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Collective Labor Supply and Welfare

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The paper develops a general, "collective" model of household labor supply in which agents are characterized by their own (possibly altruistic) preferences, and household decisions are only assumed to be Pareto efficient. An alternative interpretation is that there are two stages in the internal decision process: agents first share nonlabor income, according to some given sharing rule; then each one optimally chooses his or her own labor supply and consumption. This setting is shown to generate testable restrictions on labor supplies. Moreover, the observation of labor supply behavior is sufficient for recovering individual preferences and the sharing rule (up to a constant). Finally, the traditional tools of welfare analysis can be adapted to the new setting.

I. Introduction

The empirical analysis of joint labor supply decisions within a two-member household has received widespread attention in recent years. The theoretical models that underlie these works can be classified into two broad categories. Traditionally, the household, as a whole, is considered as the elementary decision unit; in particular, it is characterized by a *unique* utility function that is maximized under a budget constraint. On the other hand, several "collective" models have been proposed recently that are aimed at explicitly taking into account the individualistic elements of the situation; typically, they represent

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households by a pair of individual utility functions, together with a particular decision rule.

This alternative strand of the literature, however, does not seem to have yet developed a common framework; nor has it produced so far general restrictions on household behavior that would allow empirical tests to be performed (in the same way that Slutsky equations do in the traditional setting). The first purpose of this paper is to partially fill this gap. I propose a general approach for the collective line of investigation that relies on an axiomatic characterization of the decision rule. The main properties of the approach are derived for a standard labor supply model, with two labor supplies and a unique consumption good. The conditions imposed by this characterization are quite general. Indeed, it is only assumed that agents are either egoistic or "caring" in the Beckerian sense and that internal decision processes are cooperative, in the sense that they systematically lead to Pareto-efficient outcomes. This formalization encompasses not only some essential ideas of Becker's early contributions but also many of the collective approaches existing so far.

The basic result, from this point of view, is that it is possible to derive from the collective setting thus defined a set of testable restrictions on observable behavior (labor supply in our model) under the form of partial differential equations. These equations can be viewed as analogous, in the collective setting, to Slutsky relations in the traditional model. In particular, they can be used, for empirical purposes, as an alternative way of deriving additional structural conditions on functional forms for demand or labor supply functions. They can be translated into restrictions on parameters, which may in turn either be tested statistically or be used a priori for reducing the estimation task. Hence, all the advantages of the traditional setting, in terms of estimation of empirical behavior, are preserved in the new framework.

A second aim of the paper, which is closely related to the first, deals with the general question of *assignability*, namely, how families allocate their consumption across members. In most cases, few data are available on the intrahousehold allocation of goods. A natural idea, then, is to investigate whether information about nonobservable consumption could be deduced, with the help of adequate theoretical assumptions, from data on whatever good, the consumption of which can be unambiguously assigned to one of the members. For instance, in the Prais-Houthakker line, Deaton (1988) and Deaton, Ruiz-Castillo, and Thomas (1989) use data on consumption of adult goods to derive results about intrafamily allocation.

The present paper shows that the collective approach provides a very promising framework for the assignability problem. Specifically, it is shown that, in an economy with two (assignable) labor supplies and a unique (nonassignable) Hicksian consumption good, the collective setting developed here allows one to assign each member's consumption—and actually to recover the entire decision process—up to an additive constant; in particular, the variations of intrahousehold distribution of consumption with respect to wages or nonlabor income can be predicted exactly. This important fact, which has apparently been overlooked so far, has potentially major consequences. It suggests that, provided that one is ready to believe in the kind of collective rationality that has just been alluded to (and will be formally defined in the next section), there is very much to be learned about *internal* rules and allocation processes of the household from the sole observation of its *external* behavior (i.e., labor supply or aggregate consumption). From an economist's view, thus, the household need not be the kind of "black box" suggested by the traditional approach, even when the allocation of resources within the household cannot be directly recorded. A corollary of this result is also relevant for the traditional approach as well: specifically, it states that a sufficient condition for assignability is separability of the household utility with respect to individual consumption-leisure bundles, a result derived in a different context by Deaton et al. (1989).

Finally, the collective viewpoint has important normative implications. Indeed, it follows from the previous result that the observation of labor supplies is sufficient for welfare comparisons to be performed, *even when each member's utility is to be independently taken into account.* Hence, instead of exclusively concentrating on the distribution of wealth, consumption, or well-being *across* households, welfare analysis could—hence should—consider *intrahousehold* allocation as well. The last goal of the paper is precisely to illustrate how the traditional tools of public economics can be translated into the collective setting and to investigate the consequences of this shift of interest.

The paper is organized as follows. Section II briefly discusses the basic issues at stake, and Section III presents the model. Section IV gives the main results. In Section V, I investigate the consequences on welfare analysis; in particular, I show how individual indirect utilities can be deduced from the sole knowledge of labor supplies. Section VI considers two particular specifications of the model, namely the "collective neoclassical case" (which characterizes the links between the traditional framework and the collective setting) on the one hand and the Nash-bargained framework on the other hand. Section VII extends the model to "caring" agents. Conclusions are discussed in Section VIII.

II. Traditional versus "Collective" Models

A. *The Traditional Approach*

Traditional analysis basically models the household as though it were a single individual. This "household utility" approach has been adopted in most recent papers on labor supply, taxation, and welfare measurement (see, e.g., Pollak and Wales 1981; Ray 1982; King 1983; Blundell et al. 1986; Blundell and Walker 1986). A major advantage, which may explain this popularity, is that it fits exactly within the familiar treatment of consumer choice. In particular, the usual tools of optimal taxation and tax-benefit analysis can be directly applied to this kind of model. Integrability theorems, for instance, allow one to recover preferences from the sole observation of market behavior, clearly a necessary first step for any normative analysis.

It has become increasingly clear, however, that the traditional formalization, attractive and convenient as it may seem, still raises a number of serious difficulties. Its first shortcoming—which, in my view, is also a major one—is methodological: such models simply fall short of meeting the basic rules of neoclassical microeconomic analysis. Micro approaches are grounded on methodological individualism, which basically requires individuals to be characterized by their own preferences rather than be aggregated within the ad hoc fiction of a collective decision unit. Modeling a *group* (even reduced to two participants) as though it were a single individual can be seen only as a mere holistic deviation.[1] On the contrary, it is my claim that individualism should be referred to even when one is modeling household behavior; that is, the latter should be explicitly recognized as a *collective* process involving (except for singles) more than one decision unit.

A second drawback of the traditional setting is that it describes a household as a black box: while its relationships with the outside economy can be characterized, nothing can be said about its *internal* decision processes. In particular, such issues as the allocation of the household's resources among its members are simply ignored. And, of course, little (if anything) can be said about household formation or dissolution: how a pair of single preferences aggregate into a unique common utility by marriage (or disaggregate through divorce) is a question that can hardly be addressed at all. A natural question, at

[1] In the holistic view, "social groups . . . are conceived as the empirical objects which the social sciences study, in the same way in which biology studies animals or plants. This view must be rejected as naïve, . . . and has to be replaced by the demand that social phenomena, including collectives, should be analyzed in terms of individuals and their actions and relations" (Popper 1969, p. 341).

this point, is whether one can enter into the black box. But reaching this goal presumably requires new tools of investigation.

As a matter of fact, scientific curiosity is not the only motivation for analyzing intrahousehold decision processes; welfare considerations may also matter. When considering, for instance, policy issues involving individual welfare (such as optimal taxation or cost-benefit analysis), traditional models can be seriously inadequate and, in some cases, misleading. They rest on the idea that only the distribution of income *across* households matters.[2] The underlying, implicit assumption is that the allocation of consumption or welfare *within* the household is either irrelevant or systematically optimal relative to the policymaker's preferences. Of course, this is a purely ad hoc hypothesis, the realism of which is dubious. There is no rationale, as well as no evidence, for assuming that the internal distribution of resources is even in any sense. As Apps (1991) and Haddad and Kanbur (1992) rightly suggest, taking into account intrahousehold inequality might well significantly alter a number of normative recommendations provided by the traditional approach.

