CHAPTER 1

Single-Person Households

The traditional theory of consumer and household behavior developed by economists ignores cooperation and conflict among members, in essence assuming that each household has only one member. This theory focuses on the effects of changes in money income and money prices on the allocation of income among market goods. The theory of single-person households has been greatly expanded during the past twenty years, from a rather limited analysis to a powerful tool with many applications. The new analysis includes allocation of time as well as of money income and introduces household production of skills, health, self-esteem, and various other "commodities."

This short chapter outlines the traditional theory and its recent enlargement as a preparation for the discussion of families in the rest of the book. There is now a sizable amount of relevant literature; interested readers are referred to Michael and Becker (1973) for a more elaborate discussion.

Traditional Theory

In the simplest version of traditional theory, a single person spends his (or her) given income to maximize his utility function U of goods and

services (for simplicity, called "goods") purchased in the marketplace. That is, he maximizes the function

$$U = U(x_1, \ldots, x_n), \tag{1.1}$$

subject to the budget constraint $\Sigma p_i x_i = I$, where p_i is the price of the ith good x_i, and I is his money income. The well-known equilibrium condition is that the marginal utility MU of each good is proportional to its price:

$$\frac{\partial U}{\partial x_i} = MU_i = \lambda p_i, \qquad i = 1, \ldots, n, \tag{1.2}$$

where λ is the marginal utility of income.

The main implication of these equilibrium conditions is that the quantity demanded of any good is negatively related to its price: the "law of negatively sloped demand curves." This law has been extremely important in practical applications and is one of the most significant and universal laws in the social sciences, even though it results more from limited resources than from utility maximization (Becker, 1962).

A rise in income increases the demand for most goods because the additional income must be spent, where "spent" includes adding to cash balances and other assets. The equality between total expenditures and income implies that

$$\sum s_i \eta_i = 1, \tag{1.3}$$

where $\eta_i = [(dx_i)/(dI)] \cdot (I/x_i)$ is the income elasticity of demand for the ith good, and s_i is the fraction of income spent on that good. The average income elasticity equals unity, so that "luxuries" ($\eta_i > 1$) must be balanced by "necessities" ($\eta_i < 1$).

A more complicated and more realistic version of the theory recognizes that each person allocates time as well as money income to different activities, receives income from time spent working in the marketplace, and receives utility from time spent eating, sleeping, watching television, gardening, and participating in many other activities. The utility function, Eq. (1.1), then is extended to

$$U = U(x_1, \ldots, x_n, t_{h_1}, \ldots, t_{h_T}), \tag{1.4}$$

where t_{h_j} is the time spent at the jth activity. A time-budget constraint joins the money-income constraint:

$$\sum_{j=1}^{r} t_{h_j} + t_w = t, \tag{1.5}$$

where t is the total time available during some period, such as 24 hours a day or 168 hours a week, and t_w is the time spent working for pay.[1]

One important implication of this extension is that money income is no longer "given" but is determined by the allocation of time, inasmuch as earnings are determined by the time allocated to work. Therefore, the goods and time-budget constraints are not independent and can be combined into one overall constraint:

$$\sum p_i x_i = I = wt_w + v = w(t - \sum t_{h_j}) + v, \tag{1.6}$$

or

$$\sum p_i x_i + w \sum t_{h_j} = wt + v = S, \tag{1.7}$$

where w is the earnings per hour of work, v is property income, and S is "full" or potential income (or the money income when all time is allocated to the market sector). The terms on the left show that full income is spent in part directly on market goods and in part indirectly on the time used to produce utility rather than earnings.[2]

The equilibrium conditions from maximizing the utility function (Eq. 1.4) subject to the full-income constraint, Eq. (1.7), include

$$MU_{t_{h_k}}/MU_{t_{h_j}} = 1, \quad \text{and} \quad MU_{t_{h_j}}/MU_{x_i} = w/p_i. \tag{1.8}$$

The marginal utility from all uses of time are equal in equilibrium because they have the same price (w), and the marginal rate of substitution between time and each good equals the "real" wage rate, where the price deflator is the price of that good.[3]

The main implications of these equilibrium conditions are generalizations of the negatively sloped demand curves derived with the simpler model. A compensated rise in the price of any good—a rise

1. For simplicity I have assumed that working time does not enter the utility function.

2. After division by w, Eq. (1.7) becomes

$$\sum \left(\frac{p_i}{w}\right) x_i + \sum t_j = t + \frac{v}{w} = \frac{S}{w}.$$

The terms on the right now give the total time available plus the value of property income in time units, and the terms on the left show that time is spent in part directly on producing utility and in part indirectly on buying goods, where p_i/w is the time spent on a unit of the ith good.

3. In Becker (1965) the cost of time is allowed to differ among uses because of "productive consumption."

offset by a sufficient rise in property income to keep real income constant—reduces the demand for that good and increases the demand for "most" other goods. It also reduces the time spent at work and increases the time spent at most nonmarket (or household) activities, because a rise in the price of a good reduces the real wage rate in units of that good. Similarly, a compensated rise in the wage rate increases working time and demand for goods and reduces the time allocated to most household activities. For example, a compensated rise in the wage rate reduces the time spent on child care, standing in queues, or shopping, and thereby increases the demand for nursery schools, inventory of goods in the household, and consumer durables that require less maintenance. Finally, a growth in full income without any change in the wage rate reduces working time and increases the demand for most goods and household time (for more details see Becker, 1965).

If all time were spent in the household sector, the value of time would not be measured by the wage rate but by a shadow price equal to the marginal product of time in the household sector. The equilibrium condition in the second equation of (1.8) would be replaced by

$$MU_{t_{h_j}}/MU_{x_i} = \mu/p_i, \tag{1.8'}$$

where μ, the shadow price of time, equals the marginal rate of substitution between goods and time after conversion into monetary units. An increase in property income increases the consumption of goods and thereby raises the marginal product and shadow price of household time. If time is spent working in the marketplace, the wage rate has to equal the shadow price of household time:

$$\mu = w, \qquad t_w > 0; \tag{1.9}$$

otherwise, the marginal value of working time would be less than the marginal value of household time.

Household Production Functions

I have been assuming that time and goods directly provide utility, yet a more intuitive and useful assumption is that time and goods are inputs into the production of "commodities," which directly provide utility. These commodities cannot be purchased in the marketplace but are produced as well as consumed by households using market purchases,

own time, and various environmental inputs. These commodities include children, prestige and esteem, health, altruism, envy, and pleasures of the senses,[4] and are much smaller in number than the goods consumed.

The utility function can be rewritten as

$$U = U(Z_1, \ldots, Z_m), \tag{1.10}$$

where $Z_1, \ldots, Z_m$ are the various commodities consumed. Each is self-produced according to

$$Z_i = f_i(x_i, t_{h_i}; E_i), \qquad i = 1, \ldots, m, \tag{1.11}$$

where x_i and t_{h_i} represent the possibly many goods and types of time used to produce the ith commodity, and E_i represents household ability, human capital, social and physical climate, and other environmental variables. Commodities do not have market prices because they are not purchased, but they do have shadow prices equal to the cost of production:

$$\pi_i = p_i \frac{x_i}{Z_i} + w \frac{t_{h_i}}{Z_i}, \tag{1.12}$$

where π_i is the average cost of the goods and time spent on each unit of Z_i. The full-income constraint given by Eq. (1.7) can be simply expressed using these shadow commodity prices as

$$\sum p_i x_i + w \sum t_{h_i} \equiv \sum_{i=1}^{m} \pi_i Z_i = S. \tag{1.13}$$

If the utility function of commodities is maximized subject to this full-income constraint, one set of equilibrium conditions equates the ratio of the marginal utilities of different commodities to the ratio of their shadow prices:[5]

$$\frac{\partial U/\partial Z_i}{\partial U/\partial Z_k} = \frac{MU_i}{MU_k} = \frac{\pi_i}{\pi_k}, \quad \text{for all } i \text{ and } k. \tag{1.14}$$

4. Bentham (1963, chap. 5) lists about 15 fundamental sources of "pleasure and pain."

5. The relevant shadow prices are determined by marginal, not average, costs of production. However, if all production functions are homogeneous of the first degree, and if each unit of a good or of time is used to produce only one commodity (no joint production), then marginal and average costs are equal and the average prices in Eq. (1.12) would be appropriate. Joint production is considered in Grossman (1971) and in Pollak and Wachter (1975).

