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## Models of Intrahousehold Resource Allocation:

## Assumptions and Empirical Tests

**by**

**Cheryl R. Doss**

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**DEPARTMENT OF AGRICULTURAL AND APPLIED ECONOMICS**

**COLLEGE OF AGRICULTURE**

**UNIVERSITY OF MINNESOTA**

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## Introduction

In many microeconomic studies, the household is treated as an individual for analytical purposes; in other words, it is assumed that a household acts as a single entity with a single set of preferences. Recently, however, a number of economists have recognized that households are sites of conflict as well as cooperation and have begun to use new classes of models to explain how resources are allocated among household members. This literature has especially improved our understanding of households in which income is not completely pooled. In such a setting, standard household models may offer misleading conclusions about the effects of policies on individual household members.

Households are the location of both consumption and production decisions. For all households, but especially for agricultural households, these sets of decisions are related. Consumption of food and other resources provides utility directly and also serves as an input into production. People make decisions about how to allocate their labor, income, and other resources across a variety of consumption and production activities. This paper reviews and analyzes a literature that examines the restrictiveness of focusing on households as single units of analysis. In particular, this literature asks: To what extent can we use the household as a unit of analysis, and when do we need to disaggregate the household and look at individual behavior within the household?

There are several aspects of household decision making that we can examine. First, we can ask whether an aggregate household utility function is a reasonable representation of individual utilities, or whether it is important to consider the different, and often competing, preferences of individual household members.

Second, we can ask whether consumption decisions are made on the basis of a single budget constraint containing the pooled income for the entire household or whether individuals have separate budget constraints. In this paper, I will use the term "pooled income" to refer to a situation in which the household has one budget constraint. It includes the case in which a dictator or altruist makes all of the allocation decisions, as well as cases in which all household income is put into a common "pot" and household members bargain over its allocation. This definition of pooled income is contrasted with nonpooled income in which household members have separate incomes and face individual budget constraints. When income is not fully pooled, individuals may bargain over how much to contribute towards expenditures on shared household goods -- as opposed to expenditures on goods for themselves.[1]

Third, if we think of households as producing income, household goods, and leisure, we can ask whether the household makes a unified production decision or whether individuals are making separate production decisions. Finally, we can ask whether the supply of household labor and other production inputs is pooled.

In this paper, I examine the different models of intrahousehold resource allocation and the empirical work they have generated. Each of the models has a different set of assumptions about the four components of household decisions. The assumptions and predictions of each of the main models of intrahousehold resource allocation are presented; then I discuss the empirical work that tests the validity of the assumptions and discuss when the different models may be appropriate.

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[1]Within the literature on households, the term "pooled income" is used to refer to a number of different concepts and frequently the term is not clearly defined. Occasionally, pooled income is used to refer to situations in which the intrahousehold allocation of resources does not change depending on who earns the income. My usage is consistent throughout the paper, although it may not reflect the usage in each of the papers cited.

**Common Preferences Model**

Although the theoretical work of microeconomics is based upon analysis of the individual, micro-level data is often collected at the household level. The common preferences model assumes that it is possible to treat the household as a unit of analysis, using all of the tools of economic theory.

To aggregate individual preferences into household preferences, we must assume that either all of the members of the household have the same utility function and, thus, maximizing the household utility function gives the same results as maximizing individual utility functions, or we must assume that some rule exists for aggregating the utility functions of the household members. There are many possible ways in which utility could be aggregated, but as Arrow (1951) has notably shown, there may be important information about individual preferences that is lost in the process of aggregation. One possible approach is to assume that a dictator or benevolent altruist aggregates the individual utility functions by maximizing his utility function as the basis for all household decisions.

In his work on community indifference curves, Samuelson (1956) explains why family preferences may be aggregated when community indifference curves cannot exist. He claims, "If within the family there can be assumed to take place an optimal reallocation of income so as to keep each member's dollar expenditure of equal ethical worth, then there can be derived for the whole family a set of well-behaved indifference contours relating the totals of what it consumes: the family can be said to act as if it maximizes such a group preference" (p. 21). Issues of household production do not enter this framework, nor does it matter who earns the income. It is not clear how the decision is made as to how to equalize ethical worth; the weights are not based on wages, prices, or incomes.

The common preferences model does not explicitly include production decisions. It assumes that intrahousehold resource allocation will only be affected by total household income. The share of income or wealth of individuals within the household will not affect the allocations.

**Unified Household Model**

The unified household model continues to assume that the household acts as a single unit, but it incorporates production decisions as well as consumption decisions. It assumes that the household is making decisions in such a way as to maximize its utility subject to a production possibilities constraint, rather than a budget constraint.

