

6 Development Microeconomics

through individuals, however socially conditioned (or 'programmed') the latter's goals and belief systems may be. We may quote from Arrow (1994) on this; while he is convinced that 'social variables, not attached to particular individuals, are essential in studying the economy', he adds that 'it is a salutary check on any theory of the economy or any other part of society that the explanations make sense on the basis of the individuals involved'.

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2

Household Economics

Most people in developing countries earn at least part of their livelihood through work in their own enterprises. Moreover, they often consume at least a portion of the output of their productive activities, and household labour is often an important input into the production process of the enterprise. Consequently, individuals make simultaneous decisions about production (the level of output, the demand for factors, and the choice of technology) and consumption (labour supply and commodity demand). This mixture of the economics of the firm and of the household is characteristic of the situation of most families in developing countries and provides the starting point for our analysis.

Most commonly, the enterprise that households operate is a farm. In the least-developed countries, about three-quarters of the labour force is involved in agriculture (United Nations 1994, table 17). A model of a household that is jointly engaged in production and consumption, therefore, is commonly called an 'agricultural household model' (AHM). We use this nomenclature, but it will be seen that the insights of the AHM apply as well to households that operate enterprises such as small-scale trading or petty manufacturing.

Section I provides an overview of the AHM when markets are complete. With complete markets, the production decisions of the household are separable from its consumption decisions. The household maximizes profit and then maximizes utility subject to a standard budget constraint which includes the value of these profits. The analysis of production decisions in this situation is greatly simplified. Section II discusses the AHM when markets are not complete. In this instance the separation property breaks down and production decisions depend on the preferences and endowments of the household. In Section III we briefly discuss the use of extensions of the AHM to examine issues of human resource development. In Section IV we briefly examine the strong assumptions that are required to treat the aggregate behaviour of a set of individuals in a household as if they were characterized by a single utility function and budget constraint.

I

The canonical model of an agricultural household includes a utility function, defined over consumption by each member of the household, and a budget constraint, which incorporates production on assets owned by the household.¹ Consider a household with two members, each of whom gets utility from consuming a good (c_1 and c_2) and from leisure (l_1 and l_2). The most simple agricultural household models assume that each household faces a complete set of competitive markets. (This includes, in more general models than the one presented here, a complete set of markets for time- and state-indexed commodities.) Let p be the price of the good, and w be the wage of labour. (We will assume, for simplicity, that the labour of the two family members is homogeneous.) The household can produce the good on its farm according to the concave production function $F(L, A)$, where A is the area of the farm cultivated by the household and L is the amount of labour used on the farm. Let E_i^t be person i 's endowment of time, E^A the household's endowment of land, and r the price of one unit of land. The household's problem, then, is to solve

$$\text{Max } U(c_1, c_2, l_1, l_2) \quad (1)$$

subject to

$$p(c_1 + c_2) + wL^h + rA^h \leq F(L, A) + w(L_1^m + L_2^m) + rA^m \quad (2)$$

$$L = L_1^f + L_2^f + L^h \quad (3)$$

$$A = A^f + A^h \quad (4)$$

$$E^A = A^f + A^m, E_i^t = L_i^f + L_i^m + l_i, i \in \{1, 2\} \quad (5)$$

$$c_i, l_i, L_i^f, L_i^m, A^f, A^m \geq 0, i \in \{1, 2\}. \quad (6)$$

Equation (1) is a household utility function in which utility depends upon the consumption of goods and leisure by each individual. The maximization is with respect to consumption and leisure, hired labour and land, and household labour and land supplied to the market and used on the household farm: $\{c_i\}$, $\{l_i\}$, A^h , L^h , A^m , $\{L_i^m\}$, A^f , and $\{L_i^f\}$. Equation (2) is a conventional budget constraint: cash expenditures on consumption, hired labour, and rented land cannot exceed cash revenues from farming, market labour, and land rented out. Equations (3)–(5) define resource constraints: labour use on the farm is household labour used on the farm plus hired labour; land use on the farm is owned land used on the farm plus hired land; the household's land endowment is used on its own farm or rented out, and each individual's time endowment equals their labour use on the farm, plus market labour time, plus leisure time.

¹ The primary reference for the AHM is Singh *et al.* (1986).

