Testing among Models of Intrahousehold Resource Allocation

CHERYL R. DOSS*
University of Minnesota, St Paul, U.S.A.

1. INTRODUCTION

Households are the locus for much economic decision making. Households function as producers, investors in human and physical capital, managers of risk, and as consumers. Many resources are allocated within households, and the effects of many policies depend on the dynamics of household decision-making. For example, household decisions about allocating food among individual household members may determine who benefits from programs to improve health, nutrition, or welfare.

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.[1]

This paper goes beyond recent surveys of intrahousehold issues[2] by explicitly examining the assumptions, predictions, and empirical implications of different intrahousehold models. In particular, it analyzes empirical tests that distinguish among competing models. By clarifying the similarities and differences among alternative models, this paper also clarifies what has actually been demonstrated (and what has not been demonstrated) by previous empirical studies. In so doing, the paper points to specific topics in need of further research.

This paper is organized as follows: Section 2 analyzes the assumptions and predictions of each of the five main classes of intrahousehold resource allocation models. Section 3 describes empirical tests of these assumptions along with an analysis of empirical work that has been generated. Sections 4 and 5 discuss the questions that remain unanswered and directions for future research.

2. ASSUMPTIONS AND PREDICTIONS OF THE MODELS OF INTRAHOUSEHOLD RESOURCE ALLOCATION

Several aspects of household decision-making warrant examination. 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, the term "pooled income" refers to a situation in which the household has a single budget constraint. It includes the case in which a director 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 in 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 toward expenditures on shared household goods — as opposed to expenditures on goods for themselves.[3]

Third, if we think of households as producing income, household goods, and leisure, we can ask whether a unified production decision is a reasonable abstraction or whether it is important to consider individuals as making separate production decisions. Finally, we can ask whether the supply of household labor and other production inputs is pooled; in other words, whether there is a single household endowment of labor and other inputs, or whether individuals exercise independent control over their endowments. Many models aggregate individual production functions into a single household production function.

(a) Common preferences model

Although the theoretical work of microeconomics is based upon analysis of the individual, much data are 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 either that all of the members of the household have identical, homothetic utility functions,[4] in which case maximizing the household utility function gives essentially the same results as maximizing individual utility functions, or 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.[5] It is not clear how the decision is made to equalize ethical worth: the weights are not based on wages, prices,

or incomes. The share of income or wealth of individuals within the household will not affect the allocations.

(b) Unified household model

The unified household model also assumes that the household acts as a single unit, but it incorporates both production and consumption decisions. It assumes that the household makes 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 and even if the kids are selfish. If an altruistic parent provides a transfer to his/her children, then the children have incentives to behave so 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.

The "rotten kid theorem" holds however, only under very specific assumptions. Hirschleifer (1977) points out that it holds only if the transfer from parent to child is made after the child is made after the child has chosen an action. If a parent irrevocably commits to a transfer before the child acts, a rotten kid will behave selfishly to obtain a greater allocation than the parent would prefer. 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 the 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. The potential for divorce or the dissolution of the household is also not incorporated into the theorem.

Although the "rotten kid theorem" may provide some theoretical justification for the notion of a unified household model, it offers few direct applications. Other unified household models have attempted to describe household behavior in more detail. The agricultural household model is one such 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 profits, independent 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.

The agricultural household model implicitly assumes that the consumption and labor supply decisions of individuals within households can be aggregated into single household consumption and labor supply decisions. 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 remains that household labor supply decisions can be treated as a single decision. All income and factor supply is pooled in the household. Predictions about the behavior of agricultural households are 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. For example, the agricultural household model helps to explain the net effects of agricultural price changes to these households. The agricultural household model may however, give inaccurate predictions in situations where household decisions are far from unified.

A variant on the agricultural household models is the "household-firm" model in which the household allocates resources to its members on the basis of their marginal productivity — much as though it were a firm in a competitive environment.[6] 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 often is linked implicitly to an assumption that consumption is an input into production.[7]

The "household-firm" model predicts that food and other productive resources will be allocated equally among family members only if the exogenous endowments or characteristics are the same for all family members; thus, it does not predict that resources would be allocated equally and it predicts that household expenditure patterns could change as different individuals earned the income.

(c) Collective model

The common preferences model and the unified household model assume an aggregate household util-

ity function. There is a wide array of models that disaggregate the household utility function. The collective model, proposed by Chiappori (1988) and elaborated by Bourguinon and Chiappori (1994) and Chiappori (1992), begins by looking a 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. The collective model shows that with four assumptions, it is possible to recover the "sharing rule" from household expenditure data. The "sharing rule" is the implicit or explicit rule by which the household shares resources among individual members. The four 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 subutility function is separable with respect to private consumption; and (iv) at least one private good is assignable so we can determine who consumes the good (see Browning et al., 1994). Under these assumptions, the sharing rule can be recovered by observing how the expenditure on the assignable private good reacts to exogenous changes in the economic environment. Any allocation of private expenditures can be explained as the outcome of a sharing rule.