Becker, in his "Rotten Kid Theorem" (1974, 1981), offers a rationale for using a unified household model, even when household members have different preferences. This theorem suggests that altruistic parents and their children maximize the same utility function, even if the kids are selfish. If an altruistic parent provides a transfer to his children, then the children have incentives to behave in such a manner that household income is maximized. Transfers will compensate children if their actions maximize household income at the expense of their personal income. Resources are allocated in such a manner as to maximize household income.

However, the "rotten kid theorem" holds only under very specific assumptions. Hirschleifer (1977) points out that it holds only if the altruist has the last move. The transfer from the parent to the child must be made after the child has chosen his/her actions. If a parent irrevocably commits to an action or transfer before the child commits, a rotten kid will behave selfishly and a situation may result in which the child obtains a greater allocation than the parent would prefer. (The idea of a sequence of moves in which the altruist always moves last is poorly defined in a static, one-period model.) Bergstrom (1989) shows that the rotten kid theorem may not hold any time that a second commodity is introduced. The

second commodity may be a second time period, leisure (or work effort), or a public good. For the case of a second time period, Bruce and Waldman (1990) demonstrate that in a two-period model, the child may overconsume in the first period because then she will receive a larger transfer in the second period. As a result, household income may not be maximized.

The other, less clearly stated, assumption of the "rotten kid theorem" is that the altruist has the power or income to control household allocations. The altruist makes transfers to the other household members, adjusting his transfers to their needs and contributions. The "rotten kid theorem" would not hold if the kids earned more than the altruist or if there were potential large negative shocks to the altruist's income. Divorce or the dissolution of the household is also not incorporated into the theorem. Thus, in these circumstances, another rationale is needed for treating the household as a single unit. The agricultural household model is a version of the unified household model that has been used to examine household behavior in developing countries. It was explicitly designed to explain the effects of price and other policies on households that are both producers and consumers of agricultural staples. In its most basic form (Singh, Squire, and Strauss, 1986), this model assumes that production and consumption decisions are separable. The household first makes input and output calculations to maximize farm production, independently of consumption and labor-supply decisions. Consumption decisions are based on prices and income of the household, and the income is affected by farm profits.

In the basic agricultural household model, the household solves the following problem:

$$\begin{aligned} &\max\ U(X_a, X_m, X_l) \\ &s.t.\ p_m X_m + p_a X_a + w X_l = wT + p_a Q(L, A) - wL \end{aligned} \qquad \textbf{(1)}$$

where

$X_a$ = the agricultural staple consumed by the household

$X_m$ = market purchased good

$X_l$ = leisure

$p_m$ = the price of the market purchased good

$p_a$ = the price of the agricultural staple

w = the market wage

T = total time available to the household

Q = the amount of the agricultural staple produced by the household

L = total labor input on the farm

A = household's fixed quantity of land

The household faces time, cash and production constraints. They are combined into the one constraint presented here. The right hand side of the constraint is the household's full income.

The agricultural household model implicitly assumes that all consumption and labor supply decisions are made jointly. Even when the assumption that production and consumption decisions are separable is relaxed (for example, assuming that household and hired labor are not perfect substitutes) the assumption that labor supply decisions are made jointly by all members of the household is maintained. All income and factor supply is pooled in the household. Predictions about the behavior of agricultural households is more accurate using this model than models that consider the household as a site of

consumption and the farm/firm as a separate site of production. However, these predictions may be inaccurate if the assumptions of the unified model do not hold in a particular setting.

Another rationale for treating the household as a single unit is that the household decision rule is to allocate resources on the basis of the marginal productivity of each individual. Income is endogenous to the household since labor allocation decisions are made within the household. Individuals specialize within the household in the tasks that they do best, whether it be wage labor or household production, and resources are allocated based on their marginal productivity. This approach assumes that consumption is an input into production.[2]

One example of a unified household model explaining the differential allocation of resources among household members was a study by Rosenzweig (1986) who estimated the family wage and schooling effects on the activities of mothers, daughters, and sons in rural households in India. The unified household model suggests that food will be allocated equally among family members only if the exogenous endowments or characteristics are the same for all family members; thus, we would not expect food to be allocated equally. Rosenzweig's results were consistent with the hypothesis that the marginal returns to food allocated to each individual in terms of family welfare and earnings were equal for each individual and equal to the marginal cost per unit of food.

**Collective Model**

The first sets of models considered, the common preferences model and the unified household model, aggregate the household utility function. There is a wide array of models that disaggregate the household utility function. The collective model, proposed by Chiappori (1988) and elaborated by

[2] This is the rationale that is tested in the work cited in this paper. Other explanations of why it is possible to aggregate the household utility function may present different tests.

Bourguinon, Browning, and Chiappori (1993) and Chiappori (1992), begins by looking at the data and asking whether there is a decision rule that rationalizes it.