Substituting (3)–(5) into (2), we find:

$$p(c_1 + c_2) + w(l_1 + l_2) \leq \Pi + w(E_1^t + E_2^t) + rE^A \quad (7)$$

$$\Pi = F(L, A) - wL - rA \quad (8)$$

$$c_i, l_i, L, A \geq 0, i \in \{1, 2\}. \quad (9)$$

Equation (7) is called the 'full-income' constraint: the value of consumption cannot exceed the value of the household's endowment plus farm profits. The household's problem is now to maximize (1) (with respect to L, A, c_i and l_i) subject to (7)–(9).

The important fact to note is that the problem (1), (7)–(9) is recursive. As long as $U(\cdot)$ is characterized by local non-satiation, then (7) is binding at the solution and the maximized value of $U(\cdot)$ is increasing in Π . L and A do not appear in (1), hence (1) and (7) can be replaced with

$$\text{Max}_{\{c_i, l_i\}} U(c_1, c_2, l_1, l_2) \quad (1')$$

subject to

$$p(c_1 + c_2) + w(l_1 + l_2) \leq \Pi^*(w, r) + w(E_1^t + E_2^t) + rE^A, \quad (7')$$

where

$$\Pi^*(w, r) = \text{Max}_{L, A} F(L, A) - wL - rA. \quad (8')$$

Thus, an important simplification is possible. Equations (1)–(6) appear to be a joint problem in which production and consumption choices are intertwined, and in particular one in which the household's preferences over consumption and leisure might influence its choices regarding production. However, the transformation of the problem reveals the fact that the household's production decisions are characterized by a simple profit maximization condition—equation (8'). Households choose labour and land inputs so as to maximize profit. Production decisions made on any plot depend only on prices and the characteristics of that plot, not on the household's endowments or preferences. When markets are complete, therefore, the analysis of production is greatly simplified.

This result is often called the 'separation property' of the agricultural household model, because the production decisions of the household are separable from the household's consumption choices. Notice that the converse is not true. The consumption choices of the household do depend on the profit realized from production through the budget constraint (7'). To reiterate the logic, the existence of complete markets implies that a utility-maximizing household will choose to maximize profits in its production enterprise. Profit maximization, as it is commonly called in this literature, the separation property) is not

an assumption: rather, it is derived from the twin assumptions of utility maximization and complete markets.

The separation property is robust to the non-existence of some markets. For example, if there is no land market, then replace A by E^A in (8') and set $r = 0$. The problem remains recursive, and the household chooses labour inputs to maximize profits given the household's endowment of land. This choice is independent of the household's preferences or endowment of labour. An analogous result is true if there is no labour market but land can be traded freely.

If we simplify the problem further (ignoring the fact that the household contains multiple members), then a graphical analysis becomes possible. Suppose that $U(\cdot)$ is such that at all prices and wages $c_1 = c_2 = c$ and $l_1 = l_2 = l$. Again, assuming that there is no market for land, the household chooses c , l , and L . The equilibrium is depicted in Figure 2.1. $F(L, E^A)$ is the production function on the household farm, given land endowment E^A . Given the real wage rate w/p , farm profits are maximized at $\Pi(w/p, E^A)$ using L^* units of labour on the farm (where $L^* = \arg\max L F(L, E^A) - (w/p)L$). Then, given the budget constraint $pc = wE^L + \Pi(w/p, E^A) - wl$, household utility is maximized by choosing consumption c^* and leisure l^* . Thus, the household's decision-making process proceeds in two stages: first, farm profit is maximized, and then utility is maximized given the full income budget constraint.