Apps and Rees (1993) modify the collective model to include domestically produced household goods. They suggest that because domestic production is a significant empirical phenomenon, the results obtained by ignoring it may be empirically inapplicable (p. 5). They show that with data on market wages, nonwage incomes, demographic variables, supply of market labor, and time allocations to domestic work, their model can be estimated. This approach changes the interpretation of household economic activity from one of transfers among household members to one of exchange based on a division of labor between market and household production.

The collective model is very general. Both the unified model and the cooperative bargaining model are restricted cases of it. In the household-firm variant of the unified model, the sharing rule is that resources are allocated on the basis of marginal productivity. The bargaining models propose 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 a priori predictions are made about it.

(d) *Cooperative bargaining model*

The initial work to develop bargaining models of 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. In McElroy and Horney's model, there are two people, each of whom receives utility from a pure public good. In addition, the two people value leisure and consumption of private goods. They solve a Nash bargaining problem in which each individual's threat point is his/her utility outside of marriage; it is the utility that each person would obtain if they were divorced. The model incorporates parameters that shift the threat points, referred to in later work as extrahousehold environmental parameters (McElroy, 1990).[8] These parameters could include institutional, demographic, and legal factors.[9] The model assumes that couples pool their resources, 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 (1993) 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 noncooperative 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).

Both partners contribute the public goods within their respective spheres of influence; for example, men may provide housing, while women provide child care. Because public goods are provided voluntarily, they may be underprovided within the household, as is typical in models with voluntarily provided public goods.

Cooperative bargaining models predict that factors influencing 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 divorced. Similarly, these models predict 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.

As in the collective model, the potential gains from

making joint decisions are maximized and household production and consumption are Pareto efficient. Unlike the collective model, which only assumes that the outcome will be Pareto efficient, the cooperative bargaining model specifies which Pareto efficient point will be chosen.

(e) *Noncooperative models*

Noncooperative models 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, households do not pool their incomes.[10] 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. The bargaining process determines how much each person spends on both public and private goods within the household, including food, housing, and education. Each of the models was designed to address slightly different questions, but all incorporate the idea that individuals within the household make independent but interrelated consumption and production decisions.

Woolley (1993) uses a Cournot-Nash framework to predict the effect of income differentials on expenditure patterns, the properties of the household's demand functions, and the family's financial management system. She assumes that each person maximizes her/his own welfare, taking as given the expected action of the other. Each person's welfare is based on her/his preferences over consumption and over the utility level of her/his spouse. Each person's consumption includes the aggregate level of household goods provided by both partners, personal consumption, and leisure. The model predicts that 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 shared household goods. Thus, the distribution of income between household members is an important determinant of household commodity demands.

Ulph (1988) uses a similar noncooperative bar-

gaining 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.

The "conjugal contract model" developed by Carter and Katz (1992) specifically includes transfers of labor and income within the household. Katz (1995) 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. The critical feature of this model is that Carter and Katz explicitly allow partners to transfer both labor and income and assume that these transfers can be observed.[11] This model uses a noncooperative bargaining framework to analyze intrahousehold allocation and a cooperative bargaining framework to determine the levels of these transfers. Using data on such intrahousehold transfers, Katz carried out a detailed study of the impact of nontraditional cash crops in the Guatemalan highlands on individual household members. She found that women transfer labor time to the male nontraditional cash crop activities, with the single largest source of variation in women's time allocation to this activity being the presence of older daughters in the household to perform other domestic labor.

Although specific noncooperative models make assumptions and predictions about intrahousehold behavior, as a class of models, the noncooperative models are the least restrictive. Estimation of these models, however, requires much more detailed data that may include individual earnings and resources and transfers among household members. Any of the outcomes predicted by previously discussed models would be consistent with a noncooperative model.

3. TESTING THE MODELS AGAINST EMPIRICAL EVIDENCE

Each of the models described previously has a different set of assumptions and makes different predictions about how resources will be distributed within households. To select a model for a particular situation, it is important to test the validity of the assumptions against the data and to ask 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, this is rare. For many categories of goods, it is difficult to determine which individuals are consumers of goods purchased by the household. For example, housing expenditures have a "public good" component within the household. Expenditures on specific goods may be "assignable," such as expenditures on men's, women's, and children's clothing. Even for such assignable goods, however, there may be externalities within the household; an individual within the household may care whether other household members are well dressed. Qualitative information about customs or social roles may provide us with some information; for example, in most parts of the world, women are responsible for purchasing food. This information does not tell us however, how the food will be distributed among household members.

