Intrahousehold Decision-Making:
A Review of Theories and Implications on the Modelling of Aggregate Behaviour

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1 Introduction

The question of the dynamics behind decision-making within the household has been written about extensively over the last twenty years. The unitary model, postulating that members of a household behave as though they maximize a unique utility function under the constraint of a family budget is no longer the accepted convention that it once was. This is because on a theoretical level, two weaknesses exist. First, the conditions required for the existence of such behaviour within the household are quite restrictive. Second, because it is like a black box which doesn't show transactions between individuals, it is of no use for studying the changes in the composition of the household caused by marriage or divorce, for example. Furthermore, a significant number of studies have accumulated over the years in which the hypothesis of income pooling, an implication of this model, is rejected[1].

Manser and Brown (1980), as well as McElroy and Horney (1981), were the first to propose a serious alternative to the unitary model. They suggest that the decision-making process should be seen as a cooperative negotiation in which each member of the household possesses his/her own preferences and own alternative well-being, also known as the threat point. This approach has the advantage of accomplishing two things at the same time. Not only is it less restrictive than the unitary approach, but it allows the interactions between the members of the household to be studied given the role played by the threat points. Since then, several studies have followed in their steps by modelling the decision process within the household as a bargaining game, either cooperative or not[2]. These models however, have one major inconvenience: they are very difficult to estimate and therefore very difficult to validate[3].

A third, even more general, approach took form in the early 1990s under the initiative of Chiappori. Qualified as the collective approach, it consists of only two hypotheses: each member of the household has his/her own preferences and the decisions that are made are Pareto-efficient. From this point of view, the unitary and cooperative bargaining models are only a special case, because they themselves generate Pareto-optimal solutions. This approach has two important advantages. First, notwithstanding its generality, it imposes relatively easy to test restrictions on the demand and labour supply functions of the household. Second, if these restrictions are satisfied, it is possible, under certain additional conditions, to recover the preferences of the members of the household

[1] See J. Hoddinott, H. Alderman and L. Haddad (1997) or Bergstrom (1994) for a presentation of different tests and results.

[2] For example, Ulph (1988), Wooley (1988), Lundberg and Pollack (1993, 1994), Konrad and Lommerud (1997), and Gray (1998).

[3] See Kooreman and Kapteyn (1990).

(up to a translation) as well as the sharing rule (up to a constant) which prevails between them.

This is a major advantage. Individual global consumption is almost never available because budget data are typically collected on a household rather than an individual basis. This is seen as the main obstacle to intrahousehold welfare analysis, which requires at least having data disaggregated by individual and, if possible, individual preferences as well. Fortunately, the collective approach offers an astute alternative. The recovered sharing rule and recovered preferences can, in effect, be used in a straightforward way, to study the impact of economic policies on the well-being of each household member. They allow the effect of any policy modifying the household budget constraint or the relative bargaining power of its members on intrahousehold well-being, to be traced. As we will see, the constant indeterminacy of the sharing rule does not rule out welfare analysis since only variation in well-being matters.

Several tests of the collective model have already been done using consumption data (Bourguignon et al. (1993), Browning et al. (1994), Thomas and Chen (1994))[4] and labour data (Fortin and Lacroix (1997), Chiappori et al.(1998), Blundell et al.(1998), Chiuri (1999)). Their results are convergent: they generally do not reject the hypothesis of collectively rational behaviour within the household. It is this which leads Alderman, Chiappori, Haddad, Hoddinott and Kanbur to state that «the burden of proof should be shifted onto those who would claim that the unitary model should be the rule and the collective model the exception».[5]

However important this progress in microeconomic theory and empirical evidence may be, it has not yet reached the field of meso and macroeconomics. While currently a serious attempt is being made to introduce family and gender aspects into macro-modelling, much effort has been put into the disaggregation of labour by gender and to the introduction of home production, particularly in business cycle models (Benhabib et al. (1991), Collier et al. (1994), Darity (1995), Ertürk and Çagatay (1995), Taylor (1995), Arndt and Tarp (2000), Fontana and Wood (2000))[6]. The issue of decision-making inside the household has been put aside. Aggregate (or market) demands are still modelled along the lines of a unitary model and welfare analysis is still performed at the household level. To the extent that the household is the major arena where gender relations are played out, the «engendering» of macroeconomics cannot be done without recognizing the inappropriateness of the unitary model. The first step in this direction

[4] All these tests, however, must be conditional on the income level.

[5] Alderman et al. (1995), p.15. It should be noted however, that collective models do not allow, at least for the time being, the treatment of questions of changes in the composition of households.

[6] This is without listing all the work related to conceptual examinations of gender and macroeconomics, or on empirical observations of macroeconomic policies on gender. Two good references for these are the gender issues of 1995 and 2000 of World Development.

consists in investigating the implications of new models of household decision-making on the so-called aggregation problem. This problem refers to the transition between the microeconomics of household behaviour and the meso or macroeconomics of households' behaviour. More precisely, it asks what implications intrahousehold decision-making models have on the modelling of aggregate variables.

The goal of this paper, thus, is to review the different microeconomic theories on household decision-making, with a focus on the restrictions they place on the modelling of aggregate demand, aggregate labour supply and aggregate welfare. The paper is structured as follows. Section 2 defines the general framework that will be used throughout the paper. Section 3 presents the unitary approach. A detailed discussion of the collective approach, its theory and econometric applications, follows in Section 4. Bargaining models are addressed in Section 5. In each of these sections, the microeconomic implications, their empirical evidence, as well as the implications for aggregation are discussed. The paper concludes with a discussion on how meso and macro-modelling could gain from the bargaining and collective models.

2 General Framework

For the sake of coherency, we will keep to the common framework, which is presented here, throughout the paper. The notation, which will be introduced as we go along, may appear difficult for some. In order to ease the task of the reader, a definition of the symbols used is given in Appendix 1. The convention followed will be to denote vectors and matrices with letters in boldface. Also, once the arguments of a function have been listed a first time, they will be thereafter simply be represented by dot in brackets. For example, function $F(v; w; z)$ would be denoted by $F(\cdot)$.

The household considered is composed of two spouses, a man and a women, and possibly other individuals, such as children for example. In total the household comprises I individuals. Only the spouses are assumed to participate in the decision process leading to the household's consumption and labour choices. For that reason, the other household members will sometimes be referred to as non decision-makers. To avoid confusion in the indexation, the spouses will always be indexed by 1 and 2 while the remaining household members will be numbered from 3 to I. Each spouse draws his/her well-being from his/her personal consumption of N goods, indexed by $n = 1; ...; N$, and possibly from one of other household members that does not participate in the decision process. He/she also derives well-being from his/her leisure time and possibly from one of the non decision-makers. For simplicity's sake, we suppose that there is no altruism between the spouses.[7] Let's define $c_i \equiv [c_{i1}, \ldots, c_{iN}]'$ as the vector representing the consumption of member i, with $i = 1, \ldots, I$, over the N goods. Household consumption is thus given by the $N \times I$ matrix $C \equiv [c_1, \ldots, c_I]$. We also denote by $C_s \equiv [c_1, c_2]$ the $N \times 2$ matrix of spouses consumption and by $C_{-s} \equiv [c_3, \ldots, c_I]$ the $N \times (I - 2)$ matrix of remaining household members' consumption. Therefore, $C = [C_s, C_{-s}]$.

Each member i has t available time for working in the market.[8] The vector of the household market labour supplies is defined by $H \equiv [h_1, \ldots, h_I]'$. Consequently, member i's leisure time is given by $t - h_i$. Again we define the vector of market labour supplies of the spouses by $H_s \equiv [h_1, h_2]'$ and those of the remaining household members by the vector $H_{-s} \equiv [h_3, \ldots, h_I]'$, with $H = [H_s, H_{-s}]$.

Each spouse has preferences given by the utility function $U_i(c_i, h_i, C_{-s}, H_{-s})$. We make the assumption that $U_i(\cdot)$ is strongly concave,[9] twice differentiable in $(c_i, h_i, C_{-s}, H_{-s})$ and strictly increasing with (c_i, h_i) $\forall i = 1, 2$. Furthermore, we assume that $U_i(.)$ is weakly separable in (c_i, h_i), that is $U_i(c_i, h_i, C_{-s}, H_{-s}) = \tilde{U}_i[u_i(c_i, h_i), C_{-s}, H_{-s}]$ for $i = 1, 2$. Other than this, nothing is assumed about the effects of C_{-s} and H_{-s} on $U_i(\cdot)$. The spouses can be altruistic, egotistical or malevolent toward the non decision-makers. The preferences of the members that do not participate in the decision process are not needed for the analysis of decision-making within the household.[10]

We suppose that the household does not produce any of the N goods, or if it does, that the markets for these goods are perfect.[11] The price vector $p \equiv [p_1, \ldots, p_N]'$ is associated with the N market goods, while the wage rate vector $w \equiv [w_1, \ldots, w_I]'$ is associated with I labour supplies.[12] To ensure that there is no money illusion we set $p_N = 1$.

From this, it follows that the household budget constraint is given by:

$$p'(\Sigma_{i=1}^{I} c_i) = w'H + \iota' y,$$

where $y \equiv [y_1, \ldots, y_I]'$ with y_i holding for the non-labour income of member i. Thus, $\iota' y$ gives household (total) non-labour income.

[7] However the case of caring à la Becker can be easily handled .

[8] This means that the time available for market labour is the same for each household member. This assumption could easily be relaxed in order to reflect, for example, the fact that some household members are in charge of domestic production and thus have less time to spend on market labour.

[9] Strong concavity is stronger than strict concavity. It means that $\partial^2 U_i(c_i, h_i, C_{-s}, H_{-s})/\partial c_i^2 > 0$, $\partial^2 U_i(c_i, h_i, C_{-s}, H_{-s})/\partial h_i^2 < 0$ for all $(c_i, h_i, C_{-s}, H_{-s})$.

[10] They would be required, however, for a rigorous analysis of intrahousehold welfare.

[11] If the markets are perfect and the household makes Pareto-efficient decisions, then consumption and production decisions can be treated separately.

[12] To keep the analysis as simple as possible, we will assume that the two spouses are working in the labour market. That is $h_i > 0$ $\forall i = 1, 2$.

3 Unitary Approach

The unitary approach is certainly the oldest and still the most common way of representing household decision-making. It is this approach which is found in almost all microeconomic textbooks. What distinguishes unitary models is their assumption that the household acts «as if» it were maximizing a household utility function under a household budget constraint. The qualifying «as if» has importance; unitary models do not assume that the household really behaves this way, but rather that aggregate household demand is consistent with this behaviour. Or, put in another way, from the sole observation of aggregate household demands ($\Sigma_{i=1}^{I} c_i$), one could not reject the hypothesis that the household pools its income to maximize a unique utility function. Technically, this implies that household behaviour can be modelled from the solution of the following program:

$$\begin{aligned} \underset{\{C,H\}}{\text{Max}} \quad & W(C,H) \qquad\qquad (U) \\ \text{subject to} \quad & p'(\Sigma_{i=1}^{I} c_i) = w'H + \iota' y, \end{aligned}$$

where $W(\cdot)$ holds for a given household utility function. The essential question which lies at the center of the theoretical critique of this approach, is: by what process does this function emerge from the two spouses' utility functions $U_1(\cdot)$ and $U_2(\cdot)$? Depending on the answer to this question, the model will be labelled a «single-agent», «benevolent dictator», «consensus», or «common preferences» model. The single utility-maximizing behaviour can, in effect, be rationalized under three settings. The first is when only one spouse actually makes the decisions, which will be the case in a household governed by a dictator.[13] If spouse the husband was a dictator and was indexed by 1, we would simply have $W(C,H) \equiv U_1(c_1, h_1, c_2, h_2, C_{-s}, H_{-s})$. The second is when a consensus is reached between the spouses concerning the objective function to maximize. For example, $W(C,H)$ could represent a «household social welfare function» given by $\hat{W}[U_1(c_1, h_1, C_{-s}, H_{-s}), U_2(c_2, h_2, C_{-s}, H_{-s})]$. The third is when the intrahousehold distribution of non-labour income does not affect total household labour supply and demand. Bergstrom and Cornes (1981,1983) have found restrictions on the form of indirect utility

[13] See Becker (1981), Chapter 7, for an example of a «benevolent altruistic dictator» model leading to such behaviour.

functions that are necessary and sufficient to obtain this independence.[14] Needless to say, these are very restrictives conditions on preferences.

Given the household utility function $W(\cdot)$, program (U) yields Pareto-efficient outcomes for $(C; H)$. Moreover, the household vectors of labour supply functions and demand functions that are solutions to this program can be written as:

$$C = C^U(p; w; \iota' y); \tag{1}$$
$$H = H^U(p; w; \iota' y); \tag{2}$$

where exponent U stands for unitary. The demands and labour supplies vector-valued functions $C^U(\cdot)$ and $H^U(\cdot)$ are both functions of the price vector p, of the wage rate vector w and of the household non-labour income $\iota' y$.