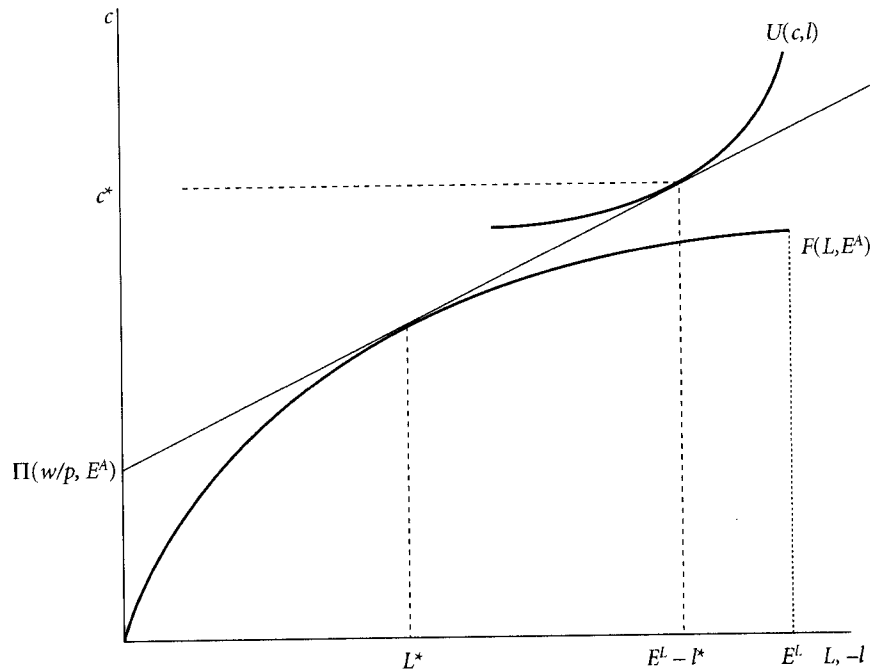


Figure 2.1

It might seem absurd to begin with the hypothesis of separation. It is difficult to argue on the basis of descriptions of economic conditions in the rural areas of developing countries that it is generally the case that markets are (nearly) complete. Therefore, it would seem appropriate to begin with the assumption that farmers do *not* maximize profits; that in fact their production decisions are related to their preferences and endowments. Indeed, in most developing countries where the hypothesis has been examined it is clear that the separation property does not hold. Everywhere in Africa, Latin America, and most of Asia where the hypothesis has been examined, it has decisively been rejected (Kevane 1994; Udry 1998; Barrett 1996; Collier 1983; Jacoby 1993; Carter 1984; Bardhan 1973). There is an interesting pair of papers, however, by Benjamin (1992, 1995) and another by Pitt and Rosenzweig (1986), which indicate that the separation property is not far from true in a large Indonesian data set. In most developing-country contexts, the separation property seems more useful as a benchmark for comparison rather than as a basis for empirical work.

II

If multiple markets are incomplete, the separation property no longer holds. The household no longer maximizes profit, and production decisions depend upon the preferences and endowments of the household. A classic example is the problem of a household that faces imperfections in both the land and labour markets. Suppose again that there is no market for land, but now add the possibility that there is some involuntary unemployment in the rural labour market. The household cultivates its endowment of land, and might face a binding constraint on the amount of labour it can supply off its own farm. The household problem (now assuming just one person in the household) is:

$$\text{Max}_{c, l, L^f, L^m \geq 0} U(c, l) \tag{10}$$

subject to

$$pc = F(L^f + L^h, E^A) - wL^h + wL^m \tag{11}$$

$$l + L^f + L^m = E^L \tag{12}$$

$$L^m \leq M, \tag{13}$$

where L^h is labour hired by the household to work on its farm, L^f is the household's own labour on its farm, L^m is the time spent by the household working for a wage, and M is the maximum amount of time the household can spend working for a wage as a result of some (here unmodelled) labour market rationing. If (13) is not binding, then (11) becomes $pc + wl = F(L, E^A) - wL + wE^L$, where L

is the amount of labour used on the farm. In this case, the household maximizes profits and the separation property holds.

If separation holds, and the production function has constant returns to scale (CRTS), then all farms look quite similar. With CRTS, we can write $F(L, E^A) = E^A f(L/E^A)$, and the first-order condition for labour use is $w = f'(L/E^A)$. All unconstrained farmers facing the same wage will use the same amount of labour per hectare, and achieve the same yield (output per unit of area) and output per unit of labour.

However, suppose (13) is binding, as it will be for small M , and when households desire to supply large amounts of labour to the market (perhaps because E^L is large relative to E^A). In this case $L^m = M, L^h = 0$ and the household's problem becomes

$$\text{Max}_{c, l \geq 0} U(c, l) \tag{14}$$

subject to

$$c = F(E^L - M - l, E^A) + wM. \tag{15}$$

The first-order conditions are (15) and $U_l/U_c = F_L$. The household's problem is illustrated in Figure 2.2 (which is similar to figure 2 in Benjamin 1992). The outer axes measure the household's consumption (goods consumption on the vertical axis, the time endowment minus leisure on the horizontal axis). The