B. Becker's Contribution

The previous criticisms highlight the need for an alternative line of investigation, which emphasizes the individual (rather than the "family") as the basic decision maker. Its origins can be traced back to the seminal works of Becker (1973, 1974*a*, 1974*b*, 1981*a*, 1981*b*), which introduce several modeling innovations. Within Becker's framework, the household consists of two members, each member being characterized by his or her own preferences. The marriage decision generates a gain, which is shared between the members according to a predetermined rule. In Becker (1973), the rule depends on the state of the market for marriage; in later works, Becker introduces the idea of "caring" by assuming that the preferences of one of the members depend on the other person's utility function. A consequence is the well-known "rotten-kid" theorem: even if only one of the members is "altruistic" in that sense, everyone within the household will try to maximize the joint family income.

Becker asserts that caring solves the household distribution and allocation problem in the general case. It must be stressed, however, that this solution relies on two strong ad hoc hypotheses. Indeed, any

[2] As Lazear and Michael (1988, p. 1) put it, "the myth persists in economic modelling of well-being and in many social policy contexts that once we know the level of resources available to the household, that is all we need to know."

collective model of household behavior faces (at least) two difficulties. One is linked with the general problem of preference aggregation: if individual utilities differ, how should one characterize collective decisions? Becker essentially avoids this problem by assuming that there exists a *unique* aggregate consumption good that is produced by the household and consumed by each member; each member simply tries to maximize his share of the total. This amounts to assuming that preferences are (ordinally) defined by the production function and, hence, are (ordinally) identical across individuals. How this framework can be extended to take into account, say, each member's trade-off between consumption and leisure is not clear.

A second problem relates to the bargaining issue itself ("who gets what?"). The answer provided by the "caring" solution is quite particular: as emphasized by Ben-Porath (1982, p. 54), "a condition for the theorem to hold is that the altruists must have the last word" since they must be able to freely modify their transfers in response to the other person's decisions. In the same way, Manser and Brown (1980, p. 32) point out very rightly that Becker introduced de facto a particular bargaining rule, namely, maximizing the altruistic member's utility.

The "collective" lines of research have been recently extended in several different directions. Apps (1981, 1982) and Apps and Jones (1986) have introduced "Walrasian" cooperative models; Ashworth and Ulph (1981), Bourguignon (1984), Ulph (1988), and Woolley (1988) refer to noncooperative game theory. An interesting approach, initiated by Manser and Brown (1980) and McElroy and Horney (1981) and illustrated by Haddad and Kanbur (1989, 1990), relies on equilibrium concepts borrowed from cooperative game theory; specifically, the household decision problem is placed into a bargaining model between two individuals.

C. *"Collective" Models: The Efficiency Approach*

I shall now describe the main features of my approach. First, households consist of several members, each of them being characterized by specific preferences. Agents are "egoistic" in the sense that their utility depends only on their own consumption and labor supply; however, the framework can readily be extended to the case in which agents are "caring" (see Sec. VII). Moreover, the *collective* nature of the household decision-making process is explicitly recognized. I assume, specifically, that the process is cooperative, that is, that household decisions are Pareto efficient. The main originality of the approach lies in the fact that no additional assumption is made about the process; in other words, *no restriction is imposed a priori on which point of the Pareto frontier will be chosen.*[3]

An alternative interpretation of the efficiency hypothesis that may help clarify its content is the following. Assume that the decision process is a two-stage budgeting one. Members first divide the total nonlabor income received by the household between them, according to some predetermined sharing rule. The way in which the rule emerges is outside the scope of this analysis; it may reflect the cultural environment, the weight of tradition, or, as in Becker, the state of the market for marriage. In any case, in the Beckerian tradition, I shall assume throughout the paper that the rule is a given characteristic of the marriage contract that is not directly observable.[4] Once income has been allocated, both members face an individual budget constraint; then they choose their own consumption and labor supply through constrained utility maximization. I first show that the two interpretations are equivalent: household decisions are efficient if and only if a sharing rule exists. In other words, efficiency essentially means that members' bundles maximize their utility *for some given level of total expenditures;* the distribution of expenditures across members, on the other hand, is defined by the sharing rule, on which no particular assumption is made.

The sharing rule interpretation is quite helpful in understanding

[3] In particular, this approach does not allow one to derive labor supplies and consumptions from preferences, since the knowledge of both utilities and the budget constraint generates only a continuum of Pareto-efficient outcomes. It must, however, be kept in mind that what economics is interested in is the *opposite* derivation. Typically, household behavior can be observed empirically. The role of a formal theory (besides generating testable restrictions) is to help recover some unobservable features—here, private consumptions and preferences—that are needed for interpreting the results and formulating normative judgments. The reason why additional assumptions are not needed in the collective approach is precisely that, as we shall see, Pareto efficiency alone is sufficient for this goal: it allows one to recover both individual preferences and the decision process. In other words, one does not need ad hoc assumptions aimed at characterizing the location of the household choice on the Pareto frontier since this location is already embedded in the household behavior and can be deduced from the form of labor supplies. In this case, Occam's razor (*essentia non sunt multiplicanda praeter necessitatem*) clearly suggests that one should accept the simplest theory that works. An additional point can be stressed. Since the outcome of any cooperative bargaining model must be efficient, at least under symmetric information, this formalization encompasses, in particular, the Nash-bargained framework mentioned above as well as the main features of Becker's models. However, the Pareto approach requires neither a cardinal representation of preferences nor interpersonal comparability of utilities: the set of Pareto-efficient outcomes is defined even if utility is ordinal and cannot be compared across individuals. This is in sharp contrast with Nash bargaining approaches, in which the problem of cardinal representation may generate important difficulties (see Chiappori 1991).

[4] In some cases (e.g., divorce), the sharing rule may become observable. Then conditions (1) of proposition 4 below could be directly tested.

how the decision process can be recovered from the sole observation of labor supplies. The basic idea is that, for each "egoistic" member, changes either in household nonlabor income or in the spouse's wage can have only an income effect; specifically, they will affect the member's behavior only insofar as her share of nonlabor income, as defined by the sharing rule, is modified. This means that any simultaneous change in nonlabor income and spouse i's wage that leaves unchanged spouse j's labor supply must keep constant j's share as well. From this idea, it is possible to derive, from the knowledge of labor supply functions, the indifference surfaces of the sharing rule. Since both shares add up to one, the sharing rule itself can actually be recovered up to an additive constant. Finally, knowing the rule allows one to write down each member's actual budget constraint, and preferences can then be computed in the usual way.

Clearly, such tools will not be fully reliable until they have been tested empirically; this will be the subject of forthcoming research. It is worth emphasizing, however, that the developments suggested in this paper are totally in line with the neoclassical tradition. Individuals are rational in the sense that they maximize utility under constraints. Collective agreements are mutually beneficial. The innovation, in fact, essentially consists in deepening the individualistic foundations of consumer theory by claiming that the members of the household should be considered *independently* rather than altogether as maximizing agents. In that sense, these new results illustrate the power of the individualistic paradigm.[5]

III. The Model

A. The Basic Framework

Let us consider a two-member household. Member i ($i = 1, 2$) consumes leisure in quantity L^i and a private Hicksian composite consumption good in quantity C^i. Labor supplies $T - L^1$ and $T - L^2$ (where T denotes total available time) are observed, together with wages w_1 and w_2, nonlabor income y, and aggregate consumption $C = C^1 + C^2$; the price of the consumption good is set to one. Private consumptions C^1 and C^2, on the other hand, are not observed. A natural interpretation of this framework is that available data are *cross-sectional*. Then wages and income vary across households, and

[5] The term "neoclassical" has sometimes been used to denote the household utility function approach (see McElroy and Horney 1981). This appellation, however, does not seem fully adequate since the collective approach—at least in the general framework presented here—relies on such neoclassical hypotheses as utility maximization for each individual and Pareto efficiency for collective decisions.

prices remain constant—hence the introduction of a Hicksian composite good.

Within a traditional framework, the first step would be to assume the existence of a unique utility function $U(L^1, L^2, C^1, C^2)$, which is maximized under the budget constraint. It is clear, however, that one cannot hope to recover consumptions from labor supplies within this framework. Indeed, since the price ($p = 1$) is common to C^1 and C^2, from Hicks's theorem, one can estimate only a reduced-form direct (indirect) utility, $\tilde{U}(L^1, L^2, C)$ ($\tilde{V}(w_1, w_2, y)$). Welfare comparisons are possible, but they essentially ignore the distribution of aggregate consumption C between C^1 and C^2. In particular, there is a continuum of "structural" utility functions $U(L^1, L^2, C^1, C^2)$ that would lead to the same reduced form, and each of them is associated with a particular pair (C^1, C^2) of individual consumption functions.[6]

As discussed above, I follow here a different path and assume that each member i is endowed with "direct" preferences on her own leisure and consumption that are represented by an "egoistic" utility $U^i(L^i, C^i)$ with the usual properties. The egoistic form of individual preferences is important; however, it will be shown in the last section that "caring" à la Becker would lead to identical results.

