < 550$	260	260			260	260		
$550 \leq E < 600$	210	210			210	210		
$600 \leq E < 650$	160	160			160	160		
$650 \leq E < 700$	110	110			110	110		
$700 \leq E < 750$	60	60			60	60		
$750 \leq E < 760$	30	30			30	30		
$760 \leq E$	0	0			0	0		

Table 9a. Simulation results: choice shares for all wives

Choice	Annual hours worked	Shares before reforms (%)	Shares after Reform 1 (%)	Shares after Reform 2 (%)	Shares after Reform 3 (%)
1	0	46.75	46.20	46.21	46.79
2	492	16.66	16.63	16.62	16.65
3	1,177	21.92	22.03	22.01	21.85
4	1,484	9.39	9.57	9.56	9.38
5	1,741	2.80	2.93	2.94	2.82
6	1,849	1.81	1.91	1.93	1.82
7	2,139	.64	.69	.70	.65
8	2,679	.03	.03	.04	.03
Average hours worked		576.03	585.05	585.36	575.90
Rate of change (%)		n.a.	1.57	1.62	–.02

Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors.

Table 9b. Simulation results: choice shares for "eligible" wives

Choice	Annual hours worked	Shares before reforms (%)	Shares after Reform 1 (%)	Shares after Reform 2 (%)	Shares after Reform 3 (%)
1	0	.00	.14	.23	.23
2	492	36.89	36.61	36.58	36.85
3	1,177	45.34	45.21	45.15	45.16
4	1,484	17.77	17.84	17.80	17.69
5	1,741	.00	.09	.10	.02
6	1,849	.00	.08	.09	.02
7	2,139	.00	.04	.05	.02
8	2,679	.00	.00	.01	.00
Average hours worked		978.68	980.58	979.98	976.43
Rate of change (%)		n.a.	.19	.13	–.23

Note: Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors. "Eligible wives" refers to working wives with (1) labor income less than 1.03 million yen, (2) annual working hours less than 1,550 and (3) husbands earning less than 10 million yen.

Table 10a. Shares of choices after reform conditional on previous choices

Choices after Reform 2		Choices before Reform 2		
Choice #	Annual hours worked	Choice 2 (%)	Choice 3 (%)	Choice 4 (%)
1	0	.15	.27	.32
2	492	99.73	.09	.10
3	1,177	.03	99.57	.04
4	1,484	.03	.02	99.47
5	1,741	.02	.01	.01
6	1,849	.02	.02	.02
7	2,139	.02	.02	.02
8	2,679	.00	.00	.00

Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors.

Table 10b. Shares of movers conditional on previous choices

Choices after Reform 2		Choices before Reform 2		
Choice #	Annual hours worked	Choice 2 (%)	Choice 3 (%)	Choice 4 (%)
1	0	53.62	62.61	60.36
2	492	n.a.	21.08	19.74
3	1,177	11.90	n.a.	8.45
4	1,484	12.10	3.80	n.a.
5	1,741	7.66	2.89	2.72
6	1,849	8.42	4.49	3.97
7	2,139	5.68	4.63	4.11
8	2,679	.62	.49	.66

Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors.