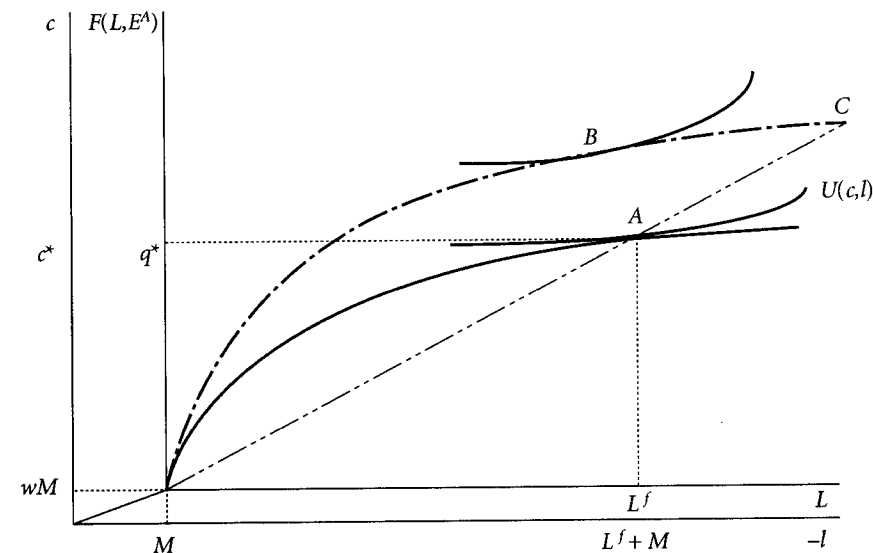


Figure 2.2

inner axes demonstrate production on the household's farm, with output on the vertical axis and labour input on the horizontal axis. M hours are spent working in the market, earning wM . The household's remaining labour time (L^f) is spent on the farm, producing q^* . So the household works $M + L^f$ hours and consumes $c^* = wM + F(L^f, E^A)$ units of the good. The household achieves a maximized utility of $U(c^*, l^*)$ at point A. The household's production choice clearly depends on its preferences and its endowment, and the separation property does not hold.

This sort of market structure could give rise to an oft-observed pattern in the rural areas of less developed countries. Many observers find that small farms are often cultivated more intensively than large farms. More labour per unit area is used on small farms, and yields are larger on these smaller farms. Consider a household with more land than the household consuming at point A in Figure 2.2, but facing the same wage and labour market constraint. If this household were to cultivate with the same intensity as household A, it would have to choose to produce and consume at point C in the figure. If leisure is a normal good, C will not be chosen. Instead, the household will choose to produce and consume at a point such as B, cultivating its larger farm less intensively than the smaller farm of household A. Formally, by implicitly differentiating the first-order condition, we find

$$\frac{dL}{dE^A} = \frac{L}{E^A} \frac{\frac{U_c f''}{E^A} - f' U_{cc} \left(\frac{E^A}{L} f - f' \right) + U_{lc} \left(\frac{E^A}{L} f - f' \right)}{\frac{U_c f''}{E^A} + U_{cc} f' f' + U_{ll} - 2U_{cl} f'} < \frac{L}{E^A} \text{ if } U_{cl} \geq 0 \tag{16}$$

(because $f'(L/E^A) < f$ for a concave CRTS function). As a household's endowment of land increases, the intensity with which it cultivates declines.

Labour and land market imperfections are perhaps the most straightforward rationale for an inverse relationship between farm size and cultivation intensity. Other market failures, however, could be associated with the same observation. For example, suppose that labour markets work well and the production function is CRTS but that production is risky, households are risk-averse, and insurance markets do not exist. To simplify this problem, suppose that households supply labour inelastically and that there is only a single good. The household's problem is to

$$\begin{aligned} &\text{Max}_{L \geq 0} EU(c) \\ &\text{subject to } c = \theta E^A f\left(\frac{L}{E^A}\right) - wL + wE^L, \end{aligned} \tag{17}$$

where θ is a random variable with positive support and mean one. The household chooses labour so that

$$EU'(c) \left[\theta f' \left(\frac{L}{E^A} \right) - w \right] = 0. \quad (18)$$

The separation property, therefore, does not hold. Equation (18) can be rewritten as $f' E \theta U' = w E U'$ (where $U' \equiv U'(c)$ and $f' \equiv f'(L/E^A)$). Subtracting $f' E U'$ from both sides, we obtain $f' E U' (\theta - 1) = E U' (w - f')$. Recalling that $E \theta = 1$, we have $f' \text{cov}(U', \theta) = (w - f') E U'$. Consumption increases with θ , so $\text{cov}(U', \theta) < 0$; f' and $E U'$ are both positive, so $w < f'$. This land is farmed less intensively than land that is cultivated under (expected) profit maximization.