Let us now formally express the Pareto efficiency assumption. Household behavior, hence, must be a solution of the following program:

$$\max U^1(L^1, C^1)$$
$$\text{subject to } \mu\text{: } U^2(L^2, C^2) \geq \bar{u}_2, \qquad (\bar{\text{P}})$$
$$\lambda\text{: } w_1 L^1 + w_2 L^2 + C^1 + C^2 \leq (w_1 + w_2)T + y$$

for some utility level $\bar{u}_2$. It must be clear that, in general, $\bar{u}_2$ is a function of the environment (i.e., of w_1, w_2, and y). For any given wage/income combination, the set of efficient outcomes obtains as $\bar{u}_2$ varies within its domain. This leads to the following formal definition.

Definition. A pair of labor supply functions $(L^1(w_1, w_2, y), L^2(w_1, w_2, y))$, together with an (aggregate) consumption function defined by the budget constraint, is said to be collectively rational if there exists a pair of individual consumption functions $(C^1(w_1, w_2, y), C^2(w_1, w_2, y))$ and some function $\bar{u}^2(w_1, w_2, y)$, such that, for all (w_1, w_2, y), (i) $C^1(w_1, w_2, y) + C^2(w_1, w_2, y) = C(w_1, w_2, y)$ and (ii) (L^1, L^2, C^1, C^2) is a solution of program $(\bar{\text{P}})$.

[6] To see why, let $V(w_1, w_2, p_1 y)$ be the general form of the indirect utility function associated with U, should the price p_1 of consumption good 1 be allowed to differ from the price of good 2, set to one. Then V is compatible with the reduced form $\tilde{V}$ if and only if $V(w_1, w_2, 1, y) \equiv \tilde{V}(w_1, w_2, y)$. Obviously, a continuum of functions will satisfy this equality; for any of them, Roy's identity allows one to derive C^1 and C^2.

Remark.—The Lagrange multiplier μ of the first constraint in ($\overline{\text{P}}$) can be interpreted as the implicit weight of member 2's egoistic utility in the collective decision process; that is, ($\overline{\text{P}}$) is equivalent to the maximization of $U^1(L^1, C^1) + \mu U^2(L^2, C^2)$ under the budget constraint. It is important to note here that, in general, μ will be a function of w_1, w_2, and y. Incidentally, a particular case of ($\overline{\text{P}}$) obtains if one assumes the existence of a *fixed* household welfare function W, so that the household maximizes $W(U^1(L^1, C^1), U^2(L^2, C^2))$ subject to the budget constraint. Of course, since W is assumed to depend only on U^1 and U^2 and not on w_1, w_2, and y per se,[7] this hypothesis is extremely restrictive. In fact, this form is at the intersection of the neoclassical and collective frameworks. I shall consider this point in Section VI.

B. *The Sharing Rule Interpretation*

Let us now consider the alternative, "sharing rule," interpretation. That is, let us assume that nonlabor income y is shared between the members, and let $\varphi(w_1, w_2, y)$ be the amount received by member 1 and $y - \varphi(w_1, w_2, y)$ by member 2 (note that φ is allowed to depend on wages as well as on nonlabor income).[8] Moreover, φ may well be negative or greater than y (for instance, if y is low and wages are very different, one member may share labor income with the other). Now each member independently chooses consumption and labor supply, subject to the corresponding budget constraint. Member i's program can thus be written as

$$\max U^i(L^i, C^i)$$
$$\text{subject to } w_iL^i + C^i \leq w_iT + \varphi^i(w_1, w_2, y), \tag{P$_i$}$$

where φ^1 stands for φ and φ^2 for $y - \varphi$.

The following result states that the income sharing rule interpretation is exactly equivalent to the initial setting, that is, that the existence of a sharing rule implies no more (and no less) than efficiency of the collective decision process.

PROPOSITION 1. Let $L^1(w_1, w_2, y)$ and $L^2(w_1, w_2, y)$ be arbitrary functions. There exists a function $\bar{u}_2(w_1, w_2, y)$ such that L^1 and L^2 are solutions of ($\overline{\text{P}}$) if and only if there exists a function $\varphi(w_1, w_2, y)$ such that L^i is a solution of (P$_i$) ($i = 1, 2$).

[7] Of course, writing W as a function of U^1, U^2 *and* w_1, w_2, y is equivalent to ($\overline{\text{P}}$). This point illustrates a formal difference between the collective model and traditional consumer analysis: the maximand in the former case will in general depend on prices.

[8] In general, φ can be thought of as a function of wages, income, and labor supplies. But here, labor supplies are given functions of wages and income, so that only the reduced form of the rule matters.

Proof. Assume, first, that L^1 and L^2 together with two consumptions C^1 and C^2 are a solution of $(\overline{\mathrm{P}})$ for some function $\overline{u}_2$. Define $\varphi(w_1, w_2, y) = w_1[T - L^1(w_1, w_2, y)] - C^1(w_1, w_2, y)$. Then L^1 is a solution of (P_1); otherwise, it would be possible to increase member 1's utility without changing member 2's expenditures, a contradiction. The same argument applies to L^2.

Conversely, assume that L^1 and L^2, together with C^1 and C^2, are solutions of (P_1) and (P_2) for some function φ. Define $\overline{u}_2(w_1, w_2, y) = U^2(L^2(w_1, w_2, y), C^2(w_1, w_2, y))$. Then L^1 and L^2 are solutions of $(\overline{\mathrm{P}})$. Indeed, we know that $w_2L^2 + C^2 = e^2(w_2, \overline{u}_2)$, where e^2 is the expenditure function associated with U^2. Hence, the cost of any pair (L'^2, C'^2) providing the utility level $\overline{u}_2$ will be no less than $w_2T + y - \varphi(w_1, w_2, y)$. In particular, if a solution (L'^1, C'^1, L'^2, C'^2) of $(\overline{\mathrm{P}})$ is such that $U^1(L'^1, C'^1) > U^1(L^1, C^1)$, the pair (L'_1, C'_1) costs no more than (L^1, C^1), a contradiction.

One can now characterize the set of labor supply functions that are consistent with the collective framework just described. From now on, I assume that L^1 and L^2 are three times continuously differentiable, and I impose the condition that φ is twice continuously differentiable.

IV. Characterization of the "Collective" Setting

Several questions can be raised, at this point, on the collective setting: (i) *Characterization:* Which necessary restrictions are imposed on L^1 and L^2 by the collective setting? (ii) *Integrability:* Are the restrictions sufficient; that is, is it possible, from any pair of labor supply functions satisfying them, to recover a sharing rule and a pair of individual preferences? (iii) *Uniqueness:* Are the sharing rule and the individual preferences uniquely determined?

An answer to question i appears in Chiappori (1988*b*); in order to make this paper self-contained, I shall briefly recall the principal result. In what follows, the notation X_z stands for the partial differential of function X with respect to variable z and $A = L^1_{w2}/L^1_y$ and $B = L^2_{w1}/L^2_y$ whenever $L^1_y \cdot L^2_y \neq 0$. Also, I introduce the following "regularity" assumption.

ASSUMPTION R. $L^1_y \neq 0$, $L^2_y \neq 0$, and $AB_y - B_{w2} \neq BA_y - A_{w1}$ for almost all (w_1, w_2, y) in $\mathbb{R}^2_+ \times \mathbb{R}$.

Note that assumption R is "generically" true, in the usual sense. An answer to question i is then given by the following result.

PROPOSITION 2. In the general case, the following conditions are necessary for any given pair (L^1, L^2) of demand for leisure functions to be solutions of (P_1) and (P_2) for some C^2 sharing rule φ: (*a*) $\alpha_yA + \alpha A_y - \alpha_{w2} = 0$, (*b*) $\beta_yB + \beta B_y - \beta_{w1} = 0$, (*c*) $L^1_{w1} - L^1_y[(T - L^1 -$

$\beta B)/\alpha] \leq 0$, and (*d*) $L^2_{w2} - L^2_y[(T - L^2 - \alpha A)/\beta] \leq 0$, where

$$\alpha = \left(1 - \frac{BA_y - A_{w1}}{AB_y - B_{w2}}\right)^{-1} \quad \text{if } AB_y - B_{w2} \neq 0,\ \alpha = 0 \text{ otherwise},$$

and

$$\beta = 1 - \alpha = \left(1 - \frac{AB_y - B_{w2}}{BA_y - A_{w1}}\right)^{-1}.$$

Conditions *a*, *b*, *c*, and *d* are analogous to Slutsky conditions in the sense that they provide a set of partial differential equations and inequalities that have to be satisfied by labor supply (or, here, demand for leisure) functions. In particular, it is possible, given any particular functional form for labor supplies, to translate the conditions into restrictions on parameters. The economic interpretation of α, β, A, and B will be discussed later; however, it is important to note here that they are totally defined (and can be computed immediately) from labor supplies.

