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Journal of Public Economics 35 (1988) 355–369. North-Holland

TAXATION AND THE HOUSEHOLD

Patricia F. APPS

Centre for Economic Policy Research, Research School of Social Sciences, The Australian National University, Canberra, Australia

Ray REES*

Department of Economics, University of Guelph, Ontario, Canada, N1G 2W1

Received March 1986, revised version received April 1988

Previous analyses of demand systems and the welfare effects of taxing male and female labour supplies suppress the analysis of household resource allocation by assuming a household utility function. This paper shows that this is only permissible if the household allocates income exactly in accordance with the distributional parameters of the usual kind of *individualistic* social welfare function. To analyse the implications of assuming this is not the case, we construct a simple but fairly general model of household resource allocation and use the properties of the equilibrium of this model to characterise the effects of tax policy on individual utilities, as determined by the household resource allocation process.

1. Introduction

For some purposes, it may be a harmless simplification to model the family, or household, as if it were a single individual, who maximises the usual kind of utility function subject to constraints on income and time. This approach has been adopted in a number of recent papers on taxation and welfare measurement.[1] The seminal work by Becker (1974) provides a rationale in terms of what could be called a theory of the benevolent patriarch. The household has a head who cares for the welfare of the other members and allocates the household resources among them. The household utility function is then that of the head, whose 'concern for the welfare of other members, so to speak, integrates all the members' utility functions into one consistent "family function"'.[2] Where policy studies based on this approach require specific assumptions about the intra-household distribution of welfare, the common practice is to assume they are all equally well off,[3]

*We are grateful to the referees for very thorough and helpful appraisals of this paper.

[1] See, for example, Pollak and Wales (1981), Boskin and Sheshinski (1983), King (1983), Blundell and Walker (1984), Kooreman and Kapteyn (1986), Ray (1982), and Blundell et al. (1986).

[2] Becker (1974, p. 1079).

[3] For example, see Blackorby and Donaldson (1987).

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though this is usually presented as an assumption faute de mieux rather than as a fact, however stylised.[4]

We want to show in this paper, however, that in analysing policy issues involving individual welfares, for example income taxation, the household utility function approach is seriously inadequate and should be generalised. We maintain that this is essential to retain the individual as the basic unit of analysis, while acknowledging that individuals' utilities are determined by processes of resource allocation within the households they form. The effects of policy changes on individual utilities are mediated through the household allocation process. The household utility function approach requires that the distribution of utility within the household is optimal relative to whatever distributional preferences the policy-maker may have, so that all that then matters for the analysis of inequality and taxation is the distribution of income across households. This seems to us to be unnecessarily restrictive as well as unconvincing. We prefer to retain the possibility of dissonance between social and household distributional preferences and to analyze its implications.

Accordingly we adopt an alternative approach which preserves the individualistic elements of the situation. Households consist of two members, whom we label, following convention, male and female. Each supplies effort to household production and may also do so to an outside labour market. They have to choose jointly time allocations and consumptions of domestic and market goods. We make the substantive assumption that the equilibrium allocation is Pareto efficient. This implies a separation between time allocation and consumption allocation decisions. Each allocates his/her time so as to equalise marginal value product in domestic production with the market wage rate (with the usual reservations for a corner solution). This determines total amounts of outside income and domestic production. They then negotiate an allocation of these and, given that the resulting consumption allocation is Pareto efficient, it can be represented as a point on the contract curve or in the core of an Edgeworth exchange game.

This set of exchange equilibria could be narrowed down in several ways. One obvious way is to assume some specific type of bargaining outcome, for example the Nash bargaining solution, as in Manser and Brown (1980) and McElroy and Horney (1981). Alternatively, if one assumes there is a competitive market in domestic contracts, then we have the Walrasian model of Apps (1981, 1982), and Apps and Jones (1986). The terms of trade at which intra-household exchange takes place are exogenous to the individual household but determined by the aggregate net demands for domestic and market outputs across all households.

[4]For a convincing argument that equality could not in general be regarded as fact, see Sen (1983).

In this paper we do not want to restrict analysis to any particular exchange or bargaining equilibrium: we simply make use of the conditions that characterise any efficient allocation. As long as the household resource allocation is Pareto efficient, it satisfies the conditions[5] which follow from maximising a weighted sum of the utilities of household members subject to the resource and budget constraints. We call this weighted sum a 'household welfare function'.[6] In using such a function, we stress that we do not see the household as necessarily 'agreeing upon' a household welfare function and then maximising it – for us it is an *as if* construction which is nevertheless useful in clarifying some points we wish to make about income taxation. It can be regarded as generalising the household utility function without serious loss of tractability. Its justification is simply that any Pareto-efficient consumption allocation implies some specific welfare weights by which the household welfare function can be constructed.