3.1 Restrictions on Microeconomic Behaviour

The particular forms taken by these functions have many empirically testable microeconomic implications. The first set of implications is obvious. The household demands and labour supplies are invariant to the distribution of non-labour income within the household:

$$\frac{\partial c_{in}^U(\cdot)}{\partial y_1} = \frac{\partial c_{in}^U(\cdot)}{\partial y_j} \qquad \forall i; j = 1; \ldots; I; \; n = 1; \ldots N; \tag{3}$$
$$\frac{\partial h_i^U(\cdot)}{\partial y_1} = \frac{\partial h_i^U(\cdot)}{\partial y_j} \qquad \forall i; j = 1; \ldots; I: \tag{4}$$

This means that if some non-labour income is taken from individual i and given to individual j, then household labour supplies and demands will be unchanged. For example, any policy that would redistribute the spouses' non-labour income between the husband and the wife, would not change the consumption structure of the household. In other words, there is pooling between non-labour income.

Also, since no place is left for bargaining in the unitary model, household demands and labour supplies are independent of what McElroy (1990) calls extra-environmental parameters (EEPs) and more generally of distribution factors in the terminology of Browning et al.(1998). These concepts will be presented in detail in the next two sections.

[14] For their result to be applicable to our framework, we would have to make one more assumption: that the wage rates are the same for all members, that is $w_i = w$, for $i = 1; \ldots; I$. In this case, Bergstrom and Cornes show that when the individuals' indirect utility functions are a particular case of the Gorman polar form and when the household behaviour is Pareto-efficient in which all decision-makers have a positive personal consumption of each good, then total household labour supply and demand are independant of the intrahousehold income distribution.

The second set of implications which concerns the form of the price effects is well known and can be found in most undergraduate textbooks. The first result is called the Slutsky equation and states that the compensated effect induced by a price change on any demand or by a wage change on any labour supply can be decomposed into two separate effects: a price effect and an income effect. More specifically,

$$\frac{\partial \hat{c}^U_{in}(p;w;\overline{W})}{\partial p_m} = \frac{\partial c^U_{in}(\cdot)}{\partial p_m} + (\Sigma^I_{i=1} c_{im})\frac{\partial c^U_{in}(\cdot)}{\partial \iota' y} \qquad \forall\, i = 1;\ldots;I;\ m;n = 1;\ldots;N; \quad (5)$$

$$\frac{\partial \hat{h}^U_i(p;w;\overline{W})}{\partial w_j} = \frac{\partial h^U_i(\cdot)}{\partial w_j} - h_j \frac{\partial h^U_i(\cdot)}{\partial \iota' y} \qquad \forall\, i;j = 1;\ldots;I; \quad (6)$$

where $\hat{c}^U_{in}(p;w;\overline{W})$ and $\hat{h}^U_i(p;w;\overline{W})$ are respectively the Hicksian (or compensated) demand for commodity n and labour supply for member i associated with a household well-being of $\overline{W}$. Second, the compensated own-substitution price effects are negative for demands and positive for labour supplies. That is,

$$\frac{\partial \hat{c}^U_{in}(\cdot)}{\partial p_n} < 0 \qquad \forall\, i = 1;\ldots;I;\ n = 1;\ldots;N; \quad (7)$$

$$\frac{\partial \hat{h}^U_i(\cdot)}{\partial w_i} > 0 \qquad \forall\, i;j = 1;\ldots;I: \quad (8)$$

Third, the compensated cross-substitution price effects are symmetric. Technically, this means that:

$$\frac{\partial \hat{c}^U_{in}(\cdot)}{\partial p_m} = \frac{\partial \hat{c}^U_{im}(\cdot)}{\partial p_n} \qquad \forall\, i = 1;\ldots;I;\ m;n = 1;\ldots;N; \quad (9)$$

$$\frac{\partial \hat{h}^U_i(\cdot)}{\partial w_j} = \frac{\partial \hat{h}^U_j(\cdot)}{\partial w_i} \qquad \forall\, i;j = 1;\ldots;I: \quad (10)$$

Finally, the Slutsky matrices for demands and labour supplies are respectively negative semi-definite and positive semi-definite. This means that for each individual i,with $i = 1;\ldots;I$, the $N \times N$ Slutsky matrix associated with its demands, which is given by:

$$\begin{bmatrix} \partial \hat{c}^U_{i1}(\cdot)/\partial p_1 & \ldots & \partial \hat{c}^U_{i1}(\cdot)/\partial p_N \\ \ldots & \ldots & \ldots \\ \partial \hat{c}^U_{iN}(\cdot)/\partial p_1 & \ldots & \partial \hat{c}^U_{iN}(\cdot)/\partial p_N \end{bmatrix} \quad (11)$$

has principal minors alternating in sign.[15] More precisely, its first principal minor is nonpositive, its second principal minor is nonnegative and so on. With regards to the $I \times I$ Slutsky matrix associated with the labour supplies:

$$\begin{bmatrix} \partial \hat{h}_1^u(\cdot)/\partial w_1 & \ldots & \partial \hat{h}_1^u(\cdot)/\partial w_I \\ \ldots & \ldots & \ldots \\ \partial \hat{h}_I^u(\cdot)/\partial w_1 & \ldots & \partial \hat{h}_I^u(\cdot)/\partial w_I \end{bmatrix} \tag{12}$$

This implies that all principal minors are nonnegative.[16]

These results, by imposing a form on the income and prices effects of demands and labour supplies stemming from the unitary model, provide a way of testing it. If empirical income and price effects do not violate these forms, then the unitary approach to household decision-making will not be rejected. Although Hicksian demands and labour supplies, on which most of the results apply, are impossible to observe, the (Marshalian) demands $c_{in}^u(\cdot)$ and labour supplies $h_i^u(\cdot)$ are technically observable. If this is the case, $c_{in}^u(\cdot)$ and $h_i^u(\cdot)$ can be empirically estimated and used to compute their Hicksian counterparts with the help of relations (5) and (6). With these calculated Hicksian demands and labour supplies, we can verify if relations (7), (8), (9), (10), (11) and (12) are respected.

While data on labour supplies are easy to find, this is not true for personal consumption c_{in}. Most of the time only $\Sigma_{i=1}^I c_{in}$ is available. This is so because budget-consumption surveys typically collect data on a household level. However, it is fairly straightforward to show that all the preceding implications for $c_{in}(\cdot)$ also hold for $\Sigma_{i=1}^I c_{in}(\cdot)$, $\forall\, n = 1, \ldots, N$. Aggregate consumptions can therefore be used to perform the test.[17]

Example 1 Let's give a concrete example of the restrictions put by a unitary model on labour supply functions. Consider a household consisting of spouses only, that is with $I = 2$ and let's posit the Working-Leser functional form:

$$h_i = \alpha_i + \gamma_i^1 y + \gamma_i^2 y \log y + \Sigma_{j=1}^2 \beta_i^j w_j + \Sigma_{n=1}^{N-1} \delta_i^n p_n + \theta_i y_1/y_2;$$

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[15] Recall that the first principal minor of a $N \times N$ matrix $A \equiv [a_{ij}]$, is given by a_{11}, the second principal minor by $\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$, the third principal minor by $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$, and so on.

[16] Note that all the preceding implications for $c_{jn}(\cdot)$ also hold for $\Sigma_{j=1}^J c_{jn}(\cdot)$, $\forall\, n = 1, \ldots, N$.

[17] See Section 3.3.

with $i = 1,2$ and $y \equiv y_1 + y_2$. The ratio y_1/y_2 expresses the spouses' relative contribution to the household non-labour income. The partial derivatives of h_i with respect to y_1 and y_2 are given by:

$$\begin{aligned}\frac{\partial h_i}{\partial y_1} &= \gamma_i^1 + \gamma_i^2 + \gamma_i^2 \log y + \theta_i/y_2;\\ \frac{\partial h_i}{\partial y_2} &= \gamma_i^1 + \gamma_i^2 + \gamma_i^2 \log y - \theta_i y_1/y_2^2.\end{aligned}$$

Therefore, restriction(4) amounts to:

$$\theta_i/y_2 = -\theta_i y_1/y_2^2 \qquad \forall\, i = 1,2;$$

Assuming that $y_1/y_2 \neq -1$, the only possible solution to this is $\theta_1 = \theta_2 = 0$, which means that the spouses' contributions to household non-labour income have the same effect on each labour supply. With regards to the wage effects, we must first compute the Hicksian labour supply function $\hat{h}_1(\cdot)$ and $\hat{h}_2(\cdot)$. Since $\partial h_i/\partial w_j = \beta_i^j$ and $\partial h_i/\partial y = \gamma_i^1 + \gamma_i^2 + \gamma_i^2 \log y$, it follows that:

$$\frac{\partial \hat{h}_i}{\partial w_j} \equiv \beta_i^j - h_j\left[\gamma_i^1 + \gamma_i^2 + \gamma_i^2 \log y\right]$$

for $i, j = 1,2$. The wage effect restrictions will thus be respected if and only if:

$$\begin{aligned}
&\text{i)} && \beta_i^i + h_i\left[\gamma_i^1 + \gamma_i^2 + \gamma_i^2 \log y\right] > 0 \qquad \forall\, i = 1,2;\\
&\text{ii)} && \beta_1^2 + h_2\left[\gamma_1^1 + \gamma_1^2 + \gamma_1^2 \log y\right] = \beta_2^1 + h_1\left[\gamma_2^1 + \gamma_2^2 + \gamma_2^2 \log y\right]\\
&\text{iii)} && \left(\beta_1^1 + h_1\left[\gamma_1^1 + \gamma_1^2 + \gamma_1^2 \log y\right]\right)\cdot\left(\beta_2^2 + h_2\left[\gamma_2^1 + \gamma_2^2 + \gamma_2^2 \log y\right]\right) -\\
& && \left(\beta_1^2 + h_2\left[\gamma_1^1 + \gamma_1^2 + \gamma_1^2 \log y\right]\right)\cdot\left(\beta_2^1 + h_1\left[\gamma_2^1 + \gamma_2^2 + \gamma_2^2 \log y\right]\right) \geq 0
\end{aligned}$$

3.2 Empirical Evidence

All of the implications stemming from the unitary model have been tested in many different ways and in many different places of the world. They have almost always been rejected[18]. For example, Thomas (1990) found that in Brazilian families, the non-labour income of the mother has a much stronger positive effect on child caloric intake, weight, and height than the non-labour income of the father. In Ivory Coast, Hoddinott and Haddad (1994) found that children's height is positively correlated to the share of household wealth controlled by their mothers. In Burkina Faso, Lachaud (1998) found

[18] See J. Hoddinott, H. Alderman and L. Haddad (1997) or Bergstrom (1994) for a presentation of the different tests and their results.

that the income share of wives or female household heads positively and significantly affects household expenditure on food and energy. Fortin and Lacroix (1997) have rejected the symmetry of the cross-wage effect on Canadian families. Quisumbing and Maluccio (2000) found that assets brought to the marriage by each spouse have differential effects on household expenditures in Bangladesh, Ethiopia, Indonesia and South Africa.

3.3 Restrictions on Aggregate Behaviour

By definition, meso and macroeconomic modelling concerns the conduct of aggregate variables. Goods are aggregated into different broad categories. Furthermore, not only is individuals' behaviour aggregated by household, but households' behaviour is aggregated as well. The question thus, is how relevant are the preceding microeconomic restrictions for the modelling of aggregate behaviour. Should aggregate behaviour satisfy the same restrictions? More generally, does the kind of decision-making taking place inside households have implications on the way aggregate variables should be modelled? The objective of this section is to answer these questions. As we will see, some of the microeconomic restrictions are lost in the aggregating process, but not all.

To study this, let's examine the extreme case where all goods are represented by a single commodity and all households are aggregated together. As stated by the composite commodity theorem, in order to aggregate several goods into one, their relative price must stay constant. Assuming this is the case, we can decompose the price vector $\mathbf{p}$ into a scalar p and a base period price vector $\mathbf{p}_B$, such that $\mathbf{p} \equiv p\mathbf{p}_B$. The changes in $\mathbf{p}$ then come via the changes in p. The constancy of relative wage rates must also be assumed in order to aggregate the labour supplies. So again, we can decompose the wage rate vector $\mathbf{w}$ into scalar w and a base period wage rate vector $\mathbf{w}_B$, such that $\mathbf{w} \equiv w\mathbf{w}_B$. The scalars p and w can be seen as the aggregate price level and the aggregate wage rate level. We can also define the household composite demand x and labour supply l by:

$$x = \mathbf{p}_B'[\Sigma_{i=1}^{I} \mathbf{c}_i^*(p\mathbf{p}_B; w\mathbf{w}_B; \lambda' \mathbf{y})] \equiv x^*(p; w; \lambda' \mathbf{y}); \tag{13}$$

$$l = \mathbf{w}_B' \mathbf{H}^*(p\mathbf{p}_B; w\mathbf{w}_B; \lambda' \mathbf{y}) \equiv l^*(p; w; \lambda' \mathbf{y}); \tag{14}$$

where $\mathbf{p}_B$ and $\mathbf{w}_B$ are dropped for simplicity. Clearly $x^*(\cdot)$ and $l^*(\cdot)$ satisfy the pooling restrictions. The price effect properties of $c_{in}^*(\cdot)$ and $h_i^*(\cdot)$ are also transferred to them. In effect, it can be shown that household preferences $W(\mathbf{C}; \mathbf{H})$ can be redefined over x and l as $\tilde{W}(x; l)$. Program (U) can thus be equivalently rewritten as:

$$\underset{\{x;l\}}{\mathrm{Max}} \quad \tilde{W}(l; x) \qquad (U')$$

$$\text{subject to} \quad px = wl + \lambda' \mathbf{y}.$$

The system x, l solving (U') is identical to the one given by functions (13) and (14). In fact, since (U') shares the structure of program (U), $x^{U}(\cdot)$ and $l^{U}(\cdot)$ possess all the properties of $c^{U}_{in}(\cdot)$ and $h^{U}_{i}(\cdot)$. That is, they satisfy restrictions (3) and (4) as well as restrictions (5) to (8) for p and w. The latter restrictions amount to:

$$\frac{\partial x^{U}(\cdot)}{\partial p} + x\frac{\partial x^{U}(\cdot)}{\partial \lambda' y} < 0;$$
$$\frac{\partial l^{U}(\cdot)}{\partial w} - l\frac{\partial l^{U}(\cdot)}{\partial \lambda' y} > 0.$$

However, because labour supplies and demands are aggregated, restrictions (9), (10), (11) and (12) are no longer relevant. If demands where not all aggregated together but were rather aggregated into two groups, such as the demands for food and for non-food commodities for example, the only difference would be that restrictions (9), (10), (11) and (12) would hold for the two composite demands.