Figure 1. Budget constraint with Spousal Allowances

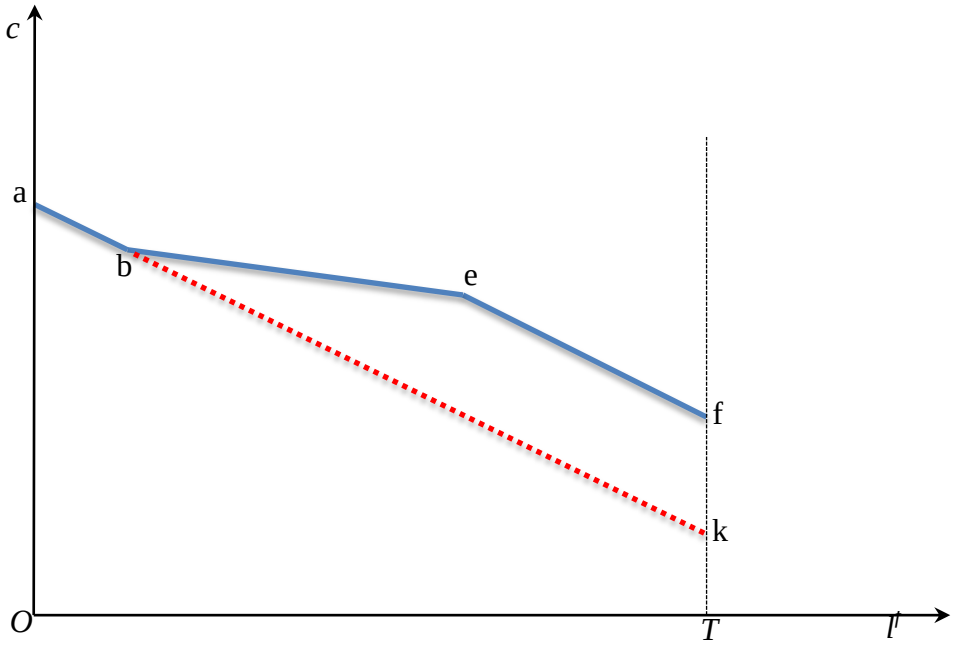


Figure 2a. Fixed costs and indifference curve: No labor supply

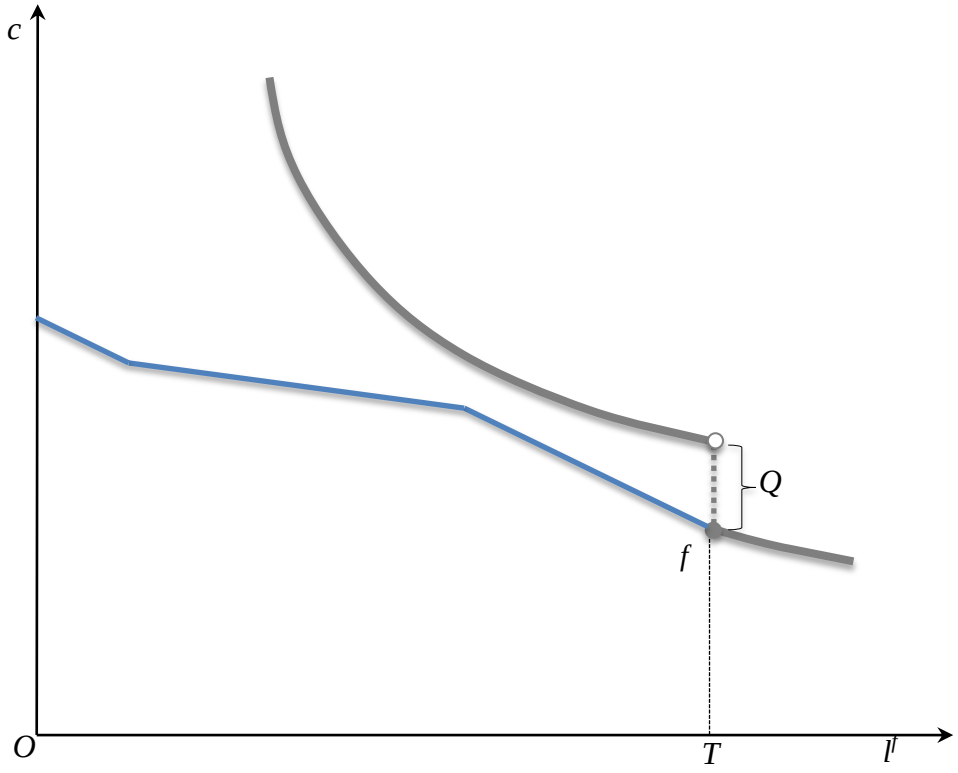