In analysing the effects of changes in tax parameters on the household equilibrium we find it useful to exploit another well-known property of a Pareto-efficient equilibrium. Any Pareto-efficient resource allocation (we make the usual convexity assumptions) can be sustained by a particular price given an appropriate initial distribution of endowments. Thus, we could think of the household as first of all imputing to the individual members an income given by their earnings from outside labour supply plus the individual of their domestic production: then, possibly, making lump-sum redistributions between themselves; and then trading outside consumption for domestic output at a fixed price, to reach their final equilibrium. This as if construction is useful in deriving the comparative statics of the household equilibrium, but again we stress that it is not intended as a literal description of how households behave. The substantive assumption we make is that the household equilibrium allocation of time and consumption is Pareto efficient, and so is in the set of exchange equilibria of the household viewed as a small economy.

2. The model of the household

In the household model both woman, f, and man, m, supply time to production of a household good, m certainly supplies time to the outside labour market and f may or may not do so. The income from outside labour

[5]Note that any particular model of the household will have more structure and so more specific equilibrium conditions than those which correspond to Pareto efficiency. However, all the household models that have been proposed have Pareto efficiency as a common element, and it is useful to see what can be said at this level of generality.

[6]By analogy with the social welfare function for an economy as a whole. In fact this type of approach was suggested by Samuelson (1965), and can be regarded as a straightforward generalisation of Becker's patriarchal – or, in social choice terms, dictatorial – family utility function.

supply is entirely spent on buying in a composite consumption good. For simplicity, no bought-in goods are required as intermediate goods in household production and household capital is assumed fixed and therefore suppressed. The notation and main relationships of the model are as follows:

x_i = i's consumption of the bought-in good,
y_i = i's consumption of the domestic good,
t_i = i's time spent in domestic production,
l_i = i's time supplied to the outside labour market,
w_i = i's wage rate on the outside labour market,
α_i = i's lump-sum transfer from government,
$1-\beta_i$ = the marginal tax rate on i's wage income,
i = f, m.

The price of the bought-in good is unity. The household production function is:

$$y_{\mathrm{f}}+y_{\mathrm{m}}=y=h(t_{\mathrm{f}},t_m),\quad h_i>0,\quad i=\mathrm{f,\,m}. \tag{1}$$

h is linear homogeneous and strictly quasi-concave, m and f are allowed to have differing productivities but we assume constant returns to scale. Each individual faces the time constraint,

$$t_i+l_i=T,\quad i=\mathrm{f,\,m}, \tag{2}$$

and has the utility function,

$$u_i=u^i(x_i,y_i),\quad u^i_j>0,\quad i=\mathrm{f,\,m},\, j=x,y,\quad u^i \text{ is strictly concave.} \tag{3}$$

These utility functions are cardinal and do not include time per se – utility depends only indirectly on time allocations, and the compensated response to, say, a tax on the market wage would take the form of a substitution of time spent in domestic production for time supplied to the market. There is no 'pure leisure' in this model.

Each individual receives an amount of the consumption good in the form of a lump-sum transfer from government and (possibly) net of tax wage income, given by

$$x_i=\alpha_i+\beta_i w_i l_i,\quad i=\mathrm{f,\,m},$$

and this implies that total feasible consumption of the market good is

$$x=\sum x_i. \tag{4}$$

We assume t_i, x_i and y_i are all strictly positive in the neighbourhood of an optimum and consider only the non-negativity conditions:

$$l_i \geqq 0, \quad i = \mathrm{f}, \mathrm{m}. \tag{5}$$

Our general view of the decision-taking process is tha' the household resource allocation is Pareto efficient, and so we can take it that f and m choose a household resource allocation (x_i, y_i, t_i, l_i) given the constraints (1)–(5) *as if* to maximise the household welfare function,

$$W = u^{\mathrm{f}} + \delta u^{\mathrm{m}}, \tag{6}$$

where $\delta > 0$ is the welfare weight implied by the actual equilibrium resource allocation of the household, however achieved.

In general, the maximisation is subject also to the conditions:

$$u^i(x_i, y_i) \geqq \bar{u}^i, \quad i = \mathrm{f}, \mathrm{m}, \tag{7}$$

where u^i represents the minimal utility level i requires to remain within the household, i.e. it is a reservation utility level. We shall, however, assume for the moment that the equilibrium resource allocation is always such as to satisfy (7) as a strict inequality – each party does at least a little better being in the household than outside it – and so as a constraint (7) can be ignored (but see section 4 below).