An increase in the relative price of Z_k reduces the demand for Z_k and for the goods and time used to produce it.

The distinction between the commodities consumed and the goods and services purchased is not only plausible, but also of considerable value in interpreting behavior. The general utility function given by Eq. (1.4) does not provide insight into special substitution or complementarity relations between different goods and time. We cannot even rule out a compensated increase in the wage rate that would *increase* the time spent at most household activities. The household production approach, on the other hand, implies a special relation between goods and time used to produce the same commodity. Fish and meat are inputs into the production of health and taste; or parental time and nursery schools are substitutes in the production of children.

Put more technically, the utility function given by Eq. (1.10) is separable in the goods and time used to produce the same commodity:

$$\frac{\partial U/\partial x_i}{\partial U/\partial t_{h_i}} \equiv \frac{(\partial U/\partial Z_i) \cdot (\partial Z_i/\partial x_i)}{(\partial U/\partial Z_i) \cdot (\partial Z_i/\partial t_{h_i})} = \frac{\partial Z_i/\partial x_i}{\partial Z_i/\partial t_{h_i}} = MP_{x_i}/MP_{t_{h_i}} = \phi(x_i, t_{h_i}), \qquad i = 1, \ldots, m. \tag{1.15}$$

This separability property implies, for example, that an increase in the wage rate necessarily decreases the ratio of time to goods spent on each commodity, and that it tends also to decrease the output of time-intensive commodities relative to goods-intensive commodities.

Investment in Human Capital

The utility function, Eq. (1.10), must be generalized to distinguish consumption at different ages because people are not indifferent between earlier and later consumption. Therefore, assume that

$$U = U(Z_{11}, \ldots, Z_{1n}, \ldots, Z_{m1}, \ldots, Z_{mn}), \tag{1.16}$$

where Z_{ij} is the consumption of the ith commodity at the jth age; n, the length of remaining life, is taken as given but can be treated endogenously (Grossman, 1972). The subsequent presentation is simplified without any significant loss in generality by combining all commodities at a given age into a single aggregate commodity. The utility function can then be written as

$$U = U(Z_1, \ldots, Z_n), \tag{1.16'}$$

where Z_j is the aggregate consumption at age j.

Wage rates change with age because of the accumulation of human capital that results from decisions about the time and other resources to spend on investments. The stock of human capital evolves according to the relation

$$H_j = H_{j-1}(1 - \delta) + Q_{j-1}, \tag{1.17}$$

where H_j is the stock at age j, δ is the given depreciation rate, and Q_{j-1}, the gross investment at age $j - 1$, is produced according to

$$Q_{j-1} = Q(x_{q_{j-1}}, t_{q_{j-1}}; H_{j-1}), \tag{1.18}$$

where x_q and t_q are the goods and time spent on investment. Wage rates in competitive labor markets are determined by

$$w_j = a_j H_j, \tag{1.19}$$

where a_j is the earnings per hour of a unit of human capital at age j.

The total time available at any age can be allocated to the household, market, or investment sector:

$$t_{h_j} + t_{w_j} + t_{q_j} = t, \qquad j = 1, \ldots, n. \tag{1.20}$$

In perfect capital markets the present value of expenditures on goods would equal the present value of earnings and other income:

$$\sum_{j=1}^{n} \frac{p_j x_j + p_{q_j} x_{q_j}}{(1 + r)^j} = \sum_{j=1}^{n} \frac{w_j t_{w_j}}{(1 + r)^j} + A, \tag{1.21}$$

where r is the interest rate and A is the value at time 0 of nonhuman assets. By substituting the time constraints into the goods constraint, we can derive the equation for "full" wealth, W:

$$\sum_{j=1}^{n} \frac{\pi_j Z_j + \pi_{q_j} Q_j}{(1 + r)^j} = \sum_{j=1}^{n} \frac{p_j x_j + p_{q_j} x_{q_j} + w_j(t_{h_j} + t_{q_j})}{(1 + r)^j}$$

$$= \sum \frac{w_j t}{(1 + r)^j} + A = W. \tag{1.22}$$

The utility function in Eq. (1.16′) is maximized subject to this full-wealth constraint, the various commodity and investment production functions, and the evolution of human capital and wage rates. The optimal investment at any age is determined by marginal investment costs and marginal returns, according to the following equation (see Mathematical Appendix, note A):

$$MC_{q_j} = R_j = \sum_{k=j+1}^{n} \frac{\{[\pi_k(\partial Z_k)/(\partial H_k)] + a_k t_{w_k}\}(\partial H_k)/(\partial Q_j)}{(1 + r)^{k-j}}. \tag{1.23}$$

The far left-hand side gives the marginal cost of investment at age j, and R_j equals the discounted value to age j of subsequent market and household returns.

Equation (1.23) implies that investments tend to decline with age because fewer years remain at older ages to receive the annual returns; moreover, investment costs tend to be lower at younger ages because the foregone value of time spent investing is cheaper then. The optimal stock of human capital would rise at a diminishing rate, reach a peak, then decline toward the end of life as depreciation exceeds gross investment. If life went on forever, the capital stock would rise to a peak during the "investment period" and be maintained at that level indefinitely.

If human capital directly raised the output of commodities only by augmenting the effective amount of household time,

$$t_h' = t_h \psi(H), \quad \text{and} \quad \frac{\partial Z}{\partial H} = \frac{\partial Z}{\partial t_h'} t_h \psi', \tag{1.24}$$

where $d\psi/dH = \psi' > 0$. Investment returns can then be written simply (see Mathematical Appendix, note B) as:

$$R_j = \sum_{k=j+1}^{n} \frac{w_k \left(\frac{\psi'}{\psi} t_{h_k} + \tilde{w}_k t_{w_k}\right)}{(1 + r)^{k-j}} \frac{\partial H_k}{\partial Q_j}, \tag{1.25}$$

where $\tilde{w}_k = (d \log w_k)/dH_k$.

Returns would depend on the allocation of time between the market and household sectors only if human capital affects the productivity of household and market time differently (if $\psi'/\psi \neq \tilde{w}$). As Eq. (1.25) implies, the incentive to invest in capital that mainly raises household productivity is greater when more time is spent in the household sector, and the incentive to invest in capital that mainly raises market productivity is greater when more time is spent at work. Some investments, such as on-the-job training, mainly raise the productivity of market time; others, such as classes in child care, cooking, or art history, mainly raise the productivity of household time. The time spent at a work or consumption activity is a measure of the scale of the activity, or of the intensity of use of capital, and affects the rate of return on investments in capital specialized to that activity.