From household expenditure data, it is also difficult to determine whether the increase in expenditures simply corresponds to changes in an individual's marginal productivity or to changes in bargaining power within the household. For example, Senauer, Sahn, and Alderman (1986) found that in Sri Lanka an increase in women's earnings resulted in higher expenditures on the "convenience" food of bread rather than on rice. This could be attributed either to changes in relative prices due to the increased value of women's time or to women's increased bargaining power within the household or both.

Much of the empirical work on intrahousehold resource allocation uses the overall 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 hypotheses about intrahousehold behavior that can be tested from survey data typically available. It also indicates under what circumstances we could reject certain of the hypotheses, and how these hypotheses relate to the different models of household behavior described previously.

This table was specifically designed to frame the question of how econometric analyses of household survey data can be interpreted as rejecting or supporting different intrahousehold models. It may also help to organize information from qualitative studies which examine whether production and consumption decisions are made jointly within households.

(a) Testing the common preferences model

The demonstration that individual labor income, as opposed to total household income, affects household

Table 1. *Tests of intrahousehold resource allocation models**

	Common preferences model	Unified model	Collective model	Bargaining models Cooperative outcome‡	Non-cooperative outcome‡
Null hypothesis†					
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 on inputs	reject	reject	reject	reject	consistent

*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.
†All of the null hypotheses assume that total household income is held constant.
‡For the bargaining models, we test whether the outcomes are cooperative or noncooperative.

expenditure patterns — holding total household income constant — is sufficient to reject the common preferences model. Under the common preferences model, expenditure patterns should depend only on total household income — not on who earns it. A number of studies have rejected the common preferences model. For example, using 1986 data from Canada, Phipps and Burton (1993) 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 eight of 12 categories of consumption goods. Cai (cited in McElroy, 1992) used the US Consumer Expenditure Survey data and rejected the common preferences model. In addition, Hoddinott and Haddad (1995) 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. The results of these studies 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.

(b) *Testing the unified household model*

The finding that individual labor income affects household expenditures, holding total household income constant, does not reject a unified household model in which households are assumed to be making both production and consumption decisions. Furthermore, in many instances, the unified household model and the cooperative bargaining model are observationally equivalent, given the available data. Senauer, Garcia and Jacinto (1988) demonstrate this

point in a study on the Philippines. Their paper estimates the effect of individual wage 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. To demonstrate that the models are observationally equivalent, the unified household model is used to obtain reduced form demand equations for each individual within the household. The same reduced form demand equation for food is obtained using a cooperative bargaining framework. The threat point for each person in the bargaining model is based on wages, which are assumed to be the same whether 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 cooperative bargaining model as for the unified household model.[12] These authors 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 of the "household-firm" model that allocations are based on marginal productivity if an exogenous variable influences household consumption patterns. Exogenous factors could include non-labor income[13] or policies that do not change the productivity or incomes of individuals within households but affect their bargaining power — specifically, their "threat points" in the context of a cooperative bargaining model.

For example, exogenous sources of income (such as transfers or nonlabor income) do not alter the marginal productivity of individuals within the household. Thus, the unified household model predicts that all exogenous income should be spent in the same manner, regardless of who receives it; in other words, there is only an income effect from receipt of unearned money. In addition, such exogenous wealth shocks should affect household factor supply decisions in the same manner, regardless of which household member receives the money. If the data indicate that exogenous income affects expenditure patterns differently, depending on who receives the income, we would reject the unified household model. Similarly, if a new policy affected the intrahousehold allocation of resources, without directly influencing prices or incomes, the unified household model would be rejected.

In order to test the assumptions of the unified household model, Thomas (1993) uses data from Brazil to test whether the distribution of nonlabor income within the household has any impact on expenditures. Thomas's 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. Doss (1996) finds that, in Ghana, the percentage of assets owned by women is also significant in explaining household expenditure patterns. These works suggest that measures of bargaining power not directly related to labor income may affect household economic decisions.

One of the reasons for the interest in bargaining models is that they suggest that policy changes may have an impact on intrahousehold resource allocation. Lundberg, Pollak and Wales (1995) examine the impact of a shift in policy in the United Kingdom from a child tax allowance that was primarily realized as a tax credit in men's paychecks to a child benefit scheme that primarily accrued as a direct payment to women. Testing for the effects of this policy change, they found that expenditures on women's and children's clothing increased relative to expenditures on men's clothing.

Where these four studies focused on consumption patterns, two additional studies have looked at household labor supply to test the implications 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 — not men's unearned income nor men's or women's earned income — is associated with women's 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.

(c) Testing for Pareto efficiency

It is not possible to test whether the collective model, cooperative bargaining model, or noncooperative bargaining model best characterizes the intrahousehold allocation of resources. What can be tested is whether a Pareto efficient outcome is attained. A Pareto efficient outcome is defined as one in which no one can be made better off without making someone else worse off. Claiming that an outcome is Pareto efficient is not synonymous with saying the outcome is desirable or preferred from a policy or welfare perspective. A situation in which one household member receives all of the resources could be Pareto efficient. A Pareto efficient outcome is consistent with any of the models presented in this paper. The collective model assumes that a Pareto efficient point is chosen. Thus, a rejection of Pareto efficiency implies a rejection of the collective model.