We now come to the second and third questions, namely, integrability and uniqueness. Are conditions *a–d* *sufficient* for the existence of a sharing rule and a pair of utility functions from which L^1 and L^2 can be derived? And are the sharing rule and the preferences uniquely determined? The answer is given by the following results.

PROPOSITION 3. *Integrability.*—Let L^1 and L^2 be two C^3 functions satisfying assumption R and conditions *a–d*; let $\bar{w} = (\bar{w}_1, \bar{w}_2, \bar{y})$ be any point in $\mathbb{R}^2_{++} \times \mathbb{R}$. Then there exists a neighborhood $\mathcal{V}$ of $\bar{w}$ such that (i) there exists a sharing rule φ, defined over $\mathcal{V}$, and (ii) there exists a pair of utility functions (U^1, U^2) with the property that the solution of (P_i), at any point of $\mathcal{V}$, is the couple (L^i, C^i) for some $C^i \geq 0$.

PROPOSITION 4. *Uniqueness.*—Under the same hypothesis as proposition 3, (i) the sharing rule is defined up to an additive constant *k*; specifically, its partials are given by

$$\varphi_y = \alpha, \quad \varphi_{w2} = A\alpha, \quad \varphi_{w1} = B(\alpha - 1) = -\beta B; \tag{1}$$

(ii) for each choice of *k*, the preferences represented by U^1 and U^2 are uniquely defined; and (iii) the indifference curves corresponding to different values of *k* can be deduced from one another by translation.

The integrability result is local rather than global because of nonnegativity restrictions; that is, the sharing rule can in general be derived globally, but it must be checked that it does not lead to negative consumptions for particular values of (w_1, w_2, y). Also, the uniqueness

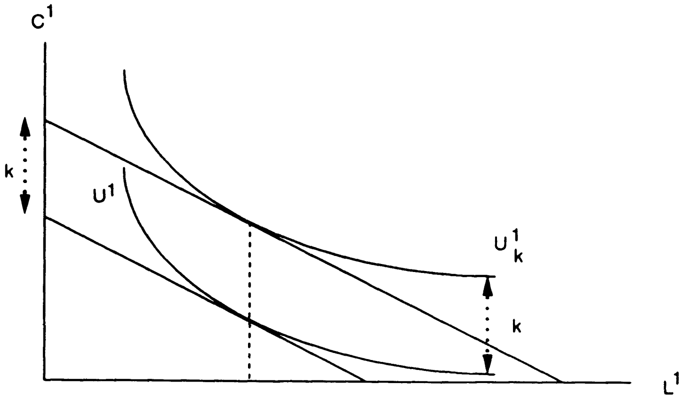

FIG. 1

result states that preferences are defined up to a translation and sharing rules up to an additive constant. This fact is an immediate consequence of the nonobservability of individual consumptions. The intuition goes as follows. Assume that a sharing rule φ and a pair of utilities U^1 and U^2 generate the observed demands for leisure. For any given k, an obvious alternative solution is defined by[9]

$$\begin{aligned} \varphi_k(w_1, w_2, y) &= \varphi(w_1, w_2, y) + k, \\ U_k^1(L, C) &= U^1(L, C - k), \\ U_k^2(L, C) &= U^2(L, C + k). \end{aligned} \tag{2}$$

Specifically, (2) simply says that the indifference curves of U_k^1 can be deduced from those of U^1 by vertical translation of magnitude k (see fig. 1). Of course, it is impossible to distinguish between (φ, U^1, U^2) and (φ_k, U_k^1, U_k^2) from the sole observation of labor supplies. Thus it is clear that φ can be defined only up to a positive constant k, and once k has been chosen, the corresponding preferences can be recovered through (2).

The economic interpretation is clear. We can always assume that member i systematically receives k additional units of the consump-

[9] Indeed, with φ_k and U_k^1, program (P_1) can be written as

$$\begin{aligned} &\max U_k^1(L, C) = U^1(L, C - k) \\ &\text{subject to } w_1 L + C = w_1 T + \varphi_k(w_1, w_2, y) = w_1 T + \varphi(w_1, w_2, y) + k. \end{aligned} \tag{P$'_1$}$$

If $\overline{C} = C - k$, (P'_1) becomes

$$\begin{aligned} &\max U^1(L, \overline{C}) \\ &\text{subject to } w_1 L + \overline{C} = w_1 T + \varphi(w_1, w_2, y), \end{aligned}$$

which is exactly (P_1) for φ and U^1.

tion good (member j's share being reduced accordingly), provided that preferences are modified in such a way that member i, with the new utility U_k and the additional k units, is exactly as well off as (initially) with utility U_0 and the "normal" share φ. In figure 1, both the indifference curves and the budget constraint are translated vertically; this, of course, does not affect labor supply. The (strong) result in proposition 4, however, is that this is the *only* degree of freedom left in the choice of φ. As we shall see, though φ is indeterminate strictly speaking, this indeterminacy is not really harmful since it does not affect welfare comparisons.

Proof of propositions 2, 3, and 4.—A detailed proof can be found in Chiappori (1988*a*, 1989). A sketch of the argument follows. It is clear, from program (P_i) above, that we have $L^i(w_1, w_2, y) = l^i(w_i, \varphi^i(w_1, w_2, y))$, where l^i is i's Marshallian demand. Hence, $A = L^1_{w2}/L^1_y = \varphi_{w2}/\varphi_y$ and $B = L^2_{w1}/L^2_y = -\varphi_{w1}/(1 - \varphi_y)$.

With cross-derivative restrictions, this implies conditions a and b of proposition 2 plus relation (1) of proposition 4. In turn, the latter defines φ up to a positive constant, and integrability follows from traditional arguments. Q.E.D.

In addition, proposition 4 helps to provide a simple interpretation of the various parameters introduced so far. Here, $\varphi(w_1, w_2, y)$ is the share of nonlabor income y received by member 1, and α is the derivative of φ with respect to y. In words, α is the share of marginal nonlabor income received by member 1 (and, of course, $\beta = 1 - \alpha$ is the share received by member 2). Proposition 2 simply shows how α can be deduced from observed labor supplies.

V. Welfare Comparisons

Let us now consider the welfare properties of the collective framework. Assume that a reform changes the initial price-income bundle $\overline{w} = (\overline{w}_1, \overline{w}_2, \overline{y})$ to $w' = (w'_1, w'_2, y')$. How should the consequences on individual well-being be analyzed from the collective viewpoint?

A. *Indirect Collective Utilities*

A first difficulty arises because of the collective nature of the decision process; the model is general enough for well-known paradoxes to appear. For instance, one might, in the Hicks-Kaldor-Scitovsky line, consider as globally beneficial for the household a reform that could *potentially* ameliorate both individuals' welfare (i.e., such that there is a point, on the new Pareto frontier, at which both members are better off than initially). However, it is well known (and could easily be illustrated in the model) that this criterion is neither complete nor acyclical. It can simultaneously accept a given reform (say, going from $\overline{w}$ to w') as well as the opposite move (from w' to $\overline{w}$). Also, a criterion of this kind may be particularly inadequate in view of the policy concern evoked above. The policymaker will probably be interested in *actual,* rather than *potential,* changes in welfare. If, because of the internal decision process, one of the members is worse off after the reform, this fact should be taken into account irrespective of whether another decision rule could have led to socially "better" outcomes.

An obvious advantage of the collective model, from this point of view, is the possibility of recovering private consumptions as well as individual welfare functions. That is, from the observation of labor supplies, one can deduce the consequences of the reform on each member. The fact that the sharing rule is defined only up to a constant does not raise any particular difficulty, as shown by the following result.

COROLLARY 1. Let φ, U^1, and U^2 be associated with a pair of given labor supply functions (in the sense of propositions 3 and 4). If U^1 (U^2) is increased by the reform, then for any k, U^1_k (U^2_k) is also increased by the reform.