Returns are independent of the allocation of time between the market and household sectors not only when wage rates and the effective amount of household time are raised by the same percent, but also when wage rates are not raised at all if the effective amount of goods is raised as much as that of time. If

$$x' = x\,y(H), \quad \text{and} \quad \frac{y'}{y} = \frac{\psi'}{\psi} = s(H), \tag{1.26}$$

where $dy/dH = y' > 0$, then

$$Z[x_k y(H_k), t_{h_k}\psi(H_k)] = y(H_k)^g Z(x_k, t_{h_k}\ell), \tag{1.27}$$

where $\ell = \psi(H_k)/y(H_k)$ is independent of H_k, and Z is assumed to be homogeneous of the gth degree in x' and t_h'. Hence (see Mathematical Appendix, note C):

$$R_j = \sum_{k=j+1}^{n} \frac{\pi_k \dfrac{\partial Z_k}{\partial H_k}}{(1+r)^{k-j}} = \sum_{k=j+1}^{n} \frac{g\,s(H_k)\pi_k Z_k}{(1+r)^{k-j}}. \tag{1.28}$$

Returns do depend on the value of commodity output, but not in any other way on the allocation of time between the market and household sectors.

Mathematical Appendix

A. If the Lagrangean expression

$$L = U - \lambda\left[\sum \frac{p_j x_j + w_j t_{h_j} + p_{q_j} x_{q_j} + w_j t_{a_j} - w_j t}{(1+r)^j}\right] - A$$

is maximized with respect to the x_j, x_{q_j}, t_{h_j}, and t_{q_j}, and if H_j has a negligible effect on the output of Q_j, the equilibrium conditions for x_{q_j} where $j = 1, \ldots, n$, are

$$\sum_{k=j+1}^{n} \frac{\partial U}{\partial Z_k}\frac{\partial Z_k}{\partial H_k}\frac{\partial H_k}{\partial Q_j}\frac{\partial Q_j}{\partial x_{q_j}} + \lambda \sum_{k=j+1}^{n} \frac{a_k t_{w_k}(\partial H_k/\partial Q_j)(\partial Q_j/\partial x_{q_j})}{(1+r)^k} = \lambda \frac{p_{q_j}}{(1+r)^j}.$$

Since utility maximization also implies

$$\frac{\partial U}{\partial Z_k} = \lambda \frac{\pi_k}{(1+r)^k} \quad \text{and} \quad MC_{q_j} = p_{q_j}\Big/\frac{\partial Q_j}{\partial x_{q_j}},$$

the first condition can be written as

$$\sum_{k=j+1}^{n} \left(\frac{[\pi_k(\partial Z_k/\partial H_k)] + a_k t_{w_k}}{(1+r)^{k-j}}\right)\frac{\partial H_k}{\partial Q_j} = MC_{q_j}.$$

B. Since

$$\frac{\partial Z_k}{\partial t_{h_k}} = \frac{\partial Z_k}{\partial t_{h_k}'}\psi,$$

and equilibrium requires (if $t_{w_k} > 0$) that

$$w_k = \mu_k \equiv \frac{\partial Z_k}{\partial t_{h_k}}\frac{p_k}{(\partial Z_k/\partial x_k)} = \frac{\partial Z_k}{\partial t_{h_k}}\pi_k,$$

then

$$\pi_k \frac{\partial Z_k}{\partial H_k} = \pi_k \frac{\partial Z_k}{\partial t_{h_k}'} t_{h_k}\psi' = t_{h_k} w_k \frac{\psi'}{\psi}.$$

Hence

$$\pi_k \frac{\partial Z_k}{\partial H_k} + a_k t_{w_k} = w_k\left(\frac{\psi'}{\psi} t_{h_k} + \frac{a_k}{w_k} t_{w_k}\right).$$

C.
$$\begin{aligned}\frac{\partial Z_k}{\partial H_k} &= \frac{\partial Z_k}{\partial x_k'} x_k y' + \frac{\partial Z_k}{\partial t_{h_k}'} t_{h_k}\psi' \\ &= \frac{\partial Z_k}{\partial x_k'}(x_k y)\frac{y'}{y} + \frac{\partial Z_k}{\partial t_{h_k}'}(t_{h_k}\psi)\frac{\psi'}{\psi} \\ &= s(H_k)\left(\frac{\partial Z_k}{\partial x_k'} x_k' + \frac{\partial Z_k}{\partial t_{h_k}'} t_{h_k}'\right) \\ &= s(H_k) g Z_k\end{aligned}$$

if Z is homogeneous of degree g in x' and t_h'.

CHAPTER 2

Division of Labor in Households and Families

This chapter begins my analysis of the purposes and effects of families by considering the division of labor within households and families. The most pervasive division is between married women, who traditionally have devoted most of their time to childbearing and other domestic activities, and married men, who have hunted, soldiered, farmed, and engaged in other "market" activities. The various divisions of labor among family members are determined partly by biological differences and partly by different experiences and different investments in human capital. Specialization in the allocation of time and in the accumulation of human capital would be extensive in an efficient family even if all members were biologically identical; indeed, this chapter argues that biological differences probably have *weakened* the degree of specialization.

Since married women have been specialized to childbearing and other domestic activities, they have demanded long-term "contracts" from their husbands to protect them against abandonment and other adversities. Virtually all societies have developed long-term protection

for married women; one can even say that "marriage" is defined by a long-term commitment between a man and a woman. These commitments are briefly considered in this chapter.

Shirking of duties, pilfering, and cheating is made easier by the extensive specialization and division of labor within families. Such conflict between the interests of members can be reduced by monitoring behavior, including invasions of the "privacy" of members, by expulsion from the family and other punishments, and by altruism. These and other methods are briefly discussed in this chapter and more completely in Chapters 8 and 11.

Specialization in Households

We shall consider the optimal investment in two types of human capital, H^1 and H^2. Each person maximizes utility by choosing the optimal path of H^1 and H^2 and the optimal allocation of time at all ages between the market and household sectors. If a person lives forever, does not age, and faces a stationary environment, our previous discussion indicates that H^1 and H^2 would be accumulated during an initial investment period, after which the equilibrium stock of H^1 and H^2 would be maintained indefinitely.

If consumption were stationary after the investment period, a single-person household would use a fixed amount of time to maintain its capital stocks and would allocate its remaining time between the market and household sectors to maximize consumption. If H^1 only raises market wage rates and H^2 only raises the effective amount of household time, aggregate consumption Z during each year would be given by

$$Z = Z(x,t'_h) = Z\left[\frac{a\hat{H}^1 t_w}{p_x},\ t_h\psi(\hat{H}^2)\right], \tag{2.1}$$

where $\hat{H}^1$ and $\hat{H}^2$ are the optimal capital stocks, $a\hat{H}^1$ is the wage rate, $t_h\psi(\hat{H}^2)$ is the effective amount of household time, and p_x is the price of market goods. The allocation of time is constrained by

$$t_w + t_h = t', \tag{2.2}$$

where t_w and t_h are the hours allocated to the market and household sectors respectively, and t' is the total time available each year after allowance for the time spent maintaining capital. The allocation of time

would be optimal if the marginal product of working time equaled the marginal product of household time:

$$\frac{\partial Z}{\partial t_w} \equiv \frac{\partial Z}{\partial x}\frac{a\hat{H}^1}{p_x} = \frac{\partial Z}{\partial t_h} \equiv \frac{\partial Z}{\partial t_h'}\psi(\hat{H}^2). \tag{2.3}$$

Optimal decisions for those in a multiperson household must take into account the skills of the different household members and conflicts in their incentives. The theory of comparative advantage implies that the resources of members of a household (or of any other organization) should be allocated to various activities according to their comparative or relative efficiencies. A major assumption of the present section is that at the beginning everyone is identical; differences in efficiency are not determined by biological or other intrinsic differences. Variations in skill result from different experiences and other investments in human capital. Even with this extreme assumption, efficient multiperson households will be shown to have a pronounced division of labor among members in the allocation of time and in the accumulation of specialized capital.