The next step, is to aggregate $x^{U}(\cdot)$ and $l^{U}(\cdot)$ for all households. Consider an economy formed by J households. To simplify, we assume that these households are identical in every aspect except with regard to their preferences and non-labour income. That is $p_{nj} = p_n$ and $w_{ij} = w_i$ $\forall j = 1, \ldots, J$. The aggregate demand and labour supplies for the whole economy, respectively denoted by X and L, are given by

$$X = \sum_{j=1}^{J} x^{U}_{j}(p, w, \lambda' y_j) \equiv X^{U}(p, w, \lambda' y_1, \ldots, \lambda' y_J); \tag{15}$$

$$L = \sum_{j=1}^{J} l^{U}_{j}(p, w, \lambda' y_j) \equiv L^{U}(p, w, \lambda' y_1, \ldots, \lambda' y_J); \tag{16}$$

where $x^{U}_{j}(\cdot)$, $l^{U}_{j}(\cdot)$ and $\lambda' y_j$ respectively denote the composite demand function, the composite labour supply and the non-labour income of household j. The aggregate demand and labour supply are thus functions of the aggregate price and wage rate levels and of the J households' non-labour income.

The question is now which properties have these aggregate functions inherited? As can be seen, the process of aggregation has no impact on the fulfillment of intrahousehold pooling of non-labour incomes. The restriction is still satisfied. More precisely, we have:

$$\frac{\partial X^{U}(\cdot)}{\partial y_{1j}} = \frac{\partial X^{U}(\cdot)}{\partial y_{ij}} \qquad \forall j = 1, \ldots, J;\ i = 2, \ldots, I;$$
$$\frac{\partial L^{U}(\cdot)}{\partial y_{1j}} = \frac{\partial L^{U}(\cdot)}{\partial y_{ij}} \qquad \forall j = 1, \ldots, J;\ i = 2, \ldots, I;$$

with y_{ij} representing the non-labour income of individual i from household j. The same applies to the effect of EEPs. Note however, that there is no «household pooling» of non-labour income. A redistribution of the economy's wealth $\Sigma_{j=1}^{J}\iota' y_j$ will prompt a change in $X^*(\cdot)$ and $L^*(\cdot)$. With regards to price effects, the story is different. In general, the Slutsky equation no longer holds, and therefore, even restrictions (7) and (8) are no longer respected. This, combined with the dependence of $X^*(\cdot)$ and $L^*(\cdot)$ on the distribution of economic wealth across households, means that there exists no «fictional» representative household whose preferences can lead to demand (15) and labour supply (2). Therefore, any welfare measure constructed from them, such as the equivalent variation and the compensating variation, would not have any welfare significance for the households in the economy.

There is, however, one case where they will remain satisfied: this is where household preferences admit having an indirect utility function of the Gorman form. More precisely, all households must have an indirect utility function of the following form:

$$\tilde{V}_j^{max}(p;w;\iota' y_j) \equiv \tilde{V}_j(x_j^*(p;w;\iota' y_j);l_j^*(p;w;\iota' y_j)) \equiv \omega_j(p;w) + \nu(p;w)\iota' y_j:$$

Thus the first term $\omega_j(p;w)$ can differ from household to household, but the $\nu(p;w)$ term is assumed to be identical for all households. Now, by Roy's identity we have:

$$-\frac{\partial \tilde{V}_j^{max}(\cdot)/\partial p}{\partial \tilde{V}_j^{max}(\cdot)/\partial \iota' y_j} = \frac{\partial \omega_j(p;w)/\partial p}{\nu(p;w)} + \frac{\partial \nu(p;w)/\partial p}{\nu(p;w)}\iota' y_j \equiv x_j^*(p;w;\iota' y_j);$$
$$\frac{\partial \tilde{V}_j^{max}(\cdot)/\partial w}{\partial \tilde{V}_j^{max}(\cdot)/\partial \iota' y_j} = \frac{\partial \omega_j(p;w)/\partial w}{\nu(p;w)} + \frac{\partial \nu(p;w)/\partial w}{\nu(p;w)}\iota' y_j \equiv l_j^*(p;w;\iota' y_j):$$

Summing over these demands and labour supplies we find that:

$$X = \sum_{j=1} \frac{\partial \omega_j(p;w)/\partial p}{\nu(p;w)} + \frac{\partial \nu(p;w)/\partial p}{\nu(p;w)} \sum_{j=1} \iota' y_j \equiv \tilde{X}^*(p;w;\Sigma_{j=1}^{J}\iota' y_j); \tag{17}$$

$$L = \sum_{j=1} \frac{\partial \omega_j(p;w)/\partial w}{\nu(p;w)} + \frac{\partial \nu(p;w)/\partial w}{\nu(p;w)} \sum_{j=1} \iota' y_j \equiv \tilde{L}^*(p;w;\Sigma_{j=1}^{J}\iota' y_j): \tag{18}$$

Thus the aggregate demand and aggregate labour supplies for the whole economy are exact: they are a function of the household's aggregate non-labour income. The distribution of $\Sigma_{j=1}^{J}\iota' y_j$ across households has no impact on them. In this context, X and L have a welfare meaning.

Until now, most macroeconomic models, if not all, have posited an aggregate demand and labour supply of the kind given by (15) and (16) and even more often of the type given by (17) and (18).

4 Collective Approach

This approach, which is also called collective rationality, took form at the beginning of the 1990s through the initiative of Chiappori. It draws on the bargaining approach, which is presented in Section 5, but is more general and at the same time just as restrictive. It is more general because cooperative bargaining models are, as we will see, a particular case of collective models. It is as restrictive because cooperative bargaining models do not bring any new testable restrictions to those provided by the collective approach. Collective models have another advantage over bargaining models. If, based on some empirical estimation, their restrictions are found to be satisfied, it is then possible, under certain conditions, to recover the preferences of the spouses (up to a translation) as well as the sharing rule (up to a constant) that prevails between them from the empirical data. Because of this, it allows for intra-household welfare analysis, making it particularly attractive.

The collective approach assumes essentially that the outcome of the decision process for the spouse is (weakly) Pareto-efficient. That is, for any set $(p; w; \pi' y)$, the vectors of labour supplies and demands $(C_s; H_s)$ chosen by the spouses are such that there exists no other set of vectors $(C_s^o; H_s^o)$ which satisfy the budget constraint and provide higher well-being to both spouses. The collective approach thus assumes that the set of vectors chosen by the spouses lies somewhere on their Paretian frontier (which depends only on their preferences and the household budget constraint), while the cooperative bargaining and unitary approaches make additional assumptions about precisely where they lie on the Paretian frontier. It is in this sense that the collective approach is more general.

The collective approach, however, recognizes that some kind of bargaining can take place within the household. This is done in part by assuming that the decision process depends on a set of K variables $d \equiv [d_1; d_2; ...; d_K]'$ which are independent of the spouses' preferences and which do not affect the overall household budget constraint. These variables are called distribution factors. The collective approach thus amounts to assuming that the household behaves as though it were maximizing the following program:

$$\begin{aligned} \underset{\{C;H\}}{\text{Max}} \quad & U_1(c_1; h_1; C_{-s}; H_{-s}) + \lambda(p; w; \pi' y; d) U_2(c_2; h_2; C_{-s}; H_{-s}) \\ \text{subject to} \quad & p'(\Sigma_{i=1}^{I} c_i) = w' H + \pi' y. \end{aligned} \tag{C1}$$

The objective function to be maximized in this program is a weighted sum of the spouses' utility functions, with $\lambda(p; w; \pi' y; d)$ holding for the relative utility weight of the second spouse with respect to the first spouse.[19] The relative utility weight can be interpreted as the bargaining power of spouse 2 relative to spouse 1. One important characteristic is that this relative utility weight is not only a function of the vector of distribution factors d, but also of the price vector, of the wage rate vector and of the overall household income.[20] The household demands and labour supplies solving program (C1) can be written as:

$$C = C^c(p, w, \iota' y, d) = \hat{C}^c(p, w, \iota' y, \lambda(p, w, \iota' y, d)); \tag{19}$$

$$H = H^c(p, w, \iota' y, d) = \hat{H}^c(p, w, \iota' y, \lambda(p, w, \iota' y, d)); \tag{20}$$

where C holds for collective rationality. Of course $\hat{C}^c(\cdot)$ and $\hat{H}^c(\cdot)$ are not observed since $\lambda(p, w, \iota' y, d)$ is unobserved. Rather, what is observed is the system $C^c(\cdot)$ and $H^c(\cdot)$, which is a function of p, w, $\iota' y$ and of the distribution factors d. One obvious difference between this system and the unitary one, is the presence of distribution of factors.

According to the second economic welfare theorem and under the hypothesis of separability between (h_i, c_i) and (H_{-s}, C_{-s}) for both spouses, it is possible to interpret the household behaviour in the following way. In the first step, the spouses choose the levels of (C_{-s}, H_{-s}) and share the resulting budget given by $\iota' y + w'_{-s} H_{-s} - p'(\Sigma_{i=3}^{I} c_i)$ between themselves, where $w_{-s} \equiv [w_3, \ldots, w_I]$. Denoting the share given to spouse 1 by φ_1 and that given to spouse 2 by $\varphi_2 \equiv \iota' y + w'_{-s} H_{-s} - p'(\Sigma_{i=3}^{I} c_i) - \varphi_1$, each spouse then maximizes his/her sub-utility function $u_i(\cdot)$ under the constraint flowing from its share:

$$\underset{\{c_i, h_i\}}{\text{Max}} \quad u_i(c_i, h_i) \tag{C2}$$

$$\text{subject to} \quad p' c_i = w_i h_i + \varphi_i(p, w, \iota' y, d);$$

for $i = 1, 2$. To see this, simply note that it is always possible to posit that $\varphi_i(p, w, \iota' y, d) \equiv p' c_i^c(p, w, \iota' y, d) - w_i h_i^c(p, w, \iota' y, d))$. Thus, the two shares φ_i, as well as the relative utility weight λ, are not constant in general, but are functions of the prices, the wage rates, the overall household non-labour income and the distribution factors. They constitute what is called the sharing rule. They reveal how much goes to spouse i when the state $(p, w, \iota' y, d)$ prevails. From the equivalence between program (C1) and (C2) it

[19] The weight $\lambda(\cdot)$ could also be interpreted as the Lagrangean multiplier associated with the inegality constraints in the program: $\text{Max}_{\{C,H\}} U_1(c_1, h_1, C_{-s}, H_{-s})$ subject to $U_2(c_2, h_2, C_{-s}, H_{-s}) \geq V_2^c(p, w, \iota' y, d)$ and $p'(\Sigma_{i=1}^{I} c_i) = w' H + \iota' y$.

[20] If λ is constant, we once again have a unitary model.

follows that any personal demand or labour supply functions of spouse i can be rewritten as:[21]

$$c_i^c(p; w; \lambda' y; d) \;=\; \hat{c}_i^c(p; w_i; \varphi_i(p; w; \lambda' y; d)) \qquad i = 1, 2; \tag{21}$$

$$h_i^c(p; w; \lambda' y; d) \;=\; \hat{h}_i^c(p; w_i; \varphi_i(p; w; \lambda' y; d)) \qquad i = 1, 2. \tag{22}$$

Thus, the labour supply and personal demands of spouse i can also be written as a function of prices, of its own wage-rate and of its own share of the budget $y^* \equiv \lambda' y + w'_{-s} H_{-s} - p'(\Sigma_{i=3}^{I} c_i)$. The wage-rates of the other members, the household non-labour income and the distribution factors, affect its labour supply and personal demands only to the extent that they affect its share φ_i of the cake. As for $\tilde{c}^c(\cdot)$, $\tilde{h}^c(\cdot)$, the system $\hat{c}_i^c(\cdot)$, $\hat{h}_i^c(\cdot)$ is not observable since the shares $\varphi_i(p; w; \lambda' y; d)$ are unobservable.

