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**EFFICIENCY IN INTRAHOUSEHOLD RESOURCE ALLOCATION**

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## **ABSTRACT**

This paper examines the allocation of productive resources within rural households of poor countries. Building upon the existing literature, it provides a consistent framework from which to study productive efficiency and intrahousehold equity. The topics discussed include returns to scale and household centralization; specialization and gender casting; separate spheres and commitment failure; labor market cartelization and discrimination; and the provision of home public goods in the presence of free riding. We show that intrahousehold productive inefficiency should not arise unless household members are prevented from entering into enforceable side contracts. Our analysis predicts that intrahousehold inefficiency increases with factors that exacerbate commitment failure such as short time horizon, low assets, unequal stakes in the household, and poor external enforcement. Patrimonial laws and customs regarding inheritance and divorce can be understood as efforts to mitigate commitment failure within the household.

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## 1. INTRODUCTION

Much of the economic literature on intrahousehold issues focuses on the distribution of consumption among household members (e.g., McElroy and Horney 1981; Manser and Brown 1980; Haddad and Kanbur 1990; Haddad, Hoddinott, and Alderman 1997; Browning et al. 1994). Production decisions are often ignored and, with the exception of Becker (1981), the emphasis is exclusively put on gender issues; intergenerational issues often are ignored. Such treatment may suffice for developed countries where small nuclear households dominate, most people work for a wage, and children go to school and leave their parents afterwards. Indeed, thanks to household equipment and public utilities, the time devoted to household chores has drastically been reduced. Meal preparation and child care services increasingly are purchased on the market instead of being self-provided.

This fundamental transformation of family life, however, has yet failed to reach much of the Third World, especially rural areas. There, households are large, occasionally encompassing several couples with their children. Household members are engaged in a multiplicity of income-generating activities, both on their own account and in collaboration with others. Self-employment is the rule—in farming, livestock raising, crafts, trade, and services. Household chores are many and time-consuming; they fall overwhelmingly on the shoulders of women. Children, of whom there are plenty, spend less time in school and more time helping around the house or the farm. It is customary for young adult

males to remain on their father's farm until they are allowed to marry—and often to stay after marriage in the case of vertically integrated households (e.g., Binswanger and McIntire 1987; Rosenzweig and Wolpin 1985). Third World households are thus more complex than present-day households in developed economies. A proper understanding of their functioning requires a conceptual framework tailored to their characteristics.

Much of the descriptive literature on intrahousehold issues in developing countries—and much of social tension and political activism—focuses on access to productive resources such as land, capital, and farm inputs (e.g., Kumar 1994; de Groote and Kebe 1995; Goetz and Gupta 1996; Smith 1994). This is hardly surprising given that the predominant avenue to financial independence—and thus to the freedom to choose one's consumption and privately enjoy it—is by engaging in an individually managed income-earning activity such as a farm or business. Third World societies have evolved detailed laws and customs governing the transfer and use of productive resources such as land and capital, and assigning specific tasks and roles to household members according to their status (e.g., Fafchamps and Quisumbing 1998). These rules restrict individual choice and impose financial and work obligations to contribute to the joint welfare of the household as a group.

Financial independence is usually granted in exchange for assuming specific responsibilities. In many Sahelian villages, for instance, the head of the household manages the main cereal fields and disposes of the output, but is responsible for feeding the family. Married wives often are granted small plots that they cultivate on their own,

but they must provide the "sauce," that is, the vegetables and condiments that spice up family meals. Unmarried sons may earn pocket money by cultivating their own field, but they must first work on the household's main fields. Tensions between household members therefore results regarding the allocation of labor among competing income-generating activities with distinct residual claimants (e.g., Jones 1983, 1986; Boe 1996). Some suspect that tension over labor allocation may even be the source of economic inefficiency (e.g., Udry 1995; Balsvik 1995). Gender inequality in the acquisition of schooling, experience and skills opening the door to wage employment is also widespread (e.g., Rosenzweig and Evenson 1977; Adams and He 1995; Alderman and Christi 1990; Khandker 1988; Jacoby 1992; Filmer 1996), together with occasional accusations that male heads of household collude to exclude women or young adults from remunerative activities (see Kevane 1996; Anderson and Francois 1996). Domestic violence and social stigma are cited as additional pressure certain heads of household bring to bear on recalcitrant members. Jones (1986), for instance, reports that if a wife refuses to work on her husband's farm, the husband is allowed by custom to beat her (see, also, Lilja 1996; Lilja et al. 1996; Kevane 1996).

While some of the themes that run through the intrahousehold literature in developing countries are similar to those that animate the feminist discourse in developed countries, the emphasis on access to productive resources and on the allocation of household labor to individual income-earning activities is original (e.g., Haddad, Hoddinott, and Alderman 1997). Issues of welfare equity within Third World households

are also not limited to gender distinctions (e.g., Haddad and Kanbur 1990, 1993; Kanbur and Haddad 1994; Quisumbing, Haddad, and Peña 1995; Dercon and Krishnan 1997). They encompass adult dependents, mostly young males. The purpose of this paper is to explore these issues in detail. To do so, we construct a simple model of intrahousehold labor allocation. We derive simple conditions for an efficient allocation of labor and other productive resources. We show that, depending on returns to scale, specialization and experience, efficiency in production may require productive inputs to be centrally managed and individuals to specialize in certain tasks or activities. Intrahousehold equity in welfare, however, need not be achieved. We then explore conditions under which commitment failure arise, that is, when household members are unable to precommit their future actions and, hence, find it difficult to enforce intrahousehold agreements. In this case, we show that imperfect factor markets prevent households from achieving allocative efficiency and that access to productive resources is likely to be conflictual. In the last part of this paper, we demonstrate that the strategic interaction between household members is seriously complicated when household public goods such as housing or children<sup>1</sup> are introduced into the model. Commitment failure problems are exacerbated and allocative inefficiency is more likely to arise. Implications for future empirical research are summarized at the end.

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<sup>1</sup>Whether and when children are best considered as "consumption goods" or as individual decisionmakers is a difficult issue that is clearly beyond the scope of this paper. For the purpose of this paper, it is sufficient to regard children below a certain age as "goods" and those above that age as decisionmakers, without being too specific about what the appropriate cutoff age is.

## 2. A BRIEF SURVEY OF THE INTRAHOUSEHOLD LITERATURE IN ECONOMICS

Early work on intrahousehold allocation is couched in terms of a unitary model of the household (e.g., Becker 1965). Labor supply response and nutrition outcomes are interpreted as results of the maximization of a single utility function. The works of Rosenzweig (1986), Rosenzweig and Evenson (1977), Pollak and Wachter (1975), Jacoby (1992), and Skoufias (1993) fall within this category. If applied wisely, this approach can yield interesting results, even if the underlying assumptions can be criticized as unrealistic. For instance, it can explain why parents prefer to send boys to school because returns to education are higher than for girls (e.g., Rosenzweig and Schultz 1987); why food, when it is scarce, goes to adult males because they are the prime income earners of the household (e.g., Pitt, Rosenzweig, and Hassan 1990); or why women concentrate on house chores because their wage outside the household is lower than that of men (e.g., Evenson 1978; Becker 1965; Low 1994).

Seminal contributions by Manser and Brown (1980) and McElroy and Horney (1981) challenged the unitary model of the household and proposed its replacement with a collective model in which household members bargain over the distribution of consumption among themselves. They show that the bargaining power of individuals depends on the resources they command, and thus on their individual incomes. Consumption thus depends not only on the household's total income, but also on which member earns it. Individual payoffs in case of breakdown of cooperation serve as threat

points in the negotiation over household expenditures, thereby helping to shape the allocation of leisure and consumption among household members. Several possible determinants of these threat points have been suggested in the literature, such as land ownership, education, entitlement programs, laws and customs about the sharing of household assets in case of divorce, and social norms regarding gender-specific tasks and parenting responsibilities (e.g., McElroy 1990; Lundberg and Pollak 1993). Tests of income pooling have usually rejected the unitary model (e.g., Manser 1993; Thomas 1993).

