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Collective Models of Household Behavior

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An introduction

François Bourguignon and Pierre-André Chiappori

DELTA, Joint Research Unit CNRS-ENS-EHESS, Paris 75014, France

1. Introduction

Micro-economic theory essentially considers the household as the basic decision unit. The usual tools of consumer theory are applied at the household level; in particular, the latter is described by a single utility function which is maximized under a budget constraint. This 'traditional' framework, however, has recently been challenged by several authors, who have developed so-called 'collective' approaches to household behavior.[1] The various contributions that follow the collective line share a fundamental option, namely that a household should be described as a group of individuals, each of whom is characterized by particular preferences, and among whom a collective decision process takes place. The first goal of this paper is to discuss some basic methodological issues involved in the collective approaches. A second goal is to review a particular class of collective models, based upon a Pareto efficiency hypothesis, that have recently been developed.

2. Models of household behavior: some methodological issues

2.1. 'Collective' vs. 'traditional' approaches

Attractive and convenient as it may be, the single utility framework has several shortcomings. A first weakness is methodological: the traditional

[1]Among early contributors, one can mention Apps (1981, 1982), Apps and Jones (1986) and Chiappori (1989, 1991), who introduced cooperative models, while Ashworth and Ulph (1981), Bourguignon (1985), Ulph (1987), Kapteyn and Kooreman (1990) refer to non-cooperative game theory, and Kooreman (1991) simultaneously considers both settings. Also, Manser and Brown (1980), McElroy and Horney (1981, 1990) and more recently Haddad and Kanbur (1989, 1990) have developed models based upon bargaining theory.

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approach simply falls short of meeting the basic rule of neo-classical micro-economic analysis, namely *individualism*, which obviously requires each individual to be characterized by his (her) own preferences, rather than being aggregated within the ad-hoc fiction of a collective decision unit.[2] A consequence is that the single utility approach is quite inadequate for the study of such demographic problems as marriage or divorce. Before household formation (or after dissolution), individuals are represented by distinct preferences. Marriage essentially merges the latter into the black box of an household utility function, but little – if anything – is said upon the underlying 'aggregation' process; as a result, it is hardly possible to relate household preferences to each agent's initial tastes.

A second shortcoming concerns the analysis of *intra-household allocation* (of consumption, wealth, or welfare). In the traditional line, such issues are simply ignored. Here, the problems with the single utility approach are twofold. Conceptually, the very notion of *individual welfare* is in contradiction with this setting, since welfare can only be defined at the (aggregate) household level. Technically, though *individual consumptions* could in principle be considered, the theory will typically face a *non-assignability* problem: most data sets contain information upon aggregate household consumption only, while one would also be interested in individual consumptions within the household. Can the latter be *deduced* from the available information, using adequate theoretical assumptions? It can actually be shown that traditional models perform quite poorly in this respect, while collective approaches may be more adequate.[3]

2.2. *What should we require from a collective theory of household behavior?*

The previous arguments emphasize the need for an alternative approach,

[2]Among the attempts to reconciliate the single utility approach with individualism are Samuelson's household welfare index (taken to be a fixed function of the members' utilities), and Becker's 'rotten kid' theorem [see Becker (1981)]. The first solution, however, relies upon a very restrictive ad hoc assumption, namely that the household decision process (as represented, for instance, by the respective weights within the collective index) does not depend on the economic environment, and especially on prices, wages and incomes. For a discussion of Becker's contribution, see Chiappori (1991).

[3]See for instance Chiappori (1991) for an elaboration of this point, and Deaton, Ruiz-Castillo and Thomas (1989) for an estimation in the 'traditional' framework. As a matter of fact, scientific curiosity is not the only motivation for analyzing intra-household decision processes; welfare considerations may also matter. When considering, for instance, policy issues involving individual welfare (such as the design of taxation or benefit schemes), taking into account intra-household inequality might well significantly alter a number of normative recommendations provided by the traditional approach. An illustration of this claim is provided by the Haddad and Kanbur paper in this issue; see also the discussion in Apps (1991).

that takes into account the collective aspects of household decision processes. This, of course, does not mean that *any* model based upon a collective representation will do. On the contrary, a collective theoretical framework will not be acceptable unless it satisfies some basic requirements.

Specifically, the role of any theory of household behavior, whatever its precise content, is twofold:

(i) it generates *testable restrictions*, that can be used both to facilitate empirical estimation, and to check ex post the adequacy of the theory to observed behavior.
(ii) it allows to *recover 'structural' components* (such as preferences) from observed behavior, hence suggests interpretations for empirical results and provides a formal basis for normative recommendations.