4.1 Restrictions on Microeconomic behaviour

The collective framework imposes restrictions that are quite easy to test. There are two kinds of restrictions. The first, developed by Bourguignon, Browning and Chiappori (1995) deals with the way distribution factors affect consumption and labour decisions. The second, by Chiappori (1988) and Browning and Chiappori (1997) has to do with the form of the price effects. Both sets provide restrictions that can be used to obtain the spouses' preferences (up to a translation) and the sharing-rule (up to an additive constant) prevailing between them.

4.1.1 Distribution Factors Restriction

There are many ways to test whether empirical data on labour supplies and commodity demands conforms to collective rationality with the use of distribution factors. However, only some allow the sharing rule to be recovered. The latter rely on the observation of a certain number of personal consumptions or labour supplies and distribution factors. The most appropriate method will depend on the availability of such data. Here we limit the presentation to the case where at least two spouses' consumptions or labour supplies (or a combination of the two) and at least one distribution factor is observed.[22] In general, individual demands c_{in} are not known, only household consumption $\Sigma_{i=1}^{I} c_{in}$ is. This is so because budget data are typically collected on a household rather than an individual basis. However individual labour supplies h_i are often available. So we will assume that this is the case here.

[21] Be careful not to confuse $\hat{c}_i^c(\cdot)$ and $\hat{h}_i^c(\cdot)$ with the Hicksian demands $\hat{c}_i^u(\cdot)$ and labour supplies $\hat{h}_i^u(\cdot)$ presented previously in Section 3.1. Note that the 'hat' symbols used here are different.

[22] The other methods can be found in BBC(1995).

The particularity of $\hat{h}_i^c(\cdot)$ and $\tilde{h}_i^c(\cdot)$ is that the vector of distribution factors d affects them only to the extent that they affect the share φ_i. The test to be presented builds precisely on this result. This is a consequence of the fact that the distribution factors do not affect the Paretian frontier but only the point chosen by the decision-makers on this frontier.

Before presenting the test, a particular type of conditional system must be introduced. Under the assumption that $\partial h_i / \partial d_1 \neq 0 \; \forall i = 1;2$ and few more hypotheses,[23] one is allowed to use the implicit function theorem in order to locally invert $h_1^c(\cdot)$ on d_1 as well as $\tilde{h}_1^c(\cdot)$ on φ_1:

$$
\begin{aligned}
d_1 &= f_{d_1}(h_1; p; w; \iota' y; d_2; ...; d_K); && (23)\\
\varphi_1 &= f_{\varphi_1}(h_1; p; w_1): && (24)
\end{aligned}
$$

The first equation $f_{d_1}(\cdot)$ gives the change of d_1 required to compensate a variation in p,w,$\iota' y$, d_k ($k \neq 1$) in order to keep the labour supply $h_1(\cdot)$ constant. The second equation $f_{\varphi_1}(\cdot)$ returns the necessary adjustment of φ_1 to maintain $\tilde{h}_1^c(\cdot)$ fixed for a change in p or w_1. By substituting d_1 for $f_{d_1}(\cdot)$ in $h_2^c(\cdot)$ and φ_1 for $f_{\varphi_1}(\cdot)$ in $\tilde{h}_2^c(\cdot)$ we get:

$$
\begin{aligned}
h_2 &= \overline{h}_2^c(h_1; p; w; \iota' y; d_2; ...; d_K) && (25)\\
&= \overline{\tilde{h}}_2^c(p; w_2; y^* - f_{\varphi_1}(h_1; p; w_1)): && (26)
\end{aligned}
$$

$\overline{h}_2^c(\cdot)$ denotes the observable labour supply of spouse 2 respectively conditional on the other spouse's labour supply and function of p, w, $\iota' y$ and of the remaining distribution factors. It is important to note that the identity of decision-maker 2 is not relevant, it could be one spouse or the other.

Provided that $\partial \overline{h}_2^c(\cdot)/\partial h_1 \neq 0$ and $\partial \overline{h}_2^c(\cdot)/\partial \iota' y \neq 0$, the conditional labour supply $\overline{h}_2^c(\cdot)$ is such that:

$$
\frac{\partial}{\partial y^*} \left(\frac{\partial \overline{h}_2^c(\cdot)/\partial h_1}{\partial \overline{h}_2^c(\cdot)/\partial y^*} \right) = 0: \qquad (27)
$$

[23] See Dauphin and Fortin (2000) for details.

To see this, first differentiate $\bar{h}_2^c(\cdot)$ and $\bar{\tilde{h}}_2^c(\cdot)$ with respect to h_1 and y^*:

$$\begin{aligned}
\frac{\partial \bar{h}_2^c(\cdot)}{\partial h_1} &= -\frac{\partial \bar{\tilde{h}}_2^c(\cdot)}{\partial y^*}\frac{\partial f^{-1}(\cdot)}{\partial h_1}, \\
\frac{\partial \bar{h}_2^c(\cdot)}{\partial y^*} &= \frac{\partial \bar{\tilde{h}}_2^c(\cdot)}{\partial y^*}.
\end{aligned}$$

Dividing the two, we obtain:

$$\frac{\partial \bar{h}_2^c(\cdot)/\partial h_1}{\partial \bar{h}_2^c(\cdot)/\partial y^*} = -\frac{\partial f^{-1}(h_1, p, w_1)}{\partial h_1} \tag{28}$$

It is clear that this expression does not depend on y^*, thus proving result (27).

This result, by imposing restrictions on the way collective labour supplies behave, can be used to test the collective approach using empirical data. Under the assumptions we made in the general framework section, household behaviour conforms to this restriction if and only if it is collectively rational. Since other assumptions are also made, it does not provide a test of collective rationality only but a joint test of all the hypothesis made.

Example 2 Let's continue with the case presented in the previous example. That is with $I = 2$ and the following functional form for the labour supplies:

$$h_i = \alpha_i + \gamma_i^1 y + \gamma_i^2 y \log y + \Sigma_{j=1}^2 \beta_i^j w_j + \Sigma_{n=1}^{N-1} \delta_i^n p_n + \theta_i d_1,$$

with $d_1 \equiv y_1/y_2$, $y \equiv y_1 + y_2$ and $i = 1, 2$. Suppose also to simplified, that there is no public consumption. Provided that $\theta_i \neq 0 \forall i = 1, 2$, we can invert h_1 on d_1 in order to obtain:

$$d_1 = [h_1 - \alpha_1 - \gamma_1^1 y - \gamma_1^2 y \log y - \Sigma_{j=1}^2 \beta_i^j w_j - \Sigma_{n=1}^{N-1} \delta_i^n p_n]/\theta_1$$

Substituting this into $h_2(\cdot)$ will give:

$$\begin{aligned}
h_2 = {} & (\alpha_2 - \alpha_1\theta_2/\theta_1) + \theta_2/\theta_1 h_1 + (\gamma_2^1 - \gamma_1^1\theta_2/\theta_1)y + (\gamma_2^2 - \gamma_1^2\theta_2/\theta_1)y\log y + \\
& \Sigma_{j=1}^2(\beta_2^j - \beta_1^j\theta_2/\theta_1)w_j + \Sigma_{n=1}^{N-1}(\delta_2^n - \delta_1^n\theta_2/\theta_1)p_n.
\end{aligned}$$

This equation represents the labour supply of member 2 conditional on the labour supply of member 1, that is $\bar{h}_2^c(\cdot)$. The test then consists in verifying whether the expression

$$\frac{\partial}{\partial y}\left(\frac{\partial \bar{h}_2^c(\cdot)/\partial h_1}{\partial \bar{h}_2^c(\cdot)/\partial y}\right) = \frac{-(\gamma_2^2 - \gamma_1^2\theta_2/\theta_1)\theta_2/\theta_1}{[(\gamma_2^1 - \gamma_1^1\theta_2/\theta_1) + (\gamma_2^2 - \gamma_1^2\theta_2/\theta_1)(1 + \log y)]^2 y}$$

is equal to zero. This will be the case if and only if $\gamma_2^2 - \gamma_1^2\theta_2/\theta_1 = 0$. The case $\theta_2/\theta_1 = 0$ is excluded because it is a condition for d_1 to be a distribution factor. If d_1 is not a distribution factor, than $h_1(\cdot)$ can not be inverted on it. If this restriction is not satisfied, then two possibilities are left. First, the household behaviour is collectively rational but does not conform to the other assumptions made in the general framework. Second, the household behaviour is not collectively rational.

If property (27) is respected by empirical labour supply functions, it means that program (C), as a representation of household decision-making, can not be rejected. Therefore, the empirical labour supply functions can be used to recover the sharing rule up to a constant and the preferences up to a translation. For the sharing rule, simply note that by equations (24) and (20) we have $\varphi_1(p, w, \iota' y, d) = f_{\varphi_1}(h_1, p, w_1) = f_{\varphi_1}(h_1^c(p, w, \iota' y, d), p, w_1)$, from which follows:

$$\frac{\partial \varphi_1(\cdot)}{\partial \iota' y} = \frac{\partial f_{\varphi_1}(\cdot)}{\partial h_1}\frac{\partial h_1^c(\cdot)}{\partial \iota' y}, \quad (29)$$

$$\frac{\partial \varphi_1(\cdot)}{\partial d} = \frac{\partial f_{\varphi_1}(\cdot)}{\partial h_1}\frac{\partial h_1^c(\cdot)}{\partial d}, \quad (30)$$

$$\frac{\partial \varphi_1(\cdot)}{\partial w_2} = \frac{\partial f_{\varphi_1}(\cdot)}{\partial h_1}\frac{\partial h_1^c(\cdot)}{\partial w_2}, \quad (31)$$

$$\frac{\partial \varphi_1(\cdot)}{\partial w_1} = \frac{\partial f_{\varphi_1}(\cdot)}{\partial w_1} + \frac{\partial f_{\varphi_1}(\cdot)}{\partial h_1}\frac{\partial h_1^c(\cdot)}{\partial w_1}, \quad (32)$$

$$\frac{\partial \varphi_1(\cdot)}{\partial p} = \frac{\partial f_{\varphi_1}(\cdot)}{\partial p} + \frac{\partial f_{\varphi_1}(\cdot)}{\partial h_1}\frac{\partial h_1^c(\cdot)}{\partial p}, \quad (33)$$

where we have $\frac{\partial f_{\varphi_1}(\cdot)}{\partial z} = -\frac{\partial \overline{h}_2^C(\cdot)/\partial z}{\partial \overline{h}_2^C(\cdot)/\partial \iota' y}$ for $z = \{h_1, w_1, p\}$ as shown by equation (28). Basically, these equations show that the unobservable marginal effects of exogenous variables $\iota' y$, d, w and p on the share φ_1 can in fact be decomposed into observable marginal effects. More precisely, the marginal effects of $\iota' y$, d, w_2 on φ_1 are the product of the marginal effect of labour supply h_1 on $f_{\varphi_1}(\cdot)$, which can be computed from $-\frac{\partial \overline{h}_2^C(\cdot)/\partial h_1}{\partial \overline{h}_2^C(\cdot)/\partial \iota' y}$, with the marginal effect of the exogenous variables in question on the (unconditional) labour supply $h_1^c(\cdot)$, which can be estimated directly. Regarding, the marginal effects of $w_1$and p on φ_1 there is one more term expressing their effect on $f_{\varphi_1}(\cdot)$, which again can be respectively calculated by $-\frac{\partial \overline{h}_2^C(\cdot)/\partial w_1}{\partial \overline{h}_2^C(\cdot)/\partial \iota' y}$ and $-\frac{\partial \overline{h}_2^C(\cdot)/\partial p}{\partial \overline{h}_2^C(\cdot)/\partial \iota' y}$.

The recovery of the other spouse's share poses a certain problem because it is a residual share $\varphi_2(p, w, \iota' y, d) \equiv \iota' y + w'_{-s}H_{-s} - p'(\sum_{i=3}^{I} c_i) - \varphi_1(p, w, \iota' y, d)$. Unless H_{-s} and C_{-s} are observed or assumed to remain constant when $\iota' y$, w, p and d varies, which is doubtful, it is not possible to identify it from the sole observation of $h_1^c(\cdot)$ and $h_2^c(\cdot)$. Take for example the case of the marginal effect of $\iota' y$ on $\varphi_2(\cdot)$. We have $\partial \varphi_2(\cdot)/\partial \iota' y \equiv 1 + w'_{-s}\partial H_{-s}/\partial \iota' y + p'\partial C_{-s}/\partial \iota' y - \partial \varphi_1(\cdot)/\partial \iota' y$, where $\partial H_{-s}/\partial \iota' y$ and $\partial C_{-s}/\partial \iota' y$ can not be computed without knowing H_{-s} and C_{-s}, which in practice, is extremely rare. The same problem arises with $\partial \varphi_2(\cdot)/\partial d$ and $\partial \varphi_2(\cdot)/\partial w_j$. The common way, far from ideal, to circumvent this problem has been to assume that H_{-s} and C_{-s} are fixed.

Two remarks must be made about the recovery of the sharing rule. The effect of individual non-labour income y_i on the shares is not identified. Nevertheless, to the extent that the contribution of member i to the household non-labour income $y_i/(\iota' y)$ can be seen as a distribution factor, it can be recovered with equation (30) for $d_k \equiv y_i/(\iota' y)$. Second, since only partial derivatives are identified, the sharing rule is identified up to a constant. By integrating these, we are left with a constant. Third, as will be shown in Section 4.2, this indeterminacy does not really impede welfare analysis.