The collective model assumes only that the household reaches a Pareto efficient outcome, i.e. that it produces on the frontier of its production possibility set and that no one could be made better off in the distribution of consumption goods without making someone else worse off. This framework was designed to let the data describe intrahousehold resource allocations and to use a limited number of assumptions to gain as much information from the data as possible.

In the collective model, nonlabor income is shared according to some rule, which we can call the "sharing rule." Let y be the nonlabor income of the household and $w_i$ be the wages of individual i (i=1,2), then the sharing rule[3], $\phi(w_1, w_2, y)$, is the amount received by individual 1, and $y-\phi(w_1, w_2, y)$ is the amount received by individual 2. The sharing rule does not require that $\phi$ be bounded by 0 and y, $\phi$ can be negative or greater than y. This would imply that transfers of wage income are made between household members. Given the sharing rule, individual i chooses labor supply and consumption so as to solve:

$$\begin{aligned} &\max \; U^i(L^i, C^i) \\ &s.t. \quad w_i L^i + C^i \le w_i T + \phi(w_1, w_2, y) \end{aligned} \qquad \textbf{(2)}$$

where $L_i$= leisure of individual i

$C^i$= consumption of individual i

$w_i$= wages of person i

T = total amount of time available.

[3] The sharing rule could incorporate exogenous variables, such as policy variables or individual nonlabor income.

Since the sharing rule involves the wages of both individuals within the household, this implies that income is pooled.

Adding four assumptions to this model allows estimation of the sharing rule (see Browning, Bourguignon, Chiappori, and Lechene 1993). The additional assumptions are: (i) some goods are private; (ii) preferences are caring, that is, individuals within the household have the utility of other household members in their utility function; (iii) each member's sub-utility function is separable with respect to private consumptions; and (iv) at least one private good is assignable so we can determine who consumes the good. Given these assumptions, any allocation of private expenditures can be explained as the outcome of a sharing rule. The sharing rule can be recovered by observing how the expenditure on the assignable private good reacts to exogenous changes in the economic environment. Browning et al. estimate the sharing rule using data on households with both spouses employed full time and find that differences in ages and incomes of the members and wealth of the household affect the sharing rule.

The collective model is very general. Both the unified model and the cooperative bargaining model are more restricted cases of it. In the unified model, the sharing rule is that resources are allocated on the basis of marginal productivity. The bargaining model proposes a different sharing rule. The collective model only says that there is a sharing rule and that we can determine what it is in each instance. No predictions are made *a priori* about the sharing rule; the only way to reject the collective model is by rejecting the assumption that a Pareto efficient outcome is reached.

**Cooperative Bargaining Model**

The initial work to develop a bargaining approach to modelling households was by McElroy and Horney (1981) and Manser and Brown (1980). They formulate a bargaining framework in which household decisions are made through a cooperative Nash game. Husbands and wives pool their income and labor and bargain over how to allocate joint household resources.

Using the notation of McElroy and Horney, the following is the framework for the cooperative bargaining models:

There are two people, m and f, each with a utility defined as

$$U^k = U^k(x) \qquad k = m, f \tag{3}$$

where x is the vector:

$x_0$ is a pure public good within the household

$x_1$ is a market good consumed by the husband

$x_2$ is a market good consumed by the wife

$x_3$ is the quantity of "leisure" consumed by the husband

$x_4$ is the quantity of "leisure" consumed by the wife.

(Leisure refers to all time not spent in market work.)

Households solve the Nash bargaining problem:

$$\begin{aligned} N &= [U\,m(x) - V_0^m(p_m, I_m; \alpha_m)][U^f(x) - V_O^f(p_f, I_f; \alpha_f)] \\ s.t.\ & p_0x_0 + p_1x_1 + p_2x_2 + p_3x_3 + p_4x_4 = (p_3 + p_4)\,T + I_m + I_f \end{aligned} \tag{4}$$

where p is the price vector corresponding to the x vector, and the vectors $p_m$ and $p_f$ are the prices of interest to each individual outside of marriage ($p_m$= (p0, p1, p3); $p_f$ = (p0,p2,p4)). $V^i$ is the threat point

of individual i, and can be interpreted as his/her utility outside of marriage; it is the utility that each person would obtain if they were divorced. The $\alpha$'s can be defined as the parameters that shift the threat points. McElroy and Horney suggest that the $\alpha$'s could be the ratio of males to females in the relevant marriage market; they could also include institutional and legal factors.[4] Married couples pool their resources and allocate them jointly and share pure public goods.

Several authors have suggested that in many cases, divorce or the dissolution of the marriage may not be the appropriate threat point. Lundberg and Pollak (1992) develop a "separate spheres model" in which household members bargain over the gains from marriage, such as the joint production of household goods and children, in a cooperative bargaining framework. If the partners do not reach agreement, gender roles determine each individual's activities and contributions to the household. This outcome, where agreement is not reached, is the threat point. Lundberg and Pollak claim, "Because socially prescribed gender roles assign primary responsibility for certain activities to the husband and others to the wife, the separate spheres default equilibrium may be established and maintained without negotiation (p. 12)." Each person contributes the public goods within their sphere of influence, for example, men may provide housing and women provide child care. Because the public goods are provided voluntarily, they may be underprovided within the household, as we would expect that any voluntarily provided public good might be.