I also assume that members do not have to be supervised because they willingly allocate their time and other resources to maximize the commodity output of their household. Since all persons are intrinsically identical, each member would receive an equal share of household output (if the market for members is competitive). Consequently, each member gains from a costless increase in household output. This provides only a weak justification, however, for the assumption that members do not have to be supervised; some may gain individually from shirking their duties and other malfeasance even though household output is reduced.

Since all persons are assumed to be intrinsically identical, they supply basically the same kind of time to the household and market sectors. Therefore, the *effective* time of different members would be perfect substitutes even if they accumulate different amounts of household capital (H^2). Similarly, the goods supplied by different members would be perfect substitutes even if they accumulate different amounts of market capital (H^1). Consequently, with no costs of supervision and no fixed costs of allocating time between different sectors, the output of a multiperson household would depend only on the aggregate inputs of goods and effective time. If the optimal accumulation of capital during the investment period were $\hat{H}_i^1$ and $\hat{H}_i^2$ for the ith member, the

stationary output after the investment period of a household of n members would be

$$Z = Z\left(\sum_{i=1}^{n} x_i, \sum_{i=1}^{n} t_{h_i}'\right) = Z\left(\sum_{i=1}^{n} \frac{a\hat{H}_i^1 t_{w_i}}{p_x}, \sum_{i=1}^{n} \psi(\hat{H}_i^2)\, t_{h_i}\right). \tag{2.4}$$

Clearly, if each member accumulated the same capital, Z would depend on the aggregate hours supplied to each sector, Σt_{w_i} and Σt_{h_i} respectively, and not on the distribution of hours between members. However, Z would depend on the distribution of hours if the capital of members differed, because then the household (or market) time of some members would be more productive than that of other members.

Output would be maximized only if marginal products in the household sector equaled marginal products in the market sector for members supplying time to both sectors. That is, only if

$$\frac{\partial Z}{\partial t_{w_j}} = \frac{\partial Z}{\partial x_j}\frac{a\hat{H}_j^1}{p_x} = \frac{\partial Z}{\partial t_{h_j}} = \frac{\partial Z}{\partial t_{h_j}'}\psi(\hat{H}_j^2) \quad \text{when } t_{w_j}, t_{h_j} > 0. \tag{2.5}$$

Marginal products in the household sector must exceed those in the market sector for members supplying all their time to the household, and conversely for members supplying all their time to the market.

The comparative advantage of a member can be defined by the relation between the ratio of his marginal products in the market and household sectors and the ratios of other members. Since a, p_x, $\partial Z/\partial x_j$, and $\partial Z/\partial t_{h_j}'$ are the same for all members, comparative advantage depends only on $\psi(H^2)$ and H^1. For example, i has a comparative advantage in the market sector relative to j if, and only if,

$$\frac{(\partial Z)/(\partial t_{w_i})}{(\partial Z)/(\partial t_{w_j})} = \frac{\hat{H}_i^1}{\hat{H}_j^1} > \frac{(\partial Z)/(\partial t_{h_i})}{(\partial Z)/(\partial t_{h_j})} = \frac{\psi(\hat{H}_i^2)}{\psi(\hat{H}_j^2)}. \tag{2.6}$$

We can immediately prove the following theorem:

Theorem 2.1 If all members of an efficient household have different comparative advantages, no more than one member would allocate time to both the market and household sectors. Everyone with a greater comparative advantage in the market than this member's would specialize completely in the market, and everyone with a greater comparative advantage in the household would specialize completely there.

Since a member allocating time to both the market and household sectors must have equal marginal products, all members with a greater comparative advantage in the market sector would have a greater marginal product there than in the household, and conversely for all members with a greater comparative advantage in the household. Consequently, the former would specialize completely in the market and the latter in the household, which proves this theorem.

Since the returns from investing in specialized capital depend on the hours spent in the sector utilizing that capital (see Chapter 1), members specializing entirely in the market sector have strong incentives to invest in market capital (H^1) and no incentive to invest in household capital (H^2). Similarly, members specializing in the household sector have strong incentives to invest in H^2 and no incentive to invest in H^1. Therefore, the sharp division of labor in the allocation of time indicated by Theorem 2.1 implies an equally sharp division in the allocation of investments. This implication can be stated as a theorem:

Theorem 2.2 If all members of a household have different comparative advantages, no more than one member would invest in both market and household capital. Members specializing in the market sector would invest only in market capital, and members specializing in the household sector would invest only in household capital.

This theorem illustrates Adam Smith's often cited but misunderstood and seldom used theorem that the division of labor is limited by the extent of the market. The extent of the market for human capital that raises productivity at particular activities is measured by the time spent at these activities. Theorem 2.2 can be read to state that the division of labor in the accumulation of specialized capital is greater when differences in the allocation of time are greater, or when differences in the extent of the market are greater.

Theorems 2.1 and 2.2 assume that all comparative advantages are different, but could several members have the same comparative advantage and invest in both market and household capital and allocate time to both sectors? The answer, which can be stated as follows, is clearly no.

Theorem 2.3 At most one member of an efficient household would invest in both market and household capital and would allocate time to both sectors.

A simple and instructive proof assumes the contrary—that, say, two members allocate time to both sectors and have the same investments and comparative advantages. If they spent $\hat{t}_w$ hours in the market sector (say $\hat{t}_w < t'/2$), output would not be changed if one of them spent $2\hat{t}_w$ hours in the market and the other specialized completely in the household. However, every member could be made better off if the member now specializing in the household did not invest in market capital and increased his investment in household capital. They would also be better off if the member now supplying $2\hat{t}_w$ hours to the market increased his investment in market capital and reduced his investment in household capital. Consequently, we have contradicted the assumption that two members allocate time to both sectors and invest in both kinds of capital, and the theorem is proved.

None of these theorems on the division of labor and investment make any assumption about returns to scale in commodity production functions or the sorting of persons into different households. If returns to scale are constant or increasing, and if inefficient households cannot survive, specialization would be even more extreme, as shown by the next theorem:

Theorem 2.4 If commodity production functions have constant or increasing returns to scale, *all* members of efficient households would specialize completely in the market or household sectors and would invest only in market or household capital.

To prove this, assume that one member of an n-person household spends time in both sectors (less in the market sector) and that he invests in both market and household capital. If two n-person households form a single $2n$-person household, one member alone can supply the total time to the market that was supplied by him and by a member of the other household. If they continue to make the same investments, constant or increasing returns to scale in the commodity production function imply that the output of the combined household will be no smaller than the sum of the outputs of the smaller households. The combined household can do even better, however; one member can eliminate his investment in market capital, and the other can invest more in market capital and less in household capital since he spends more time in the market. Hence, a small household will be less efficient than larger households if some members do not completely specialize.

These theorems are readily generalized to many commodities in the

household sector if commodities are produced independently of one another (no joint production) with their own specialized capital.

Theorem 2.5 All but possibly one member of households with more members than independent commodities would completely specialize their investments and time to the market or to a particular commodity. Moreover, with constant or increasing returns to scale, *all* members of efficient households must be completely specialized.