The household equilibrium resource allocation can then be characterised by the conditions:

$$u_x^{\mathrm{f}} = \lambda = \delta u_x^{\mathrm{m}}, \tag{8}$$

$$u_y^{\mathrm{f}} = \mu = \delta u_y^{\mathrm{m}}, \tag{9}$$

$$\mu h^i = \tau_i, \quad i = \mathrm{f}, \mathrm{m}, \tag{10}$$

$$\lambda \beta_i \leqq \tau_i, \quad l_i \geqq 0, \quad l_i(\lambda \beta_i w_i - \tau_i) = 0, \quad i = \mathrm{f}, \mathrm{m}, \tag{11}$$

and all constraints (except that on reservation utilities) are assumed strictly binding at the optimum. μ, τ_i and λ are Lagrange multipliers associated with the production function, time constraints and budget constraint, respectively. If $l_i > 0$, (11) implies:

$$\beta_i w_i = p h_i, \tag{12}$$

where $p = \mu / \lambda$ is the implicit price, in terms of the bought-in consumption good, that the household places on the domestically produced good at the optimum. Thus, i's time is allocated so as to equalise its marginal value product in household production with its opportunity cost outside the household. If $\tau_i > \lambda\beta_i w_i$, then $l_i = 0$, i works only within the household, and the marginal value product ph_i exceeds i's outside opportunity cost. Note that in this model the issue of whether either party will specialise entirely in household production is determined by the relation between the relative value of the household good, his/her marginal productivity in household production, the given market wage rate and the tax rate.[7]

We now develop an interpretation of the household equilibrium allocation on which our analysis of taxation will be based. Since the household produces efficiently, it can be regarded as solving the cost-minimisation problem:

$$\min \sum \beta_i w_i (T - l_i) \quad \text{s.t.} \quad y = h(T - l_\mathrm{f}, T - l_\mathrm{m}), \quad l_i \geqq 0, \quad i = \mathrm{f}, \mathrm{m}, \tag{13}$$

for any given domestic output y. This implies the household cost function, $C(\beta_\mathrm{f} w_\mathrm{f}, \beta_\mathrm{m} w_\mathrm{m}, y)$. Moreover, h linear homogeneous implies that the cost function takes the form $c(\beta_\mathrm{f} w_\mathrm{f}, \beta_\mathrm{m} w_\mathrm{m}) \cdot y$, where c is the unit cost function. Then

$$t_i(\beta_\mathrm{f} w_\mathrm{f}, \beta_\mathrm{m} w_\mathrm{m}, y) = c_i(\beta_\mathrm{f} w_\mathrm{f}, \beta_\mathrm{m} w_\mathrm{m}) \cdot y \equiv \frac{\partial c}{\partial \beta_i w_i} \cdot y$$

is the demand function for i's domestic labour, and $l_i(\beta_\mathrm{f} w_\mathrm{f}, \beta_\mathrm{m} w_\mathrm{m}, y) = T - c_i y$ is the supply function of i's market labour. Since c is the marginal cost of producing the domestic good, we must have, for efficiency, $p = c$, and this can be confirmed from conditions (10) and (11) (noting that $c = \beta_\mathrm{m} w_\mathrm{m}/h_\mathrm{m} = \beta_\mathrm{f} w_\mathrm{f}/h_\mathrm{f}$). It follows therefore that in this model, because of the constant returns to scale assumption, the price of domestic consumption is fully determined by the net of tax wage rates, and we have:

$$\frac{\partial p}{\partial \beta_i} = w_i c_i; \qquad \frac{\partial p}{\partial \alpha_i} = 0, \quad i = \mathrm{f}, \mathrm{m}, \tag{14}$$

where c_i has the usual interpretation as the input–output coefficient of labour of type i, $(T - l_i)/y$.

Given the net-of-tax wage rates $\beta_i w_i$, once efficient labour supplies have been determined the household's available 'endowments' of consumption goods x and y are determined by (1) and (4). There then follows a Pareto-efficient allocation of these, which satisfies conditions (8) and (9) and brings the common marginal rate of substitution between x and y into equality with

[7] In everything that follows we shall assume that both m and f supply labour to the outside market, so that the conditions in (11) hold as strict equalities. It is straightforward to apply our results to the case of a corner solution.