The cooperative bargaining model predicts that factors that influence the threat points of individuals may affect the distribution within households, even if the individual and total household resource levels are not altered. For example, a policy that guaranteed support payments to divorced women with children could alter the intrahousehold allocation of resources in favor of women by increasing their utility if

[4] Folbre (1992) provides an analysis of exogenous factors that may affect the intrahousehold allocation of resources.

divorced. Similarly, this model predicts that an increase in the wages for women will affect the allocation of resources within households, even in households where the women are not employed. Unlike the collective model which only assumes that the outcome will be Pareto efficient, the cooperative bargaining model provides a rule to specify which Pareto efficient point will be chosen.

**Noncooperative Models**

Noncooperative models, such as those by Woolley (1993), Ulph (1988), and Bernasek (1993), assume that income is not pooled and explicitly model how the levels of shared goods are chosen. There is an extensive qualitative literature that suggests that in many developing countries, household do not pool their incomes (e.g. Dwyer and Bruce, 1988; Guyer, 1980). The noncooperative models not only allow for individuals to have different preferences, but also allow for individuals to make consumption and production decisions based on their own labor and access to resources. Both Pareto efficient and non-Pareto efficient outcomes are consistent with this model.

The noncooperative models draw heavily on the public goods literature of welfare economics. Whereas in the noncooperative outcome of the cooperative models, the level of the shared good is exogenous to the model -- for example, it is based on traditional gender roles in Lundberg and Pollak's separate spheres model -- in the noncooperative bargaining model the level of public goods is endogenous and determined through the bargaining process.

Following the notation of Woolley (1993), we can examine a noncooperative bargaining model. Each household member maximizes his/her welfare, taking as given the expected action of the other:

$$W^j = \Sigma_{i=m,f} s_{ij} U^i(L_i, s_i, x_h) \qquad \textbf{(5)}$$

Each person's welfare is the weighted sum of both household members' utilities. The restrictions on the weights are $s_{jj}=1$ and $0 \leq s_{ij} \leq 1$ which means that no one cares more about his/her partner than about him/herself. Each person's utility depends on $x_h$, the aggregate level of consumption of household goods provided by both partners; $x_i$, the personal consumption good; and $L_i$, leisure. Household expenditures are pure public goods that each partner would purchase if the other did not, whereas, personal expenditures are private goods.

We can rewrite the objective function

$$\begin{aligned} \max \quad & W^i(x_h, x_i, L_i, ; x^{*j}_h, s^*_j, L^*_j) \qquad i=m,w \quad j=m,w \quad i \neq j \\ & s.t. \quad R_i + w_i(T - L_i) + p_h x^j_h = p_h x_h + p_i x_i \end{aligned} \qquad \textbf{(6)}$$

where

$x_h$ = household expenditures, $\Sigma x^i_h = x_h$

$x_i$ = private expenditures

$p_h$ = price of household goods

$p_i$ = price of private goods

$L_i$ = leisure

$s_i$ = weights

T = total time

The choices that person i expects the other person to make are given by $x^*$, $s^*$, and $L^*$, assuming that transfers between household members are zero. (The model can be generalized to allow for transfers between spouses.) Thus, the wife makes a decision of how much of the household good should be

provided, based on her expectation of her partner's contribution; the husband does the same. Each partner has a household expenditures reaction function given by

$$x_h = \max[0,\ x_h(p, w_i T + R_i + p_h x_h^j; x^*_j, L^*_j)] \qquad (7)$$

where p is the vector of prices.

When incomes are relatively equal, both spouses contribute to household expenditures; as incomes become more unequal, the household moves to a corner solution and the spouse with the higher income finances all household consumption.

Ulph (1988) uses this type of bargaining framework and proves that for the distribution of income to matter at any given level, the two individuals must spend a portion of their income on mutually exclusive subsets of goods. This could result because they are at a corner solution and only one member is providing the public or household good, or it could result from a situation in which men and women provide different public goods. Thus, if men were responsible for providing housing and women for providing food, small increases in the income of one partner could locally affect the demands for housing and food.

Carter and Katz (1992) develop a noncooperative model, the "conjugal contract model", that specifically includes transfers of labor and income within the household. Katz (1992) uses this model to examine the behavior of peasant households in Guatemala. Instead of including a purchased public good, the model includes private goods and a household-produced z-good. Individuals solve their own optimization problems taking their partners' behavior as given. The critical feature of this model is that Carter and Katz explicitly allow for partners to transfer labor and income and assume that these

transfers can be observed. Katz collected the data for her empirical analysis herself because it is not included in other available data sets. With this additional information, the impact of policies such as the introduction of nontraditional cash crops in the Guatemalan highlands can be more accurately predicted.