The cooperative bargaining model predicts which Pareto efficient point is chosen, based on the specification of the model. It is difficult to reject the cooperative bargaining model based on the conclusion that a different Pareto efficient point than the one predicted by the model was attained. A rejection of Pareto efficiency implies, however, a rejection of a cooperative outcome of a cooperative bargaining model. It rejects a "divorce threat" cooperative bargaining model but is consistent with a noncooperative outcome of the separate spheres 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. If the marginal utility is higher for one person, the budget could be reallocated to increase the utility of at least one person without decreasing any one else's utility. If the following equation holds for all pairs c_i, c_j,

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

where y_f is women's income and y_m is men's income, we can conclude that the household is allocating consumption goods Pareto efficiently. (If the data are consistent with a common preferences model, then this ratio will equal one.) Thus, the result that this equation holds is consistent with any of the models; if it does not hold, then the unified and collective models and the cooperative outcome of bargaining models are rejected. 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 for men and women across all pairs of goods. They find that equation (1) holds for all pairs of goods, and thus their results indicate that a Pareto efficient consumption 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 that equation (1) holds and that the marginal propensities to consume out of total income are the same across goods. Using data for households in which both adults work full time and in which there is at most one child, 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 the unified household model, the collective model, or either of the bargaining 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 from men's plots to women'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, 1986) found similar results in an analysis of labor allocation after the introduction of irrigated rice production in Northern Cameroon. Both men and women continued to grow sorghum after the introduction of irrigated rice, although the returns to labor from rice production were higher, because they were 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. Much of the rice is sold and the income belongs to the men. Although most women received some compensation for working on the rice plots, the amount of compensation was contested. Jones suggests that women were holding out for higher compensation and undersupplied labor to the rice fields. Higher household income could have been attained if women allocated a greater proportion of their labor to rice production. Thus, Pareto inefficient outcomes were attained.

4. CONCLUSIONS

Using data that are currently available, it is possible to test among the different models of intrahousehold resource allocation. We can conclude that there is substantial evidence against the common preferences model. In addition, evidence from such diverse places as Taiwan, Thailand, and the United States indicates that exogenous factors affect the intrahousehold allocation of resources and thus suggests that the unified household model may be inadequate for many situations. Unified household models should not be used in a given context without testing their assumptions. Researchers and policy makers need to ask whether using an overly simplified model will provide misleading conclusions for a particular question, in light of the evidence presented here. Models of the household that disaggregate preferences and recognize individual behavior within households should be considered. Policy makers should not in general assume that the household behaves as if one decision maker makes production and consumption decisions.

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

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 implicitly assumed that households do attain Pareto efficient outcomes. The predicted impacts of new economic opportunities may differ depending on whether households reach a Pareto efficient solution to the allocation of members' labor and resources.

5. 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. Many questions about economic decision making within households, however, remain unanswered, both theoretical and empirical. A few such questions follow.

First, earlier discussion questions why a non-Pareto efficient outcome would occur within a household. We would expect that, even among households where individual preferences and endowments differ, trade would occur among household members to attain a Pareto efficient solution. The fact that we observe inefficient outcomes suggests that there may be missing markets within households.

Jones (1983, 1986) suggests that labor may not be allocated in a manner to maximize household income if conflicts between household members over the intrahousehold terms of exchange are not resolved. Although for most women in Jones's sample, working in the rice fields would have increased both their own income and total household income, the increase to their own income was relatively small. Women were, in effect, striking for control over a greater proportion of the additional income received from their labor in irrigated rice fields.

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 other household members' 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. Although the institutional dimensions of intrahousehold decision-making are clearly important, further research is needed to understand what happens in the absence of these institutions.

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. For agricultural households, however, 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.[14] 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 disaggregated intrahousehold models do not provide many insights into how resources might be allocated in such a risky or uncertain environment. These models suggest however, that under some circumstances, it is important to look beyond the household level and examine individual behavior within the household.

A third area for further research involves the division of household goods into "public" and "private" goods. Each of the models makes different assump-

tions about public and private goods within the household. The boundary between public and private goods however, is not well defined; instead there is a continuum of goods, ranging from pure public to pure 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.

Another 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,[15] the intrahousehold resource allocation models generally do not directly incorporate children as actors or decision makers. Although children may provide labor and earn an income, the implicit assumption is that children are an investment or 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. Behrman, Pollak and Taubman (1993) examine the similarity and differences of resource allocations and outcomes among siblings and between parents and children in the United States.