We can now show that an inverse correlation between farm size and cultivation intensity is a consequence of this market imperfection. Apply the implicit function formula to (18) to find

$$\frac{dL}{dE^A} = \frac{L (f''/E^A) E \theta U' + f' E \theta (\theta f' - w) U''}{(f''/E^A) E \theta U' + E (\theta f' - w)^2 U''}. \quad (19)$$

Both terms in the denominator of the coefficient of L/E^A are negative, as of course is the first term in the numerator. The second term in the numerator is $f'' (f' E \theta^2 U'' - w E U'') > 0$ because $f' > w$ and $E \theta^2 U'' < E \theta U'' < 0$. Thus $dL/dE^A < L/E^A$, and farm size is inversely correlated with cultivation intensity.

It is not possible, therefore, to conclude from the observation of an inverse farm size–productivity relationship that any particular market is malfunctioning. We have shown that a combination of labour, land, and/or insurance market failures could be associated with this observation; it is possible to construct simple models of financial market imperfections that lead to the same observation.

III

Simple extensions of the agricultural household model can be used to examine issues of human resource development in less developed countries. (See Strauss and Thomas, 1995, for a helpful and thorough review of the literature.) For example, households consume not only marketed goods, but also goods that are produced at home using household labour. One's utility might depend on a vector of consumption goods c , and on health, which depends on c and on time spent at home 'producing' health (e.g. by maintaining sanitation). This household's problem, in a simple one-period model with no uncertainty, is

$$\text{Max}_{c, l, L, L^c, \geq 0} U(c, H, l) \quad (20)$$

subject to

$$pc + wl + wL^c = F(L) - wL - wE^l \quad (21)$$

$$H = H(c, L^c), \quad (22)$$

where L^c is household labour devoted to producing health. The separation property is maintained with respect to production on the farm, but the production of health depends on preferences. The first-order condition for the allocation of labour to health is $\partial H / \partial L^c = w \lambda (\partial U / \partial H)^{-1}$. So the home production of health will depend on the prices of the goods that are used in maintaining health (p), and on the wage rate, but also on the parameters of the household utility function and on the household's endowments of labour and land. The use of models similar to this for the analysis of the determinants of human capital outcomes is discussed in more detail in Chapter 10.

IV

In setting up the problem of the household, we rather blithely wrote down a 'household utility function' in equation (1), which depended upon the leisure and consumption vector of each of the two individuals in the household. This approach, which (after Alderman *et al.* 1995) we called the *unitary household model*, seems at odds with the methodological individualism that is a basic premiss of microeconomic theory. Only in restricted circumstances can the collective actions of utility-maximizing individuals in a household be treated as if they were generated by the choices of a single utility-maximizing agent.

In order to represent the aggregate choices made by the individuals in a household as though they were made by a single optimizing agent, the preferences of these agents must be characterized by some form of transferable utility. Loosely speaking, transferable utility means that it is possible to find some utility representation of each individual's preferences such that, if one distribution of utilities within the household is feasible, then any other distribution of utilities such that the sum is constant is also feasible. Again loosely speaking, if utility is transferable, then household aggregate demand is not influenced by the distribution of utility within the household and the aggregate choices of the household would be consistent with the choices of a single individual who controls the household's aggregate income.²

The simplest case is that of a household that consumes only private goods and whose members have identical homothetic preferences. If this household always achieved a Pareto-efficient allocation of resources within the household, then by the second welfare theorem this allocation could be achieved through a

² Bergstrom (1997) is an excellent and comprehensive review of the literature on theories of the household.

competitive equilibrium within the household. Since the income-consumption paths of the members of the household are parallel lines, aggregate demand is independent of the distribution of income (and utility) within the household. Moreover, this aggregate consumption is what would be demanded by a single agent with these preferences endowed with the aggregate household income. The choices of this set of individuals, therefore, could be represented by a unitary household model (See Gorman 1953 for a fuller exposition.)