Intrahousehold modeling has recently been rejuvenated by the work of Chiappori (1988, 1992, 1997) and coauthors (e.g., Browning et al. 1994; Bourguignon et al. 1993; Bourguignon, Browning, and Chiappori 1995). Chiappori's idea is a simple but powerful one. Even though there is no commonly accepted model of bargaining, most such models discussed in the economic literature—whether cooperative or not—generate Pareto efficient outcomes (as do unitary models that are a special case of collective models; see Haddad, Hoddinott, and Alderman 1997). Efficient allocations within the household exhibit certain characteristics that can serve as a basis for a test of allocative efficiency without assuming any particular form of bargaining. The application of these ideas to household consumption data from developed countries has failed to reject allocative efficiency while rejecting income pooling (e.g., Browning et al. 1994; Bourguignon et al. 1993; Thomas 1993; Manser 1993; Fortin and Lacroix 1993). Using data from Taiwan, Thomas and Chen (1994) nevertheless reject Pareto efficiency for some allocations.

Taken together, these results constitute evidence in favor of the collective model of the household, leading Alderman et al. (1995) to urge analysis to think seriously about collective model alternatives to the unitary model.

Early work by Jones (1983, 1986) and a recent paper by Udry (1995) nevertheless suggest that farming households in Africa fail to efficiently allocate productive resources within the household. Rather than relying on the complicated consumption-based tests proposed by Chiappori and coauthors, Udry (1995) focuses on the production side and tests whether yields are equalized across plots managed by different household members. He finds conclusive evidence that plots in the hands of women and young adult males have lower yields than those operated by male heads of household. His results and those of Jones, obtained in African farming households where individual members are known to operate in separate spheres (e.g., Lundberg and Pollak 1994, 1993; Katz 1994; Carter and Katz 1997), cast doubt on the efficient collective model of the household.

The reasons for allocative inefficiency is unclear, however. Balsvik (1995) suggests that it may be due to commitment failure: because the head of the household is unwilling or unable to credibly commit to reward the work of his wife and dependents after harvest, the latter prefer to divert their labor to their own fields and income-earning activities. Similar ideas permeate the works of Jones (1983) and Lundberg and Pollak (1994). In a repeated long-run union, the threat of future noncooperation should in principle induce voluntary collaboration and solve the commitment failure problem.<sup>2</sup> If, however, certain

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<sup>2</sup>Indeed, in many societies, laziness is often an accepted motive for divorce.

promises are not credible and certain Pareto improving trades are not feasible, the achievement of allocative efficiency may be prevented. One of the objectives of this paper is to examine the precise conditions under which a commitment failure may arise. We leave, for future work, the enforcement difficulties arising from the presence of multiple wives or nuclear households within the production unit, as in the case of polygamous or vertically integrated households (e.g., Jacoby 1995).<sup>3</sup>

### 3. A NEOCLASSICAL MODEL OF INTRAHOUSEHOLD LABOR ALLOCATION

To capture the essence of the allocative issue, consider the following stylized model of a collective household operating in separate spheres. The household is assumed comprised of  $N$  members, each of whom is endowed with total time  $T_i$ , productive assets  $A_i$ —representing land, capital, and livestock—and labor efficiency  $e_i$ —representing schooling, skills, and experience (e.g., Becker 1981). Nonproductive members of the household are ignored for simplicity. Individual household members allocate their time between work on their own account, work for other members of the household, outside

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<sup>3</sup>It is immediately apparent that many concepts developed for firms can be applied to complex household structures, such as multiple agents models, theory of hierarchies, information circulation issues, etc. Patrimonial law—e.g., rules of devolution of assets upon death or dissolution—also becomes more complicated in multiple households.

wage work, and leisure. They choose how to spend their income.<sup>4</sup> Individual consumption expenditures are financed through income from own production and wages, net of transfers to and from other household members. The production and consumption of household public goods is delayed until Section 7.

We begin by assuming that factor markets are totally absent. This assumption is lifted later on. Formally, the decision facing each individual member of the household can be denoted as follows:

$$\text{Max}_{c_i, L_{ij}, g_{ij}} U^i(c_i) + V^i(T_i - \sum_j L_{ij}), \quad (1)$$

subject to a budget constraint,

$$p c_i = F(A_i, \sum_j e_j L_j)_i + \sum_j g_{ji} - \sum_i g_{ij} \quad (2)$$

and nonnegativity constraints  $L_{ij} \geq 0$  and  $g_{ij} \geq 0$ . Variables  $c_i$  stands for consumption (possibly a vector);  $L_{ij}$  is the labor time provided by individual  $i$  on  $j$ 's income-earning activity; and  $g_{ij}$  is the transfer from individual  $i$  to individual  $j$ . Utility is assumed nonaltruistic and separable between goods and leisure. Preferences may vary across individuals but all have access to the same production technology  $F(\cdot)$ , which depends on total effective labor  $\sum_j e_j L_j$  and a vector of nonlabor inputs  $A_i$ . Leisure  $l_i$  equals total

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<sup>4</sup>In other words, we rule out paternalism, that is, the possibility that a particular household member may decide the consumption of another member against his or her will. How individual consumption is decided is irrelevant, as long as individual preferences dictate how money is spent on someone's consumption bundle.

time  $T_i$  minus total labor  $\sum_j L_{ij}$ . When deciding their own labor and consumption, individuals take transfers from others,  $L_{ji}$  and  $g_{ji}$  as given. First-order conditions yield the usual

$$\frac{\partial U^i}{\partial c_i} = \lambda_i p \quad (3)$$

and

$$\frac{\partial V^i}{\partial l_i} = \lambda_i e_i \frac{\partial F}{\partial L_i}, \quad (4)$$

where  $L_i \equiv \sum_j L_{ji}$ . Variable  $\lambda_i$  is the Lagrange multiplier associated with the budget constraint; it measures the marginal utility of income. Voluntary transfers of labor and gifts to others are against individual's self-interest since they subtract from own consumption. In equilibrium therefore,  $L_{ij} = 0$  and  $g_{ij} = 0$  for all  $i \neq j$ .

In this world of isolated individuals, production efficiency is not achieved. Individuals with low  $A_i$  and thus low returns to labor would be better-off exchanging labor for consumption with better endowed individuals who would themselves benefit from hiring other people's labor. Also, the absence of markets implies that production decisions are a function not only of individual assets  $A_i$  but also of tastes  $U^i(\cdot)$  and  $V^i(\cdot)$  and of individual efficiency of labor  $e_i$ . This result is a well-known feature of unitary household

models with missing markets (e.g., Singh, Squire, and Strauss 1986; de Janvry, Fafchamps, and Sadoulet 1991).

Suppose, now, that a complete competitive market exists in which individuals can freely exchange labor at the same wage  $w$  per unit of effective labor. The production and consumption choices of individuals operating in their separated spheres become

$$\text{Max}_{c_i, L_{ij}} U^i(c_i) + V^i(T_i - \sum_j L_{ij}), \quad (5)$$

subject to a budget constraint,

$$p c_i = F(A_i, \sum_j e_j L_{ij}) + \sum_j w e_i L_{ij} - \sum_i w e_j L_{ij} \quad (6)$$

and the usual nonnegativity constraints  $L_{ij} \geq 0$ . First-order conditions yield the usual

$$w = \frac{\partial F(A_i, L_i)}{\partial L_i}. \quad (7)$$

Labor use and thus output no longer depend on individual preferences and labor efficiency, but they still are a function of individual endowments  $A_i$ . The wage rate  $w$  clears the market for labor. Labor flows from resource-poor to resource-rich individuals. Everybody is at least as well-off and many are strictly better-off, although better-endowed individuals continue to enjoy a higher level of welfare. How gains from trade are divided across buyers and sellers of labor depends on labor supply and demand elasticities.