Example 3 Suppose that h_1 and h_2 are found to be collectively rational, that this $(\gamma_2^2 - \gamma_1^2 \theta_2/\theta_1) = 0$. Using result (28) we can find that:

$$\frac{\partial f_{\varphi_1}(h_1;p;w_1)}{\partial h_1} = -\frac{\partial \overline{h}_2^c(\cdot)/\partial h_1}{\partial \overline{h}_2^c(\cdot)/\partial y^*} = \frac{-\theta_2/\theta_1}{(\gamma_2^1 - \gamma_1^1\theta_2/\theta_1)};$$

$$\frac{\partial f_{\varphi_1}(h_1;p;w_1)}{\partial w_1} = -\frac{\partial \overline{h}_2^c(\cdot)/\partial w_1}{\partial \overline{h}_2^c(\cdot)/\partial y^*} = \frac{-(\beta_2^1 - \beta_1^1\theta_2/\theta_1)}{(\gamma_2^1 - \gamma_1^1\theta_2/\theta_1)};$$

$$\frac{\partial f_{\varphi_1}(h_1;p;w_1)}{\partial p_n} = -\frac{\partial \overline{h}_2^c(\cdot)/\partial h_1}{\partial \overline{h}_2^c(\cdot)/\partial y^*} = \frac{-(\delta_2^n - \delta_1^n\theta_2/\theta_1)}{(\gamma_2^1 - \gamma_1^1\theta_2/\theta_1)}.$$

From the unconditional labour supplies h_1, we also know that:

$$\frac{\partial h_1}{\partial y} = \gamma_1^1 + \gamma_1^2(1 + \log y);$$

$$\frac{\partial h_1}{\partial w_i} = \beta_1^i; \quad \frac{\partial h_1}{\partial p_n} = \delta_1^n; \quad \frac{\partial h_1}{\partial d_1} = \theta_1.$$

The partial derivatives of the shares are thus given by:

$$\frac{\partial \varphi_1(\cdot)}{\partial y} = \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}\gamma_1^1 + \gamma_1^2(1 + \log y);$$

$$\frac{\partial \varphi_i(\cdot)}{\partial d_1} = \frac{\theta_2}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)};$$

$$\frac{\partial \varphi_i(\cdot)}{\partial w_2} = \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}\beta_1^2;$$

$$\frac{\partial \varphi_i(\cdot)}{\partial w_1} = \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}\beta_2^1;$$

$$\frac{\partial \varphi_i(\cdot)}{\partial p_n} = \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}\delta_2^n.$$

Integration of the above derivatives yields the following shares:

$$\begin{aligned} \varphi_1 &= \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}(\gamma_1^1 y + \gamma_1^2 y \log y + \beta_2^1 w_1 + \beta_1^2 w_2 + \Sigma_{n=1}^{N-1}\delta_2^n p_n + \theta_1 d_1) + A_1; \\ \varphi_2 &= y_1 + y_2 - \varphi_1. \end{aligned}$$

where A_1 is an unknown constant.

Once the shares φ_i are identified, the standard approach of integrability can be use to recover the sub-utility functions of the spouses that lead to their choices. What is recovered, in fact, is the indirect utility function. It should be clear that we are not considering the indirect utility function associated with $U_i(c_i, h_i, C_{-s}, H_{-s})$, but rather with $u_i(c_i, h_i)$. So what is recovered is in fact $u_i^{max}(p, w_i, \varphi_i) \equiv u_i(c_i(p, w_i, \varphi_i), h_i(p, w_i, \varphi_i))$. Let's denote the cost or expenditure function associated with $u_i = u_i(c_i, h_i)$ by $\xi_i(p, w_i, u_i)$. This function computes the minimal level of wealth required to reach the level of utility u_i at prices and wage-rate (p, w_i). The so-called integrability equation is given by[24]:

$$\begin{aligned} \frac{\partial \xi_i(p, w_i, u_i)}{\partial w_i} &= -\tilde{h}_i^c(p, w_i, \xi_i(p, w_i, u_i)); & (34) \\ \xi_i(p, w_i, u_i) &\equiv \varphi_i; & (35) \end{aligned}$$

for $i = 1, 2$. Thus, for a certain level of utility u_i, (34) is in fact a partial differential equation which can be integrated in order to obtain $\xi_i(p, w_i, u_i)$. The integration constant will serve to characterize the level of utility.[25] Once $\xi_i(p, w_i, u_i)$ is recovered, the indirect utility function is simply found by using (35). More precisely, we can inverse u_i and φ_i, yielding $u_i^{max}(p, w_i, \varphi_i)$.

Since there is a constant indeterminacy concerning the share, the indirect utility function is recovered only up to a translation having the magnitude of the constant. To see this, note that $\varphi_i = \phi_i + A_i$ where ϕ_i is the recovered part and A_i is an unknown constant. Substituting this into the indirect sub-utility function gives $v_i(p, w_i, \phi_i + A_i)$.

Example 4 Let's recover the indirect sub-utility function of individual 1. The first thing to do is to derive $\tilde{h}_1^c(p, w_1, \varphi_1)$ from $h_1^c(p, w, \iota' y, d_1)$. Recall that earlier we found the following share for spouse 1:

$$\varphi_1 = \frac{\theta_2/\theta_1}{(\gamma_1^1\theta_2/\theta_1 - \gamma_2^1)}(\gamma_1^1 y + \gamma_1^2 y \log y + \beta_2^1 w_1 + \beta_1^2 w_2 + \Sigma_{n=1}^{N-1}\delta_2^n p_n + \theta_1 d_1) + A_1.$$

[24] These equations can be found in any advanced microeconomic textbook.

[25] The expenditure functions associated with the most commonly used functional forms for labour supply have already been derived by Stern (1986).

By rearranging the terms, we can express y as a function of φ_1:

$$\gamma_1^1 y + \gamma_1^2 y \log y = \frac{(\gamma_1^1 \theta_2/\theta_1 - \gamma_2^1)}{\theta_2/\theta_1}(\varphi_1 - A_1) - \beta_2^1 w_1 - \beta_1^2 w_2 - \Sigma_{n=1}^{N-1}\delta_2^n p_n - \theta_1 d_1.$$

Substituting this into $h_1(\cdot)$ gives us $h_1^c(\cdot)$:

$$h_1 = \alpha_1 + \frac{(\gamma_1^1 \theta_2/\theta_1 - \gamma_2^1)}{\theta_2/\theta_1}(\varphi_1 - A_1) + (\beta_1^1 - \beta_2^1) w_1 + \Sigma_{n=1}^{N-1}(\delta_1^n - \delta_2^n) p_n.$$

Using this result with the first integrability equations we obtain:

$$\frac{\partial \xi_i(p; w_i; u_i)}{\partial w_1} = -\alpha_1 - \Phi \xi_i(p; w_i; u_i) + \Phi A_1 - (\beta_1^1 - \beta_2^1) w_1 - \Sigma_{n=1}^{N-1}(\delta_1^n - \delta_2^n) p_n;$$

with $\Phi \equiv \frac{(\gamma_1^1 \theta_2/\theta_1 - \gamma_2^1)}{\theta_2/\theta_1}$. This equation can be solved for $\xi_i(p; w_i; u_i)$ by using the solution method for nonhomogeneous linear differential equations, which yields:

$$\xi_i(p; w_i; u_i) = \exp\{-\Phi w_1\}\left(B_1 + \frac{\Phi A_1 - \alpha_1 - \Sigma_{n=1}^{N-1}(\delta_1^n - \delta_2^n) p_n - (\beta_1^1 - \beta_2^1) w_1}{\Phi} + \frac{(\beta_1^1 - \beta_2^1)}{\Phi^2} \right).$$

where B_1 is the constant of integration. By setting it equal u_i and by using (35), we can write:

$$\varphi_1 = \exp\{-\Phi w_1\}\left(u_1 + \frac{\Phi A_1 - \alpha_1 - \Sigma_{n=1}^{N-1}(\delta_1^n - \delta_2^n) p_n - (\beta_1^1 - \beta_2^1) w_1}{\Phi} + \frac{(\beta_1^1 - \beta_2^1)}{\Phi^2} \right).$$

In the last step, we invert u_1 on φ_1 in order to obtain:

$$\begin{aligned} u_1 &= v_1(p; w_1; \varphi_1) = \exp\{\Phi w_1\}\left(\varphi_1 + \frac{\alpha_1 + \Sigma_{n=1}^{N-1}(\delta_1^n - \delta_2^n) p_n - \Phi A_1 + (\beta_1^1 - \beta_2^1) w_1}{\Phi} - \frac{(\beta_1^1 - \beta_2^1)}{\Phi^2} \right) \\ &= \Phi \exp\{\Phi w_1\}\left(\begin{array}{c} \gamma_1^1 y + \gamma_1^2 y \log y + \beta_1^1 w_1 + \beta_1^2 w_2 + \\ \Sigma_{n=1}^{N-1}\delta_1^n p_n + \theta_1 d_1 + A_1 \end{array} \right). \end{aligned}$$

4.1.2 Prices Effect

The restrictions developed here are based on the recognition that the Slutsky equation presented in the unitary section by (5) and (6), no longer applies. To see this, first note that from program (C1) commodity demands (19) and labour supplies (20), we can derive the following (Marshalian) price and income effects:

$$\begin{aligned} \frac{\partial h_i^c(\cdot)}{\partial w_j} &= \frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial w_j} + \frac{\partial \tilde{h}_i^c(\cdot)}{\partial \lambda}\frac{\partial \lambda(\cdot)}{\partial w_j} \qquad i,j = 1,\dots,I; \\ \frac{\partial h_i^c(\cdot)}{\partial \iota' y} &= \frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial \iota' y} + \frac{\partial \tilde{h}_i^c(\cdot)}{\partial \lambda}\frac{\partial \lambda(\cdot)}{\partial \iota' y} \qquad \forall\, i. \end{aligned}$$

Using these to compute the right hand side of the Slutsky equation (6) we obtain:

$$\begin{aligned} \frac{\partial h_i^c(\cdot)}{\partial w_j} - h_j\frac{\partial h_i^c(\cdot)}{\partial \iota' y} &= \frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial w_j} - h_j\frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial \iota' y} + \frac{\partial \tilde{h}_i^c(\cdot)}{\partial \lambda}\left(\frac{\partial \lambda(\cdot)}{\partial w_j} - h_j\frac{\partial \lambda(\cdot)}{\partial \iota' y}\right) \\ &= \frac{\partial \hat{h}_i^u}{\partial w_j} + \frac{\partial \tilde{h}_i^c(\cdot)}{\partial \lambda}\left(\frac{\partial \lambda(\cdot)}{\partial w_j} - h_j\frac{\partial \lambda(\cdot)}{\partial \iota' y}\right) \end{aligned}$$

for $i,j = 1,\dots,I$, and where the equalities $\frac{\partial \hat{h}_i^u(\cdot)}{\partial w_j} = \frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial w_i}$ and $\frac{\partial \hat{h}_i^u(\cdot)}{\partial \iota' y} = \frac{\partial \tilde{h}_i^c(\cdot)|_{\bar\lambda}}{\partial \iota' y}$ were used.[26] This shows that the Slutsky equation does not hold in the collective setting. The expression $\frac{\partial h_i^c(\cdot)}{\partial w_j} - h_j\frac{\partial h_i^c(\cdot)}{\partial \iota' y}$ no longer gives just the traditional compensated effect, but instead has an added effect on the reservation well-being $\lambda(\cdot)$. The same applies to $c_j^c(\cdot)$.

It is from this observation that Browning and Chiappori formulated their restrictions. There exists in fact two kind of restrictions. The first were derived by Chiappori (1988) and concern labour supplies. The second set was developed by Browning and Chiappori (1998) and applies to commodity demands. Here, we will only discuss the first set which also allows us to recover the sharing rule and preferences. These restrictions are more complex than the ones presented in the preceding section and because of this, we do not derive or prove them. Readers are invited to consult Chiappori (1988) for the derivations and proofs.

Two definitions must be introduced before presenting the restrictions:

$$\begin{aligned} D_i &\equiv \frac{\partial h_i^c(\cdot)/\partial w_j}{\partial h_i^c(\cdot)/\partial \iota' y}, \qquad i, j\,(\neq i) = 1, 2; \\ \eta &\equiv \left[1 - \frac{\left(D_2\frac{\partial D_1}{\partial \iota' y}\right) - \frac{\partial D_1}{\partial w_1}}{\left(\frac{\partial D_2}{\partial \iota' y}D_1\right) - \frac{\partial D_2}{\partial w_2}}\right]^{-1}; \end{aligned}$$

where it is assumed that $\partial h_i^c(\cdot)/\partial \iota' y \neq 0$, which implies that the labour supplies of both spouses are responsive to changes in household non-labour income and that $\left(D_1\frac{\partial D_2}{\partial \iota' y}\right) - \frac{\partial D_2}{\partial w_2} \neq$

[26] It should be understood that the right-hand side of relation (??) does not correspond to the derivative of the collective Hicksian labour supply of member j.