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 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; Del Boca and Flinn, 1993) has examined the payment of child support by divorced fathers. The question of how resources are allocated between a parent and children in a single-parent household is not addressed, however. The allocation of resources between parents and children has also been considered in the context of whether children provide transfers to elderly parents (Bernheim, Shleifer and Summers, 1985; Hoddinott, 1992). Altonji, Hayashi and Kotlikoff (1992) examine the economic relationships of parents and adult children and reject the hypothesis that the distribution of consumption is independent of the distribution of resources in the extended family. Quisumbing (1994) examines intergenerational transfers in the Philippines and concludes that parents provide different types of transfers to sons and daughters. In addition, some of these issues have been addressed through dynamic general equilibrium models,[16] although they tend to focus on the macro effects of intergenerational transfers, such as social security policy.

Asking questions about how resources are allocated among generations presents the need to model the intrahousehold allocation of resources in a dynamic framework. The issue 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. This begs the question however, 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[17] provides one framework for understanding how households change. Fertility models address another aspect of the endogeneity of household formation, while studies of child-fostering raise further questions about household formation and about the intrahousehold allocation of resources when household formation is endogenous.[18]

Although households are important, other social relations may also be important to understand resource allocations. The ties that individuals have with a natal family, an 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. If groupings of individuals other than households are making collective decisions, then empirical analyses at the level of the household might obtain non-Pareto efficient results, because the household is not the appropriate decision-making unit. Markets may exist within the decision-making unit although they may not exist in households and communities.

A number of critiques of economic models of intrahousehold resource allocation suggest that economists level out critical aspects of these household decisions. These criticisms point to some other directions for research. Pollak (1994) details some of the criticisms regarding the specification of the models — including the omission of critical variables, treatment of endogenous variables as exogenous, and exclusion of "noneconomic variables," such as power. Seiz (1991) is critical of the usefulness of formalized bargaining models although she concludes that a bargaining framework may offer insights into understanding gender relations within and outside the household.

Sen (1990) suggests that actual contributions to households may be less important then perceived contributions to the household. Most survey data do not provide us with any direct means to test this hypothesis. In general, we might expect that survey responses are biased in the direction of perceived contributions, even when the questions ask about actual contribu-

tions. Survey data that include women's income from both more and less visible sources, however, could provide support of this hypothesis.

An additional question is how violence fits into the intrahousehold allocation of resources. When violence against household members is sanctioned by social norms, then we might expect that violence, or the threat of violence, limits women's choices. For example, Jones (1986) found that the threat of violence from their husbands limited women's opportunities to work for wages. Violence may also be used directly as a tool to obtain resources. Rao (1995) finds that in households where husbands engage in severe beatings of their wives, children receive smaller allocations of calories.

One way to approach the question of violence in households is to think of violence as one of the outcomes of decisions. Tauchen, Witte and Long (1991), using data on households in the United States that had experienced violence, find that women's share of total household income does affect household welfare outcomes when violence is considered one of the components of household welfare.

Although this paper examines the tests of the assumptions of different models of intrahousehold resource allocation, it is also important to test alternative hypotheses of the observed outcomes. One hypothesis that is often presented for differential impacts of women's and men's income on expenditure patterns is that the flow of their income is often different. In many situations, men produce cash crops or earn a wage income which is received in periodic large lump sums, whereas women earn income in smaller, much more frequent — possibly daily — installments. Thus, we might predict that the flow of income, rather than the gender of the income earner, affects household expenditure patterns. In an attempt to address this issue, Hopkins, Levin and Haddad (1994) demonstrate that the gender-disaggregated seasonal flow of income is an important determinant of seasonal food expenditure.

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 the wealth of individuals, individual access to resources (such as expenditures on schooling for each child), and transfers within and across households. To understand how risk is distributed within households, it would help to know how transfers from family members outside the household are distributed, and who has control over these resources. In addition, better measures of bargaining power are needed, such as details on which household members would receive the household home and land if the marriage dissolved. This additional data will improve the analyses of intrahousehold resource allocation.

NOTES

1.   See for example, Phipps and Burton (1995) and Haddad, Hoddinott and Peña (1992).

2.   For example, Haddad, Hoddinott and Alderman (1994) and Bergstrom (1993). Alderman *et al.* (1995) compare aggregated models (common preferences and unified) with disaggregated models (collective, and cooperative and non-cooperative bargaining models) to emphasize the importance of using disaggregated models. Their paper does not, however, provide information on choosing among the disaggregated models.

3.   Within the literature on households, the term "pooled income" is used to refer to a number of different concepts. Often, pooled income is used to refer only 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.

4.   This technical assumption claims that the utility received from different goods does not vary across income levels. Thus, assuming identical, homothetic utility functions assumes that the utility received from different goods does not vary across household members or across household income levels.

5.   The common preferences model is often used in consumer demand studies in which income is treated as exogenous. It is less frequently used in studies of household economics which are concerned about both production and consumption. In addition, the common preferences model is presented separately from other models that assume a single household utility function because several empirical studies have only rejected the existence of an aggregated household utility function if income is exogenous.