Figure 2b. Fixed costs and indifference curve: Labor market participation

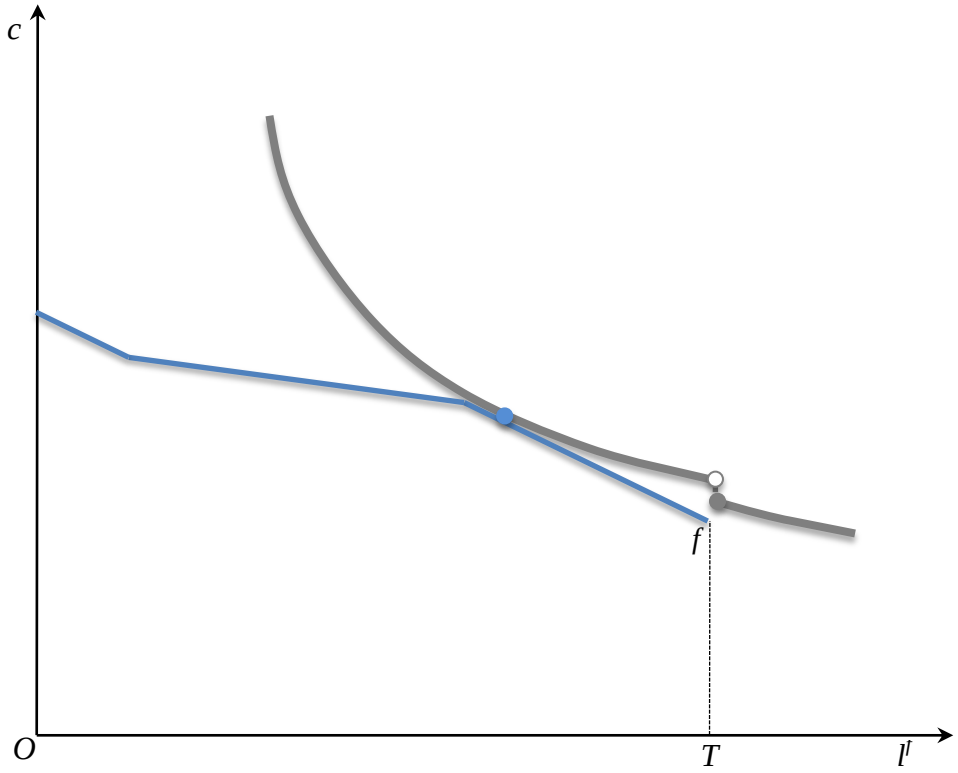


Figure 3. Reforms, budget sets, and allowance schedules