Proof. From proposition 4, replacing φ by φ_k and U^1 by U^1_k does not change utility levels. Q.E.D.

One can now define a pair of collective indirect utility functions, ν^1 and ν^2. Intuitively, $\nu^i(w_1, w_2, y)$ is i's welfare when wages are w_1 and w_2 and *household* nonlabor income is y. In particular, ν^i must be distinguished from the traditional indirect utility $V^i(w_i, Y)$ associated with U^i, which gives i's welfare when wage is w_i and i's *potential income* is Y. The difference is that, in the definition of ν, the sharing rule is implicitly taken into account; that is, the relationship between those functions is simply

$$\nu^1(w_1, w_2, y) = V^1(w_1, w_1 T + \varphi(w_1, w_2, y)) \tag{3a}$$

$$\nu^2(w_1, w_2, y) = V^2(w_2, w_2 T + y - \varphi(w_1, w_2, y)). \tag{3b}$$

From relations (1) and (3), we can deduce that

$$\nu^1_y = V^1_y \cdot \varphi_y = V^1_y \cdot \alpha, \tag{4a}$$

$$\nu^1_{w2} = V^1_y \cdot \varphi_{w2} = V^1_y \cdot \alpha A, \tag{4b}$$

$$\nu^1_{w1} = V^1_{w1} + V^1_y(T + \varphi_{w1}) = V^1_{w1} + V^1_y(T - \beta B). \tag{4c}$$

Since $L^1 = -(V^1_{w1}/V^1_y)$, equation (4c) gives

$$\nu^1_{w1} = V^1_y(T - L^1 - \beta B). \tag{4d}$$

Also, note that V^1_y (i.e., 1's marginal utility of his *own* income) is equal to λ, the Lagrange multiplier of the budget constraint in program

($\bar{\mathrm{P}}$). The economic interpretation is clear: the utility, for member 1, of an additional dollar received by the household is simply his marginal utility of income, multiplied by the share of the marginal dollar he will receive. In the same way, the marginal utility, for member 1, of member 2's wages is equal to his marginal utility of (own) income, multiplied by the increase in his income that results from the change in w_2. We can thus state the following formal result.

PROPOSITION 5. Let v^1 and v^2 be indirect utilities associated with L^1 and L^2. Then

$$v^1_{w1} = \lambda(T - L^1 - \beta B), \quad v^2_{w1} = \frac{\lambda}{\mu}\beta B, \tag{5a}$$

$$v^1_{w2} = \lambda\alpha A, \quad v^2_{w2} = \frac{\lambda}{\mu}(T - L^2 - \alpha A), \tag{5b}$$

$$v^1_y = \lambda\alpha, \quad v^2_y = \frac{\lambda}{\mu}\beta. \tag{5c}$$

Since v^1 and v^2 are defined up to composition by an increasing function, the partial derivatives are defined up to a multiplicative positive function (λ or λ/μ). Also, μ is the relative weight of members in the household decision process. In particular, the derivatives satisfy the following relationships:

$$\begin{aligned} v^1_y + \mu v^2_y &= \lambda, \\ v^1_{w1} + \mu v^2_{w1} &= \lambda(T - L^1), \\ v^1_{w2} + \mu v^2_{w2} &= \lambda(T - L^2). \end{aligned} \tag{6}$$

Relations (6) simply express the fact that, locally, program ($\bar{\mathrm{P}}$) is equivalent to the maximization of $U^1 + \mu U^2$ under the budget constraint. As a first consequence, we can deduce a collective counterpart of traditional Roy identities:

$$\begin{aligned} T - L^1 &= \frac{v^1_{w1} + \mu v^2_{w1}}{v^1_y + \mu v^2_y}, \\ T - L^2 &= \frac{v^1_{w2} + \mu v^2_{w2}}{v^1_y + \mu v^2_y}. \end{aligned} \tag{7}$$

Second, it can be noted that $v^1_y + \mu v^2_y$ is always positive; that is, an increase in nonlabor income unambiguously ameliorates the collective maximand. However, v^1_y (v^2_y) is positive if and only if α is positive (α is lower than one). Though this may seem a natural assumption, it is by no means implied by the collective setting; specifically, depending on L^1 and L^2, α might perfectly take values outside (0, 1). To see

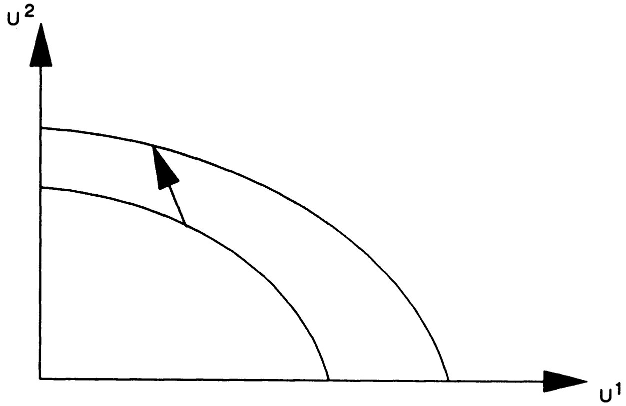

FIG. 2

why this is possible, consider figure 2, where axes represent utilities. Whenever y is increased, the Pareto frontier is translated to the northeast. It is then clear that, whatever collective index is maximized, the household will be better off in the sense defined by this index. This, however, does certainly not imply that *each* member will be better off. That is, the point chosen over the efficiency frontier may be moved as indicated in figure 2, where member 1's utility is *decreased* (of course, member 2's is increased). This illustrates the fact that an increase in nonlabor income (due to, say, higher benefits) might *lower* the welfare of one of the members. Also, the important point here is that one can directly check, from the sole knowledge of labor supplies, whether this is the case or not. Of course, the same argument exactly applies to wage increases as well.

A last consequence of equations (5) is that they allow one to recover indirect utilities from labor supplies. Since ν^1 and ν^2 are defined up to composition by an increasing function, we shall deduce the indifference surfaces of ν^i from labor supplies. Briefly, consider the equation

$$\nu^1(w_1, w_2, y) = K \Leftrightarrow y = \psi^K(w_1, w_2), \tag{8}$$

which defines the generic indifference surface. Then

$$\psi^K_{w1} = -\frac{\nu^1_{w1}}{\nu^1_y}, \quad \psi^K_{w2} = -\frac{\nu^1_{w2}}{\nu^1_y};$$

hence ψ^K must satisfy

$$\psi^K_{w1} = -\frac{1}{\alpha}(T - L^1 - \beta B), \quad \psi^K_{w2} = -A. \tag{9}$$

Here, L^1, α, β, A, and B can be expressed as functions of w_1, w_2, and $y = \psi^K(w_1, w_2)$; hence (9) provides a partial differential system, which can be integrated to give the ψ^K ($K \in \mathbb{R}$). Of course, K will be nothing else than the integration constant; the set of solutions of (9), indexed by this constant, is exactly the set of indifference surfaces. An example of a computation using a specific functional form is given below.

B. *Welfare Effects of Tax Reforms*

Let us go back to my initial question, that is, what are the effects of a reform that changes $\overline{w}$ into w'? There are four possible cases: (i) both v^1 and v^2 are increased, (ii) both v^1 and v^2 are decreased, (iii) v^1 is increased and v^2 is decreased, and (iv) v^1 is decreased and v^2 is increased.

The set of possible wage/income bundles, hence, will typically be partitioned into four areas corresponding to the various possible situations, in contrast to the traditional approach, characterized by two areas only. An illustration is given in figure 3 (under the assumption that only w_1 and w_2 are changed). These areas can be computed from labor supply functions, as indicated above; the frontiers are simply the indifference curves (or surfaces) of v^1 and v^2.

Finally, how can μ, the implicit weight of member 2, be recovered? First note that μ is defined only conditionally on a particular *cardinal* representation of preferences; that is, one must first choose two functions v^1 and v^2 (consistent with the ψ defined above). Now μ is simply defined by $\mu = (\beta/\alpha)(v_y^1/v_y^2)$. But, of course, this relation requires comparability of preferences across individuals; otherwise, μ is meaningless!