Slightly weaker assumptions on the preferences of members of the household are required for the validity of the unitary household representation if one makes strong assumptions regarding the allocation of resources within the household. For example, Becker's (1981) 'rotten kid theorem' relaxes the assumption of transferable utility to transferable utility conditional on the actions (e.g. labour supply decisions) of the household members. This relaxation comes at the cost of additional assumptions about the household allocation mechanism. In Becker's model, the allocation is not only efficient, but also driven by the presence of one household member (the altruist) who cares about the utility of each of the other household members and is rich enough, relative to the other members, to make positive transfers to each. As long as these gifts remain positive, a redistribution of income within the household has no effect on anyone's consumption, as the gift-giver simply reallocates the gifts to compensate for the changes. Conditional on the actions chosen by the household members, therefore, the household is indistinguishable from a unitary actor. More strikingly, as long as the utility of each household member is a normal good for the altruist, each member has an incentive to choose actions that shift out the household utility possibility frontier. The aggregate behaviour of the household, therefore, corresponds to that of a single utility-maximizing actor faced with the household's budget constraint.

There is no theoretical reason to presume the validity of any of the various combinations of assumptions required to make the aggregate behaviour of individuals in households correspond to the choices of a unitary optimizing agent. Nor is the available empirical evidence supportive of the unitary household model. In the unitary model, aggregate demand does not depend on the distribution of income within the household. However, a growing number of studies (see the review in Strauss and Thomas 1995) have found evidence that the budget shares of particular goods are significantly related to the shares of (arguably exogenous) income accruing to women in the household. For example, Thomas (1991) finds that in Brazil the unearned income of mothers has a much stronger positive effect on child health than the unearned income of fathers, contradicting the unitary household model.

To move beyond the unitary household model, it is necessary to model the interaction between the individuals who comprise the household. In seminal papers, Manser and Brown (1980) and McElroy and Horney (1981) proposed

Nash cooperative bargaining models of the allocation of household resources. These models assume that resources within the household are allocated efficiently, and that the particular Pareto-efficient allocation that is chosen is determined by the 'threat points' of the individual members of the household. The threat point of an individual is defined as the utility achieved by that person if the household does not come to an agreement regarding the distribution of resources. The higher an individual's threat point relative to those of the other individuals in the household, the higher the utility of that person in the equilibrium. Manser-Brown and McElroy-Horney proposed that the threat point of each person is determined by his or her utility in the event of a divorce; later authors (e.g. Lundberg and Pollak 1993) have assumed that the relevant threat point is determined by some sort of non-cooperative equilibrium within the household.

Chiappori (1988, 1992) and Browning and Chiappori (1994) argue that economists generally have little notion of the actual intra-household bargaining process. They argue, therefore, that any model of this process should make only very minimal assumptions. Of all the assumptions that underlie the bargaining models of earlier authors, they retain only that of the efficiency of household resource allocation. This 'efficient household' model makes minimal assumptions, but retains enough content to guide analysis in many cases. For example, if markets are complete, then the separation property holds for efficient households, just as it does for unitary households. To see this, replace equation (1) in the household's problem with (1')

$$\text{Max } \sum_i \lambda_i U_i(\{c_i\}, \{l_i\}). \quad (1')$$

Each individual i might care about the vector of consumption and leisure consumed by each other household member. A Pareto-efficient allocation of resources within the household is defined as the solution to the problem defined by (1') and the household resource constraints (equations (2)–(6)) for some choice if $\lambda_i > 0$. As was the case for the unitary household model with complete markets, decisions regarding production do not depend on the preferences or endowments of the individuals in the household, nor on the 'Pareto weights' λ_i assigned to each individual. Production decisions for the efficient household are guided by (8'), just as they were for the unitary household.

The assumption of household Pareto efficiency is weak relative to the assumptions required for the unitary household model, but it remains just that: an assumption that must be confronted with the actual behaviour of households. The demand patterns generated by an efficient household are different from those of a unitary household. Where tested (Browning *et al.* 1994; Browning and Chiappori 1994; Thomas and Chen 1994), the unitary model has been rejected in favour of the more general efficient household model. Udry (1996), however, finds that women's plots are cultivated much less intensively

than their husbands' plots in parts of Burkina Faso, implying that total agricultural output within the household could be increased by reallocating factors of production across the plots cultivated by household members and contradicting the Pareto efficiency of resource allocation within the household.

The available empirical evidence casts serious doubt on the validity of the unitary model. While the available work is mostly supportive of the more general model of efficient households, there is some evidence, particularly in Africa, that calls even this weaker model into question. More research is required before the general validity of the efficient household model can be accepted. If the efficient household model cannot adequately account for the intra-household allocation of resources, it appears that it will be necessary to move towards more detailed, culturally and institutionally informed noncooperative models of the interaction between household members.

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