This theorem is readily proved following the reasoning used for Theorems 2.1 to 2.4 and implies that an increase in the number of independently produced commodities raises the size of efficient households because greater specialization becomes more profitable.

I have assumed that each type of human capital raises efficiency at only a single activity, but we do not need to hold to this limitation. For example, Theorems 2.1 to 2.4 would hold if H^1 and H^2 raise efficiency in both the market and the household sectors, as long as H^1 is more market-intensive in the sense that a dollar spent on H^1 raises wage rates more and household efficiency less than a dollar spent on H^2. A household would not be efficient if two members supplied time to both sectors and invested in both H^1 and H^2, for one of the members could supply all of their combined time to the market, and the other could specialize entirely in the household and eliminate any investment in H^1. Theorem 2.3 can be extended in the same way.

Returns on investments in types of human capital that raise either wage rates or effective goods by the same percent as effective household time would be independent of the allocation of time between the market and household sectors (see Chapter 1). All members of an efficient household might invest in these types regardless of their investment in more specialized types or of their allocation of time.

The analysis developed here is relevant not only to households, but also to countries and to the explanation of comparative advantage in international trade. Modern trade theory explains the gain from trade by international differences in endowments of labor, human and physical capital, and natural resources. I would argue, however, that differences in endowments are often only a proximate explanation of the gains from trade; the fundamental source of much of the gain is, as with households, the advantage of specialized investment and the division of labor.

Even intrinsically identical countries could increase the rate of return on their investments by specializing in particular types of human and physical capital and products that utilize such capital intensively. These products would be traded for products that are intensive in the capital specialized in by other countries. The proximate explanation of the gain from trade is differences in endowments of different kinds of capital, or the comparative advantage of traditional theory. However, the ultimate explanation is the gain from specialization.

Although the importance of intrinsic differences cannot be denied, the gain from international specialization in capital resolves some of the paradoxes besetting the traditional approach. An example of these paradoxes is that countries with apparently similar intrinsic endowments, such as Great Britain and Germany, tend to trade more with each other than do countries with apparently different intrinsic endowments, such as India and Japan;[1] another example is that trade does not decrease in the long run when factor endowments are supposed to become more similar.

The Sexual Division of Labor in Families

Although the sharp sexual division of labor in all societies between the market and household sectors is partly due to the gains from specialized investments, it is also partly due to intrinsic differences between the sexes. A man completes his biological contribution to the production of children when his sperm fertilizes a woman's egg, after which she controls the reproductive process: she biologically houses and feeds the fetus, delivers the baby, and often feeds the infant with her own milk. Sexual reproduction along these lines is all but universal among vertebrates: not only mammals, but also fish, reptiles, birds, and amphibians reproduce sexually (Ghiselin, 1974, chaps. 3 and 4; Wilson, 1975, p. 315).

Women not only have a heavy biological commitment to the production and feeding of children, but they also are biologically committed to the care of children in other, more subtle ways.[2] Moreover, women have been willing to spend much time and energy caring for their children because they want their heavy biological investment in produc-

1. I owe this enigma to lectures by Jacob Viner at Princeton University many years ago. Kleiman and Kop (1978, pp. 11-13, 22-23) find that trade is greater between countries with more similar incomes (see also Linder, 1961).
2. A discussion of some different ways is presented in Rossi (1977).

tion to be worthwhile. In addition, a mother can more readily feed and watch her older children while she produces additional children than while she engages in most other activities. This complementarity between bearing and rearing children has been important because, until the last century, practically all women spent most of their prime adult lives with children. Indeed, as recently as 1880 in the United States they averaged 5.4 births (see U.S. Bureau of the Census, 1975c, p. 53, 1910 census). Men have been less biologically committed to the care of children, and have spent their time and energy on food, clothing, protection, and other market activities.

From biological differences emerges the not-very-startling conclusion that the sex of household members is an important distinguishing characteristic in the production and care of children, and perhaps also in other household commodities and in the market sector. Analytically, these differences can be distinguished by the assumption that an hour of household or market time of women is not a perfect substitute for an hour of the time of men when they make the same investments in human capital. These differences between men and women illuminate several aspects of the composition of households and the division of labor within households that are not explained solely by the advantages of specialized investments in human capital.

If women have a comparative advantage over men in the household sector when they make the same investments in human capital, an efficient household with both sexes would allocate the time of women mainly to the household sector and the time of men mainly to the market sector. Indeed, either men or women would be completely specialized to one of these sectors if the time of men and women were perfect substitutes at a rate different from unity.[3] Households with only

3. For example, a household with one man and one woman would maximize

$$Z(x,t_h^i) = Z\left(\frac{wt_w^m}{p} + \frac{\alpha wt_w^f}{p},\ t_h^m + \beta t_h^f\right),$$

where by Eq. (2.2) $t_w + t_h = t^i$, and where $\beta > \alpha$ because women are assumed to have a comparative advantage in the household. If the man allocates time to both sectors,

$$\frac{\partial Z}{\partial x}\frac{w}{p} = \frac{\partial Z}{\partial t_h^i}.$$

Then the woman would allocate all her time to the household because her marginal product would be greater there than in the market:

$$\alpha\frac{\partial Z}{\partial x}\frac{w}{p} < \beta\frac{\partial Z}{\partial t_h^i}.$$

men or only women are less efficient because they are unable to profit from the sexual difference in comparative advantage.

Consequently, biological differences in comparative advantage between the sexes explain not only why households typically have both sexes, but also why women have usually spent their time bearing and rearing children and engaging in other household activities, whereas men have spent their time in market activities. This sexual division of labor has been found in virtually all human societies, and in most other biological species that fertilize eggs within the body of the female (Barash, 1977, pp. 188–201).

The analysis of specialized investments given earlier implies that women invest mainly in human capital that raises household efficiency, especially in bearing and rearing children, because women spend most of their time at these activities. Similarly, men invest mainly in capital that raises market efficiency, because they spend most of their working time in the market. Such sexual differences in specialized investments reinforce any biologically induced sexual division of labor between the market and household sectors and greatly increase the difficulty of disentangling biological from environmental causes of the pervasive division of labor between men and women.

Since the biological natures of men and women differ, the assumption that the time of men and women are perfect substitutes even at a rate different from unity is not realistic. Indeed, their times are complements in sexual enjoyment, the production of children, and possibly other commodities produced by the household. Complementarity implies that households with men and women are more efficient than households with only one sex, but because both sexes are required to produce certain commodities complementarity reduces the sexual division of labor in the allocation of time and investments.

Introducing complementarity alters the notion of comparative advantage. Women can be said to have a comparative advantage in the household sector when there are complementarities between men and women if the ratio of the marginal product in the household to the wage rate in the market is higher for women than for men when both supply the same amount of time to the household and when both invest in the same human capital. A woman with such a comparative advantage supplies more time to the household and less to the market than a man, and these time allocations are more different when the time of the two members is less complementary and more substitutable. Since specialized investments depend on the allocation of time, the investments of men and women more strongly reinforce their biological differences

when differences in comparative advantage are larger and complementarities weaker.

Apparently, differences in comparative advantage and in investments have been more important than complementarities because women traditionally have allocated much more time to the household than men have. Yet complementarities cannot be unimportant, especially in modern times; women are becoming less specialized in household activities, and men are spending more time at household activities.