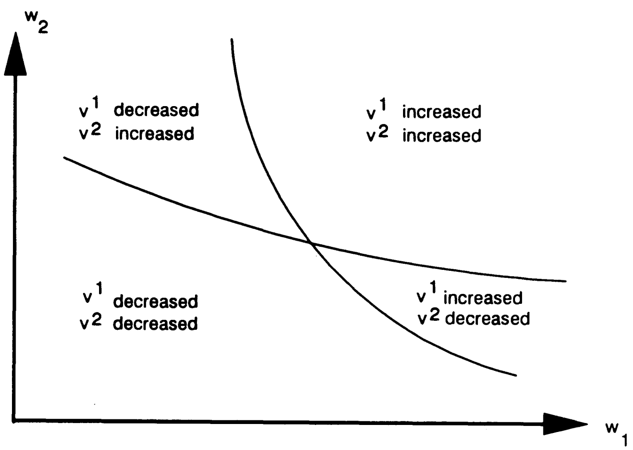

FIG. 3

C. An Application

The previous results can be illustrated using a particular functional form. Consider the following demand for leisure:

$$\begin{aligned} L^1 &= a_1 + b_1 y + c_1 y \log y + d_1^1 w_1 + d_1^2 w_2, \\ L^2 &= a_2 + b_2 y + c_2 y \log y + d_2^1 w_1 + d_2^2 w_2. \end{aligned} \tag{10}$$

These demands are linear, except for the Workin-Leser additional term y log y, which allows for flexibility in income (i.e., nonlinear Engel curves). Since $L^1_{w2} = d^2_1$ and $L^1_y = (b_1 + c_1) + c_1 \log y$, we get

$$A = d_1^2(b_1 + c_1 + c_1 \log y)^{-1}, \quad B = d_2^1(b_2 + c_2 + c_2 \log y)^{-1} \tag{11}$$

and

$$\begin{aligned} \alpha &= \frac{c_2}{c_2 b_1 - b_2 c_1}(b_1 + c_1 + c_1 \log y), \\ \beta &= \frac{c_1}{c_1 b_2 - b_1 c_2}(b_2 + c_2 + c_2 \log y). \end{aligned} \tag{12}$$

The signs of α and β depend not only on the signs but also on the respective magnitudes of the income terms b_i and c_i. It can be noted that, for y high enough, either α or β must be negative; a typical graph is presented in figure 4.

Conditions a and b of proposition 2 are always satisfied since α_{w2} is zero and αA is constant. Condition c gives

$$d_1^1 + \frac{c_1}{c_2} d_2^1 - \frac{D}{c_2}(T - L^1) \leq 0,$$

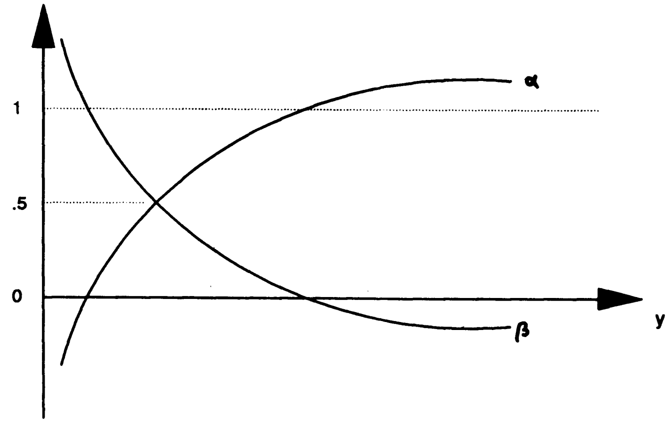

FIG. 4

and, in the same way, condition d gives

$$d_2^2 + \frac{c_2}{c_1} d_1^2 - \frac{D}{c_1}(T - L^2) \leq 0,$$

where $D = c_1 b_2 - b_1 c_2$.

Assuming that these conditions are satisfied, we can, first, derive the sharing rule. It is characterized by

$$\varphi_y = \alpha = \frac{c_2}{D}(b_1 + c_1 + c_1 \log y),$$

$$\varphi_{w2} = A\alpha = \frac{d_1^2 c_2}{D}, \tag{13}$$

$$\varphi_{w1} = -\beta B = -\frac{d_2^1 c_1}{D},$$

which gives

$$\varphi = \frac{c_2}{D}(b_1 y + c_1 y \log y) + \frac{d_1^2 c_2}{D} w_2 + \frac{d_2^1 c_1}{D} w_1 + k. \tag{14}$$

Also, we can recover the collective indirect utility ν^1; indeed, with previous notation, the generic indifference curve ψ satisfies

$$\psi_{w1} = -\frac{1}{\alpha}(T - L^1 - \beta B), \quad \psi_{w2} = -A.$$

Defining $\theta = b_1 \psi + c_1 \psi \log \psi$, we get

$$\theta_{w2} = -d_1^2$$

and

$$\theta_{w1} = \frac{D}{c_2}(-T + L^1 + \beta B)$$
$$= \frac{D}{c_2}\left(-T + a_1 + \theta + d_1^1 w_1 + d_1^2 w_2 - \frac{c_1 d_2^1}{D}\right).$$

Hence

$$\theta = K e^{D w_1 / c_2} - d_1^1 w_1 - d_1^2 w_2 + \gamma_1,$$

where K is the integration constant and

$$\gamma_1 = \frac{d_1^1 c_2 + d_2^1 c_1}{D} + T - a_1.$$

This leads to

$$v_1(w_1, w_2, y) = e^{-Dw_1/c_2}(-\gamma_1 + b_1 y + c_1 y \log y + d_1^1 w_1 + d_1^2 w_2) \quad (15)$$

and, by symmetry,

$$v_2(w_1, w_2, y) = e^{-Dw_2/c_1}(-\gamma_2 + b_2 y + c_2 y \log y + d_2^1 w_1 + d_2^2 w_2).$$

Finally, for these particular indirect utilities, the reader may check that

$$\mu = \frac{\alpha}{\beta} \cdot \frac{v^1}{v^2} = \left(\frac{c_1}{c_2}\right)^2 \exp D\left(\frac{w_2}{c_1} - \frac{w_1}{c_2}\right). \quad (16)$$

Note that μ is always nonnegative.

In words, the labor supply function defined by equation (14) can be derived from the maximization of the (household) welfare index

$$U^1(L^1, C^1) + \left(\frac{c_1}{c_2}\right)^2 \exp D\left(\frac{w_2}{c_1} - \frac{w_1}{c_2}\right) U^2(L^2, C^2),$$

where U^i is the corresponding direct utility. Also, *traditional* indirect utilities can easily be derived from the previous results. Just note that

$$v^1(w_1, w_2, y) = e^{-Dw_1/c_2}\frac{D}{c_2}\left[(\varphi + w_1 T) - w_1 T + \gamma\left(1 - \frac{c_2}{D}\right) - T + a_1\right].$$

Hence, for $Y = w_1 T + \varphi$,

$$V^1(w_1, Y) = D_1 e^{-Dw_1/c_2}(Y - w_1 T + \gamma_1'), \quad (17)$$

with obvious notation. Direct utilities can readily be recovered from (17).

VI. Further Specifications of the Decision Process

A. *Collective Neoclassical Labor Supply*

Though the collective approach provides an alternative framework, it is by no means incompatible with the traditional setting. In fact, an interesting situation obtains when both representations are simultaneously fulfilled. Assume, for instance, that the household behavior can be represented by the maximization, under the budget constraint, of a (unique) utility function of the form $W[U^1(L^1, C^1), U^2(L^2, C^2)]$. Of course, the neoclassical hypotheses are satisfied since a unique index is maximized. On the other hand, it is well known that, for any given pair of individual utility functions (U^1, U^2), the maximization of a Bergsonian index $W[U^1, U^2]$ will always lead to Pareto-efficient decisions. Hence the collective assumptions are verified as well. How can the corresponding labor supply functions be characterized? And how can preferences be recovered?

It should be noted that the answers to these questions cannot be immediately derived from traditional results. On the one hand, the collective index W must be separable in (L^1, C^1) and (L^2, C^2). Should private consumptions be observable, this would simply imply, in addition to Slutsky conditions, that Gorman's separability conditions are satisfied. But here, C^1 and C^2 are not observed; moreover, the two corresponding prices are always equal. For these two reasons, Gorman's conditions cannot be used directly. Hence it is not clear, from a traditional point of view, which conditions on L^1 and L^2 *alone* are necessary or sufficient for the existence of such a "collective neoclassical utility."