p. As is well known, any Pareto-efficient solution to an allocation process can be viewed as achievable by exchange at a fixed price, given appropriate initial endowments. Thus, consider the individual *full-income* budget constraints:

$$x_i + py_i = s_i + \beta_i w_i l_i + ph_i t_i = s_i + \beta_i w_i T \equiv I_i, \quad i = \mathrm{f}, \mathrm{m}, \tag{15}$$

where i is credited with an income in which time spent in domestic production is valued at an implicit wage rate equal to ph_i. Since time allocation is efficient, $ph_i = \beta_i w_i$ and so the income side of the budget constraint reduces to full income at the net of tax market wage rate. s_i is the lump-sum endowment of income to i implied by the household equilibrium, and is the net result of the government lump-sum payment α_i and an implicit intra-household transfer. Thus, $\sum s_i = \sum \alpha_i$. Then, given appropriate choice of the s_i, the consumption allocation implied by conditions (8) and (9) can be sustained as a competitive allocation by the price p. We can also define the indirect utility functions $v^i(p, I_i)$, with, in the usual way, $\partial v^i/\partial p = -\lambda_i y_i$, $\partial v^i/\partial I_i = \partial v^i/\partial s_i \equiv \lambda_i$, the marginal utility of i's income. Since the s_i are defined in such a way that conditions (8) and (9) are satisfied, it follows that $\lambda_\mathrm{f} = \delta\lambda_\mathrm{m} \equiv \eta$, which can be called the marginal household utility of income. Thus, the transfers s_i optimise the distribution of income within the household, in terms of the implicit household welfare function. It is *as if* the household solved the problem

$$\max_{s_\mathrm{f}, s_\mathrm{m}} v^\mathrm{f}(p, I_\mathrm{f}) + \delta v^\mathrm{m}(p, I_\mathrm{m}) \quad \text{s.t.} \quad I_\mathrm{f} + I_\mathrm{m} = \sum(\alpha_i + \beta_i w_i T), \tag{16}$$

with p fixed.

The purpose of this interpretation of the household resource allocation in terms of cost minimisation and efficient consumption allocation is to facilitate the analysis of taxation. The effect of a change in tax parameters is of course to change the household's allocation of labour, the total amounts of x and y available, and the allocation of these between individuals. The change in the consumption allocation equilibrium can be fully described in terms of changes in p and the I_i, and, as is usual with the use of duality, this simplifies the analysis of the welfare effects of the change.

3. Welfare effects of tax changes

Our first proposition is that when evaluating the welfare effects of tax changes, the intra-household distributional effects cannot in general be ignored, and will be an important determinant of tax policy. This rests on the assumption that the social welfare function is defined on *individual* utilities, as is usually the case in welfare economics. To sharpen the results, we assume that the social welfare function takes the form of a simple sum of individual utilities. Moreover, to establish the main results it suffices simply to consider a single household. Thus, suppose the social welfare function takes the form:

$$S=\sum v^i(p,I_i),\quad i=\mathrm{f},\mathrm{m}. \tag{17}$$

A normative tax analysis in essence always compares the marginal social welfare of a tax parameter to its marginal social tax cost (the partial derivative of an appropriately defined tax revenue constraint).[8] Since the latter will be standard, we concentrate on the former. Thus, we have:

$$\frac{\partial S}{\partial \alpha_j}=\sum \lambda_i\frac{\partial I_i}{\partial \alpha_j}=\sum \lambda_i\frac{\partial s_i}{\partial \alpha_j},\quad i,j=\mathrm{f},\mathrm{m}, \tag{18}$$

$$\frac{\partial S}{\partial \beta_j}=\sum\left(\frac{\partial v^i}{\partial p}\frac{\partial p}{\partial \beta_j}+\lambda_i\frac{\partial I_i}{\partial \beta_j}\right),\quad i,j=\mathrm{f},\mathrm{m}. \tag{19}$$

Recalling that $\lambda_{\mathrm{f}}=\delta\lambda_{\mathrm{m}}=\eta$, we have:

$$\frac{\partial S}{\partial \alpha_j}=\eta\left(\frac{\partial s_{\mathrm{f}}}{\partial \alpha_j}+\frac{1}{\delta}\frac{\partial s_{\mathrm{m}}}{\partial \alpha_j}\right),\quad j=\mathrm{f},\mathrm{m}. \tag{20}$$

Now if $\delta=1$, so that the implicit weight each individual receives in the household welfare function is exactly that received in the social welfare function, we have simply:

$$\frac{\partial S}{\partial \alpha_j}=\eta, \tag{21}$$

and the precise impact on the change in lump sum on the household income distribution is irrelevant. However, if $\delta\neq 1$ then, this is no longer true. For example, if $\delta>1$, then from (20), $\delta S/\partial\alpha_j$ will be smaller, the greater the share of any increase in the lump sum paid to either individual that accrues to m, $(\partial S_{\mathrm{m}}/\partial\alpha_j)$, and conversely. That is, the lump sum is less useful as a redistributive instrument across *individuals*, the greater the marginal share taken by the individual who is 'overweighted' in the household income distribution, from the point of view of the social welfare function. We could think of the value $1/\delta$ as a measure of the dissonance between the implicit household and the actual social welfare functions. Only where no such

[8]Thus, an optimal tax is characterised by equating these, a desirable direction of tax reform is found by comparing their values at some initial non-optimal point.

dissonance exists can the household be regarded as having a well-defined marginal utility of income independent of intra-household distribution effects.