6.   Rosenzweig (1986) details this model.

7.   This is the rationale of the unified household model that is tested in the work cited in this paper. Other explana-tions of why it is possible to aggregate the household utility function may present different tests.

8.   For example, McElroy and Horney suggest that one such extrahousehold environmental parameter could be the ratio of males to females in the relevant marriage market.

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

10.   For example, see Guyer (1980) and the volume by Dwyer and Bruce (1988), especially the article by Fapohunda.

11.   For her empirical work, Katz was able to collect data on transfers; however, such data is not available in standard household survey data sets.

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

13.   Nonlabor income is often assumed to be an exogenous variable. It could include rental, interest, transfer or remit-tance income. Some nonlabor income however, may be the result of previous labor allocation decisions.

14.   See Alderman and Paxson (1992).

15.   See Behrman (1992) for a review of this literature.

16.   For example, Imrohoroglu, Imrohoroglu and Joines (1992); Leimer and Lesnoy (1982).

17.   See Bergstrom (1993) for a description of this litera-ture.

18.   For example, see Bledsoe and Isiugo-Abanihe (1989) and Ainsworth (1992).

REFERENCES

Ainsworth, Martha, "Economic aspects of child fostering in Cote d'Ivoire," Living Standards Measurement Study Working Paper No. 92 (Washington, DC: World Bank, 1992).

Alderman, Harold and Christina H. Paxson, "Do the poor insure? A synthesis of the literature on risk and con-sumption in developing countries," Research Program in Development Studies, Discussion Paper #164 (Princeton, NJ: Princeton University, 1992).

Alderman, Harold, Pierre-Andre Chiappori, Lawrence Haddad, John Hoddinott and Ravi Kanbur, "Unitary vs. collective models of the household: Is it time to shift the burden of proof?," *World Bank Research Observer*, Vol. 10, No. 1 (February 1995), pp. 1–19.

Altonji, Joseph G., Fumio Hayashi and Laurence J. Kotlikoff, "Is the extended family altruistically linked? Direct tests using micro data," *American Economic Review*, Vol. 82, No. 5 (December 1992), pp. 1177–1198.

Apps, P. F. and R. Rees, "Labor supply, household produc-tion and intra-family welfare distribution," Working Papers in Economics and Econometrics No. 248 (Canberra, Australia: Australian National University, 1993).

Arrow, Kenneth J., *Social Choice and Individual Values* (New York: John Wiley, 1951).

Becker, Gary, "A theory of social interactions," *Journal of Political Economy*, Vol. 82, No. 6 (1974), pp. 1063–1093.

Becker, Gary, *Treatise on the Family* (Cambridge, MA: Harvard University Press, 1981).

Behrman, J. R., "Intra-household allocation of nutrients and

gender effects: A survey of structural and reduced-form estimates," in S. R. Osmani, (Ed.), *Nutrition and Poverty* (New York: Clarendon Press, 1992).

Behrman, Jere R., Robert A. Pollak and Paul Taubman, *From Parent to Child: Intragenerational Allocations and Intergenerational Relations in the United States* (Chicago, IL: University of Chicago Press, 1993).

Bergstrom, Theodore, "A fresh look at the rotten kid theorem — and other household mysteries," *Journal of Political Economy*, Vol. 97, No. 5 (1989), pp. 1138–1159.

Bergstrom, Theodore, "A survey of theories of the family," Working Paper 93-02, CREST, Dept. of Economics (Ann Arbor, MA: University of Michigan, 1993).

Bernheim, B. Douglas, Andrei Shleifer and Lawrence Summers, "The strategic bequest motive," *Journal of Political Economy*, Vol. 93, No. 6 (1985), pp. 1045–1076.

Bledsoe, Caroline and Uche C. Isiugo-Abanihe, "Strategies of child fosterage among Mende 'Grannies' in Sierra Leone," in Ron Lesthaeghe (Ed.), *African Reproduction and Social Organization in Sub-Saharan Africa* (Berkeley, CA: University of California Press, 1989), pp. 442–474.

Bourguignon, Francois and Pierre-Andre Chiappori, "The collective approach to household behaviour," in Richard Blundell, Ian Preston and Ian Walker (Eds.), *The Measurement of Household Welfare* (New York: Cambridge University Press, 1994).

Bourguignon, Francois, Martin Browning, Pierre-Andre Chiappori and Valerie Lechene, "Intra household allocation of consumption: A model and some evidence from French data," *Annales d'Economie et de Statistique*, Vol. 29 (1993), pp. 137–156.

Browning, Martin, Francois Bourguignon, Pierre-Andre Chiappori and Valerie Lechene, "Incomes and outcomes: A structural model of intra-household allocation," *Journal of Political Economy*, Vol. 102, No. 6 (1994), pp. 1067–96.