**Testing the Models & Empirical Evidence**

Each of the models described above has a different set of assumptions and makes different predictions about how resources will be distributed within households. In order for these models to be relevant to policy decisions, it is important to know whether the assumptions are valid and whether the outcomes that we observe are consistent with the framework and predictions of the model.

It is difficult to determine from survey data how resources are actually allocated within households. We may observe household expenditures, but we do not usually observe the distribution of goods within the household. Although a few surveys have data on actual calorie intake of individuals, it is rare. It is difficult to determine which individuals have been allocated specific expenditures, especially since many goods, such as housing, have a public good component. Knowing who purchases different consumption goods may provide us with some information; for example, in most parts of the world, women are responsible for purchasing food. However, this information does not tell us how the food will be distributed among household members.

Much of the empirical work on intrahousehold resource allocation uses the pattern of household expenditure data as a proxy. If household expenditure patterns differ depending on who earns the income, we can conclude that the allocation of resources within the household has changed, even though we do not observe exactly who obtains what.

Table 1 indicates the different null hypotheses that can be tested from data about the allocation of resources and labor supply among household members. It indicates whether a rejection of the null hypotheses is consistent with the various models or whether a rejection of the null hypotheses implies a rejection of each of the models. Each of these tests and the empirical work that has implemented these tests is discussed in some detail below.

Testing the Common Preferences Model

In order to reject the common preferences model, it is simply necessary to demonstrate that individual labor income, not simply total household income, affects household expenditure patterns. Under the common preferences model, expenditure patterns should be constant given a level of total household income regardless of who earns it. A number of studies have rejected the common preferences model. For example, using 1986 data from Canada, Phipps and Burton (1992) demonstrate that even for the subsample of households where both the husband and wife worked full time, the sources of income made a difference in the level of expenditure on 8 of the 12 categories of consumption goods. In addition, Hoddinott and Haddad (1993) analyze the determinants of household expenditures in Côte d'Ivoire and find that the percentage of female income significantly affects budget shares for a number of goods. These results by Phipps and Burton and Hoddinott and Haddad are consistent with any of the other models. All of the other empirical work cited in this paper provides additional evidence against the common preferences model.

Testing the Unified Household Model

In many instances, the unified household model and the cooperative bargaining model are observationally equivalent with the data that is currently available. Senauer, Garcia, and Jacinto (1988) demonstrate this point in their study on the Philippines where they estimate the effect of individual wages rates on the intrahousehold allocation of food. In this study, a household is defined as a unit that

pools all or most of its income; thus the question of whether the household faces a single budget constraint is assumed and not tested.[5]

To demonstrate that the models are observationally equivalent, Senauer et al. first use the unified household model to obtain reduced form demand equations for the $i^{th}$ individual in the household as

$$X^i = g^i(P_x, P_y, W, C) \quad \textbf{(8)}$$

where

$X^i$ is the demand for food by the $i^{th}$ individual

$P_x$ is the price of food

$P_y$ is the price of nonfood items

W is the vector of wages for n household members

C is the matrix of personal characteristics for all household members.

The same reduced form demand equation for food is obtained using a bargaining framework. The threat point for person i in the bargaining model is defined as

$$V^i = V^i(P_x, P_y, W^i, C^i) \quad \textbf{(9)}$$

In this analysis, bargaining power is only based on wages, which are assumed to be the same whether or not individuals are married or divorced. No parameters that would shift the threat point are included. Thus, the reduced form demand equations are the same for the bargaining model as for the unified household model.

[5] Kapteyn and Kooreman (1992) make a similar point about the observational equivalence of the bargaining models and the unified household models.

For each individual within the household, the estimating equation, assuming constant prices, is

$$\frac{X^i}{X} = r^i(W,C) \qquad \textbf{(10)}$$

The dependent variable is the $i^{th}$ individual's calorie adequacy ratio divided by the overall calorie adequacy ratio for the household.

Senauer et al. conclude that the value of time of household members, as represented by estimated wages, affects the intrahousehold distribution of food. This result rejects the common preferences model, but is consistent with the other models.

Although it is difficult to reject the unified household model entirely, it is possible to reject some versions of it. For example, it is possible to reject the assumption that allocations are based on marginal productivity if an exogenous variable influences household consumption patterns. Exogenous factors could include nonlabor income[6] or policies that do not change the productivity or incomes of individuals within households but affect their threat point in the context of a cooperative bargaining model. For example, nonlabor income does not affect the marginal productivity of individuals within the household. Thus, the unified household predicts that all nonlabor income should be spent in the same manner, regardless of who controls it. In addition, exogenous income should have the same effect on individual labor decisions, regardless of who controls it. Alternatively, if it could be demonstrated that a policy that did not directly affect prices or the incomes of individuals within the household had an effect on the intrahousehold allocation of resources or labor supply, the unified household model would be rejected.