$\left(\frac{\partial D_1}{\partial \iota' y} D_2 - \frac{\partial D_1}{\partial w_1}\right)$ for all $(w_1; w_2; \iota' y)$. With these definitions in hand, it is possible to show that the spouses' labour supplies $h_1^c(\cdot)$ and $h_2^c(\cdot)$ necessarily satisfy the following equality and inequality constraints:

$$\text{i)} \qquad \frac{\partial \eta}{\partial \iota' y} D_1 + \eta \frac{\partial D_1}{\partial \iota' y} - \frac{\partial \eta}{\partial w_2} = 0; \tag{36}$$

$$\text{ii)} \qquad \frac{\partial (1-\eta)}{\partial \iota' y} D_2 + (1-\eta) \frac{\partial D_2}{\partial \iota' y} - \frac{\partial (1-\eta)}{\partial w_1} = 0; \tag{37}$$

$$\text{iii)} \qquad \frac{\partial h_1}{\partial \iota' y} \frac{[h_1 - (1-\eta) D_2]}{\eta} - \frac{\partial h_1}{\partial w_1} \leq 0; \tag{38}$$

$$\text{iv)} \qquad \frac{\partial h_2}{\partial \iota' y} \frac{[h_2 - \eta D_1]}{(1-\eta)} - \frac{\partial h_2}{\partial w_2} \leq 0. \tag{39}$$

Since $h_1(\cdot)$ and $h_2(\cdot)$ are observed, these four constraints can be used as restrictions imposed on them by collective rationality. Given any particular functional form for labour supplies, these constraints translate into conditions on the parameters. If the latter are satisfied, then collective rationality, along with the other hypothesis made, can not be rejected.

Example 5 Let's continue with the same example. Recall that the functional form given to the spouses' labour supplies is given by: $h_i = h_i = \alpha_i + \gamma_i^1 y + \gamma_i^2 y \log y + \Sigma_{j=1}^2 \beta_i^j w_j + \Sigma_{n=1}^{N-1} \delta_i^n p_n + \theta_i d_1$ with $i = 1; 2$. From this D_1, D_2 and η can be computed:

$$D_1 \equiv \frac{\beta_1^2}{\gamma_1^1 + \gamma_1^2 + \gamma_1^2 \log y};$$

$$D_2 \equiv \frac{\beta_2^1}{\gamma_2^1 + \gamma_2^2 + \gamma_2^2 \log y};$$

$$\eta \equiv \frac{\gamma_2^2}{\gamma_2^2 \gamma_1^1 - \gamma_1^2 \alpha_2^1} \left(\gamma_2^1 + \gamma_2^2 + \gamma_2^2 \log y\right):$$

It is now easy to show that the first two equality constraints are automatically satisfied. For the third and fourth restrictions to be satisfied we must find:

$$\frac{\gamma_1^2}{\gamma_2^2} \beta_2^1 - \frac{(\gamma_1^2 \gamma_2^1 - \gamma_2^2 \gamma_1^1)}{\alpha_2^2} h_1 - \beta_1^1 \leq 0;$$

$$\frac{\gamma_2^2}{\gamma_1^2} \beta_1^2 - \frac{(\gamma_2^2 \gamma_1^1 - \gamma_1^2 \gamma_2^1)}{\alpha_1^2} h_2 - \beta_2^2 \leq 0:$$

If restrictions (36), (37), (38) and (39) are all satisfied by empirical data, then again the sharing rules ϕ_1 and ϕ_2, as presented in the preceding section, as well as the spouse's

$u_1(\cdot)$ and $u_2(\cdot)$ sub-utility functions can be recovered. For share φ_1, the partial derivatives are given by:

$$\frac{\partial \varphi_1}{\partial \iota\gamma y} = \eta; \quad (40)$$

$$\frac{\partial \varphi_1}{\partial w_2} = D_1 \eta; \quad (41)$$

$$\frac{\partial \varphi_1}{\partial w_1} = (\eta - 1) D_2. \quad (42)$$

The money metric sub-utility function can be recovered in the same way.

4.2 Empirical Evidence

The test on the effect of the distribution factors can be implemented using cross-sectional data. With a sample of households having only two decision-makers, it requires having a least two observed commodities and one distribution factors. The distribution factors that have most often been the subject of empirical studies deal with the respective contributions of the spouses to the household revenue.[27] The popularity of this set of distribution factors is explained in large part by the availability of data on individuals' revenue (at least in developed countries) and by the fact that this variable fluctuates considerably from one individual to another.

The test on the pseudo-Slustky matrix must be performed using time-series of consumption-price data or cross-sections of labour-supply wage data. Also, it cannot be implemented when the number of observed commodities is less than two times the number of intra-household decision-makers. In this case, the symmetry plus rank restrictions are always satisfied. This means, for instance, that it cannot be used with the standard labour supply model with one Hicksian consumption good, and as many labour supplies as there are decision makers. For this reason, if the intention is to use the estimation of collective rationality for macro-modelling purposes, an estimation based on the approach using the distribution factors test is more appropriate than one based on the pseudo-Slutsky matrix.

Several tests have been done using consumption data (Bourguignon et al. (1993), Browning et al. (1994), Thomas and Chen (1994), Browning and Chiappori (1995)) and labour market data (Fortin and Lacroix (1997), Chiappori et al.(1998), Blundell et al.(1998), Chiuri (1999)). Their results all provide evidence in favour of the collective model.

[27] See for example Schultz (1990), Thomas (1990, 1993), Thomas and Chen (1994), Bourguignon et al. (1993, 1994), Fortin and Lacroix (1997).

4.3 Restrictions on Aggregate Behaviour

Let's look again at the case where all goods are represented by a single commodity and all households are aggregated together. As for the unitary model, we assume that relative prices and relative wage rates stay constant. The vectors p and w are again decomposed into p ´ pp_B and w ´ ww_B. Again, the composite household demand x and labour supplies l are respectively given by $p_B^0 §_{i=1}^I c_i^c$ and $w_B^0 H^c$. From functions (19) to (22), we can obtain the equivalent following functions for x:

$$
\begin{aligned}
x &= p_B^0[§_{i=1}^I c_i^c(p;w;¶^0 y)] \\
&´\ x^c(p;w;¶^0 y;d) && (43)\\
&= p_B^0[§_{i=1}^I c_i^c(p;w;¶^0 y;¸(p;w;¶^0 y;d))] \\
&´\ \tilde{x}^c(p;w;¶^0 y;¸(p;w;¶^0 y;d)) && (44)\\
&= p_B^0[§_{i=1}^2 c_i^c(p;w;'_i(p;w;¶^0 y;d)) + §_{i=3}^I c_i^c(p;w;¶^0 y-'_1(p;w;¶^0 y;d)-'_2(p;w;¶^0 y;d))] \\
&´\ \hat{x}^c(p;w;¶^0 y;'_1(p;w;¶^0 y;d);'_2(p;w;¶^0 y;d)); && (45)
\end{aligned}
$$

where p_B and w_B are dropped for simplicity. The functions $c_i^c(p;w;¶^0 y-'_1(¢)-'_2(¢))$ for i=3,...,I, ‡ow from a simple, rewritten household budget constraint: $p^0 §_{i=3}^I c_i - w_{-s}^0 H_{-s} = ¶^0 y - '_1(¢) - '_2(¢)$. By analogy, we …nd the following functions for the composite labour supply:

$$
\begin{aligned}
l &= l^c(p;w;¶^0 y;d) && (46)\\
&= \tilde{l}^c(p;w;¶^0 y;¸(p;w;¶^0 y;d)) && (47)\\
&= \hat{l}^c(p;w;¶^0 y;'_1(p;w;¶^0 y;d);'_2(p;w;¶^0 y;d)) && (48)
\end{aligned}
$$

We see that the observable functions $x^c(¢)$ and $l^c(¢)$ share the structure of $c_i^c(¢)$ and $h_i^c(¢)$. The structure of $\tilde{c}_i^c(¢)$ and $\tilde{h}_i^c(¢)$ is also transferred to $\tilde{x}^c(¢)$ and $\tilde{l}^c(¢)$. However, $\hat{x}_i^c(¢)$ and $\hat{l}_i^c(¢)$ do not inherit the properties of $\hat{c}_i^c(¢)$ and $\hat{h}_i^c(¢)$. Consequently, $x^c(¢)$ and $l^c(¢)$ satisfy the restrictions imposed by the structure of $\tilde{c}_i^c(¢)$ and $\tilde{h}_i^c(¢)$ but not those imposed by the structure of $\hat{c}_i^c(¢)$ and $\hat{h}_i^c(¢)$. Since the restrictions presented in Section 4.1 were all based on the equivalence between the system $c_i^c(¢)$, $h_i^c(¢)$ and the system $\hat{c}_i^c(¢)$, $\hat{h}_i^c(¢)$, none are satis…ed by the composite demand and labour supply. Nevertheless, $x^c(¢)$ and $l^c(¢)$ have one di¤erence with their unitary counterparts. The di¤erence is that, unlike to $x^u(p;w;¶^0 y)$ and $l^u(p;w;¶^0 y)$, they depend on distribution factors.

Even if $x^c(¢)$ and $l^c(¢)$ respected the restrictions, there would be no utility function generating them as the solution of its maximization under the household budget constraint. This is due to the very nature of collective models. The objective function maximized by the household in program (U) depends on exogenous variables through the intermediary of $¸(¢)$. Therefore, it can not be considered as a utility function in the strict sense of the term. Any welfare measure based on $x^c(\cdot)$ and $l^c(\cdot)$ would thus have no welfare significance for household members.

Let's now aggregate together the behaviour of all households. Recall that the aggregate demand and labour supply are defined by $X \equiv \Sigma_{j=1}^{J} x_j$ and $L \equiv \Sigma_{j=1}^{J} l_j$. Also, we assume that the J households face the same prices and wage rates. Only their preferences and non-labour income are allowed to differ. Using the functions (43) to (48) we can find that:

$$X = \sum_{j=1} x_j^c(p; w; \iota' y_j; d_j) \equiv X^c(p; w; \iota' y_1; \ldots; \iota' y_J; d_1; \ldots; d_J)$$

$$L = \sum_{j=1} l_j^c(p; w; \iota' y_j; d_j) \equiv L^c(p; w; \iota' y_1; \ldots; \iota' y_J; d_1; \ldots; d_J)$$

The aggregate demand and labour supply for the economy are thus functions of the aggregate price and wage levels, of the J households' non-labour income and of the J vectors of distribution factors. As is the case with their unitary counterparts $X^u(\cdot)$ and $L^u(\cdot)$, a redistribution of the economy's wealth $\Sigma_{j=1}^{J} \iota' y_j$ across the households will change X and L. However, unlike their unitary counterparts, the collective aggregate demand and labour supply depend on the distribution factors associated with the J households. To the extent that the relative contributions of the spouses to the household income, that is $y_{1j}/\iota' y_j$ and $y_{2j}/\iota' y_j$, are two distribution factors, then a redistribution of the household's non-labour income, changing y_{1j} and/or y_{2j}, would modify X and L.

Given this setting, a change of men's and women's bargaining power caused by an external shock or a policy have the potential of modifying the households' demands even if the overall households' income would remain the same. The change in the composition of households' demands would affect the market equilibrium for these goods. New prices would prevail, which again could change the bargaining power of men and women and the household budget constraint and so on. It could thus create general equilibrium effects. These bargaining effects are absent when the households' decision process is modelled in a unitary way. Within a unitary model, a policy that doesn't change the households' budget cannot modify the households' demands. A policy affects the households' demands of unitary models only through prices and household income effects. In collective models, these effects are still present, but there is also a bargaining effect. Of course, the general equilibrium effects would be sizeable only if the economic sectors are correctly and sufficiently disaggregated to permit the gender differences in preferences to be expressed. If the sectors' aggregation is too strong, the only possible way in which preferences could express their difference would be between composite consumption and saving.

Since $x_j^c(\cdot)$ and $l_j^c(\cdot)$ do not satisfy the restrictions, then $X^c(\cdot)$ and $L^c(\cdot)$ will obviously not satisfy them either. Furthermore, $X^c(\cdot)$ and $L^c(\cdot)$ will have no welfare meaning for the households in the economy.