In the traditional approach, for instance, demand functions must satisfy homogeneity, Walras law and Slutsky equations (or revealed preferences restrictions). Moreover, integrability results state that from any system of demand functions fulfilling these conditions, it is possible to recover (at least locally) the agent's preferences, the corresponding utility function being *uniquely defined* up to an increasing mapping. The latter property guarantees that normative conclusions can be drawn in an unambiguous way, provided that we accept the underlying theoretical framework; and a good reason for such an acceptation can be that the testable restrictions implied by the theory turn out to be empirically fulfilled.

A 'good' collective theory of household behavior, hence, must both generate falsifiable restrictions (*testability* requirement) and allow to uniquely recover the members' preferences and the decision process (*integrability* requirement). Lastly, in addition to these 'traditional' requirements, the collective approach should help solving the assignability problem described above.

3. 'Collective' decision processes: a general framework

In order to discuss in more detail the properties of a collective approach, it is useful to define a general framework within which the above issues can be conveniently addressed.

3.1. Preferences and consumption bundles

We consider a household of two members, A and B, with respective preferences U^A and U^B. The household can consume $n+N$ goods, among which n are consumed privately by each member, whereas N are public goods for the household; let $x^A=(x_1^A,\ldots,x_n^A)$, $x^B=(x_1^B,\ldots,x_n^B)$ denote the respective private consumption bundles of A and B, and $X=(X_1,\ldots,X_N)$ the household consumption of public goods. Hence, U^A and U^B can be written respectively $U^A(x^A,X)$ *and* $U^B(x^B,X)$. A polar case, considered for instance by Chiappori (1991), is $N=0$; all goods are privately consumed, and preferences are said to be *egoistic*. At the other extreme, we might assume, as in McElroy and Horney (1981), that all consumptions of any member do enter both members' utility function; then the preferences will be said *altruistic*,[4] and take the form

$$U^A(x^A,x^B,X),U^B(x^A,x^B,X).$$

An intermediate case of interest is Becker's notion of *caring*. Here, each member is assumed to maximize a welfare index that depends on both his (her) own 'egoistic' utility and his (her) companion's; technically, the preferences are of the form $W^A[U^A(x^A,X),U^B(x^B,X)]$, $W^B[U^A(x^A,X),U^B(x^B,X)]$. Note that this form is less general than the altruistic one, since it exhibits a *separability* property. The latter will be shown to play an important role in deriving the properties of the models.

If $p\in R^n$ (resp. $P\in R^N$) is the price vector for the private (resp. public) goods, and y denotes the household's total income, the overall budget constraint is $p\cdot(x^A+x^B)+P\cdot X=y$. In some cases, each member's income y^X $(X=A,B)$ can be independently observed; then $y=y^A+y^B$.

A last distinction that is relevant for private consumptions is between *exclusive*, *assignable*, and *non-assignable* goods. A good is exclusive when it is consumed by one member only; a typical example is labor supply (or leisure), at least insofar as it is not a public good for the household. A non-exclusive good is assignable when each member's consumption can be observed independently; it is non-assignable otherwise. As we shall see later, the existence of either an assignable good or a pair of exclusive goods will be crucial for the integrability properties of the models.

3.2. The decision process

The next step is to define the assumptions made on the decision process. A

[4]Of course, the altruistic setting is the most general one; the price to pay for this generality being, unsurprisingly, that it is less testable, and that the uniqueness of the structural model underlying a given demand function is more difficult to guarantee. For a detailed discussion, see Chiappori (1988, 1991).

first and basic distinction is between *cooperative* and *non-cooperative* settings. The procedure will be said cooperative if it is such that only Pareto efficient outcomes can be reached. On the contrary, some works adopt a non-cooperative framework, in which the process is described as a game between the participants; in the latter case, efficiency may – and in most cases will – not obtain.