The existence of a competitive labor market implies that labor resources are allocated efficiently within the household as well: since all household members face the same opportunity cost for effective labor, workers are efficiently allocated to individual production units. There is no need for intrahousehold bargaining. Intrahousehold labor transactions need not, however, take the form of an explicit wage contract. Household members may be compensated for the work they provided to others in an implicit manner, e.g., through gifts or a larger share of household consumption expenditures. Formally, this situation can easily be represented in our model by letting the size of the gifts from other household members to  $i$  be a function of the labor provided to them, i.e.,

$$g_{ji} = w e_i L_{ij} \quad (8)$$

As long as the "brownie points" that individuals gain by helping out other household members are commensurate to the wage they would earn outside the household, their labor will be allocated efficiently within the household. In equilibrium, if households are sufficiently similar, labor transactions between households may be infrequent without necessarily implying that labor is not put to the best use.

The existence of a labor market does not, however, by itself, ensure productive efficiency, unless  $A_i$  is not a vector but a single factor and the production function  $F(A, L)$  exhibits constant returns to scale (CRS). In this case, the existence of a competitive labor market ensures that output per unit of  $A$  is the same for all individuals. For instance, if  $A$  stands for acreage and  $F(A, L)$  for crop output, then (expected) yields will be the same

on all plots—maintaining our assumption of common technology. Evidence that yields differ then constitutes an indication that labor markets are inefficient (e.g., Gavian and Fafchamps 1996; Udry 1996). When  $A_i$  is a vector of inputs, however, markets for all factors of production except one must exist for production efficiency to be achieved. Short of that, output will continue to depend on individual resource endowments.

If production is not CRS, efficiency in production requires that markets exist for all factors of production.<sup>5</sup> Exchange can take a variety of forms (e.g., rentals, sales, or partnerships), which, for our purpose, are largely irrelevant so long as efficiency is achieved. Assume that it does. What will efficient production look like? The answer depends on returns to scale. If they are decreasing, the atomization of production is optimal: each individual should be an independent producer. If they are increasing, all production should be undertaken by a single individual who will buy and rent all factors from the market. If returns to scale are first increasing, then decreasing, the optimal size of the production unit may require that several, though not all, individuals pool their productive resources together; individual production will be suboptimal.

These results, although hardly original, seem to have been overlooked in much of the lay discourse on intrahousehold allocation. Efforts by heads of household to centralize farm management and gather control over productive resources are customarily

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<sup>5</sup>There are many reasons why production techniques may not be perfectly replicated from field to field and thus why returns to scale in agriculture may not be constant. All ultimately have to do with the presence of imperfectly traded inputs, such as credit, management, experience, and rental services of indivisible equipment and infrastructure (e.g., Feder 1985; Eswaran and Kotwal 1986).

interpreted as a devious ploy to deprive women of their rights. This may very well be the case, as we shall argue when we discuss commitment failure within the household, but one should also be open to the possibility that centralization is, in fact, efficient, especially as von Braun and Webb's (1989) work suggests, when new technologies are introduced. Financial outlays for fertilizer, improved seeds, and pesticides raise marginal returns to labor and increase the penalty for untimely performance of agricultural tasks, especially if the household is risk averse. New agricultural technologies may also raise the returns to education, and, hence, the comparative advantage of better educated household heads as farm managers. In these cases, technology adoption is expected to trigger a concentration of control over household labor into the hands of a single individual, typically the head of household (e.g., von Braun and Webb 1989).<sup>6</sup> If concentration is efficient, then it should be possible for household heads to improve everyone's lot while at the same time compensating other members for their loss of individual output. From an economic point of view, such compensation can be regarded as a payment for the use of productive resources controlled by individual household members.

The structure of production is also likely to be affected by returns to experience (e.g., Becker 1981). Suppose that production requires that various tasks be performed, e.g., planting, weeding, harvesting, threshing. Further suppose that, thanks to learning by

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<sup>6</sup>This, of course, begs the issue of who in the household is the most suitable person to assume management responsibilities. For instance, if schooling and experience raise effectiveness in management, the better schooled and most experienced member of the household ought to be the one to take over management duties. Some of these issues are addressed below.

doing, individuals with a lot of experience in a certain task  $k$  are more proficient in that task, i.e., that

$$e_{ik}^t = g_k \left( \sum_{s=\Theta}^{\infty} \sum_j \gamma^s L_{ij}^{t-s} \right), \quad (9)$$

where  $e_{ik}^t$  denotes the labor efficiency of individual  $i$  in task  $k$  at time  $t$ ,  $\gamma \leq 1$  is a depreciation factor, and  $g_k(\cdot)$  is some increasing function. In the presence of returns to experience, it is in society's interest to encourage individuals to specialize in particular tasks and to make sure that a task is always performed by the most experienced person. To achieve this result, individuals may have to work on each other's fields, e.g., men clearing women's fields and women weeding men's fields. Alternatively, they may become exclusively responsible for particular activities involving closely connected tasks, such as food preparation or beer brewing, for instance.

From the point of view of efficiency, how tasks are distributed among people is largely irrelevant as long as gains from learning by doing are achieved. This may account for the existence of extremely wide variations in the distribution of agricultural tasks by gender and age: in northern Nigeria, for instance, women do not participate in fieldwork (e.g., Hill 1977; Fafchamps 1986); in much of Zaire, they perform almost all agricultural tasks with the exception of land clearing. Individual comparative advantage in learning and performing particular tasks may, nevertheless, dictate who specializes in what. It would be unwise, for instance, to assign children to tasks that require much physical

strength, such as clearing fields, but they are perfected adapted to herding livestock. In countries where women bear many children and breast-feed them for extended periods of time, one may argue that activities around the home constitute their comparative advantage. In stable preindustrial societies where the range of tasks and activities to be undertaken does not change over time, the allocation of people to specific tasks is achieved largely through age and gender casting. Gender-specific role models often reinforce gender casting (e.g., Collier and Yanagisako 1987). Certain societies push this principle even further by restricting particular tasks or activities to individuals belong to a specific lineage or caste (e.g., the caste system in India or Yemen; marabouts, griots, and blacksmith in Africa).

In the presence of learning by doing, sorting people among multiple activities cannot easily be achieved in a decentralized manner. Letting individuals decide what to specialize in may lead to over- or underprovision of certain skills.<sup>7</sup> Age and gender casting can thus be seen as a means of solving the coordination problem involved in achieving gains from specialization. It nevertheless raises two serious objections. First, it seldom is equitable. Certain tasks are more pleasant than others, and the return from certain skills higher than others. Those forced to undertake unpleasant and undervalued tasks are likely to resent the allocation process and oppose it if they can. Second, age and gender casting is unlikely to be fully efficient because it prevents many individuals from expressing their full

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<sup>7</sup>See Matsuyama (1991) for an illustration of how occupational decisions can lead to multiple Pareto-ranked equilibrium paths in the presence of sunk costs.

potential. The efficiency loss will be larger when new economic opportunities arise and traditional casting rules no longer ensure a match between the supply and demand for task-specific skills. This may explain why age and gender casting have been more successfully challenged in modern societies than in traditional ones.<sup>8</sup>

It would be erroneous to assume that economic growth necessarily leads to a loosening of gender roles, however. In many societies, a sizeable gap exists between ideal gender casting as specified in the dominant ideology, and the actual division of tasks by gender. For instance, the local culture may stipulate that women should not work in the field because such work is thought demeaning. Yet many poor households may fall short of the social ideal simply because they cannot afford to abide by it (e.g., Hill 1977; Matlon 1977). In such an environment, increased prosperity is likely to result in a closer match between social ideals and social realities and thus to reinforce gender casting in practice. Good examples of such processes can be found in many Islamic countries (e.g., Saudi Arabia, Pakistan).<sup>9</sup> Efforts by trade unions and other progressive political forces to have strenuous jobs declared unsuitable for women in turn-of-the-century Europe can be seen in a similar light. A complete discussion of these issues is left for future work.