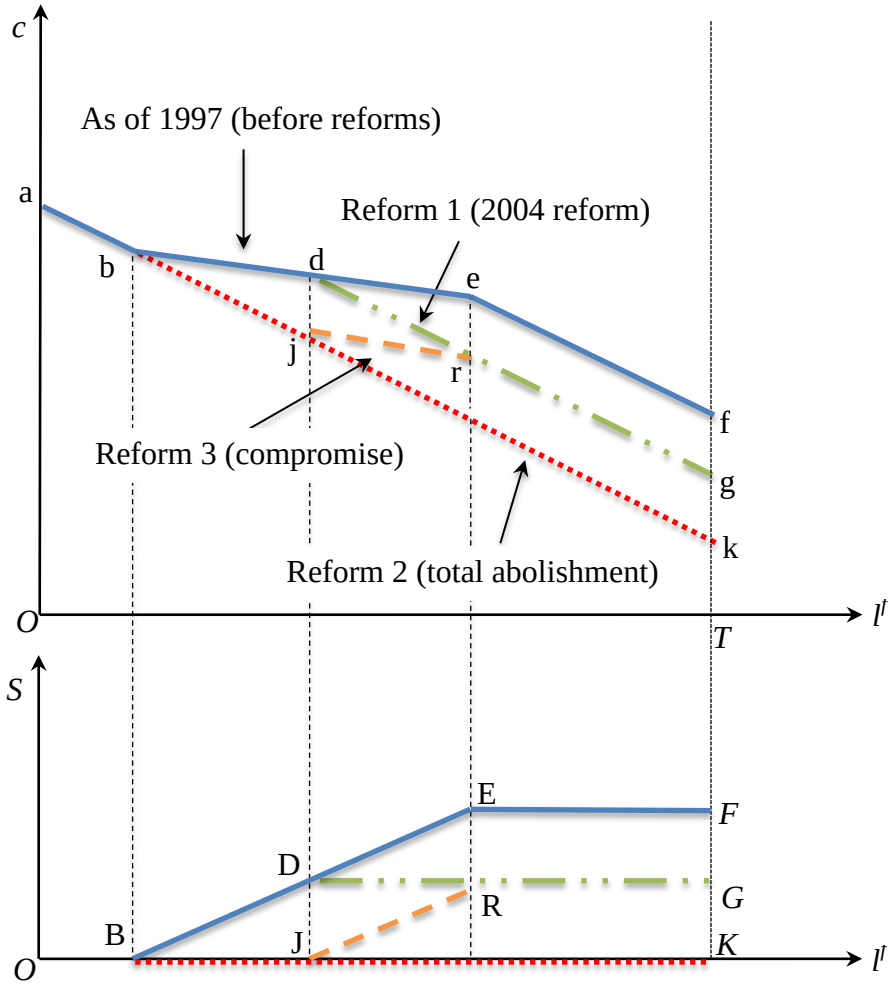


Figure 4a. A non-working wife stays out of the labor market after Reform 2.

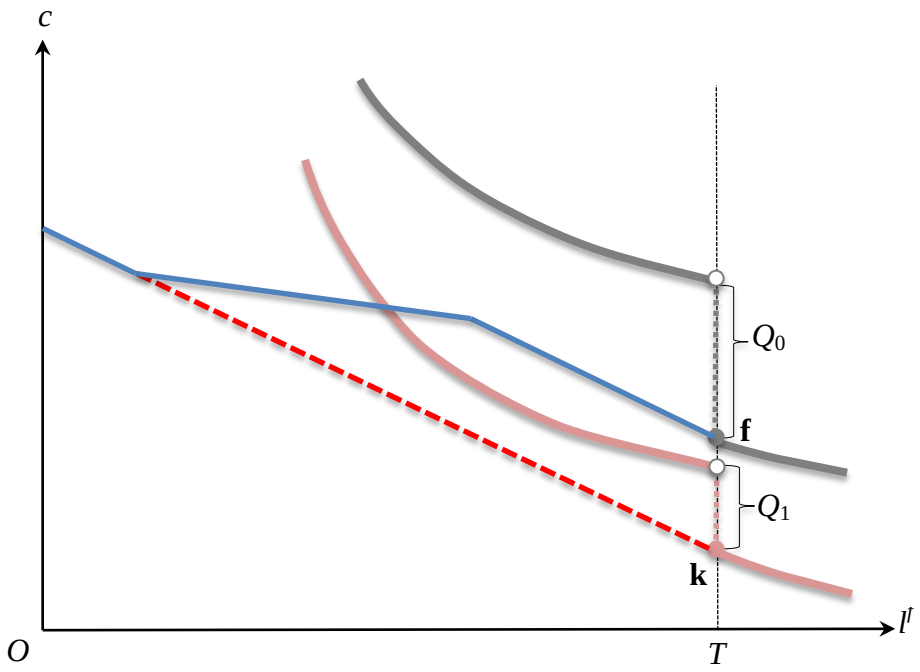
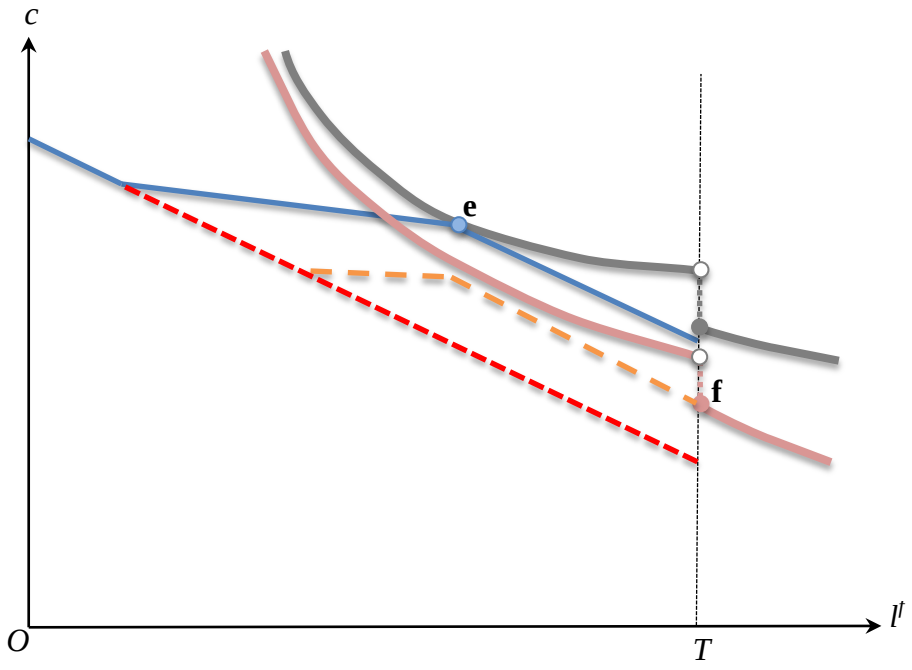