Turning now to the marginal social welfare of the marginal tax rates, we have:

$$\frac{\partial S}{\partial \beta_j}=\sum\left(\lambda_i\left(\frac{\partial s_i}{\partial \beta_j}-\frac{y_i w_j t_j}{y}\right)+\lambda_j w_j T\right), \quad i,j=\mathrm{f},\mathrm{m}, \tag{22}$$

using the results of the previous section, and noting that

$$\frac{\partial l_i}{\partial \beta_j}=\frac{\partial s_i}{\partial \beta_j}, \qquad \frac{\partial l_j}{\partial \beta_j}=\frac{\partial s_j}{\partial \beta_j}+w_j T, \quad i,j=\mathrm{f},\mathrm{m}, \quad i\neq j.$$

Moreover, $\sum(\partial s_i/\partial \beta_j)=0$ since $\sum s_i=\sum \alpha_i$. It again follows that if $\delta=1$, so that $\lambda_{\mathrm{f}}=\lambda_{\mathrm{m}}=\eta$, then

$$\frac{\partial S}{\partial \beta_j}=\eta w_j l_j. \tag{23}$$

Thus, again intra-household distributional effects are irrelevant. This is the type of result familiar from the analysis of optimal taxation for individuals or for a household with a single utility function:[9] the marginal social welfare of the marginal tax rate is proportional to the tax base. The substitution between domestic and market time is irrelevant since they have the same marginal value. However, if $\delta\neq 1$, we obtain a far more interesting result. We then have:

$$\frac{\partial S}{\partial \beta_{\mathrm{f}}}=\eta w_{\mathrm{f}} l_{\mathrm{f}}+\eta\left[\frac{\partial s_{\mathrm{f}}}{\partial \beta_{\mathrm{f}}}+\frac{1}{\delta}\frac{\partial s_{\mathrm{m}}}{\partial \beta_{\mathrm{f}}}+(1-\gamma)w_{\mathrm{f}} t_{\mathrm{f}}\right], \tag{24}$$

$$\frac{\partial S}{\partial \beta_{\mathrm{m}}}=\frac{\eta}{\delta} w_{\mathrm{m}} l_{\mathrm{m}}+\frac{\eta}{\delta}\left[\frac{\delta\,\partial s_{\mathrm{f}}}{\partial \beta_{\mathrm{m}}}\frac{\partial s_{\mathrm{m}}}{\partial \beta_{\mathrm{m}}}+(1-\gamma)w_{\mathrm{m}} t_{\mathrm{m}}\right]. \tag{25}$$

In these expressions, $\gamma\equiv(y_{\mathrm{f}}+y_{\mathrm{m}}/\delta)/y$, is a *distributional characteristic* in the sense of Feldstein (1972). It gives the sum of shares of household members' consumptions of the domestic good, weighted by the 'dissonance parameter'. It takes a value of 1 when $y_{\mathrm{f}}/y=1$, and of $1/\delta$ when $y_{\mathrm{f}}/y=0$, and differs from 1 only if $\delta\neq 1$.

The basic idea underlying these expressions is as follows. A change in j's marginal tax rate will cause changes in the allocation of each individual's time between market and household production, the total amounts of the

[9] See, for example, Boskin and Sheshinski (1983).

two goods to be allocated between them and so a change in equilibrium allocations. Since the latter are Pareto efficient, these changes can be expressed in terms of the changes in the imputed income distribution and price which sustain the equilibrium. Thus, in (24), the first two terms inside the square brackets give the effect on the household income distribution. If $\delta > 1$ (m is overweighted in the household utility function) and $\partial s_f/\partial \beta_f > 0$ (a reduction in her marginal tax rate improves f's share of the total lump-sum payment to the household) then $(\partial s_f/\partial \beta_f) + (1/\delta)(\partial s_m/\partial \beta_f) > 0$. That is, the reduction in f's marginal tax rate has, from the point of view of the social welfare function, a beneficial effect on the household income distribution. This then increases the value of $\partial S/\partial \beta_f$. The marginal social benefit of a reduction in f's marginal tax rate would now be greater than in the case where household distributional effects are ignored.