[6] Nonlabor income is often assumed to be an exogenous variable. However, nonlabor income, such as interest income, may be the result of previous labor allocation decisions.

In order to test the assumptions of the unified household model, Thomas (1992) uses data from Brazil and incorporates an exogenous variable into his model which allows him to reject the unified household model. He assumes that nonlabor income is exogenous and tests whether the distribution of nonlabor income within the household has any impact on expenditures. He estimates the following equation:

$$c_i = \alpha_1 I_f + \alpha_2 I_f^2 + \alpha_3 I_m + \alpha_4 I_m^2 + \alpha_5 I_f I_M + \beta' X + \epsilon_i \qquad \textbf{(11)}$$

where

$C_i$ = the share of the household budget allocated commodity i

$I_{j=}$ individual nonlabor income (j=f,m)

X = household characteristics (including whether there is a male and female head, education levels, household size, proportions of members in 9 age/gender groups, prices, and month and state dummy variables.

His results indicate nonlabor income controlled by women is associated with larger increases of the household budget share being devoted to human capital and leisure. Thus, the unified household model is rejected. Thomas and Chen (1993) obtain similar results for Taiwan. Nonlabor income of individuals is significant in explaining household resource allocations.

Two studies have looked at household labor supply, testing the assumptions of the unified household model. Both Horney and McElroy (1988) and Schultz (1990) assume that nonlabor income is exogenous to household production decisions and test whether nonlabor income affects household labor supply.

Horney and McElroy (1988) develop a three-equation linear expenditure system consistent with the Nash model. The three goods are male supply of market labor, female supply of market labor, and expenditures on a composite commodity. The results show that individual nonwage income is significant in determining levels of labor supply: the Nash bargaining expenditure system does not collapse to the system of the unified household.

Similarly, using data from Thailand, Schultz (1990) demonstrates that the unearned income of women affects the amount of wage labor that they provide. He does not find the same result for men's supply of wage labor. In addition, only the unearned income of women is associated with women's fertility levels. Neither men's unearned income nor men's and women's earned income is associated with fertility levels. This suggests that unearned income shifts the bargaining power of women in the household. These two studies provide further evidence rejecting the unified household model.

Testing for Pareto efficiency

It is not possible to test whether the collective model, cooperative bargaining model, or noncooperative bargaining model provide the best framework for understanding intrahousehold resource allocations. What can be tested is whether a Pareto efficient outcome is attained. A Pareto efficient outcome is a critical assumption of the collective model, thus a rejection of Pareto efficiency implies a rejection of the collective model.

The collective model assumes that a Pareto efficient point is chosen. The cooperative bargaining model predicts which Pareto efficient point is chosen, based on the specification of the model. However, it is difficult to test whether the predicted Pareto efficient point is the one chosen, since it would require detailed information to specify the correct threat point. Instead we can test whether any Pareto efficient outcome is attained.

A Pareto efficient outcome is consistent with any of the models, including the cooperative and noncooperative bargaining models. A rejection of Pareto efficiency, however, does not imply a rejection of either of the bargaining models. A non-Pareto efficient outcome is consistent with cooperative bargaining models that specify a noncooperative outcome as the threat point.[7] In addition, a non-Pareto efficient outcome is consistent with a noncooperative bargaining model.

There are two aspects of Pareto efficiency that we can test. First, we can test whether there is a constant ratio of income effects across all pairs of goods, i.e. whether marginal utility is being equated across all individuals. Second, we can test whether there is a constant ratio of marginal productivity across all inputs, i.e. whether marginal productivity is being equated across all production activities.

Thomas and Chen (1993), using data from Taiwan, calculate the ratio of income effects of men and women for all pairs of goods. If the data is consistent with a joint utility model, then this ratio will equal one, i.e.,

$$\frac{\partial c_i / \partial y_f}{\partial c_i / \partial y_m} = 1 \qquad \textbf{(12)}$$

However, if the ratio does not equal one, but the following equation holds for all pairs $c_i$, $c_j$,

$$\frac{\partial c_i / \partial y_f}{\partial c_i / \partial y_m} = \frac{\partial c_j / \partial y_f}{\partial c_j / \partial y_m} \qquad \textbf{(13)}$$

then we can conclude that the household is allocating consumption goods Pareto efficiently. Thus, the result that (13) holds is consistent with any of the models; if it does not hold, then the unified and

[7] Some authors refer to a Pareto efficient outcome as a cooperative outcome and a non-Pareto efficient outcome as a noncooperative outcome. Since either outcome can be the result of either a cooperative or a noncooperative bargaining model, for clarity, I am not using these terms.

collective models are rejected. Thomas and Chen find that (13) holds for all pairs of goods and thus, their results indicate that a Pareto efficient outcome was obtained.