Figure 4b. A working wife stops supplying labor after Reform 3.



Appendix

Table A1a. Simulation results: choice shares for all husbands

Choice	Annual hours worked	Shares before reforms (%)	Shares after Reform 1 (%)	Shares after Reform 2 (%)	Shares after Reform 3 (%)
1	0	1.07	1.11	1.09	1.13
2	492	1.25	1.40	1.32	1.79
3	1,177	28.00	27.91	27.99	28.08
4	1,484	27.20	27.10	27.17	26.99
5	1,741	14.22	14.23	14.21	14.08
6	1,849	8.67	8.73	8.67	8.64
7	2,139	10.59	10.60	10.58	10.48
8	2,679	9.00	8.92	8.96	8.81
Average hours worked		576.03	1,614.77	1,612.19	1,613.12
Rate of change (%)		n.a.	–.16	–.10	–.63

Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors.

Table A1b. Simulation results: choice shares for husbands with "eligible" wives

Choice	Annual hours worked	Shares before reforms (%)	Shares after Reform 1 (%)	Shares after Reform 2 (%)	Shares after Reform 3 (%)
1	0	.75	.79	.79	.82
2	492	1.33	1.45	1.43	1.86
3	1,177	32.42	32.35	32.39	32.46
4	1,484	31.03	30.95	30.97	30.79
5	1,741	13.20	13.2	13.2	13.06
6	1,849	9.39	9.4	9.38	9.3
7	2,139	9.02	9.01	9	8.91
8	2,679	2.85	2.85	2.84	2.81
Average hours worked		576.03	978.68	1521.25	1519.59
Rate of change (%)		n.a.	−.11	−.11	−.55

Note: Percentages in columns do not necessarily add up to 100% due to rounding-off errors. "Eligible wives" refers to working wives with (1) labor income less than 1.03 million yen, (2) annual working hours less than 1,550 and (3) husbands earning less than 10 million yen.

Table A2. Simulation results: average household incomes and taxes

(Thousand yen)

	Before reforms	After Reform 1	After Reform 2	After Reform 3
Gross income	8,648.3	8,646.0	8,642.6	8,642.6
(% change)		(–.03%)	(–.07%)	(–.07%)
Tax liabilities	1,666.3	1,821.2	1,738.3	1,903.3
(% change)		(9.30%)	(4.33%)	(14.20%)
After tax income	6,982.0	6,807.5	6,904.5	6,739.7
(% change)		(–2.25%)	(–1.11%)	(–3.47%)

Note: Percentage changes are in parentheses.