The third term in the brackets in (24), $(1-\gamma)w_f t_f$, summarises two effects. A change in the marginal tax rate will change f's imputed income from domestic production, since this is valued at the after-tax wage rate. Against this is set the effect of a change in f's net of tax wage on the marginal cost and price of the domestic good, and this effect is proportional to the value of f's time spent in domestic production (recall that $\partial p/\partial \beta_j = w_j t_j/y$, $j = \mathrm{f, m}$). The distributional significance of this effect is expressed by γ. If $\delta = 1$, then $\gamma = 1$, and the whole term vanishes. If, say, $\delta > 1$, then $y_f/y = 1$ implies $\gamma = 1$ and again the whole term vanishes: the effect on f's imputed income of a change in the marginal tax rate is exactly offset by the effect on the cost of her consumption. More generally, however, $y_f/y < 1$, and so $1-\gamma > 0$, and the net effect of this term is to increase $\partial S/\partial \beta_f$. The smaller is y_f/y, for given $\delta > 1$, the greater this latter effect.

The terms in (25) can be interpreted in a similar way. Here we simply note that if $\delta > 1$, then $\partial s_m/\partial \beta_m > 0$ implies $(\delta\, \partial s_f/\partial \beta_f) + (\partial s_m/\partial \beta_m) < 0$, and so $\partial S/\partial \beta_m$ will be less than it would be in the absence of household distributional effects. Moreover, $1/\delta$ acts as a kind of discount factor, reflecting the lower social significance of the marginal benefit to m of a reduction in his marginal tax rate. In this case, other things being equal, an optimal tax formula would have a higher marginal tax rate for m than in the case where household distributional effects are absent or excluded.

The purpose of the analysis in this section has been to show as simply but as generally as possible how household distributional effects influence the social valuation of changes in tax parameters. However, although the analysis has brought out the significance of the terms $\partial s_j/\partial \alpha_j$ and $\partial s_j/\partial \beta_j$, the model here is too general to say very much about their signs. The Pareto-efficiency property of the household equilibrium alone is not sufficient to allow analysis of these effects, more structure is required. We pursue this point in the following section.

4. Household redistribution

The general characterisation of the household equilibrium by the efficiency conditions (8)–(11) allows us to bring out in a general way the significance of household distribution effects, but does not itself allow a precise analysis of these. For this it is necessary to specify how the household distributes income among its members, and this requires a more substantive hypothesis than that the final allocation is Pareto efficient. A key distinction here concerns whether or not the household members are assumed to pool their incomes. This in a sense reflects the difference between the situations in which lump-sum income redistributions are or are not possible in the analysis of economic policy for the economy as a whole.

Consider, for example, the change recently made to the U.K. income tax structure, whereby primary earners ceased to receive a tax allowance for dependent children, and instead family allowance was increased. It was argued that this would improve the distribution of income within the household since primary earners are typically men and family allowance is usually collected by women. As we shall see, under fairly general conditions, in a model in which incomes are pooled, such a change would have no effect on the household income distribution provided it left total household income unchanged, while in a non-pooling model such as that in Apps and Jones (1986) it has a fully redistributive effect. It is clearly important for family taxation policy that we have empirical evidence on the extent to which lump-sum income redistribution takes place within households.

Models based on a household utility function implicitly, and the Nash bargaining model of Manser and Brown (1980) explicitly, assume complete pooling of household incomes. In any model that makes this assumption, we find that the 'identity tag' of a lump-sum payment matters *only if* the reservation utility of that individual is in some sense a binding constraint at the household equilibrium (in a Nash bargaining model of course the reservation utilities constitute the 'threat points' and so will always influence the outcome). To show this, we take the model of section 2 literally, now, as a description also of *how* the household achieves an equilibrium. The household members agree upon a household welfare function which expresses the intra-household distributional judgements. Moreover, no serious generality is lost if we take the ratio of partial derivatives of this function at the household equilibrium as locally constant, so we can continue to denote this by δ. Thus, the household makes its lump-sum redistributions in such a way as to solve the problem:

$$\max_{s_f s_m} v^f(p, I_f) + \delta v^m(p, I_m)$$

s.t.

$$s_f + s_m = \alpha_f + \alpha_m \quad \text{and}$$

$$p=c(\beta_{\mathrm{f}}w_{\mathrm{f}},\beta_{\mathrm{m}}w_{\mathrm{m}}) \tag{26}$$

and we then carry out in the usual way the comparative statics analysis of the effects of changes in α_j and β_j, to obtain the derivatives:[10]

$$\frac{\partial s_{\mathrm{f}}}{\partial\alpha_{\mathrm{f}}}=\frac{\partial s_{\mathrm{f}}}{\partial\alpha_{\mathrm{m}}}=\delta v_{II}^{\mathrm{m}}>0, \tag{27}$$