Within the class of cooperative models, a particular subclass that has been considered by a number of authors relies upon equilibrium concepts borrowed from cooperative game theory, and especially Nash bargaining. The first step is to define for each member a 'reservation utility' or 'threat point' $\phi^X(p, P, y^X)$ (where $X = A, B$), representing the minimum welfare level X could obtain in any case (and especially if no collective agreement could be reached); of course, this will depend on the economic environment, i.e., prices (including wages) and incomes. Then the surplus arising from cooperation is shared geometrically between the members; i.e., the household maximizes $[U^A - \phi^A] \cdot [U^B - \phi^B]$ under a budget constraint. Clearly, the outcome of such a process will be Pareto efficient; but whether the converse is true (or whether, on the contrary, the Nash-bargaining assumption impose additional restrictions upon behavior as compared to the sole efficiency hypothesis) is still not clear, and may depend on the particular model at stake.[5]

An appealing property of cooperative models, whatever the particular formulation, is the *income sharing rule* interpretation. Assume, for simplicity, that all goods are private. Then any efficient decision process can be interpreted as follows [Chiappori (1988), and Bourguignon, Browning, Chiappori and Lechène (1991)]. Agents first allocate total income between them, according to some sharing rule θ which may depend on prices and income (say, A receives $\theta(p, y)$, B receives $y - \theta(p, y)$). Then each agent maximizes his (her) utility, subject to the budget constraint thus defined. There is a one-to-one correspondence between the decision process and the sharing rule; also, the sharing rule is an ordinal concept, i.e., it is defined independently of the cardinal representation of preferences.[6]

[5]An important issue is the choice of threat points; should one take utilities when divorced, as in McElroy (1990), or rather non-cooperative equilibrium within the household, as argued by Ulph (1989) in line with several models in international economics. In both cases, simultaneous estimation of preferences *and* threat points from data on married couples may be quite difficult (at the present stage, whether it is simply possible is not known), while independent estimation of threat points (e.g., on a sample of divorced individuals) raises delicate problems of cardinality [see Chiappori (1991)].

[6]This result can be extended to 'caring' utilities (i.e., $W^A[U^A(x^A, X), U^B(x^B, X)]$, $W^B[U^A(x^A, X), U^B(x^B, X)]$), since any allocation that is efficient for W^A and W^B is also efficient for U^A and U^B. Also, in the presence of public goods, the sharing approach must be defined *conditionally* on the level of public expenditures [see Bourguignon, Browning, Chiappori and Lechène (1991) for a precise statement].

3.3. Testability and integrability

As we argued above, a natural requisite is that the collective theories that we want to develop must have two basic properties. They must, on the one hand, be testable, i.e., imply some consequences that can potentially be falsified by empirical results; and, on the other hand, they must enable to uniquely recover preferences and decision processes from the available observations on agents' behavior. We may briefly discuss these two requirements.

On the one hand, there seems to be some confusion about the exact sense of the testability criteria. It has sometimes been argued that the collective approach (and, more specifically, Nash bargaining models) could be tested *against* the traditional setting by investigating whether some conditions, that were implied by the traditional framework but not by the collective one, turned out to be empirically fulfilled. For instance, it is well known that the single utility approach implies income pooling: only total income, and not income composition, may matter. Empirical evidence against these properties have thus been interpreted, on some occasions, as supporting the collective approach in general, and, even worse, particular collective model. This is a clear mistake. While any evidence against income pooling falsifies the traditional approach, it certainly does *not* support any alternative model in particular. There are certainly hundreds of ad hoc assumptions that could explain the observed results within the traditional approach, and thousands of more or less funny alternative models that could justify them outside it. The only way to empirically support the collective setting is to derive, *from the particular model under consideration*, conditions that can potentially be, but are actually not falsified by empirical observation. This requirement should be kept in mind when constructing the model.

Integrability, on the other hand, requires that one and only one structural model can be associated to the reduced form (i.e., demand functions) that is empirically estimated. An immediate consequence is that the structural model must be *identifiable* in the usual econometric sense. It must however be stressed that *integrability is a much stronger requirement than identifiability.* Indeed, identifiability means that, given the initial functional form, the parameters can uniquely be recovered. It could however be the case that two functionally different structural models (i.e., with different functional forms for utilities, decision rules, or both) lead to the same functional form for demands, as illustrated by the following example. Take a two members household, and assume there are two public goods; the model simply assume that the household maximizes $\lambda U^A + (1-\lambda) U^B$, where

$$U^A = \alpha \ln X_1 + (1-\alpha) \ln X_2, \qquad U^B = \beta \ln X_1 + (1-\beta) \ln X_2,$$

and

$$\lambda = \lambda_1 \frac{p_1}{y} + \lambda_2 \frac{p_2}{y}.$$

The resolution of this program gives the following demand function for good 1 (consumption of good 2 being then derived from the budget constraint):

$$p_1 . x_1 = \beta y + (\alpha - \beta)\lambda_1 p_1 + (\alpha - \beta)\lambda_2 p_2.$$