Now, rather than being interested in the behaviour of an aggregate demand and labour supply of all the individuals in the economy, we could be interested in the behaviour and interactions between some socio-demographic groups, such as children, wives and husbands. In this case, we could define three composite goods for each household. Reserving the indice $i = 1$ for the wife and $i = 2$ for the husband, we could have one composite good for the children $x_{-s} \equiv \Sigma_{i=3}^{I} p'_{\beta} c_i$, one (private) composite good for the wife $x_1 \equiv p'_{\beta} c_1$ and one for the husband $x_2 \equiv p'_{\beta} c_2$. We could also have a composite labour supply for the children given by $l_{-s} \equiv \Sigma_{i=3}^{I} w_{i\beta} h_i$ with $w_{-s} \equiv w_{-s} w_{-s\beta}$. Using (21) we would have the following functions for the spouses and the children:

$$
\begin{aligned}
x_i &= x_i^c(p, w_1, w_2, w_{-s}, \pi' y, d) \qquad i = 1, 2;\\
&= \tilde{x}_i^c(p, w_i, \varphi_i(p, w_1, w_2, w_{-s}, \pi' y, d)) \qquad i = 1, 2;\\
x_{-s} &= x_{-s}^c(p, w_1, w_2, w_{-s}, \pi' y, d)\\
&= \tilde{x}_{-s}^c(p, w_{-s}, \pi' y, \varphi_1(p, w_1, w_2, w_{-s}, \pi' y, d), \varphi_2(p, w_1, w_2, w_{-s}, \pi' y, d))\\
l_{-s} &= l_{-s}^c(p, w_1, w_2, w_{-s}, \pi' y, d)\\
&= \tilde{l}_{-s}^c(p, w_{-s}, \pi' y, \varphi_1(p, w_1, w_2, w_{-s}, \pi' y, d), \varphi_2(p, w_1, w_2, w_{-s}, \pi' y, d))
\end{aligned}
$$

Again we use the fact that $p' \Sigma_{i=3}^{I} c_i - w_{-s}' H_{-s} = \pi' y - \varphi_1(\cdot) - \varphi_2(\cdot)$ to derive $\tilde{x}_{-s}^c(\cdot)$ and $\tilde{l}_{-s}^c(\cdot)$. Regarding the spouses' labour supply, they are still given by (20). Note that here, only the relative wage rates of the children need to remain constant.

Now, as opposed to $x^c(\cdot)$, the spouses' composite goods behave as any $\tilde{c}_{in}^c(\cdot)$. They satisfy all the restrictions derived for $c_{in}^c(\cdot)$: distribution factor restrictions and price effect restrictions. Furthermore, since it is possible to find a sub-utility function $\tilde{u}_i(x_i, h_i)$ showing the same preferences as $u_i(c_i, h_i)$ and such that $\tilde{x}_i^c(p, w_i, \varphi_i(p, w_1, w_2, w_{-s}, \pi' y, d))$ and $\tilde{h}_i^c(p, w_i, \varphi_i(p, w_1, w_2, w_{-s}, \pi' y, d))$ are a solution of:

$$
\begin{aligned}
\max_{\{x_i, h_i\}} \quad & \tilde{u}_i(x_i, h_i)\\
\text{subject to} \quad & p x_i = w_i h_i + \varphi_i(p, w_1, w_2, w_{-s}, \pi' y, d);
\end{aligned}
$$

they will have welfare significance for the spouses.

Let's now turn to what happens when we aggregate all the children, wives and husbands in the economy. Denoting X_{-s}, $X_{-1}$and X_{-2} as the aggregate demand of, respectively the children, wives and husbands, we can obtain that:

$$
\begin{aligned}
X_{-s} &= X^c_{-s}(p;w_1;w_2;w_{-s};\iota' y_1;...;\iota' y_J;d_1;...;d_J);\\
&= \hat{X}^c_{-s}(p;w_{-s};\iota' y_1;...;\iota' y_J;\varphi_{11}(\cdot);\varphi_{21}(\cdot);...;\varphi_{1J}(\cdot);\varphi_{2J}(\cdot));\\
X_i &= X^c_i(p;w_1;w_2;w_{-s};\iota' y_1;...;\iota' y_J;d_1;...;d_J);\\
&= \hat{X}^c_i(p;w_i;\varphi_{i1}(\cdot);...;\varphi_{iJ}(\cdot));
\end{aligned}
$$

with i=1,2. By analogy, we can find the composite labour supply L_{-s} of children, the wives' composite labour supply L_1 and the husbands' composite labour supply L_2:

$$
\begin{aligned}
L_{-s} &= L^c_{-s}(p;w_1;w_2;w_{-s};\iota' y_1;...;\iota' y_J;d_1;...;d_J);\\
&= \hat{L}^c_{-s}(p;w_{-s};\iota' y_1;\varphi_{11}(\cdot);\varphi_{21}(\cdot);...;\iota' y_J;\varphi_{1J}(\cdot);\varphi_{2J}(\cdot));\\
L_i &= L^c_i(p;w_1;w_2;w_{-s};\iota' y_1;...;\iota' y_J;d_1;...;d_J);\\
&= \hat{L}^c_i(p;w_i;\varphi_{i1}(\cdot);...;\varphi_{iJ}(\cdot));
\end{aligned}
$$

with i=1,2. The aggregate (private) demand $\hat{X}^c_i(\cdot)$ and labour supply $\hat{L}^c_i(\cdot)$ of the spouses are functions of the aggregate price level, of their own (common) wage rates and of the J household' shares accruing to them. The other exogenous variables, such as the wage rates of the other spouse, the aggregate wage rate level of the children and the distribution factors, affect these functions only to the extent that they affect their shares $\varphi_{i1}(\cdot)$.

If we are ready to make a strong assumption in order to be closer to an exact aggregation, we could suppose that the spouses' sub-utility function $\mathbf{e}_i(x_i;h_i)$ has the following Gorman form:

$$
\mathbf{e}^{max}_{ij}(p;w_i;\varphi_{ij}) \equiv \mathbf{e}_{ij}(\hat{x}^c_{ij}(p;w_i;\varphi_{ij});\hat{h}^c_{ij}(p;w_i;\varphi_{ij})) \equiv \omega_{ij}(p;w_i) + \nu_i(p;w_i)\varphi_{ij}
$$

Thus, the first parameter $\omega_{ij}(p;w_i)$, can differ between wives and husbands and from household to household. On the other hand, the second term $\nu_i(p;w_i)$, is assumed to be identical for all i spouses, but is allowed to differ between spouses 1 and 2. From Roy's identity, we know that:

$$
\begin{aligned}
-\frac{\partial \mathbf{e}^{max}_{ij}(\cdot)/\partial p}{\partial \mathbf{e}^{max}_{ij}(\cdot)/\partial \varphi_{ij}} &= \frac{\partial \omega_{ji}(p;w)/\partial p}{\nu_i(p;w)} + \frac{\partial \nu_i(p;w)/\partial p}{\nu_i(p;w)}\varphi_{ij} = \hat{x}^U_{ij}(p;w;\varphi_{ij});\\
\frac{\partial \mathbf{e}^{max}_{ij}(\cdot)/\partial w}{\partial \mathbf{e}^{max}_{ij}(\cdot)/\partial \varphi_{ij}} &= \frac{\partial \omega_{ij}(p;w)/\partial w}{\nu_i(p;w)} + \frac{\partial \nu_i(p;w)/\partial w}{\nu_i(p;w)}\varphi_{ij} = l^U_{ij}(p;w;\iota' y_j):
\end{aligned}
$$

By summing over these demands and labour supplies we find that:

$$
\begin{aligned}
X_i &= \sum_{j=1} \frac{\partial \omega_{ji}(p,w)/\partial p}{\nu_i(p,w)} + \frac{\partial \nu_i(p,w)/\partial p}{\nu_i(p,w)} \sum_{j=1} \varphi_{ij} = \widehat{X}_i^c(p, w_i, \Sigma_{j=1}^J \varphi_{ij}); \\
L_i &= \sum_{j=1} \frac{\partial \omega_{ij}(p,w)/\partial w}{\nu_i(p,w)} + \frac{\partial \nu_i(p,w)/\partial w}{\nu_i(p,w)} \sum_{j=1} \varphi_{ij} = \widehat{L}_i^c(p, w_i, \Sigma_{j=1}^J \varphi_{ij});
\end{aligned}
$$

for $i = 1,2$. In this particular case, the aggregation is perfect. The aggregate (private) demand and the aggregate labour supply of spouses i are a function of the aggregate price level p, of their (common) wage rate level w_i and of the share of the economy's wealth accruing to them $\Sigma_{j=1}^J \varphi_{ij}$. Furthermore, these functions would have welfare significance for the spouses in the economy.

4.4 Intrahousehold Welfare Analysis

The most appropriate way to do intrahousehold welfare analysis of economic policies would be to examine what happens to the well-being of each household member. For that, we would need to have information on the preferences, the labour supply and the composite consumption of each household member. Unfortunately, it is quite rare that one finds enough data to be able to compute the composite consumption of each household member. Surveys typically collect data on a household rather than an individual basis. There are surveys that gather information on some individual consumption, but this is usually not enough to approximate the global consumption of all individuals in the household. As a result, preferences remain unknown, since it is individual consumption which embodies information on them. So, while one would want to treat the well-being of each household member separately, there would be no empirical basis for that.

The collective approach offers an astute alternative. Since the sharing rule can be obtained from the observation of data that are quite easy to obtain, it can serve to disaggregate household consumption into individuals' consumptions up to a constant. Furthermore, the recovered preferences can serve to assess the well-being of each household member up to a translation. An economic policy will potentially affect the household members in two ways. First by changing the household budget constraint. Second by changing the sharing rule. The new household budget and sharing rule will result in new individual consumptions and new well-being, again respectively recovered up to a constant and up to a translation. The impact of the policy for each household member will thus correspond to the variation in its consumption and well-being, which are both independent of the constant and translation indeterminacy. Thus, the collective setting permit to track the impact of economic policy not only on the household aggregate consumption and individual labour supplies, but also on the sharing rule and thus on the distribution of well-being within the household.

We can enrich the intrahousehold welfare analysis by using a general equilibrium framework, rather than a partial one. Economic policies would affect the household budget constraint and the sharing rule prevailing inside households. The change in the sharing rule and the household budget would generate an intra-household redistribution of welfare and a modification of household composite demand and labour supplies. These new household demands and labour supplies, in turn, would affect the market equilibrium for these goods and possibly the value of some distribution factors (the for example, the male-female wage rate ratio could be a distribution factor). Theses new prices, wage rates and distribution factors would again create an intra-household redistribution of welfare and a modification of household composite demand and labour supplies, and so on. Thus, intra-household redistributions created by economic policies could lead to general equilibrium effects.

In fact, any policies affecting the distribution factors would generate intra-households' welfare redistribution even if the household budget would stay constant. The individuals for whom the bargaining power would increase would see their well-being increase while the others would undergo a reduction in well-being. This is not possible in the unitary model since there is no place for bargaining. In the case where the households' income would also change but the relative prices would remain constant, then, to the extent that household income influences the spouses' bargaining power, the collective model could again lead to a redistribution of household welfare, while the unitary model could only generate a change in well-being in the same direction for all the household members. That is, if one member wins then all members win. However, since the unitary model acts like a black box, it would not show to what extent each member is winning. The collective model would. Now, if the relative prices were also to change, then both models could potentially produce intra-household welfare redistribution. When the relative prices change, the redistribution in the unitary model flows from the fact that the members who prefer the goods for which the price has increased are more penalized than the others because the household will probably substitute away from these goods. In the collective setting, this effect also exists, but there is again an additional effect produced by the change in relative bargaining power that could result from the change in the relative price. Again, as opposed to the collective model, the unitary model would not give the extent to which each member wins or loses.

5 Bargaining Models

The bargaining approach recognizes that preferences can di¤er between spouses and that household decisions are taken in a kind of negotiation process where spouses have certain power. More precisely, it assumes that the respective power of a spouse in household decision-making comes from its reservation well-being. The reservation well-being of a spouse, also known as its threat point, is understood as being the maximum well-being he/she can attain from the situation in which no agreement is reached with his/her partner.[28] The lower this is, the weaker is his/her power. Intuitively, the weaker the alternative well-being of a spouse, all things remaining equal, the more he has to gain from agreement, and thus, the more he will be willing to make concessions in order to achieve an agreement.

Manser and Brown (1980) and McElroy and Horney (1981) and yet others assume that this alternative corresponds to divorce. From this viewpoint, any variables that a¤ect the maximum level of well-being that a spouse can reach outside the marriage, will a¤ect the bargaining power of that spouse. These types of variables are called extra-environmental parameters (EEPs). The prices, the wage-rate of the spouse, his/her non-labour income, the unemployment rate faced by the group he/she belongs to, are all examples of potential EEPs. For Becker (1981), the state of the marriage market, as proxied for example by the sex-ratio (Fortin and Lacroix (1998)), is another factor which could in‡uence the bargaining power of the spouses. McElroy (1990) adds to this list «parameters that characterize government taxes and government or private transfers that are conditioned on marital or family status». Haddad and Kanbur (1991) stress the importance of the economic possibilities of spouses outside of the household, such as access to communes, laws related to food pensions and to the support of children, which directly depend upon public policies.

For Lundberg and Pollack (1993), «While divorce may be the ultimate threat available to both spouses and is a possible destination for marriage in which bargaining has failed, it is not the only possible threat point from which bargaining could proceed. [...] we consider a noncooperative Cournot-Nash equilibrium within marriage as an alternative threat point». Depending on the speci…cities taken by the noncooperative game, the threat point of an individual could again depend on prices, his/her wage rate, non-labour income and the unemployment rate faced by the group he/she belongs to.

In fact the nature of threat points is likely to vary from one culture to the other. In some cultures divorce might be the most relevant alternative, while in others it might be to ‡ee or some other particular form of non-cooperative game. Furthermore, the variables a¤ecting these di¤erent threat points are also likely to change with the culture.

[28] This reservation well-being should not be confused with the one found in Footnote 19, that is V_2^C (¢).