An additional test was done by Bourguinon et al. (1993) using data from France. After rejecting the common preferences model, they test what they call the "cooperative hypothesis" that there is Pareto efficient collective decision-making within the family. They test two restrictions suggested by the cooperative hypothesis: that the ratio of marginal propensity to consume a good with respect to the income of both spouses, at a constant total family income, is the same across goods, and that the marginal propensities to consume out of total income are the same across goods.

Using data from France for households in which both adults work full time and in which there is at most one child, Bourguinon et al. cannot reject the cooperative hypothesis. Because they only include households in which both adults work full time, they do not have to deal with the fact that household labor supply is endogenous. They assume that labor supplied to the market is constrained at the upper bound of full-time work. The behavior that they observe is consistent with the hypothesis that households allocate resources efficiently and obtain a Pareto efficient outcome. Thus, their results are consistent with any of the models.

In order to test whether production resources are allocated Pareto efficiently, Udry (1994) uses detailed agronomic data from Burkina Faso. He finds that crop yields are different for plots controlled by men from those controlled by women within the same household in a given year. He also finds that the household could achieve higher total output by reallocating labor and fertilizer to women’s plots from men’s plots. This result is inconsistent with Pareto efficiency. Pareto efficiency requires that the marginal productivity for an additional unit of labor or fertilizer be the same across all plots within the household.

Jones (1983) found similar results in an analysis of labor allocation in Northern Cameroon. She reworked the cooperative bargaining model to better reflect the West African situation, by including a noncooperative outcome as the threat point, rather than divorce. Her empirical results suggest that households obtain a non-Pareto efficient outcome; rather than maximize total household income, men and women maximize their individual incomes.

In the region of Cameroon that Jones studied, sorghum is the major food crop. Both men and women farmers continue to grow sorghum, although the returns to labor from rice production are higher, because they are unwilling to rely on the market for sorghum to meet their subsistence needs. Men and women cultivate sorghum on separate plots, whereas rice fields are jointly cultivated. Sorghum is consumed by the household, whereas much of the rice is sold and the income belongs to the men. When women worked on their husband's rice fields, they did not receive any payment for their labor. Thus, the women were unwilling to do this work, since it simply decreased their leisure time and the time that they had to pursue other income generating ventures. The responsibilities and preferences of the women regarding their expenditures did not change; thus, they continued to maximize their individual incomes, rather than total household income. Women continued to work on the less remunerative sorghum fields, rather than working on their husbands rice fields. Thus, Jones found that a non-Pareto efficient outcome was attained by these households.

**Conclusions**

We can conclude that there is substantial evidence against the common preferences model. In addition, there is evidence from such diverse places as Taiwan, Thailand, and the U.S. that exogenous factors also affect the intrahousehold allocation of resources, suggesting that the unified household model may not adequately reflect many household situations.

Unified household models should not be used in a given context without testing their assumptions. Instead, models of the household should be used that disaggregate preferences and recognize individual behavior within households. Policy-makers should not assume that the household behaves as if there is one decision maker who makes production and consumption decisions.

Evidence is inconclusive as to whether or not households attain Pareto efficient outcomes. The works cited in this paper found Pareto efficient consumption decisions, but not Pareto efficient production decisions, although these results were not from the same studies. Further work is needed to understand when households arrive at Pareto efficient outcomes and when they arrive at non-Pareto efficient outcomes.

If many households attain non-Pareto efficient outcomes, this could have a significant impact on how policies are translated within households. Economists and policy makers have long assumed that households do attain Pareto efficient outcomes. The predicted impacts of new economic opportunities may differ depending on whether or not households reach a Pareto efficient solution to the allocation of member's labor and resources.

One of the questions that arises is why a non-Pareto efficient outcome would occur within a household. We would expect that, even among households where there were strong disagreements about preferences, trade would occur among household members to attain a Pareto efficient solution. The fact that we observe noncooperative outcomes suggests that there are missing markets within households.

For example, Jones (1983) suggests that if conflicts between household members over the intrahousehold terms of exchange are not resolved, then labor may not be allocated in a manner to maximize household income. We would expect that husbands would compensate their wives for labor

on the rice fields, but Jones found that this only occurred in households where the husband was in need of immediate cash and thus was willing to pay compensation in order to increase his net earnings.

In the context of Burkina Faso, Udry suggests that Pareto efficiency is not attained because individuals care more about output on their own plots than about output on others' plots. In addition, he attributes the misallocation of labor among plots to the difficulties faced by individuals in households as they attempt to invent institutions -- such as labor markets -- that are absent from the larger environment.