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<sup>8</sup>Gender casting may be less rigid than sometimes assumed, however. von Braun and Webb (1989) showed, for instance, that the introduction of modern irrigation methods along the Gambia river led men to rapidly replace women in rice cultivation in spite of strong taboos regarding male involvement with rice.

<sup>9</sup>I observed similar trends in rural Morocco and Northern Nigeria.

#### 4. MISSING LABOR MARKET AND VOLUNTARY EXCHANGE

In Section 3, we argued that productive resources are allocated efficiently within the household if outside markets exist and are competitive. In practice, however, factor markets are notoriously subject to transaction costs, information asymmetries, and enforcement problems. Can the household efficiently allocate resources within its confines even in the absence of outside markets? The answer is yes, provided traditional gender casting rules ensure a perfect match between the demand and supply of skills and rewards for work on household enterprises equate the marginal return to labor. In the absence of an outside market to set clearly identifiable wage rate  $w$  and factor prices  $r_i$ , however, household members may disagree as to how gains from resource reallocation ought to be shared among themselves.

To see this, consider the model presented in Section 3 and suppose for a moment that the economy is limited to the household. Formally, nothing has changed. There exists, therefore, a wage rate  $w$  and resource prices  $r_i$  that equilibrate the household factor markets and ensure allocative efficiency within the household. Given the small number of people involved, however, it is unlikely that the household will resort to explicit wage labor transactions. It can, in principle, achieve the same outcome through implicit contracts. Furthermore, the household economy being small, perfect competition is unlikely; there is scope for parties to bargain over the distribution of the gains from resource reallocation. If bargaining is efficient, however, productive resources will,

nevertheless, be allocated such that their marginal returns are equalized across all activities undertaken by the household.

Thanks to the second welfare theorem, any resource allocation that would result from Pareto-efficient bargaining can be represented as a price system combined with lump-sum transfers. Then, any efficient bargained outcome can be written as the solution to a series of individual maximization problems of the form,

$$\text{Max}_{c_i \in L_{ij}} U^i(c_i) + V^i(T_i - \sum_j L_{ij}), \quad (10)$$

subject to a budget constraint,

$$\begin{aligned} p c_i = & F(A_i + \sum_j \hat{A}_{j i} - \sum_j \hat{A}_{i j} \sum_j e_j L_{j i}) \\ & + \sum_j (w e_i L_{i j} - w e_j L_{j i} + r \hat{A}_{i j} - r \hat{A}_{j i} + G_{j i} - G_{i j}), \end{aligned} \quad (11)$$

and the usual nonnegativity constraints,  $L_{ij} \geq 0$ ,  $G_{ij} \geq 0$ , and  $\hat{A}_i \geq 0$ . Variable  $\hat{A}_i$  denotes a temporary transfer of productive resources  $A_i$  from  $i$  to  $j$  and  $G_{ij}$  is a lump-sum transfer from  $i$  to  $j$ . The wage rate  $w$  and the rental price  $r$  can be thought of as the shadow cost of labor and resource  $A_i$  that individuals face in their bargaining over consumption with other household members.<sup>10</sup>

For a bargaining equilibrium to be both efficient and voluntary, individuals must internalize the true opportunity cost of the resources and labor they command. This is achieved by providing rewards or transfers  $w e_i L_{ij}$  and  $r \hat{A}_{ij}$  for labor and resources

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<sup>10</sup>  $\hat{A}_i$ ,  $L_{ij}$ ,  $w$ , and  $r$  can be vectors without affecting the argument.

contributed to other members' productive activities, and by demanding rewards and transfers equivalent to  $w e_j L_{ji}$  and  $r \hat{A}_j$  for labor and resources contributed by others to  $i$ . In practice, of course, these transfers are netted out, so that they are not separately observed.<sup>11</sup> What matters is simply that household members perceive that, at the margin, an additional unit of labor or resource that they provide to others or receive from others is matched by an increase or decrease in individual consumption equivalent to the economic usefulness of these assets in household production. In an efficient bargaining framework, differences in bargaining power only determine the size of lump-sum transfers  $G_{ij}$  between household members, not shadow prices  $w$  and  $r$ .<sup>12</sup>

Without specifying the bargaining process, we now examine the conditions under which individual household members will voluntarily agree to an incentive scheme  $(w, r, G_{ij}, G_{ji})$ . For readers familiar with general equilibrium or cooperative game theory, this is akin to constructing the core of the household economy (e.g., Hildenbrand 1974; Friedman 1990). We consider three possible threat points: (1) noncooperation within the household, (2) separation from the household, and (3) domestic violence (e.g., Lundberg and Pollak 1993; Kevane 1996). In the case of noncooperation within the household, we assume that individual members can refuse to exchange labor and resources with others

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<sup>11</sup>Jones (1983, 1986) nevertheless reports that Cameroonian women who work in their husband's field customarily receive a share of the harvest that is proportional to the work they have contributed. In Papua New Guinea, it is customary for all household members to receive a share of crop revenue that is commensurate to their contribution to output.

<sup>12</sup>The size of lump-sum transfers may, nevertheless, affect the supply of labor and thus the equilibrium wage rate  $w$ .

and choose to rely on their own labor and assets  $A_i$ . In the case of separation from the household, we allow for the possibility that laws and customs may request that resources  $A_i$  be redistributed<sup>13</sup> and that compulsory transfers be imposed on one of the parties.<sup>14</sup> Finally, we examine how the threat of domestic violence may induce someone to "voluntarily" agree to a distribution of the gains from resource reallocation that they would otherwise reject.

Let  $W_i^a$  be the discounted utility of a noncooperating household member,  $i$ :

$$W_i^a = \sum_{t=\eta}^T \delta_i^t U^i(c_i^a) + V^i(T_i - L_i^a), \quad (12)$$

where  $c_i^a$  and  $L_{ij}^a$  are the levels of consumption and labor that solve equations (1-2) and  $\delta_i$  is the discount factor of individual  $i$ . Let  $W_i^c$  be the discounted payoff of a cooperating household member:

$$W_i^c = \sum_{t=\eta}^T \delta_i^t U^i(c_i^c) + V^i(T_i - \sum_j L_{ij}^c), \quad (13)$$

where  $c_i^c$  and  $L_{ij}^c$  are the solution to the individual's optimization problem when facing incentive scheme  $\{w, r, G_{ij}, G_{ji}\}$ . Individual  $i$  will voluntarily agree to the incentive scheme if

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<sup>13</sup>For example, some customs specify that the bride price must be returned in case of repudiation.

<sup>14</sup>For example, alimony and child support.

$$W_i^c \geq W_i^a. \quad (14)$$

This condition, called the household participation constraint, sets limits to the redistribution of welfare that can credibly take place within the household.