Many different types of bargaining model can be found in the literature, but most apply the Nash cooperative bargaining approach. The model presented here will be of this kind. Without specifying the nature of the threat points, we will assume that the value of alternative well-being for each spouse is given by the function $V_i^B(p, w_i, y_i, e_i)$. That is, the maximum well-being that spouse i will receive if he does not reach an agreement with his partner depends on a set of exogenous variables, which comprises the price vector p, its wage-rate w_i, its non-labour income y_i and a K_i dimension vector of EEPs $e_i \equiv [e_{i1}, ..., e_{iK_i}]'$. The Nash cooperative bargaining model is then given by program:

$$
\begin{aligned}
&\max_{\{C,H\}} && [U_1(c_1, h_1, C_{-s}, H_{-s}) - V_1^B][U_2(c_2, h_2, C_{-s}, H_{-s}) - V_2^B] \\
&\text{subject to} && p'(\Sigma_{i=1}^{I} c_i) = w'H + \iota' y \\
& && V_i^B = V_i^B(p, w_i, y_i, e_i) \\
& && U_i(c_i, h_i, C_{-s}, H_{-s}) \geq V_i^B \quad \forall\, i = 1, 2.
\end{aligned}
\tag{B}
$$

In this approach, the household is seen as though it were maximizing the product of the surplus well-being created for each spouse from an agreement[29] under a household budget constraint and a set of threat points.

Household labour supplies and demands satisfying an interior solution will take the following form:

$$
\begin{aligned}
C &= \tilde{C}^B(p, w, \iota' y, V_1^B(p, w_1, y_1, e_1), V_2^B(p, w_2, y_2, e_2)) && (49) \\
&= C^B(p, w, y_1, y_2, \iota' y, e_1, e_2); && (50) \\
H &= \tilde{H}^B(p, w, \iota' y, V_1^B(p, w_1, y_1, e_1), V_2^B(p, w_2, y_2, e_2)) && (51) \\
&= H^B(p, w, y_1, y_2, \iota' y, e_1, e_2); && (52)
\end{aligned}
$$

where B holds for bargaining. The system given by $\tilde{C}^B(\cdot)$ and $\tilde{H}^B(\cdot)$ is not observable since the threat point functions $V_i^B(\cdot)$ are not unobservable. Rather, what is actually observed are $C^B(\cdot)$ and $H^B(\cdot)$. The latter labour supplies and demands depend on the price vector p, the wage rate vector w, the non-labour incomes of each spouse y_1 and y_2, the household non-labour income $\iota' y$ and of the EEPs vectors.

[29] This kind of objective function is refered to as a Nash product.

5.1 Restrictions on Microeconomic Behaviour

Before starting, note carefully that the microeconomic implications presented here only apply to cooperative bargaining games. They do not concern non-cooperative games.

We can immediately see that the system $\xi^B(\cdot)$, $h^B(\cdot)$ is very similar to the collective system $\xi^C(p; w; \rho' y; \mu(p; w; \rho' y; d))$, $h^C(p; w; \rho' y; \mu(p; w; \rho' y; d))$. First, the EEPs, which are a particular case of distribution factors, also affect the demands and labour supplies only through their effect on the threat points. Second, the household non-labour income is again not necessarily pooled. In fact, since cooperative bargaining games lead to Pareto efficient outcomes, it is possible to show that $\xi^B(\cdot)$ and $h^B(\cdot)$ can be rewritten as $\tilde{\xi}^B(p; w; \rho' y; \gamma(V_1^B(p;w_1;y_1;e_1); V_2^B(p;w_2;y_2;e_2)))$ and $\tilde{h}^B(p; w; \rho' y; \gamma(V_1^B(p;w_1;y_1;e_1); V_2^B(p;w_2;y_2;e_2)))$ with $\gamma(\cdot)$ being an aggregate function of $V_1^B(\cdot)$ and $V_2^B(\cdot)$. They therefore satisfy all the collective rationality restrictions presented previously. The question of knowing whether the bargaining framework imposes additional testable restrictions still remains unsolved. For the moment, no additional testable restrictions have been proposed. This is why bargaining models are said to be unrestrictive.

5.2 Empirical Evidence

Since it does not provide additional restrictions on the effect of prices, wages and non-labour incomes on household demands and labour supplies, the only evidence of the bargaining approach is the rejection of the unitary model and the non-rejection of the collective model. As McElroy says «That would be consistent with the Nash model but does not single out the Nash model from other members of the (possibly large) class of models that would lead to this restriction, including no restrictions at all. To test the Nash model versus no restrictions at all, or to test the neoclassical model versus the specific alternative that the model holds, the data requirements are stringent.»

5.3 Restrictions on Aggregate Behaviour

All the implications of the collective approach on aggregate labour supply and demands remain true under the (cooperative) bargaining approach. The value added of collective rationality compared to bargaining models concerns the possibilities it is given in terms of intrahousehold welfare analysis.

6 Conclusion

We have seen that the kind of decision-making taking place within households has direct implications on the way aggregate variables should be modelled. While the aggregate behaviour does not inherit all the restrictions placed on the microeconomic behaviour, those that are transferred are enough to produce quite di¤erent results in terms of the functional forms of aggregate demand and labour supply and in terms of the welfare distribution inside households. With the collective approach, any policies that change the bargaining power of men and women, through a change in distribution factors, will result in a modi…cation of the aggregate demand and labour supply. New prices will then prevail, which again will change the bargaining power of men and women and the household budget constraint and so on. The collective model is thus capable of creating general equilibrium e¤ects even when the initial policy did not change the households budget constraint. This is not the case for the unitary model, since no place is left for bargaining e¤ects.

The impact of economic policies on intrahousehold welfare redistribution is also different in the collective model. In the unitary model, a policy reallocating the non-labour income, for example, between the spouses would have not e¤ect on the spouses' well-being. In the collective setting, to the extent that the spouses' relative contribution is a distribution factor, such a policy would produce a reallocation of well-being between the spouses. Moreover, the collective approach, by recognizing the speci…city of individual preferences, o¤ers a richer theoretical analysis of intrahousehold welfare than the unitary model which acts like a black box. By allowing the recovery of the sharing rule and the spouses preferences, it also allows for a rich applied analysis of intrahousehold welfare.

Therefore, if the collective model is a better representation of household behaviour than the unitary model, as the empirical evidence seems to demonstrate, then the predictions of any macroeconomic model using aggregate demand and labour supply consistent with the unitary model, will be misleading in terms of the variations in macroeconomic variables and in welfare.

7 References

Alderman, H. P.-A. Chiappori, L. Haddad, L. Hoddinott and R. Kanbur, 1995, «Unitary versus Collective Models of the Household: Is it Time to Shift the Burden of the Proof?". World Bank Research Observer, Vol.10, no.1.

Arndt C. and F. Tarp, 2000, «Agricultural Technology, Risk, and Gender: A CGE Analysis of Mozambique», World Development, Vol.28, no.7, pp.1307-1326.

Becker, G., 1981, A Treatise on the Family. Harvard University Press.

Benhabib, J., R. Rogerson, and R. Wright, 1991, «Homework in Macroeconomics: Household Production and Aggregate Fluctuations». Journal of Political Economy, Vol. 99, no. 6, December, pp. 1166-87.

Bergstrom, T.C., 1996, «A Survey of Theories of the Family». In Handbook of Population and Family Economics. Amsterdam: North-Holland.

Bergstrom, T.C. and R. Cornes, 1981, «Gorman and Musgrave are Dual-Antipodean Theorem on Public Goods». Economic Letters, pp.373-378.

Bergstrom, T.C. and R. Cornes, 1983, «Independence of Allocative E¢ciency from Distribution in the Theory of Public Goods». Econometrica, Vol.51, pp.1753-1765.

Blundell, R., P.-A. Chiappori, T. Magnac and C.Meghir, 1998, «Collective Labor Supply: Heterogeneity and Nonparticipation», Mimeo.

Bourguignon, F., M. Browning and P.-A. Chiappori, 1995, «The Collective Approach to Household Behaviour». Document no.95-04, DELTA, 35 pages.

Bourguignon, F., M. Browning, P.-A. Chiappori and V. Lechene, 1993, «Intra-household Allocation of Consumption: A Model and Some Evidence from French Data». Annales d'économie et de statistique, No.29, pp.137-156.

Browning, M. and P.-A. Chiappori, 1998, «E¢cient Intra-household Allocations: A General Characterization and Empirical Tests». Econometrica, Vol.66, no.6, pp.1241-1278.

Browning, M., F. Bourguignon, P.-A. Chiappori and V. Lechene, 1994, «Income and Outcomes: A Structural Model of Intrahousehold Allocation». Journal of Political Economy, Vol.102, No.6, pp.1067-1096.

Chiappori, P.-A., 1992, «Collective Labour Supply and Welfare». Journal of Political Economy, Vol.100, no.3, p.437-467.

Chiappori, P.-A., B. Fortin and G. Lacroix, 1998, «Household Labour Supply, Sharing Rule and the Marriage Market», Working Paper no.9810, CRÉFA, Laval University.

Chiuri (1999)

Collier, P., A. C. Edwards, J. Roberts and J. R. K. Bardhan, 1994, «Gender Aspects of Labour Allocation During Structural Adjustment ». In Labour Markets in an Era of Adjustment, Vol. 1, Issues Papers, S. Horton, R. Kanbur, and D. Mazumdar editors.

Economic Development Institute Development Studies. Washington, D.C.: World Bank, pp. 277-345.

Darity, W. Jr., 1995, «The Formal Structure of a Gender-Segregated Low-Income Economy». World Development, Vol. 23, no. 11, pp. 1963- 1967.

Dauphin, A. and B. Fortin, 2000, «A Test of Collective Rationality for Multi-Person Households». Economics Letters, forthcoming.

Deaton, A. and J. Muellbauer, 1980, Economics and Consumer Behavior. Cambridge University Press.

Ertürk, K. and N. Çagatay, 1995, «Macroeconomic Consequences of Cyclical and Secular Changes in Feminization: An Experiment in Gendered Economy». World Development, Vol. 23, no. 11, pp. 1969- 1979.

Fontana M. and A. Wood, 2000, «Modelling the E¤ects of Trade on Women, at Work and at Home», World Development, Vol.28, no.7, pp.1173-1190.

Fortin, B. and G. Lacroix, 1997, «A Test of the Unitary and Collective Models of Household Labour Supply». Economic Journal, Vol.107, no.443, pp.933-955.

Gray, J. S., 1998, «Divorce-Law Changes, Household Bargaining, and Married Women's Labour Supply». American Economic Review, Vol.88, no.3, pp. 628-642.

Haddad, L. and R. Kanbur, 1991, «Public employment schemes and intrahousehold inequality». Mimeo, International Food Policy Research Institute.

Hoddinott, J., H. Alderman and L. Haddad, 1997, «Testing competing models of intrahousehold allocation». Intrahousehold resource allocation in developing countries, edited by L. Haddad, J. Hoddinott and H. Alderman, The Johns Hopkins University Press, Baltimore and London.

Hoddinott and Haddad (1994)

Konrad, K.A.and K.E. Lommerud, 1997, «The Bargaining Family Revisited». Working paper, Free University of Berlin.

Kooreman, P. and A. Kapteyn, 1990, «On the Empirical Implementation of Some Game Theoretic Models of Household Labour Supply». Journal of Human Resources, no.25.

Lachaud, J.-P., 1998, «Gains féminins et nutrition des enfants au Burkina Faso». Revue d'Économie du Développement, Vol.2, pp.3-53.

Lundberg, S. and R. A. Pollak, 1994, «Noncooperative Bargaining Models of Marriage". American Economic Review, Papers and Proceedings, Vol.84, no.2, pp.132-137.

Lundberg, S. and R. A. Pollack, 1993, «Separate Spheres Bargaining and the Marriage Market». Journal of Political Economy, Vol.101, no.6, pp.988-1010.

Manser, M. and M. Brown, 1980, «Marriage and household decision-making: A bargaining analysis». International Economic Review, Vol.21, No.1, pp.31-44.

McElroy, M. B., 1990, «The Empirical Content of Nash-Bargained Household Behavior», Journal of Human Resources, Vol.25, no.4, pp.559-583.

McElroy, M.B. and M. J. Horney, 1981, «Nash-bargained household decisions: Toward a generalization of the theory of demand». International Economic Review, Vol.22, No.2, pp.33-349.

Quisumbing and Maluccio (2000)

Shultz, P., 1990, «Testing the Neo-Classical Model of Family labour Supply and Fertility". Journal of Human Resources, Vol.25, pp.599-634.

Taylor, L.,1995, «Environmental and Gender Feedback in Macroeconomics». World Development, Vol.23, no.11, pp. 1953-1996.

Thomas, D., 1993, «The Distribution of Income and Expenditure within the Household». Annales d'économie et de statistique, no. 29, pp.109-135.

Thomas, D., 1990, «Intrahousehold Resource Allocation: An Inferential Approach». Journal of Human Resources, Vol.25, pp.635-664.

Thomas, D. and C. Chen, 1994, «Income Shares and Shares of Income: Empirical Tests of Models of Household Resource Allocation». Labour and Population Program Working Paper 94-08, Santa Monica CA, The Rand Corporation.

Ulph, D., 1988, «A General Noncooperative Nash Model of Household Consumption Behaviour». Working paper, Department of Economics, University of Bristol, Bristol, U.-K.

Wooley, F., 1988, «A Noncooperative Model of Family Decision-making». Discussion Paper no. TIDI/125, London School of Economics, London.