Since investment differences reinforce biological differences, biological comparative advantage cannot be readily disentangled from specialized investments. There is an additional reason for the difficulty of separating the two. Since specialized investments begin while boys and girls are very young (rates of return to human capital investments are higher at younger ages; see Chapter 1), they are made prior to full knowledge of the biological orientation of children, which is often not revealed until the teens and even later. If only a small fraction of girls are biologically oriented to market rather than household activities, and if only a small fraction of boys are biologically oriented to household activities, then in the face of no initial information to the contrary, the optimal strategy would be to invest mainly household capital in *all* girls and mainly market capital in *all* boys until any deviation from this norm is established.

In this manner investments in children with "normal" orientations reinforce their biology, and they become specialized to the usual sexual division of labor. Investments in "deviant" children, on the other hand, conflict with their biology, and the net outcome for them is not certain. For some, their biology might dominate and they would seek a deviant division of labor, with men in the household and women in the market.[4] For others, however, their investments would dominate, and they would become oriented, less strongly than normal persons, to the conventional sexual division of labor. Presumably the discrepancy between investments and biology is a source of conflict and even agony for the biologically deviant.

4. I say "seek" rather than "engage in" a deviant division of labor because each deviant should be matched with another deviant, yet normal persons can be matched more easily because they are more common. Consequently, a larger fraction of deviants either remain single, marry and then divorce, or remain in unsuccessful marriages (see also the discussion of homosexual marriages in Chapter 10). Let me emphasize that "deviance" is used only in a statistical, not in a pejorative, sense.

Note that in this analysis parents and society are not irrational, nor do they willingly discriminate against deviants. Rather, they respond rationally and without discrimination in the face of imperfect information about the biological constitutions of children and the much greater incidence of normal constitutions. Deviant investments would presumably be more common if deviant biology were more common—or if it were revealed at younger ages.

Specialized investments and time allocation together with biological differences in comparative advantage imply that married men specialize in the market sector and married women in the household sector. Therefore the market wage rates of married men will exceed those of married women, partly because women spend more time in the household and invest more in household human capital. Table 2.1 shows that average hourly earnings in the United States have been 60 percent higher for married men than for married women, and married men have spent considerably more time at work and less time at child care and in other domestic activities.

Since single persons anticipate marriage and the sexual division of labor of married persons, single working men are likely to be more specialized toward the market sector than single working women. However, single persons cannot as readily take advantage of the sexual division of labor because they do not have mates. Table 2.1 indicates that

TABLE 2.1 Earnings and hours and weeks worked in the marketplace in the United States, by sex and marital status.

	Male	Female
Average hourly earnings in 1970		
Single (never married)	3.53	3.07
Married (spouse present)	4.79	2.98
Average hours worked per week in 1977[a]		
Single (never married)	35.6	32.5
Married (spouse present)	43.5	34.2
Average weeks worked in 1977[b]		
Single (never married)	27.2	24.2
Married (spouse present)	41.0	22.5

SOURCES: The figures on hourly earnings are from Polachek (1978, p. 119). Hours worked come from the U.S. Bureau of Labor Statistics (1978, table A-35). Weeks worked are calculated from the U.S. Bureau of Labor Statistics (1979, tables A-6 and A-9) and from additional data supplied by the bureau.

[a] Nonagricultural working population only.
[b] Includes population outside the labor force.

wage rates and hours per week and weeks worked in the marketplace are greater for single men than single women, although the differences are much smaller than between married men and women because single men tend to work fewer hours and earn less per hour than married men, while single women tend to work and earn more than married women.

Wage rates are lower for women at least partly because they invest less than men in market human capital, while the productivity of household time is presumably greater for women partly because they invest more than men in household capital. The time of women is worth less than the time of men at younger and older ages, but is worth more during the peak child-rearing years when women are very busy and productive. Since women are more likely to enter the labor force when their household time is worth less, a false inference is drawn from their lower earnings in the labor force about the time value of all women compared to all men.

Figure 2.1 illustrates this point with typical age–wage-rate profiles for men and women and an age–household-productivity profile for women when they spend all their time in the household. Women would be in the labor force prior to age t_1 and after age t_2, because during these periods their wage rates exceed their household marginal productivities. During these ages women supply sufficient hours to the market sector to equate their household marginal product and their wage rate. Clearly, in this illustration women in the labor market have a lower

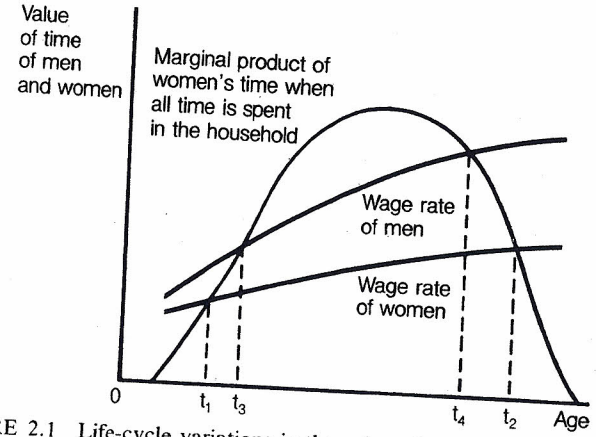

FIGURE 2.1 Life-cycle variations in the value of time of men and women.

value of time than men. However, women are not in the labor force between ages t_1 and t_2 because their time is worth more at home; moreover, between t_3 ($>t_1$) and t_4 ($<t_2$) their home time is worth more than the market time of men. In this illustration the *average* value of time over the lifetime may not be lower for women than for men, even though women's time is less valuable whenever they work in the marketplace.

Chapter 3 shows that women have less incentive to invest in human capital than men do when the number of children is the main result of marriage, and that the incentives of men and women are more equal when the "quality" of children is important. Women do receive considerably less schooling than men in poor countries that emphasize numbers, and about equal schooling in rich countries that emphasize quality (see Table 3.1). Therefore, in poor countries the average value of the time of women tends to be lower than that of men; in rich countries the value of the time of women is more equal to that of men. Explanations of behavior in rich countries that assume a much lower value of time for women may be misled by the much lower market earnings of women.[5]

Specialization of tasks, such as the division of labor between men and women, implies a dependence on others for certain tasks. Women have traditionally relied on men for provision of food, shelter, and protection, and men have traditionally relied on women for the bearing and rearing of children and the maintenance of the home. Consequently, both men and women have been made better off by a "marriage," the term for a written, oral, or customary long-term contract between a man and a woman to produce children, food, and other commodities in a common household.[6]

The nature of the division of labor between married men and women has meant that men have been more able than women to enter into marriages with several mates, simultaneously via polygyny or sequentially

5. See, for example, Azzi and Ehrenberg's discussion (1975) of participation in religious activities.

6. "Any marriage contract preserved in the Geniza shows that the first and foremost obligation of the husband was to provide his wife with food and clothing and to maintain her in general" (Goitein, 1978, pp. 118–119). However, in parts of Africa and Asia that did not use the plow, farming was often women's work along with child care and other domestic activities (see Boserup, 1970, chap. 1, and Goody, 1976, chap. 4). Moslems and Jews have had written contracts, whereas Chinese, Japanese, and Christians usually relied on oral and customary agreements.

through divorce or abandonment (see Chapters 3 and 10). Consequently, marriage law and contracts have mainly protected domestically specialized women against divorce, abandonment, and other unfair treatment—as when Moslem law stipulates that all the wives of a polygynous male must be treated equally and that the bride price is forfeited in whole or in part when a wife is divorced without cause (Goode, 1963, pp. 155 ff.), or when Jewish marriage contracts stipulate the amounts paid to wives in the event they are divorced or widowed,[7] or when Anglo-Saxon law provides alimony and child support to divorced women with children.