Since cooperating households allocate resources more efficiently than noncooperating ones, individuals can be made to cooperate to incentive schemes that specify lump-sum transfers to others. A lump-sum transfer can be thought of as an entry fee that individuals have to pay to join the cooperating entity. Some household members may be able to capture most of the gains from better resource allocation, even if participation by others is voluntary. The maximum size of voluntary transfers is large when gains from cooperation are large, e.g., in the presence of returns to scale and specialization.

Individuals may also object to transfers  $G_{ij}$  that would make them worse-off than what they could guarantee themselves by leaving the household. Let  $W_i^l$  represent the discounted payoff after separation. Depending on laws and customs regarding the rights and obligations of separating household members (e.g., laws regarding divorce, minors, support to the elderly),  $W_i^l$  may be larger or smaller than  $W_i^a$ . If  $W_i^l > W_i^a$ , individual  $i$  can credibly threaten to separate from the household unless the intrahousehold distribution of consumption is such that  $W_i^c \geq W_i^l$ . What happens if  $W_i^l < W_i^a$ ? Can the household member credibly threaten to refuse to cooperate without leaving the household? This depends on what happens upon separation. If separation only entails a redistribution of

household resources,  $A_i$ , and direct transfer obligations, then if  $W_i^l < W_i^a$ , necessarily  $W_j^l < W_j^a$  for some  $j$ : taking resources away from one must make the other better-off. Consequently, any threat by household member  $i$  to refuse to cooperate without leaving the household will be met by  $j$ 's threat to leave the household. In this case, all that matters are the  $W_i^a$  payoffs. Threats to remain within the household while refusing to cooperate have no power.

The situation is different if household members must relinquish control over some of their assets,  $A_i$ , should the household separate. For example, upon repudiation, the bride price may have to be returned to the wife's parents, not to the wife herself. Court fees in case of divorce also subtract from the household assets,  $A_i$ .<sup>15</sup> In these cases, it is possible that  $W_i^a > W_i^l$  for all  $i$ 's in the household. If this condition is satisfied, no household member can credibly threaten to separate from the household;  $W_i^a$  payoffs are the relevant bounds to the household participation constraints. If, however,  $W_i^a < W_i^l$  for *any* household members, then the relevant payoffs are the  $W_i^l$ 's.

Household members may also try to affect the distribution of gains from cooperation through the threat or use of verbal and physical violence. Domestic violence is, unfortunately, too common for this possibility to be discounted. Let  $P_{ij}$  denote the pain and suffering that  $i$  can inflict to  $j$  and let  $W_i^a - \sum_j P_j$  be the payoff of a noncooperating household member who is "punished" by the others through domestic violence. Whether

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<sup>15</sup> Another example would be if a young adult who has received land from the chief must return it to the community in case of dispute with his father.

or not the threat of violence is credible depends on social attitudes and on the legal protection (or lack thereof) that is granted to victims. Clearly, if the threat of violence is credible,  $W_i^a - \sum_j P_j < W_i^a$  and the threatened household member will be more amenable to intrahousehold distributions of leisure and consumption that are detrimental to himself or herself.

Depending on the social context,<sup>16</sup> a household member may be able to escape violence by leaving the household, provided, of course, that violence ceases once the victim leaves the household. This is not always true, as numerous cases of ineffective restraining orders against violent spouses amply demonstrate in the United States. If the threat of violence after separation is credible, the payoff upon separation becomes

$W_i^l - \sum_j P_j$ , thereby further reducing bargaining power. If violence against runaway household members is not credible, perhaps because of physical distance, it is then possible that  $W_i^l > W_i^a - \sum_j P_j$ . If the above inequality holds, the threat of violence to noncooperating household members is ineffective—provided individuals can flee the household fast enough to avoid ever incurring  $P_{ji}$ .

Given that most domestic violence takes place behind closed doors, deterrence by outside institutions is only feasible if victims choose to report it. Reporting is not problematic after separation, since, by definition,  $W_i^l - \sum_j P_j < W_i^l$ . In the case of violence to noncooperating members within the household, complaining to an external

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<sup>16</sup> In some societies, runaway wives are hunted down and brought back to their husbands (e.g., Kevane 1996). The same treatment is reserved to runaway children almost anywhere.

agency may not be individually rational if it leads to the dissolution of the household (e.g., husband or father arrested) and if life after separation is not an attractive option, i.e., if  $W_i^C > W_i^I$ . As a corollary of this principle, a poor wife might optimally choose, ex post, not to report a beating rather than starve. If this is the case, the threat of domestic violence is credible and effective even though external deterrence is available at no cost. In other words, household members can only be protected against the threat of physical violence if their outside payoff,  $W_i^I$ , is high enough. The same reasoning explains why domestic violence might be more readily tolerated by poor, illiterate women in environments characterized by widespread unemployment.

Given that men are, on average, larger and stronger than women and that they appear more prone to violence than women—if not genetically, at least culturally, the threat of violence is, in general, more credible for men than women.<sup>17</sup> On this single basis, we would expect that, other things being equal, men would have more bargaining power than women. The rational—though cynical—use of violent threats to affect household distribution of resources is to be distinguished from irrational recourse to violence, such as a "wife beating habit" or violence resulting from drug or alcohol abuse. The fear engendered by violence may, nevertheless, affect bargaining power and thus resource allocation, even when violence is not consciously used as a bargaining tool. Men do not have a monopoly over mischief and there are ways to harass somebody other than physical violence. For this reason, the jury is still out on whether men or women have an

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<sup>17</sup> Males, for instance, account for the overwhelming majority of violent crimes.

overwhelming advantage when it comes to credible threats of harassment—though much of the circumstantial evidence weighs against men.

## 5. DISCRIMINATION AND COLLUSION IN THE LABOR MARKET

Throughout the previous section, we assumed that markets do not exist for labor and productive resources so that the only way efficiency gains from resource reallocation can be achieved is for individuals to form households.<sup>18</sup> In this section, we investigate the effect of various labor market configurations on intrahousehold allocation. We begin by noting that, if complete markets exist and there are no household public goods, there are no efficiency gains to be made from the formation of households.<sup>19</sup> There is, however, no room for the cooperative payoff,  $W_i^c$ , to be higher than the noncooperative payoff,  $W_i^a$ , for all  $i$ . The only way  $W_i^c$  can be greater than  $W_i^a$  for some  $i$  is for  $W_j^c$  to be below  $W_j^a$  for some  $j$ . In this case, if separation is costless<sup>20</sup> and domestic violence cannot be exerted on separated household members, cooperative payoffs must equal autarky payoffs:

$$W_i^c = W_i^a \quad (15)$$

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<sup>18</sup> Or other, looser structures such as coresidence units (e.g., compounds) and social networks.

<sup>19</sup> This simple, but powerful, result may account for the erosion of the family in developed countries. See Binswanger and McIntire (1987) on vertically integrated households.

<sup>20</sup> That is, if household members do not have to incur costs to separate (e.g., legal costs), they do not have to relinquish household assets to nonhousehold members (e.g., bride-price returned to wife's family), and they do not lose entitlement benefits (e.g., tax break).

for all  $i$ 's. If separation is costly for the household, there is room left for negotiation on the distribution of household leisure and consumption. But if it is not, individual welfare is entirely dictated by factor prices and the distribution of household resources after separation.

The above suggests that legal provisions governing the attribution of household assets and providing for alimony and child support should have a direct effect on the relative welfare of household members. In a world of complete markets, however, individuals should refuse to voluntarily join households unless they are guaranteed a payoff after separation that is equivalent to their expected payoff, should they remain on their own. Once laws and customs affecting intrahousehold welfare are fully anticipated, they should result in side payments (e.g., bride price, dowry) at the onset of the union itself, making it difficult for an equity-minded policymaker to durably affect the intrahousehold distribution of welfare (e.g., Becker 1981; Lundberg and Pollak 1993).