**Further Research Needed**

The literature on intrahousehold models challenges the traditional assumptions of the common preferences and unified household models. It provides econometric support for the qualitative evidence that household decisions are contested and that individual preferences and endowments matter. However, many questions remain unanswered, both theoretical and empirical, about economic decision-making within households. A few such questions follow:

Most of the bargaining models have been developed in the context of households in which members earn their income from wage employment. In such a case, individual incomes are relatively constant and predictable. However, for agricultural households, especially those in developing countries, incomes fluctuate widely from year to year. The literature on peasants' strategies for managing risk usually assumes that household members act jointly, making unified production and consumption decisions[8]. It assumes that households allocate labor across activities and across space so as to reduce the covariance of income from different sources, thus reducing the fluctuations of total household income. The

[8] See Alderman and Paxson (1992).

disaggregated models do not provide many insights into how resources might be allocated in such a risky or uncertain environment. However, these models suggest that under some circumstances, it is important to look beyond the household level and examine individual behavior within the household.

A second area for further research involves the division of household goods into "public" and "private" goods. Each of the models makes different assumptions about public and private goods within the household. However, the boundary between public and private goods is not well defined; instead there is a continuum of goods, ranging from public to private goods. To use these models for policy analysis, we need a better sense of where this boundary lies and how it may change over time and space.

A third research topic is to expand the intrahousehold analysis to explicitly include children and old people. Although there is a body of literature looking at how resources such as food, health care, and education are allocated between sons and daughters (see Behrman, 1992, for a review of this literature), the intrahousehold resource allocation models generally do not directly incorporate children. The models involve two adult decision-makers, although children may provide labor and earn an income. The implicit assumption is that children are a public good, with mothers and fathers having different preferences over the quantity and quality of children and possibly different preferences over the treatment of sons and daughters.

Lazear and Michael (1988) look at the allocation of income within households, focusing on the allocation of income between adults and children rather than the allocation of income between males and females within the household. The
cooperative bargaining models (esp. Lundberg and Pollak, 1992) show that policy decisions about child support and alimony will affect the distribution of income within households prior to the dissolution of the household. Other work (Weiss and Willis 1985, 1990; DelBoca and Flinn 1991, 1993) has

examined the payment of child support by divorced fathers. However, the question of how resources are allocated between a parent and children in a single parent household is not addressed. The allocation of resources between parents and children has been considered in the context of whether children provide transfers to elderly parents (Bernheim, Shleifer and Summers, 1985; Hoddinott, 1992).

Asking questions about how resources are allocated intergenerationally presents the need to model the intrahousehold allocation of resources in a dynamic framework. The issues of how investment decisions are made -- both in terms of capital and human capital -- are endogenous to the long run intrahousehold allocation of resources.

In addition, the formation and dissolution of households can also be viewed as endogenous processes. The model of a stable, nuclear family does not hold for much of the world. Instead, households are ever-changing, with family members coming and going as new opportunities present themselves. Many studies define a household as people who eat out of the same pot. However, this begs the question of how people choose which pot to eat from. Especially in societies where extended families are the norm, individuals (especially unmarried adults) may choose where to eat. The work on marriage markets (see Bergstrom, 1993, for a description of this literature) provides one framework for understanding how households change. But this framework leaves out all of the other members of households who may be influential in determining how resources are allocated.

Although households are important, other social relations may also be important to understand resource allocations. The ties that individuals have with their natal family, their extended family, and other social institutions, such as age groupings, may also be critical to understanding how economic decisions are made by individuals within the context of households.

The lack of data at the intrahousehold level continues to present problems for research. Income is often collected only at the level of the household. In addition to income by individual, it would be useful to have data on wealth of individuals, individual access to resources (such as expenditures on schooling for each child), and transfers within households and across households. To understand how risk is distributed within households, it would be useful to understand how transfers from family members outside the household are distributed, and who has control over these resources. This additional data will improve the analyses of intrahousehold resource allocation.

Table 1: Tests of intrahousehold resource allocation models.

(The cells indicate whether a rejection of the null hypothesis is consistent with the model or implies a rejection of the model. An acceptance of the null hypothesis is consistent with any of the models.)

| Null hypothesis | Common Preferences Model | Unified Model | Collective Model | Bargaining Models | |
|---|---|---|---|---|---|
| | | | | Cooperative Outcome* | Non-cooperative Outcome* |
| Individual labor income does not affect expenditures | reject | consistent | consistent | consistent | consistent |
| Individual exogenous income does not affect expenditures | reject | reject | consistent | consistent | consistent |
| Individual exogenous income does not affect labor supply | reject | reject | consistent | consistent | consistent |
| Pareto efficiency: constant ratio of income effects | reject | reject | reject | reject | consistent |
| Pareto efficiency: constant ratio of marginal productivity of inputs | reject | reject | reject | reject | consistent |

* For the bargaining models, we test whether the outcomes are cooperative or noncooperative.

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