Bruce, Neil and Michael Waldman, "The rotten kid theorem meets the Samaritan's dilemma," *Quarterly Journal of Economics*, Vol. 105, No. 1 (1990), pp. 155–165.

Carter, Michael R. and Elizabeth G. Katz, "Separate spheres and the conjugal contract: Understanding the impact of gender-biased development," Paper presented at the Conference on Intrahousehold Resource Allocation: Policy Issues and Research Methods (Washington, DC: IFPRI and the World Bank, February 12–14, 1992).

Chiappori, Pierre-Andre, "Rational household labor supply," *Econometrica*, Vol. 56, No. 1 (1988), pp. 63–89.

Chiappori, Pierre-Andre, "Collective labour supply and welfare," *Journal of Political Economy*, Vol. 100, No. 3 (1992), pp. 437–467.

Del Boca, Daniela and Christopher J. Flinn, "Rationalizing child support decisions," C. V. Starr Center for Applied Economics Research Report #93-16 (New York: New York University, 1993).

Doss, Cheryl R., "Testing the Unified Model for Ghana: Evidence and implications," Mimeo, Dept. of Applied Economics (St Paul, MN: University of Minnesota, 1996).

Dwyer, Daisy and Judith Bruce, *A Home Divided: Women and Income in the Third World* (Standford, CA: Stanford University Press, 1988).

Fapohunda, Eleanor R., "The non-pooling household: A challenge to theory," in Daisy Dwyer and Judith Bruce (Eds.), *A Home Divided: Women and Income in the Third World* (Stanford, CA: Stanford University Press, 1988).

Folbre, Nancy, "Rotten fathers or rotten policy? Extrafamily influences on intrafamily inequality," Paper presented at the Conference on Intrahousehold Resource Allocation: Policy Issues and Research Methods (Washington, DC: IFPRI and the World Bank, February 12–14, 1992).

Guyer, Jane, "Household budgets and women's incomes," African Studies Center, Working Paper No. 28 (Boston: Boston University, 1980).

Haddad, Lawrence, John Hoddinott and Harold Alderman, "Intrahousehold resource allocation: An overview," Policy Research Working Paper No. 1255 (Washington, DC: World Bank Policy Research Department, Poverty and Human Resources Division, 1994).

Haddad, Lawrence, John Hoddinott and Christine Peña, "Intrahousehold resource allocation: Policy issues and research method," Report prepared for USAID (Washington, DC: USAID, 1992).

Hirschleifer, J., "Shakespeare vs. Becker on altruism: The importance of having the last word," *Journal of Economic Literature*, Vol. 15, No. 2 (1977), pp. 500–502.

Hoddinott, John, "Rotten kids or manipulative parents: Are children old age security in western Kenya?" *Economic Development and Cultural Change*, Vol. 40, No. 3 (1992), pp. 546–566.

Hoddinott, John and Lawrence Haddad, "Does female income share influence household expenditure patterns?," *Oxford Bulletin of Economics and Statistics*, Vol. 57, No. 1 (1995), pp.77–96.

Hopkins, Jane, Carol Levin and Lawrence Haddad, "Women"s income and household expenditure patterns: Gender or flow? Evidence from Niger," *American Journal of Agricultural Economics*, Vol. 76, No. 5 (December 1994), pp. 1219–1225.

Horney, Mary Jean and Marjorie B. McElroy, "The household allocation problem: Empirical results from a bargaining model," *Research in Population Economics*, Vol. 6 (1988), pp. 15–38.

Imrohoroglu, A., S. Imrohoroglu and D. Joines, "A life cycle analysis of social security," *Economic Theory*, Vol. 6, No. 1 (1995), pp. 83–114.

Jones, Christine W., "Mobilization of women's labor for cash crop production: A game theoretic approach," *American Journal of Agricultural Economics*, Vol. 65, No. 5 (1983), pp. 1049–1054.

Jones, Christine, "Intra-household bargaining in response to the introduction of new crops: A case study from northern Cameroon," in Joyce Lewinger Moock (Ed.), *Understanding Africa's Rural Households and Farming Systems* (Boulder, CO: Westview, 1986).

Kapteyn, Arie and Peter Kooreman, "Household labor supply: What kind of data can tell us how many decision makers there are?," *European Economic Review*, Vol. 36, No. 2–3 (1992), 365–371.

Katz, Elizabeth, "Gender and trade within the household: Observations from rural Guatemala," *World Development*, Vol. 23, No. 2 (1995), pp. 327–342.

Lazear, Edward P. and Robert T. Michael, *Allocation of Income Within the Household* (Chicago, IL: University of Chicago Press, 1988).

Leimer, D. R. and S. D. Lesnoy, "Social security and private saving: New time-series evidence," *Journal of Political Economy*, Vol. 90 (1982), pp. 606–629.

Lindberg, S. and R. Pollak, "Separate spheres bargaining and the marriage market," *Journal of Political Economy*, Vol. 101, No. 6 (1993), pp. 988–1010.