Assume, furthermore, that we have some additional information (say, α is known); then the initial model is *exactly* identified. However, any conclusion drawn from the estimation of the demand function above is highly suspect, because *the integrability condition is not satisfied.* Indeed, assume, rather, that

$$U^A = \alpha \ln(X_1 - \gamma_1) + (1-\alpha)\ln(X_2 - \gamma_2),$$

$$U^B = \beta \ln(X_1 - \gamma_1) + (1-\beta)\ln(X_2 - \gamma_2),$$

and

$$\lambda = \textit{constant};$$

then the demand function is:

$$p_1 . x_1 = [\lambda\alpha + (1-\lambda)\beta] y + \gamma_1[1 - \lambda\alpha - (1-\lambda)\beta] p_1 + \gamma_2[\lambda\alpha + (1-\lambda)\beta] p_2.$$

Thus we get an identical functional form for demand, though the structural model (hence the interpretation) is totally different. Such a situation is ruled out in the traditional setting because we have strong integrability results; but in other frameworks, a preliminary and careful investigation of the theoretical properties of the model is strongly recommended!

4. The efficiency approach: recent results

In this section, we finally review results that have recently been obtained in the collective line. Interestingly enough, they are based upon the sole efficiency hypothesis; i.e., no assumption is made upon the decision process besides the fact that it always generates outcomes located on the Pareto frontier.

In what follows, we consider cross-sectional data; as a consequence, prices are assumed identical for all households, while wages and non-labor income vary across households. Also, utilities are either of the egoistic or of the caring type; and we assume for the moment that all goods are private. Two classes of models are considered. In the first category, each member's labor supply is supposed to be freely chosen and observable; in the previous terminology, each spouse's labor supply is an exclusive good. This setting has been considered by Chiappori (1988, 1991) and can be extended to the case of several consumption goods. Models of the second category suppose, on the contrary, that each member's income is exogenous, for instance because working time is fixed by demand constraints (which requires, in particular, considering a subsample of households in which both spouses work full time). They have been analyzed by Bourguignon, Browning, Chiappori and Lechène (1991a, b).

4.1. *Models of labour supply*

We first consider the simplest model of labor supply, with a single (aggregate) consumption good. Under the assumptions stated above, the following results can be proved:

(i) testable restrictions upon labor supply function can be derived, from both the parametric (partial differential equations) and non-parametric ('revealed preferences' types of conditions) viewpoints,
(ii) the sharing rule can be recovered from labor supplies up to an additive constraint. Each member's utility can also be recovered, up to the same additive constraint.

The results can be extended to the case of several consumption goods. Each of those generate additional restrictions that can be empirically tested. In addition, for non-assignable goods, individual consumptions can be recovered up to a constant.

Lastly, what can be said if preferences are supposed to be altruistic in the sense defined previously? The answer essentially depends on the number of goods. Chiappori (1990) shows that for a two-member household with only one positive labor supply and one consumption good, *any* finite set of data on labor supply can be exactly rationalized by adequately defined preferences, even if the sharing rule is assumed to be known ex ante. Conversely, with two labor supplies, non-parametric restrictions can be derived (Chiappori 1988); whether parametric restrictions can be obtained in more general settings (e.g., several goods) is not known, though we conjecture that the answer is positive.

4.2. *Consumption models with exogenous incomes*

We now consider consumption models. For simplicity, we assume that there are only two sources of (exogenous) income, y^A and y^B. In the single utility framework, only $y = y^A + y^B$ should matter, a property that can be used for empirical tests.[7] In contrast, within the collective framework:

(i) consumption may depend independently on y^A and y^B
(ii) testable implications can be derived
(iii) the sharing rule can be recovered up to an increasing transformation, provided that one member's private consumption of one good can be observed. If a private consumption can be observed for both members (an assignable good, or two exclusive goods), the sharing rule can be recovered up to a constant. In the latter case, individual consumptions can also be recovered (up to a constant) for non-assignable goods.

5. Conclusion

The collective approach described above is still in a preliminary stage. Several theoretical issues remain unsolved; and the empirical work only begins.[8] We however believe that it constitutes a coherent and promising research program, which is likely to be pursued in the forthcoming years.

[7]For an example of such tests, see for instance Thomas (1990, 1991).

[8]Bourguignon, Browning, Chiappori and Lechène (1991) provide preliminary estimates of the consumption model on French data, while Bourguignon, Browning, Chiappori and Lechène (forthcoming) analyze Canadian data.

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