The biological differences between men and women in the production and care of children, and the specialized investments in market and household skills that reinforce the biological differences, explain why the institution of marriage has been important in all societies. The dominance of marriage as a form of household organization and the close ties between marriage and child rearing are shown in Table 2.2. Row (8) shows, for example, that married couples headed 71 percent of the households in sixteenth-century England and 94 percent in colonial America, and in 1970 headed 69 percent in the United States and 85 percent in rural India. Row (7) shows that 72 percent of the households in sixteenth-century England, 87 percent in colonial America, 46 percent in the United States, and 84 percent in rural India had children. Many of the households without children either planned to have them or raised children who left to form separate households; for example, from columns (3) and (4) we see that 83 percent of the households in the United States headed by males in their prime years have children compared to 46 percent of all households.

Practically all married couples have and rear their own children instead of hiring persons in separate households to rear them (as proposed long ago by Plato and practiced today in some kibbutzim) or

7. "The principal function of the Ketuba [the Jewish marriage contract that originated thousands of years ago] is therefore to serve as a document that safeguards the position of the woman after she has entered the marital state," and "following . . . the prohibition of divorcing and dismissal of a woman against her will, the practical importance of the Ketuba declined . . . and there was no longer any major significance to its monetary safeguards" (Davidovitch, 1968, pp. 112, 109). Many marriage contracts for Jews living in the Arab world between the tenth and fifteenth centuries have been found (Goitein, 1978, appendix). Invariably, the husband or his heirs had to return the wife's dowry and provide an additional payment if he terminated the marriage through divorce or death (ibid., pp. 95–142).

adopting children produced by others.[8] Of course, most societies forbid the purchase and sale of children, but it is easy to forbid what would be uncommon. One could postulate a "taste for own children," which is no less (and no more) profound than postulating a taste for good food or for any other commodity entering utility functions. Fortunately, the demand for *own* children, the distinguishing characteristic of families, need not be postulated but can be derived.

Women producing children can use their own milk as food and can more readily take care of young children while pregnant than while working in the marketplace.[9] Moreover, most women have been reluctant to commit so much time, effort, emotion, and risk to producing children without considerable control over rearing. Presumably the genetic similarity between parents and children further increases the demand for own children.

Own children are preferred also because of the value of information about children when investing in them. Information is more readily available about the intrinsic characteristics of own than adopted children, because parents and own children have half their genes in common and the health and some other characteristics of own children at birth and during infancy are directly observed. (See the discussion of a baby market in Chapter 5.) This may also explain why orphaned children of siblings and other close relatives are more frequently adopted than are orphaned children of strangers (Goody, 1976), and even why adopted children are less valued as marriage partners.

Since each woman is biologically limited to a relatively small number of own children,[10] and since the incidence of polygyny is limited by the

8. Of course, many upper-class families have reared their children with the help of nurses and tutors, and some have sent their infants to the homes of wet nurses: "the infants of the landed, upper bourgeois and professional classes [in England] in the sixteenth and seventeenth centuries [were] sent out to hired wet-nurses for the first twelve to eighteen months" (Stone, 1977, p. 107).

Goody (1976, chap. 6) discusses adoption in different societies. The Chinese, especially those on Taiwan, have had the unusual practice of adopting young girls as future brides for their own sons (on Taiwan, see also Wolf, 1968, pp. 100–101).

9. Labor force participation by mothers may also reduce the health of their children; see Popkin and Solon (1976) for evidence from a poor country and Edwards and Grossman (1978) for evidence from the United States.

10. A typical woman marrying at age twenty can produce no more than ten children, whereas by contrast a female oyster lays millions of eggs. Women who are unable to produce children usually either have been divorced, have become part of a polygynous household, or have adopted the children of others (Goody, 1976, pp. 81, 91–92).

TABLE 2.2 Number of members per household in various countries at different times. (NA = data not available.)

	Taiwan, 1975	India, 1970–1971	U.S., 1970, all households except group quarters	U.S., 1970, households headed by males ages 35–44 years	Syria, 1970	Thailand, 1970	Mormons, U.S., 1860	France, 1778	Serbia, 1733–1734	Japan, 1713	Colonial America, 1689	England, 100 communities, 1574–1821	England, 1599	Florence (Tuscany), 1427
(1) Average household size	5.27	6.64	3.11	4.58	5.91	5.82	5.54	5.04	5.46	4.97	5.85	4.75	4.75	3.92
(2) Standard deviation of household size	2.11	3.61	1.82	1.94	3.00	2.81	3.15	2.55	2.92	2.49	2.88	2.56	3.35	2.42
(3) Coefficient of variation	0.40	0.54	0.58	0.42	0.51	0.48	0.57	0.51	0.54	0.50	0.49	0.54	0.71	0.62
(4) Skewness A (see below)	0.20	0.25	0.20	0.20	0.15	0.03	0.14	0.14	0.33	0	0.14	0.33	0.43	0.14
(5) Skewness B (see below)	0.79	1.20	1.07	0.88	0.67	0.88	1.16	0.97	1.14	0.83	0.99	0.99	1.44	0.94
(6) Percentage of persons in the average household who are head, spouse of head, or children	NA	69.0	89.4	94.1	NA	NA	70.0[a]	80.3	62.6	72.2	86.2	76.9	72.2	NA
(7) Percentage of households with children[b]	NA	84.4	46.4	83.4	NA	NA	85.1	77.3	76.5	81.9	87.0	74.6	71.8	NA
(8) Percentage of households headed by a married couple	NA	85.3	69.0	91.7	NA	NA	86.7	71.0	82.2	64.0	93.9	70.4	71.0	58.3
(9) Percentage of single-member households	3.1	2.7	17.5	5.0	5.7	3.2	4.0	0	3.1	7.1	4.0	5.6	9.1	20.5
(10) Percentage of households with more than nine members	6.0[c]	16.0	0.5	1.5	11.8	8.2	8.7	5.0	8.2	5.0	9.1	5.0	5.0	NA

SOURCES: Computer tape created by the U.S. Bureau of the Census, 1970 Census of Population, 1/1000 Public Use Sample—15% County Group Sample; private communications from Indra Makhija and Wallace Blackhurst; United Nations (1974, table 24); Taiwan Directorate-General of Budget, Accounting and Statistics (1976, table 18); Laslett (1972, tables 1.7, 1.8, 1.10, 1.13); and Klapisch (1972).

Skewness A = [(90th pct − 50th pct) − (50th pct − 10th pct)]/(90th pct − 10th pct), where pct = percentile.

Skewness B = $\left(\frac{\Sigma[(X_i - \bar{X})/\sigma]^3}{N}\right)^{1/3}$, where $\bar{X}$ = mean, σ = standard deviation, N = number of cases.

[a] Children under eighteen years old.
[b] For U.S., children are family members under eighteen years of age related to family head (regardless of marital status); for India, children are fourteen years old and under; for other cultures, all unmarried offspring in the household are children, but servants are not children.
[c] Percentage of households with more than eight members.

sex ratio and other considerations (see Chapter 3), a nuclear family containing parents and their own children usually is small. For example, Table 2.2 shows that even the polygynous Mormons averaged less than six persons to a household.

Shirking, Household Size, and the Division of Labor

I have assumed that a household assigns its members to investments and activities that maximize the household's output of commodities without regard to incentives. Yet shirking, cheating, pilfering, and other malfeasance of members may not be readily detected, for the division of labor due to biological and investment specialization implies that a household's output is produced by members performing separate tasks.