Lundberg, S. J., R. A. Pollak and T. J. Wales, "Do husbands and wives pool their resources? Evidence from the U.K. child benefit," Mimeo (Seattle, WA: University of Washington, April 1995).

Manser, Marilyn and Murray Brown, "Marriage and household decision-making: A bargaining approach," *International Economic Review*, Vol. 21, No. 1 (1980), pp. 31–44.

McElroy, Marjorie, "The empirical content of Nash-bargained household behavior," *Journal of Human Resources*, Vol. 25, No. 4 (1990), pp. 559–583.

McElroy, Marjorie, "The policy implications of family bargaining and marriage markets," Paper presented at the Conference on Intrahousehold Resource Allocation: Policy Issues and Research Methods (Washington, DC: IFPRI and the World Bank, February 12–14, 1992).

McElroy, Marjorie and Mary Jean Horney, "Nash-bargained household decisions: Toward a generalization of the theory of demand," *International Economic Review*, Vol. 22, No. 2 (1981), pp. 333–349.

Phipps, Shelley A. and Peter S. Burton, "What's mine is yours?: The influence of male and female incomes on patterns of household expenditure," Mimeo, Department of Economics (Halifax, Nova Scotia: Dalhousie University, 1993).

Phipps, Shelley A. and Peter S. Burton, "Sharing within families: Implications for the measurement of poverty among individuals in Canada," *Canadian Journal of Economics*, Vol. 28, No. 1 (February 1995), pp. 177–204.

Pollak, Robert A., "For better or worse: The roles of power in models of distribution within marriage," *American Economic Review*, Vol. 84, No. 2 (1994), pp. 148–152.

Quisumbing, Agnes R., "Intergenerational transfers in Philippine rice villages," *Journal of Development Economics*, Vol. 43 (1994), pp. 167–195.

Rao, Vijayendra, "Wife-beating in a rural south Indian community," Center for Development Economics, Research Memorandum Series RM-143 (Williamstown, MA: Willliams College, 1995).

Rozenzweig, Mark, "Program interventions, intrahousehold distribution, and the welfare of individuals: modeling household behavior," *World Development*, Vol. 14, No. 2 (1986), pp. 233–243.

Samuelson, Paul, "Social indifference curves," *Quarterly Journal of Economics*, Vol. 70 (1956), pp. 1–22.

Schultz, T. Paul, "Testing the neoclassical model of family labor supply and fertility," *Journal of Human Resources*, Vol. 25, No. 4 (1990), pp. 599–634.

Seiz, Janet A., "The bargaining approach and feminist methodology," *Review of Radical Political Economics*, Vol. 23, No. 1&2 (1991), pp. 22–29.

Sen, Amartya, "Gender and cooperative conflicts," in Irene Tinker (Ed.), *Persistent Inequalities* (New York: Oxford University Press, 1990).

Senauer, Ben, Marito Garcia and Elizabeth Jacinto, "Determinants of the intrahousehold allocation of food in the rural Philippines," *American Journal of Agricultural Economics*, Vol. 70, No. 1 (1988), pp. 170–180.

Senauer, Ben, David Sahn and Harold Alderman, "The effect of the value of time on food consumption patterns in developing countries: Evidence from Sri Lanka," *American Journal of Agricultural Economics*, Vol. 68, No. 4 (November 1986), pp. 920–927.

Singh, Inderjit, Lyn Squire and John Strauss, "The basic model: Theory, empirical results, and policy conclusions," in Inderjit Singh, Lyn Squire, John Strauss (Eds.), *Agricultural Household Models: Extensions, Applications and Policy* (Baltimore, MD: Johns Hopkins University Press, 1986).

Tauchen, Helen V., Ann Dryden Witte and Sharon K. Long, "Domestic violence: A nonrandom affair," *International Economic Review*, Vol. 32, No. 2 (May 1991), pp. 491–511.

Thomas, Duncan, "The distribution of income and expenditure within the household," *Annales d'Economie et de Statistique*, Vol. 29 (1993), pp. 109–136.

Thomas, Duncan and Chien-Liang Chen, "Income shares and shares of income: Empirical tests of models of household resource allocations," Mimeo (Santa Monica, CA: RAND, 1993).

Udry, Christopher, "Gender, agricultural production and the theory of the household," Mimeo, (Evanston, IL: Northwestern University, 1994).

Ulph, David, "A general non-cooperative Nash model of household consumption behaviour," Discussion Paper 88/205 (Bristol, England: University of Bristol, 1988).

Weiss, Yoram and Robert J. Willis, "Children as collective goods and divorce settlements," *Journal of Labor Economics*, Vol. 3, No. 3 (1985), pp. 268–292.

Woolley, Frances, "A Cournot-Nash model of family decision making," Mimeo, Department of Economics (Ottawa, Canada: Carleton University, 1993).