We just saw that the existence of a labor market makes it harder for a particular household member, e.g., the male head of household, to appropriate the efficiency gains from the redistribution of productive resources. It may, therefore, be tempting for, say, male heads of households to collude and deny their wives and dependents the right to work outside the household (e.g., Fafchamps and Quisumbing 1998). So doing, they would lower their  $W_i^a$  and  $W_i^l$  and more easily extract transfers from them. The prohibition to work outside the home or farm may further raise the bargaining power of household heads if the members who specialize in domestic or household-level chores

become less well-informed about possible exit options, less able to secure a job through job market contracts, and thus be more fearful of the consequences of dissent.<sup>21</sup>

The allocation of labor resulting from collusion among male heads need not be inefficient, however, provided that heads of household spend at least part of their time on their own farm or business.<sup>22</sup> Indeed, as long as captive and noncaptive workers work together on the same production activity, the opportunity cost of captive labor is the same as the market wage. Aggregate labor resources can thus be allocated efficiently by ensuring that captive workers are given an implicit incentive to work equivalent to  $w e_i$ .

Only when noncaptive workers spend all their time outside the household is the allocation of labor inefficient: the household no longer is at an interior solution and the marginal return to captive labor falls below the market wage. In this case, all could be made better-off by letting underemployed captive workers hire themselves out for a wage. If Pareto gains from letting women and children work for other households are large enough, the redistributive gain that household heads obtain by colluding not to hire each others' dependents is smaller than the efficiency gain that they could achieve by letting them work. Such a situation is likely to arise in villages and regions with many landless workers and submarginal farmers. Collusion to keep dependents out of the labor market

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<sup>21</sup> Formally, the lack of information about job market opportunities translates into flat (i.e., high variance) priors which, if the person is risk averse, lower the expected utility of exit. The lack of network contracts has the same effect by reducing the probability of finding a job. See, also, Schaffner (1995) for evidence that servility shift preferences against exit.

<sup>22</sup> As Basu and Van (1996) argue in the case of child labor, prohibiting certain household members from working outside the household may also be efficient if the withdrawal of their labor raises total wages. See, also, Anderson and Francois (1996).

then loses much of its attraction and can reasonably be expected to collapse or take another form. Heads of households may, however, continue to extract transfers from dependents by colluding to pay women and dependents a lower wage. Formally, the situation is akin to forming a cartel of employers.

Both types of collusive arrangements among heads of households—captive labor or lower age—are, of course, vulnerable to free riding. In both cases, it is in the interest of a single employer to circumvent the collusive arrangement. Employers could attract captive workers by paying them a wage below the market rate because, by working for such a wage, captive workers would avoid paying the lump sum "tax" imposed by the household<sup>23</sup> and could thus be better-off. Similarly, by raising the wage paid to women and children slightly above that paid by others, employers could attract a larger number of low age, but equally productive, workers and thus make more profit. Cartel-like arrangements are thus not self-enforcing and require a meta-punishment to be sustained. The form that the meta-punishment may take is unclear, although one can imagine things like social ostracism by other heads of households, sabotage, violence, etc. Women and children who work in violation of social prohibition may also face various forms of harassment, including sexual harassment by coworkers.<sup>24</sup>

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<sup>23</sup> Either directly by leaving the household, or indirectly by renegotiating their obligations within the household.

<sup>24</sup> In such a setting, nondiscriminatory employment opportunities for women can be created by setting up rural public works programs open to all (e.g., Deolalikar and Gaiha [1993] and the references cited therein that show that women often constitute an important proportion of public works employees).

Another, more subtle, way to lower the wage of dependents and thus their exit payoff is to lower their  $e_i$  by restricting their access to education and by encouraging them to learn tasks with low potential for wage employment, such as household chores. As we have argued in Section 3, age and gender casting of this type need not be inefficient,<sup>25</sup> even though they clearly have detrimental effects on equity. Finally, in places where income earning opportunities mostly take the form of self-employment, access to individual income requires personal finances. In that case, another way of lowering the compensation for dependents' labor is to restrict their access to credit and hence to remunerative uses of their time other than collaboration in household production (e.g., de Groote and Kebe 1995; Goetz and Gupta 1996; Smith 1994).

## 6. TIME AND COMMITMENT

In the two preceding sections, we argued that individual household members will object to a distribution of gains from resource reallocation that makes them worse-off than what they could guarantee themselves by leaving the household or refusing to cooperate. This idea was captured in a household participation constraint of the form,  $W_i^c \geq W_i^k$ , where  $W_i^k$  denotes the credible threat point of household member  $i$ , which is either  $W_i^a$  or  $W_i^l$ , with or without violence, depending on circumstances (see Section 4). We now

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<sup>25</sup> With the caveat as before, namely that age and gender casting are restrictions to the freedom of opportunity and prevent individuals from achieving their full economic potential, e.g., as entrepreneurs, leaders, researchers, inventors, and the like.

examine how participation constraints are affected by the passage of time between the reallocation of productive resources and the enjoyment of consumption. Throughout this section, we assume that households first allocate labor and productive resources to production (period one). Output is then realized and the proceeds used to finance consumption (period two).

Consider the following arrangement between household members:  $i$  agrees to work on  $j$ 's field in period one in exchange for a share of output in period two (e.g., Jones 1986; Boe 1996). As we have seen in the preceding section, it is rational for  $i$  to accept such an arrangement if  $W_i^c \geq W_i^k$ . For  $j$  to voluntarily compensate  $i$ , however, the agreement must be self-supporting, that is, it must also be rational for  $j$  to fulfill his or her promise in period two:

$$U_j(q_j^c) - U_j(q_j^c - eL_{ij} + G_{ij} - G_j)_i \leq \delta(W_i^c - W_i^k). \quad (16)$$

In other words, for  $j$ 's promise to be credible, it must be  $j$ 's interest to share output with  $i$  afterwards. As the above equation shows,  $j$  will do so only if the short-term loss from having to compensate  $i$  is smaller than the long-term gain from a continued relationship.<sup>26</sup> This is unlikely to be true if the promised compensation,  $eL_{ij} + G_{ij} - G_j$ , is large, the gain from cooperation,  $W_i^c - W_i^k$ , is small, or  $j$ 's time horizon is short, i.e.,  $\delta$  is low. If equation (16) is not satisfied,  $j$  is unable to credibly commit to compensate  $i$  and the

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<sup>26</sup> We have implicitly assumed that if  $j$  fails to pay  $i$ , individual  $i$  responds by not transferring  $G_{ij}$  and refusing to transfer cooperate in the future.

agreement will not be fulfilled. Anticipating this,  $i$  should refuse to cooperate. There is commitment failure: a Pareto improving transaction does not take place because one party cannot credibly commit to honor the contract (e.g., Balsvik 1995).

Clearly, the possibility of commitment failure puts additional constraints on the type of resource reallocation and compensation schemes that are self-supporting (e.g., Pollak 1985). For a household member to credibly commit to any ex post payment, that member must not have been pushed to his or her exit payoff; he or she must derive some benefit from participating in the household. Second, for any distribution of the gains from collaboration  $W_i^c - W_i^a$ , there are limits to the ex ante redistribution of productive resources. If equation (16) is binding, production efficiency may be impossible to achieve:  $i$  may refuse to work more than a certain number of days  $L_{ij}$  on  $j$ 's field because any promise of payment in excess of  $w e_i L_{ij}$  is not credible. Of course, it may be possible to redistribute the gains from cooperation differently and raise  $W_j^c - W_j^k$  so as to satisfy equation (16). But this would mean taking something away from  $i$ , a prospect  $i$  is likely to object to.