A complete answer can nevertheless be deduced from the previous results. Let Π denote the following program:

$$\begin{gathered} \max W[U^1(L^1, C^1), U^2(L^2, C^2)] \\ \text{subject to } w_1 L^1 + w_2 L^2 + C^1 + C^2 = (w_1 + w_2)T + y. \end{gathered} \tag{Π}$$

PROPOSITION 6. Let L^1 and L^2 be arbitrary C^2 functions of w_1, w_2, and y. The following conditions are necessary and sufficient for the existence of functions C^1, C^2, U^1, U^2, and W such that L^1 and L^2 are solutions of (Π): (i) conditions *a–d* of proposition 2 and (ii) the Slutsky conditions

$$\begin{aligned} &L^1_{w2} - (T - L^2)L^1_y = L^2_{w1} - (T - L^1)L^2_y, \\ &L^1_{w1} - (T - L^1)L^1_y \leq 0, \\ &L^2_{w2} - (T - L^2)L^2_y \leq 0. \end{aligned}$$

Proof. See Chiappori (1989).

Proposition 6 clearly shows the key role of the separability assumption that is implicit in the collective setting. We have seen in Section I that the neoclassical framework is not sufficient for the derivation of C^1 and C^2. However, under the additional restriction that household preferences should be separable in individual welfares, C^1 and C^2 can be identified up to a constant, and individual as well as household utilities can be recovered. In particular, we get, as a corollary of this proposition, a result that has been known for some time within the "assignability" literature (see Deaton et al. 1989), namely, that individual consumptions can be recovered provided that preferences exhibit some adequate separability properties.

COROLLARY. Assume that the household maximizes a unique utility function that is separable in individual consumption/labor supply bundles. Then individual consumptions can be assigned up to an additive constant.

Also, it should be noted that this "collective utility" case is highly particular within the collective framework developed above. The existence of a (fixed) household utility function is by no means an innocuous assumption; on the contrary, it entails strong additional restrictions on the form of labor supply. For example, it is easy to exhibit functional forms of labor supply that are compatible with the collective setting, but not with the Slutsky conditions. It can thus be argued that, while the traditional model is not restrictive enough, that model plus separability may be unnecessarily restrictive (when compared with the collective approach). Slutsky restrictions are not necessary, whether for recovering income sharing rules or for welfare purposes.

B. Bargaining Approaches

A second particular case of the general framework developed above is the cooperative game theory approach, initiated by Manser and Brown (1980) and McElroy and Horney (1981). The basic idea is to place the household decision problem into a bargaining framework and then to use some cooperative equilibrium concept (e.g., Nash bargaining). Specifically, one must first define, for each agent i, a "threat point" $\overline{U}^i$, corresponding to the minimum level of welfare the agent can obtain "if no collective agreement is reached." Then, for any given wage/income combination, the outcome of the decision process is supposed to maximize the product $(U^1 - \overline{U}^1)(U^2 - \overline{U}^2)$ under the budget constraint; hence, collective labor supply will be the solution of the Nash bargaining program:

$$\begin{aligned} &\max\,[U^1(L^1, C^1) - \overline{U}^1][U^2(L^2, C^2) - \overline{U}^2] \\ &\text{subject to } w_1 L^1 + w_2 L^2 + C^1 + C^2 \leq (w_1 + w_2)T + y. \end{aligned} \tag{NB}$$

Of course, any solution of this program is Pareto efficient; hence, it is a particular case of $(\overline{\text{P}})$. An interesting question, however, is whether (NB) provides restrictions on labor supplies that go beyond those given in proposition 2, that is, whether the Nash bargaining assumption brings additional structure to the general setting we have just developed. The answer is not immediate, because a program like (NB) entails several degrees of freedom, described as follows.

1. We must define the threat points $\overline{U}^i$. The question here is what is exactly meant by the expression "if no collective agreement is

reached." Some authors (Ulph 1988; Woolley 1988) have suggested that threat points should be identified with the (assumed unique) *noncooperative* Nash equilibrium of the game; intuitively, if the players cannot agree, they will skip to a noncooperative kind of behavior, with Nash equilibria as natural outcomes. This idea leads to a kind of two-stage process: the household first computes the noncooperative utility levels and then uses them as status quo points for deriving the Nash-bargained outcomes. Whether this setting leads to restrictions on labor supplies, however, is an open question.

On the contrary, McElroy and Horney (1981) argue that threat points must be understood as individual utility levels when divorce is involved. Specifically, if agent i's wage (nonlabor income) when divorced is w_i (y_i), then $\overline{U}^i = V^i(w_i, y_i)$, where V^i is i's indirect utility function. Two ambiguous points, however, remain. First, should we take V^i as the indirect utility function that corresponds to i's direct, "egoistic" utility when married, U^i? In this case, we must assume that preferences (say, the marginal rate of substitution between leisure and consumption) are not affected by the marital status, a rather strong hypothesis. Conversely, if preferences are allowed to depend on the marital status, then the *simultaneous* estimation of the U's and the V's may be difficult. Second, we must be able to observe the way in which household nonlabor income would be split between the members in case of divorce; again, this will turn out to be a difficult task and may require ad hoc assumptions on the divorce procedure.

2. We must choose a particular *cardinal* representation of preferences. It must be remembered, indeed, that Nash bargaining requires cardinality, since composing utility functions, threat points, or both by an arbitrary monotonic mapping modifies the solution of (NB). This point may, in particular, raise some problems when one is trying to independently estimate preferences or threat points (see n. 10 below).

Of course, the choice between these alternative options will crucially affect the structure of the model. The simplest way, here, is probably to assume that preferences do not depend on marital status. In that case, the Nash-bargained decision must be a solution of the following program:

$$\max\, [U^1(L^1, C^1) - V^1(w_1, y_1)][U^2(L^2, C^2) - V^2(w_2, y_2)]$$

$$\text{subject to}\; w_1L^1 = w_2L^2 + C^1 + C^2 \leq (w_1 + w_2)T + y_1 + y_2 \quad (\text{NB}')$$

for some particular cardinal representation of preferences for the agents. This, in turn, leads to the following formally well-defined problem: Given any pair (L^1, L^2) of labor supply functions that satisfy the conditions of proposition 2, is it possible to find a particular cardinal representation of preferences, such that $(L^1(w_1, w_2, y), L^2(w_1, w_2, y))$ is a solution of (NB′) for all w_1, w_2, and y (where $y = y_1 + y_2$)? Should the answer be negative, then the Nash bargaining framework (or, more precisely, the simplified version defined by the assumptions above) would actually introduce additional structure within the general model presented here. My conjecture is that this is the case. However, no formal proof has been provided so far; this must be the topic of further research. Also, the additional conditions, even if they exist, may be extremely difficult to derive formally, as suggested by the failure of most previous attempts.

Finally, we may broaden the set of assumptions by allowing for altruistic preferences or for dependence of preferences to marital status. This line has been followed, for instance, by McElroy and Horney's (1981) model; however, this (very general) framework does not seem restrictive enough to provide tractable restrictions, at least in the simple framework investigated here.[10]

Even if *formal* conditions may be difficult to derive, the bargaining approach may, however, suggest several intuitive conclusions that, in some cases, lead to empirical tests. As an illustration, consider the way in which the sharing rule φ is affected by a change in the wage of one of the members. Assume, for instance, that member 2's wage is increased. How should member 1's share φ of nonlabor income be modified? One may, at this point, interpret the sharing process in two opposite ways. A first interpretation would emphasize the "redistribution" purpose: transfers occur to compensate inequalities in wage incomes within the household. In that case, an increase in w_2 ameliorates member 2's situation and hence reduces the need for a compensating transfer in his favor; a consequence is that φ should *increase*. The alternative interpretation, based on the general idea of a bargaining process, leads to an inverse conclusion. An increase in

[10] From McElroy and Horney's (1981) approach, it is simply not possible to derive falsifiable restrictions on demand functions; a detailed analysis appears in Chiappori (1988*a*) (see also Chiappori [1990] for a more formal argument). It has been recently suggested, in particular by McElroy (1992) and McElroy and Horney (1992), that restrictions could be deduced from a bargaining model with "egoistic" agents (plus a collective good) by the following trick: Estimate indirect utilities when divorced from a distinct sample of divorced individuals. Then compute accordingly threat points for married couples and estimate the whole bargaining model. However, a number of difficulties still have to be solved. Selectivity bias can be difficult to correct and is likely to require an explicit model of household formation. Also, whether preferences are allowed to depend on marital status clearly becomes an essential issue (if they are, preferences when married may be difficult to recover). Finally, the Nash bargaining equilibrium concept may turn out to be inadequate for this approach. The reason is that it requires a *cardinal* representation of preferences that is difficult to obtain by independent estimation on a sample of divorced individuals (such an estimation will typically provide [at best] an ordinal representation).

w_2 ameliorates member 2's bargaining strength since he would probably be better off than before in case of divorce; technically, member 2's threat point, whatever its precise definition, is likely to increase with w_2. In this case, member 2 will be able to recover a larger share of nonlabor income, and φ should consequently *decrease*. In other words, the "compensating transfer" story suggests the following properties for φ: $\varphi_{w2} = \alpha A > 0$ and $\varphi_{w1} = -\beta B < 0$, whereas bargaining ideas lead to $\varphi_{w2} = \alpha A < 0$ and $\varphi_{w1} = -\beta B > 0$.