$$\frac{\partial s_{\mathrm{m}}}{\partial\alpha_{\mathrm{f}}}=\frac{\partial s_{\mathrm{m}}}{\partial\alpha_{\mathrm{m}}}=\frac{v_{II}^{\mathrm{f}}}{v_{II}^{\mathrm{f}}+v_{II}^{\mathrm{m}}}>0, \tag{28}$$

$$\frac{\partial s_{\mathrm{f}}}{\partial\beta_{\mathrm{f}}}=\frac{v_{II}^{\mathrm{f}}w_{\mathrm{f}}T+(v_{Ip}^{\mathrm{f}}-\delta v_{Ip}^{\mathrm{m}})c_{\mathrm{f}}w_{\mathrm{f}}}{-(v_{II}^{\mathrm{f}}+v_{II}^{\mathrm{m}})}\gtrless 0;\quad \frac{\partial s_{\mathrm{m}}}{\partial\beta_{\mathrm{f}}}=-\frac{\partial s_{\mathrm{f}}}{\partial\beta_{\mathrm{f}}}, \tag{29}$$

$$\frac{\partial s_{\mathrm{f}}}{\partial\beta_{\mathrm{m}}}=\frac{\delta v_{II}^{\mathrm{m}}w_{\mathrm{m}}T+(v_{Ip}^{\mathrm{f}}-\delta v_{Ip}^{\mathrm{m}})c_{\mathrm{m}}w_{\mathrm{m}}}{-(v_{II}^{\mathrm{f}}+v_{II}^{\mathrm{m}})}\gtrless 0;\quad \frac{\partial s_{\mathrm{m}}}{\partial\beta_{\mathrm{m}}}=-\frac{\partial s_{\mathrm{f}}}{\partial\beta_{\mathrm{m}}}. \tag{30}$$

We then see from (27) and (28) that, as is intuitively obvious, the identity of the recipient of the lump sum is irrelevant to its effects on the household income distribution. However, as we shall soon show, this is only because it is implicitly assumed that no reservation utility constraints are binding at the optimum. Given this, it is clear that any redistribution of lump sums between the two individuals which leaves total household income unaffected has no impact on the household income distribution.

The values of the derivatives themselves in (27) and (28) reflect the equilibrium condition that $v_I^{\mathrm{f}}=\delta v_I^{\mathrm{m}}$. Then, an increase in a lump-sum payment to the household, whoever the nominal recipient, causes both individuals' imputed incomes to rise in order to maintain this equality. This is in direct contrast to Apps' trade model, where, in effect, the household accepts whatever income distribution results from trade of domestic for market goods.

The derivatives in (29) and (30) involve two effects, an income effect and a price effect, which unfortunately may work in opposite directions. For example, in (29), the first term, $v_{II}^{\mathrm{f}}w_{\mathrm{f}}T$, is an income effect. A reduction, say, in f's marginal tax rate increases her imputed income, and that of the household, at the rate $w_{\mathrm{f}}T$. In order to maintain the equality $v_I^{\mathrm{f}}=\delta v_I^{\mathrm{m}}$, with p fixed, her share in the lump sum must be reduced at the rate $(v_{II}^{\mathrm{f}}/(v_{II}^{\mathrm{f}}+v_{II}^{\mathrm{m}}))w_{\mathrm{f}}T$. In effect she has to pay over some proportion of the increase in her after-tax wage rate, by giving m a higher share in the lump sum. The second term, $(v_{Ip}^{\mathrm{f}}-\delta v_{Ip}^{\mathrm{m}})c_{\mathrm{f}}w_{\mathrm{f}}$ arises because the change in f's

[10] For convenience we write $\partial v^i/\partial I_i$ as v_I^i, and $\partial^2 v_i/\partial I_i^2$, as v_{II}^i, etc.

after-tax wage causes a change in price of the domestic good and hence in general a change in marginal utilities of income. Then, the allocation of the total lump sum has to be adjusted in whatever way is required to maintain the equality $v_I^f = \delta v_I^m$. A priori, this term could be either positive or negative and so could the derivative overall.

These results change quite sharply if a reservation utility is binding at the equilibrium. To fix ideas, suppose that at the household equilibrium f is at her reservation utility $\bar{v}^f$. We regard this utility as representing what she could achieve if she left the household in question, and would expect it to be an increasing function $\bar{v}^f(\alpha_f, \beta_f)$ of the tax parameters. In other words, the higher her net of tax income as an individual, the higher her reservation utility in this household. In this case, the household income distribution can be found by solving the problem:

$$\max_{s_f, s_m} v^m(p, I_m)$$

s.t.

$$v^f(p, I_f) \geqq \bar{v}^f(\alpha_f, \beta_f) \quad \text{and} \quad s_f + s_m = \alpha_f + \alpha_m$$

with, by assumption, the utility constraint binding at the optimum. The value of δ in this case is then given by the reciprocal of the Lagrange multiplier attached to the utility constraint.