Third, commitment failure may be mitigated by allowing for an external enforcement mechanism. One possible mechanism is for household members to engage in market transactions among themselves that are at least theoretically enforceable by courts.<sup>27</sup> One conceivable mechanism is reliance on legal institutions, such as nuptial agreements,

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<sup>27</sup> Market transactions among spouses are common in parts of Sub-Saharan Africa, notably the coastal areas of Ghana and Nigeria. It is, for instance, frequent for women traders to purchase the output of their husband farmers or fishermen.

business partnership agreements, joint ownership of assets, joint holding of bank accounts, etc. When small amounts are involved, however, court action is seldom attractive because it is too costly and time consuming. Alternative legal institutions at the village or community level—such as chiefs and marabouts—may exist that have jurisdiction to adjudicate matrimonial disputes and can put pressure on a recalcitrant spouse to honor a promise. Proving that a promise has been breached and that one spouse is at fault is often difficult to verify, given that households often engage in complex implicit arrangements. If breach of promise cannot be established, external agents may choose to rely on general standards of fairness instead. Given the paucity of data on these issues, providing empirical evidence of what these standards are and how matrimonial disputes are adjudicated in practice is a promising area of research.

Fourth, agreements are more difficult to enforce if compensation is promised only in the distant future (i.e.,  $\delta$  low). In some cases, compensation may be delayed until the death of the spouse or until dissolution of the marriage. In this case, rules and customs about the devolution of assets limit the forms that compensation may take, while at the same time making some forms of credible commitments possible. For instance, if laws and customs stipulate that the wife inherits half of the household assets upon death or divorce, it will be easier for the husband to convince his wife to help build up joint assets than if the wife has no right upon them. In this case, asset devolution rules can be seen as providing a crude commitment mechanism. For such a commitment mechanism to be effective,

husbands must have no discretion to change the devolution of joint assets and efforts to circumvent rules must be regarded as a form of fraud and punished accordingly.

Credit constraints also matter. Household members who are credit constrained may be unable to promptly pay for labor services and may have to wait until sufficient output has been generated before doing so. Their production activity may also be subject to shocks, in which case they may be unable to pay in period two. One would therefore expect commitment problems to be more severe and the intrahousehold allocation of resources to be less efficient in poor, credit constrained households. Finally, commitment failure is more likely when  $j$ 's time horizon is short, as would be the case if  $j$  expects to leave the household in the near future. Implicit agreements among household members are thus less likely to be made and more likely to be broken in households that are dysfunctional or are breaking apart. For the same reason, commitment failure is more problematic for individuals who expect to migrate, exit, or marry out of the household: these individuals are more likely to free-ride and less likely to take a long-term interest in the prosperity of the household. Laws and customs about inheritance, bride price, and dowry, etc., can be regarded as an effort to mitigate this form of free riding. Societies in which daughters marry before they are old enough to rationally choose to free ride, also typically deny daughters a right to inherit. In contrast, sons often continue to contribute

to household production until they are much older and are typically given, through customs regarding inheritance and inter vivos transfers, a stake in their father's farm.<sup>28</sup>

Another possible way that commitment problems can be solved is by trading labor against other productive resources. Suppose  $j$  tries to convince  $i$  to work full-time on his field, but  $i$  objects that she does not believe she will be fully compensated for her effort—i.e., equation (16) is violated. Given this state of affairs, it may be in  $j$ 's interest to let  $i$  cultivate part of his land and keep the proceeds in exchange for a payment after harvest,  $r\hat{A}_j$ . The transfer of user rights over land can then be seen as a way of giving an immediate payment and thus of bypassing commitment failure. Since the land transfer partly or fully cancels out the implicit wage payment,  $w_e L_{ij}$ , equation (16) is more easily satisfied and the exchange of labor can take place. Whether or not this arrangement is efficient depends on returns to scale and specialization: if returns to scale are increasing, it is inefficient to divide the farm into distinct units. Even so, the efficiency gain from a better allocation of labor may compensate the efficiency loss from a worse allocation of land, so that the net effect of the arrangement is beneficial.<sup>29</sup>

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<sup>28</sup> For a discussion of how the concentration of land into the hands of the elder affect family organization and sectoral employment, see, for instance, St.-Amour and Vencatachellum (1996).

<sup>29</sup> The above is consistent with Udry's (1995) finding that women work harder on their fields than on their husband's.

## 7. HOUSEHOLD PUBLIC GOODS

Until now, we have ignored an important defining feature of households, namely the sharing of public goods (e.g., Manser and Brown 1980; McElroy and Horney 1981; Bergstrom 1995). Certain types of public goods, such as common meals, imply exclusive use in the sense that the food consumed by one household member detracts from the food available for another. Other household public goods, such as children, housing, heat, furniture, home entertainment, landscaping, and housecleaning, are examples of nonexclusive goods, that is, of goods whose enjoyment by one household member does not detract from the enjoyment of another.<sup>30</sup> From a purely formal point of view, household public goods whose use is exclusive do not differ from private consumption and are treated as such in our model. Household public goods whose use is nonexclusive, however, raise interesting strategic interactions that are examined in the rest of this section.

Let  $h$  denote a nonexclusive household public good—or vector of goods. We assume that there is no labor market and that the household must produce good  $h$  with household labor, i.e.,<sup>31</sup>

$$h = H\left(\sum_i e_i I_i h\right), \quad (17)$$

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<sup>30</sup> Assuming away congestion and conflicting tastes.

<sup>31</sup> Similar results can be obtained if a labor market exists and  $h$  can be purchased from the market. In this case, the issue is who contributes to the financial cost of  $h$ .

where  $L_{ih}$  represents labor devoted by individual  $i$  to the production of the public good  $h$  and  $e_{ih}$  denotes the proficiency of  $i$  in the production of the public good. The optimization problem facing individual household members now is

$$\text{Max}_{c_i, L_i, L_{ih}} U^i(c_i, h) + V^i(T_i - L_{ih} - \sum_j L_{ij}), \quad (18)$$

subject to  $h$ 's production function (17) and to budget constraint

$$p c_i = F(A, \sum_j e_j L_j)_i \quad (19)$$

and to nonnegativity constraints  $L_{ij} \geq 0$  and  $L_{ih} \geq 0$  for all  $j$ .

As in Section 3, begin by considering the situation in which individual household members do not cooperate. To simplify the algebra and make the argument easier to follow, further assume that utility is linear in leisure, i.e., that  $V_i(l_i) = l_i$ . Similar results can be obtained when  $V^i$  is not linear. The first-order conditions for an interior solution require that

$$\frac{\partial U^i}{\partial c_i} \frac{\partial F}{\partial L_i} e_i = 1 = \frac{\partial U^i}{\partial h} \frac{\partial H}{\partial L_h} e_{ih} \quad (20)$$

Since  $\frac{\partial H}{\partial L_h}$  is the same for all, the above equation cannot be simultaneously satisfied for several household members unless the utility they derive from the nonexclusive public good times  $e_{ih}$  is exactly identical. If any household member derives a marginal utility from  $h$  times  $e_{ih}$  that is lower than that of another household member, i.e., if

$$\frac{\partial U^i}{\partial h} e_{ih} < \frac{1}{\partial L_h} \quad (21)$$

for some  $i$ , then that individual does not contribute to the provision of the public good:

$L_{ih} = 0$  for that  $i$ . Equation (21) is more likely to be satisfied for a member who

(1) derives much utility from the public good and (2) is very effective in its production.