Again, it can be stressed that both hypotheses can be tested from the knowledge of labor supplies. In particular, the choice of the appropriate theoretical structure (e.g., Nash bargaining vs. redistribution) could be guided by a preliminary estimation of the general Pareto model, which would allow one to check whether the bargaining conditions above are indeed satisfied. In the same line, the Pareto model can provide a useful framework for testing more specific approaches (such as bargaining models) since the former encompasses the latter.

VII. Extensions

A. *Caring*

Agents have been modeled so far as egoistic, in the sense that each agent's utility depends only on his own consumption and labor supply. This assumption, however, is quite restrictive; in particular, the egoistic model provides little rationale for household formation (or dissolution). It is thus important to stress that *egoistic preferences are not necessary for the previous results to hold true.* Specifically, caring (à la Becker) can be introduced without fundamentally altering the conclusions of the model. To see why, assume that member i actually maximizes some "altruistic" index $W^i[U^1(L^1, C^1), U^2(L^2, C^2)]$ that depends on both his own direct, "egoistic" utility and his spouse's; W^i is continuous, increasing, and quasi-concave. Now, a fundamental remark is that *any decision that is Pareto efficient within this new setting would be Pareto efficient as well, were the agents egoistic.* Indeed, any change that ameliorates U^1 without decreasing U^2 would strictly increase both W^1 and W^2; hence such a change is not possible if the starting point is already efficient for the W. It can readily be shown that the locus of Pareto-efficient decisions for altruistic agents is a connected subset of the Pareto frontier $\mathcal{P}$ derived from egoistic preferences. Specifically, the egoistically efficient outcomes that are efficient for the W as well lie on $\mathcal{P}$ between the members' best choices under caring (fig. 5). In other words, the basic conclusions above (with the possible exception of corner solutions) still apply when caring is introduced. Note that

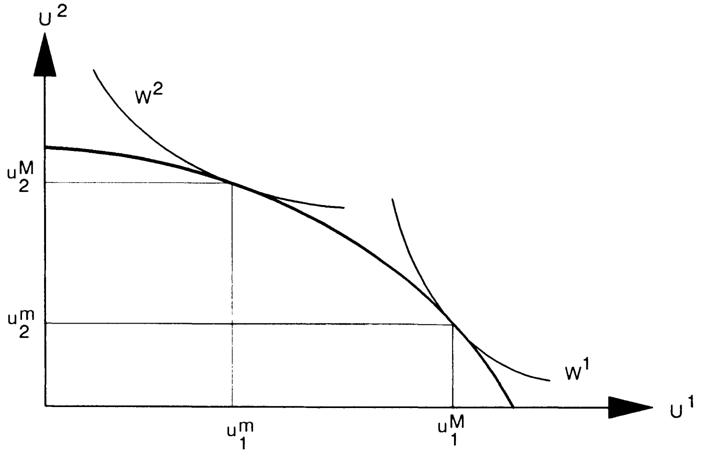

FIG. 5

this property is due to the Pareto hypothesis; specifically, it holds true because we consider the whole Pareto frontier (rather than any particular point on it). It would not obtain, for instance, within any of the bargaining frameworks discussed in Section VI.

This conclusion is not really surprising. As it may have become clear from the remarks above, the important property of this setting, from which most of the results derive, is the separability of the welfare indexes in (L^1, C^1) on the one hand and (L^2, C^2) on the other hand. However, though this property does not seem exceedingly restrictive, it is certainly not an innocuous assumption. Typically, my marginal rate of substitution between leisure and consumption may depend on my wife's free time. Hence, the most general form for individual utilities should be $U^i(L^1, C^1, L^2, C^2)$. The problem, however, is that such a structure might well not be restrictive at all.[11] And, of course, no uniqueness conclusion can be expected to hold in this case. So the cost of introducing this general form of altruism may be very high, in terms of predictive power of the model.

B. *Many Consumption Goods, Public Consumption, and So Forth*

A natural extension of the model would be to assume that there are n consumption goods in the economy; the more general hypothesis is

[11] In fact, it is possible to derive nonparametric restrictions characterizing labor supplies in that case (Chiappori 1988*b*). Conversely, it can be shown that, whenever one of the spouses is assumed not to work, any finite set of data on labor supply is compatible with this setting (Chiappori 1990).

that, for each of them, only aggregate consumption can be observed. Sticking to the cross-sectional interpretation mentioned above, we would be interested, in that case, in deriving the way in which *each member's* consumption of each good depends on wages and nonlabor income. This will be the topic of further research; I conjecture, however, that such a derivation is possible in general.

An analogous, but in a sense opposite, extension would be to distinguish between various kinds of income; this will be the case, for instance, if a part y_1 of nonlabor income y is directly given to member 1, who can spend it at his own will (we may think of family benefits received by the wife, personal wealth, etc.). For instance, several contributions (e.g., McElroy 1990; Thomas 1992) have tested the "income pooling" hypothesis (only total nonlabor income may matter) that is implied by the traditional approach. In the framework of this paper, the sharing rule φ will depend on four arguments, namely, w_1, w_2, y_1, and $y_1' = y - y_1$. It can be shown that this additional component will generate additional testable conditions on labor supplies; again, a detailed exposition appears in Chiappori (1989). In other words, the model presented here can perfectly encompass such empirical facts as differential effects of each spouse's own income on behavior. Moreover, it allows one to derive additional conditions that characterize this situation and leads to immediate econometric tests. This is done in particular by Bourguignon et al. (1992).

Finally, the framework has to be extended to take into account the existence of collective consumption within the household. This task may require specific assumptions, for example, that each member's preferences are additively separable with respect to the collective goods. This aspect is of special interest since it would allow one to introduce children's expenditures within the model, provided that one is ready to assume that children's consumption can be modeled as a public good for parents' preferences.

VIII. Conclusions

The main conclusions of the paper can be summarized as follows. First, if we model the household as a pair of individuals characterized by a particular utility function of their leisure and consumption or, alternatively, an altruistic index of the "caring" type, then Pareto efficiency alone generates a set of testable restrictions on labor supplies, which are independent of (though not incompatible with) the traditional conditions. Second, in sharp contrast to the traditional approach, this collective setting allows one to "assign" private consumptions, as well as to recover individual welfare functions. In particular, it is possible to deduce, from the shape of labor supply functions, the income sharing rule within the household. Hence, the field open to normative judgment is no longer limited to the interhousehold distribution of welfare; the issue of intrahousehold allocation can be considered as well. The collective approach seems especially adequate for analyzing the effects of particular policies (e.g., tax-benefit systems) on *individual* poverty or inequality. Of course, the value judgments implied by such concepts cannot stop one from facing the difficulties due to the collective nature of the situation. For instance, a reform may increase a member's well-being at the expense of the other's, so that the consequence on social welfare is not straightforward. The collective approach, however, enables one to weight individual utilities differently from what is implicit in the household decision process instead of assuming that the latter is always socially optimal.

The basic framework can be extended in several ways, such as several goods or several sources of income. Of course, numerous questions deserve further work. Collective conditions must be empirically tested against neoclassical ones; this will be the topic of forthcoming research. From a purely theoretical viewpoint, the problems linked with the multiplicity of consumption goods can be investigated. Of special interest is the introduction of collective goods or, on the contrary, of specific commodities that can be consumed only by one of the members. Also, "corner" solutions, such as nonparticipation, need to be analyzed, and domestic labor supply should be considered as well. Finally, the collective approach should not be limited to labor supply. In the spirit of the model above, Bourguignon et al. (1992) investigate the differential effects of individual incomes on household consumption. They find that, while the traditional approach (and specifically the "income pooling" property) is strongly rejected, the restrictions implied by the collective framework are compatible with the data (a general survey of this line of research can be found in Bourguignon and Chiappori [1992]). Hence, the collective approach should be viewed as a general research program, in which most of the work still has to be done.

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