The essential nature of the comparative statics results for this case is quite clear. Any change in a tax parameter that changes f's reservation utility must be accompanied by an equal change in her utility level within the household, and so the household income distribution must change accordingly. Thus, we have:

$$\frac{\partial s_f}{\partial \alpha_f} = \frac{\bar{v}_I^f}{v_I^f}; \qquad \frac{\partial s_f}{\partial \beta_f} = \left(\frac{\bar{v}_p^f \, \partial \bar{p}}{\partial \beta_f} - \frac{v_p^f \, \partial p}{\partial \beta_f} \right) + w_f T(\bar{v}_I^f - v_I^f). \tag{31}$$

The effect of a change in f's lump sum is given by the ratio of her marginal utility of income in the alternative household (for example where she lives alone) to that in her present household. This need not exactly equal unity. For example, if $\bar{v}_I^f > v_I^f$ because, say, she would be 'poorer'[11] in her alternative household, then her share of the household lump sum must increase by more than her individual lump sum has increased, to meet the reservation utility constraint. In that case, of course, $\partial s_m / \partial \alpha_f < 0$. Clearly,

[11] By this we mean both that f's imputed income could be lower in the alternative household ($\alpha_f \leqq s_f$) and the price of the domestic good higher ($\bar{p} \geqq p$), since each results in a lower value of the indirect utility function.

then, in this kind of case, reallocation of the lump sums α_f and α_m can have significant effects on the household income distribution via its effects on the alternatives f has to the household in question. Similarly, the effect of the change in f's marginal tax rate depends on precisely how it changes her utilities in her present and alternative households, but if we assume that the price effects in the two households roughly cancel each other out, and that the marginal utility of income is higher in the alternative household, then her share of the lump sum in her present household would have to rise and m's to fall.

Changes in m's tax parameters will of course leave f's reservation utility unaffected, while a change in α_m leaves f's actual utility unchanged but a change in β_m causes f's utility to change because of the price effect. Hence, we have:

$$\frac{\partial s_f}{\partial \alpha_m}=0, \quad \frac{\partial s_m}{\partial \alpha_m}=1; \qquad \frac{\partial s_f}{\partial \beta_m}=\frac{-\bar{v}_p^f\,\partial p}{v_I^f\,\partial \beta_m}>0, \quad \frac{\partial s_m}{\partial \beta_m}=-\frac{\partial s_f}{\partial \beta_m}. \tag{32}$$

So, m bears the full effect of a change in his lump sum, but must compensate f for the price effect of a change in his marginal tax rate since her reservation utility is unchanged.

Finally, as a further contrast to the results of the household welfare function model, we consider the 'trade model' of Apps (1982). No pooling of individual incomes takes place and no lump-sum redistribution is possible. The final equilibrium is reached from the individuals' initial endowment points $(\alpha_i-\beta_i w_i T)$, $i=\mathrm{f,m}$, by trade at a fixed price. This then obviously implies the indirect utility functions $v^i(p,\alpha_i+\beta_i w_i T)$, $i=\mathrm{f,m}$, and so we have for this model:

$$\frac{\partial S}{\partial \alpha_f}=\eta; \qquad \frac{\partial S}{\partial \beta_f}=\eta(w_f l_f-(1-\gamma)w_f t_f), \tag{33}$$

$$\frac{\partial S}{\partial \alpha_m}=\frac{\eta}{\delta}; \qquad \frac{\partial S}{\partial \beta_m}=\frac{\eta}{\delta}(w_m l_m+(1-\gamma)w_m t_m). \tag{34}$$

Then, if $\delta\neq 1$, a redistribution of the lump sums can never be distributionally neutral.

5. Conclusions

In this paper we have sought to explore the implications for tax policy of dissonance between social distributional preferences and the household distributional preferences implicit at a household allocation equilibrium. The household utility function approach adopted so far in the literature entirely obscures this issue. Using a thoroughly neoclassical model of the household[12] we have shown that a central issue is whether the household pools income or, equivalently, makes lump-sum redistributions among its members and, if so, whether any member is on his/her reservation utility constraint. It is straightforward to show how the expressions for the marginal social utility of individual tax parameters are affected by intra-household distributional considerations, and these could then easily be incorporated into theoretical analysis of optimal taxation and tax reform. The precise nature of the distributional terms, however, will depend on the way in which the household allocates its resources, a topic on which economists seem to say surprisingly little. The appropriate response to this lack of knowledge does not, however, appear to us to be to suppress the issue.

[12]A very similar model is analysed by Chiappori (1988), who is concerned with the implications of this type of approach for the analysis of labour supply.

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