We thus see that, unless all individuals derive the same utility times  $e_{ih}$  from the

nonexcludable public good, in a noncooperating household only the individual who has the

highest  $\frac{\partial U^i}{\partial h} e_{ih}$ , say  $i$ , provides it; other household members free ride. Such a

configuration is the only possible Nash equilibrium of this game: any threat by  $i$  not to

provide the public good is not credible because it is in  $i$ 's interest to supply  $L_{ih}$  for the

production of the public good, even if the others do not contribute.<sup>32</sup> This noncooperative

Nash equilibrium determines the payoffs,  $W_i^a$ , that each household member obtains in a

noncooperating household. Together with exit payoffs,  $W_i^l$ , (see Section 4), they

determine the credible threat points of each household member in a bargaining game over

intrahousehold resource allocation.

One interesting feature of the above setup is that it is quite possible for a household

member, say  $j$ , with fewer productive resources than  $i$  to be better-off than  $i$  because the

latter provides all the public good while the former does not. Needless to say, such

configuration is likely to raise tension, although casual observation suggests that it is not

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<sup>32</sup> Readers familiar with game theory will have recognized a one-sided chicken game.

altogether implausible.<sup>33</sup> Household members are thus likely to negotiate over who is responsible for providing  $L_{ih}$ . One interesting possibility that arises in practice is for the head of household to reward individual members in proportion with their contribution to the production of  $h$ . Jones (1983, 1986) and Lilja et al. (1996), for instance, describe situations in which African heads of the household de facto pay their wives to work on the common field that provides for the household's food. The optimization problem of dependents then becomes

$$\text{Max}_{c_j, L_{jh}} U^j(c_j, h) + V^j(T_j - L_{jh} - \sum_i L_{ji}), \quad (22)$$

subject to  $h$ 's production function (17) and to budget constraint

$$p c_j = F(A_j \sum_i e_i L_{ji}) + w e_j L_{jh} \quad (23)$$

and to nonnegativity constraints  $L_{ji} \geq 0$  and  $L_{jh} \geq 0$  for all  $i$ . The shadow wage rate,  $w$ , is chosen such as to equilibrate the internal supply and demand for public good labor,  $L_{jh}$ .

First-order conditions yield

$$\frac{\partial U^j}{\partial c_j} w + \frac{\partial U^j}{\partial h} \frac{\partial H}{\partial L_{jh}} e_j = 1 \quad (24)$$

and

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<sup>33</sup> Think of teenagers' contribution to household chores, for instance.

$$\frac{\partial U^j}{\partial c_j} \frac{\partial F}{\partial L_j} e_j = 1, \quad (25)$$

which implies that

$$\frac{\partial F}{\partial L_j} e_j = w + \frac{\partial U^j / \partial h}{\partial U^j / \partial c_j} \frac{\partial H}{\partial L_h} e_j > w. \quad (26)$$

Dependents now contribute to the production of the public good,  $h$ . The compensation that each of them is given is inferior to the marginal returns to labor in their own farm or business because they now internalize the effect of their labor on the production of  $h$ . An interesting property of the above compensation scheme is that, although aggregate welfare goes up, thanks to gains from trade, dependents' welfare may go down. The reason is that, in the absence of an offer, they can enjoy  $h$  without having to work for it. Only if their productive resources are sufficiently small relative to those of the head—and thus their  $W_j^a$  is sufficiently small—do dependents unambiguously benefit from cooperation. Otherwise, it is in their interest to refuse to cooperate and insist on free riding. Naturally, such an attitude is likely to generate resentment and friction.

To prevent friction, societies may find it preferable to limit the amount of productive resources that dependents can control, thereby making sure that they will accept the head's offer to contribute to the production of  $h$ . It is theoretically possible to

define an optimum distribution of productive resources,  $A_i$  and  $A_j$ , with  $A_j < A_i$ , such that  $i$  and  $j$ 's welfares are equated. In practice, however, this level is probably difficult to ascertain. Societies may prefer to err on the side of caution by ensuring that  $A_j$  is sufficiently below  $A_i$ , so that free riding does not arise and friction can be avoided. The unpleasant consequence of this approach, if applied, is that the welfare of the dependents will be lower than that of the head of household; furthermore, most of  $h$ 's work will fall on dependents' shoulders.

We conclude this section with two remarks. First, the sharing of nonexcludable public goods generates externalities that favor the formation of households. The distribution of the welfare gains from these externalities can be discussed in the same way as done in Section 4. The only change is that, even if complete markets exist for all factors of production, the distribution of welfare gains from household formation will still be subject to negotiation. Second, commitment problems can arise in the provision of public goods as well. If, for instance, the head of household offers to compensate dependents after the harvest for work done before it, dependents may worry that compensation may actually never take place. Dependents may then refuse to contribute to the provision of the household's public goods. Convincing them that the commitment is credible may require, as before, either an immediate compensation in the form of increased financial independence and access to household productive resources, or a reconfiguration of intrahousehold transfers so as to ensure that the head's participation constraint is satisfied.

## 8. CONCLUSION AND PROSPECT FOR EMPIRICAL WORK

This paper has examined the conditions under which productive resources and labor might not be allocated efficiently within (and across) households. We noted that, depending on returns to scale, specialization, and experience, efficiency may require the centralization of production and the specialization of individual household members in certain tasks and activities. In this context, age and gender casting can be understood as an institution meant to resolve the allocation of tasks among household members. We also noted that age and gender casting is overly restrictive and unlikely to provide sufficient opportunities for individuals to express their talent. In other words, by attempting to fix one possible source of inefficiency—intrahousehold task allocation, it introduces another one—the misallocation of innate talent among specialized economic activities. The welfare loss from a mismatch of talents is probably low in unspecialized, undifferentiated societies such as poor rural areas of the Third World, but it is likely to be high in highly diversified, rapidly evolving societies. Consequently, we expect age and gender casting to become increasingly costly and ill-adapted as societies become more differentiated—and thus to be progressively repealed as development takes place. More work is needed on this issue.

Next, we investigated the relationship between intrahousehold resource allocation, voluntary participation constraints, efficiency, and equity and showed that commitment failure within the household may lead to inefficiency. We also demonstrated that the provision of nonexclusive household public goods opens the door to strategic interaction

between household members. We showed that the resulting strategic inefficiency could be resolved, provided credible commitments are feasible.

The framework presented here suggests avenues for testing the efficiency of resource allocation within the household and the possible role of commitment failure in preventing the achievement of full efficiency. Udry's (1995) paper constitutes an interesting starting point to measure the extent of allocative inefficiency.<sup>34</sup> It does not, however, provide much understanding of the reasons for the observed inefficiency. The model presented here proposes one avenue—commitment failure—through which inefficiency in intrahousehold resource allocation may arise and it makes the following testable empirical predictions. In the presence of commitment failure, women and other dependents should apply more labor to their farm and business than is efficient. The head of household is expected to attempt to resolve commitment problems by allocating individual plots and other productive resources on a discretionary basis. Household members with fewer productive assets under their control should end up producing most of the household public goods. Inefficiency is expected to be fostered by factors that exacerbate commitment failure, such as short time horizon (sons and daughters who expect to leave the household; dysfunctional families), low assets (low gains from intrahousehold exchange), unequal stakes in the household (some members have low welfare gains from household participation), and poor external enforcement. Finally, our

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<sup>34</sup> Udry's approach suffers from some problems, however. For instance, using plot level data, Udry estimates returns to scale to be decreasing in Burkinabe agriculture. If true, this result implies that farmers should keep plot size as small as possible; in practice, they do not. The paper does not explain why.

framework predicts that the allocation of consumption and leisure should reflect participation constraints. It therefore provides the basis for a test of the effect of determinants of exit options on the intrahousehold allocation of leisure and nutrition. Providing empirical verification for these predictions is the object of future research.

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