Malfeasance within a family is not simply a theoretical possibility but one that has been recognized for thousands of years, starting with the biblical recommendation to trust wives: "The heart of her husband trusts in her, and he will have no lack of gain" (Proverbs 31:11). Jewish marriage contracts sometimes expressly stipulated that the bride should be trusted: her "complete and absolute trustworthiness," or "she is trustworthy in her statements concerning everything" (from two contracts written in the Middle Ages). Her trustworthiness was sometimes in doubt, partly because of the division of labor and her divided loyalties: "Because of the strong attachment of the wife to her paternal family she could be suspect of pilfering from her husband's house," or "Since [her] earnings were mostly derived from needlework, spinning, or weaving, or from serving as a sales woman to other women, it was difficult for her husband to know her actual takes, and suspicion might rear its ugly head." Of course, grooms frequently were not trusted either: for example, one marriage contract stipulated, "His father stands security for him" (Goitein, 1978, pp. 143–145).

Female adultery is a serious offense in traditional societies, mainly because men are reluctant to rear children fathered by others. These societies have tried to control the incidence of adultery by limiting the opportunities of their women, as when Moslem women are secluded or are forced to cover their faces and their arms and legs in the presence of men, or when married Jewish women must cut their hair and wear wigs.

The ideal Chinese household contains parents, unmarried children,

and the families of married sons, yet shirking and lack of trust make such households far from serene:

> This ideal is occasionally achieved by the wealthy, but among the poor, *two married brothers rarely maintain a joint household after the death of their father.* The wife of one is too sure that the wife of the other feeds her children more when it is her turn to cook, or that she shirks her share of the housework. While the brothers' mother is still living and active, she can control or at least mediate disputes in the kitchen, but the loser of any dispute is sure to whisper to her husband about the favoritism his parents are showing to the other brother's children (Wolf, 1968, p. 28; italics added).

and

> She refuses to accept, however, that a man [her brother-in-law] who must obtain custom from city businessmen must dress better than a farmer [her husband]; . . . to [her], it is a simple case of one half of the family working very hard and the other half [her brother-in-law's] living better, sweating less (ibid., pp. 142–143).

Malfeasance in families in different societies has been punished by fines,[11] divorce, religious oaths (Goitein, 1978), or in various other ways, including disgrace for adultery (see Hawthorne, 1864). Moreover, because parents and siblings in some societies have been responsible for the actions of kin who marry into other households, they have had an incentive to limit the malfeasance of family members. In addition, a senior and successful person has sometimes been appointed head of a household or extended family and asked to adjudicate disputes and otherwise determine and punish the malfeasance of members.

Shirking, pilfering, or other malfeasance would be suspected if someone were frequently intoxicated, spent more than his legal income, had secret rendezvous, or engaged in other suspicious behavior. Malfeasance could sometimes be detected, therefore, by invading the privacy of members to gather evidence on the fidelity of their behavior to the interests of the household (see the more extensive discussion in Chapter 11). This suggests that specialization and the division of labor could actually reduce the privacy of members, in that their behavior would then be scrutinized more carefully for malfeasance.

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11. Jewish marriage contracts of the Middle Ages in the Arab world often provided that a groom breaching his contract would be fined specified amounts (Goitein, 1978, p. 144).

If greater specialization did reduce the net privacy of members in view of this relation between specialization and malfeasance, and if the marginal utility of privacy were positive (privacy as a good is discussed in Posner, 1979), the increased output from greater specialization would be weighed against the reduction in privacy, and the optimal degree of specialization and privacy determined. The growth of separate households for single persons, especially elderly widows, in the United States, illustrates this trade-off. Over the past thirty years widowed parents have become less valuable as baby-sitters, cooks, and the like in their children's households because fertility has declined sharply and nursery schools and child-care centers have become more common. Moreover, social security payments have reduced transfers to elderly parents from their children. As a result of these developments, the gain from living with children has been reduced and the trade-off between privacy and specialization in this case has shifted toward privacy (see Michael et al., 1980).

The effect on malfeasance and privacy of the greater specialization of larger households constitutes a diseconomy of household scale.[12] If this effect were important, households would be considerably smaller than suggested by our analysis of specialized investments and division of labor. And in virtually all societies the average household has indeed been quite small. For the communities shown in Table 2.2, which span the fifteenth to the twentieth centuries in Western and Eastern Europe, Asia, and the United States, the average household comprised less than seven members; only in rural India did it comprise more than six.[13] Moreover, row (6) shows that the nuclear family—the head, his wives, and their own children—usually contributed more than 70 percent of the members.

12. Many years ago Wesley Mitchell blamed the small and allegedly inefficient size of modern households on the demand for privacy: "We have jealously insisted upon maintaining the privacy of family life; . . . most of us still prefer a large measure of privacy, even though we pay in poor cooking," and "If housekeeping were organized like business, these efficient managers [of their households] would rapidly extend the scope of their authority, and presently be directing the work of many others" (1937, pp. 5, 6, 10).

13. The average household in some Serbian towns of the nineteenth century had more than nine members (Halpern, 1972), and the average zadruga (extended household) in sixteenth-century Serbia may have had more than ten members (Hammel, 1972, p. 362). The *effective* size of households is perhaps understated by the data in Table 2.2, because siblings and other relatives frequently live near one another and cooperate in the production of defense, celebrations, and other commodities.

Household size can be placed in perspective by a comparison with the size of business establishments. The data in Table 2.3 indicate that more than half the establishments in retailing, minerals, farming, and law have fewer than four paid employees, and more than one-third in retailing and about two-thirds in farming have no paid employees. The average establishment in retailing, farming, and law is smaller than the average household in rural India, colonial America, and Mormon Utah.

Yet the data also indicate that large establishments are much more prevalent than large households. Almost 50 percent of the establishments in manufacturing and 29 percent in wholesaling have more than nine paid employees, whereas only 16 percent of the households in rural India and less than 1 percent in the United States have more than nine members. The coefficient of variation in household size ranges

TABLE 2.3 Number of paid employees per establishment in different sectors of the United States. (NA = data not available; * = fewer than five employees.)

	Manufactures, 1972	Retail services, 1967	Wholesale services, 1967	Mineral industries, 1972	Law firms, 1972	Agriculture, 1969 (seasonal workers)
(1) Average establishment size	57.7	5.4	11.3	23.6	1.9	1.9
(2) Standard deviation of establishment size	254.5	17.8	27.7	88.5	6.9	6.9
(3) Coefficient of variation	4.4	3.3	2.5	3.8	3.7	3.7
(4) Skewness A (see below)	0.9	1.0	0.8	1.0	0.5	1.0
(5) Skewness B (see below)	2.5	2.2	2.7	2.5	2.6	2.1
(6) Percentage of establishments with no paid employees ("family firms")	NA	36.5	4.1	NA	48.3	64.7
(7) Percentage of establishments with fewer than four paid employees	35.9*	68.9	42.5	51.3*	85.8	90.6*
(8) Percentage of establishments with more than nine paid employees	49.2	12.7	28.6	35.0	3.2	4.4

SOURCE: U.S. Bureau of the Census, 1971a and b; 1973a; 1975a; 1976a and b.

Skewness A = [(90th pct − 50th pct) − (50th pct − 10th pct)]/(90th pct − 10th pct), where pct = percentile.

Skewness B = $\left(\frac{\Sigma[(X_i - \bar{X})/\sigma]^3}{N}\right)^{1/3}$ where $\bar{X}$ = mean, σ = standard deviation, N = number of cases.

between 0.40 and 0.65 for 13 of the communities in Table 2.2, and between 0.50 and 0.59 for eight communities.[14] By contrast, the coefficient of variation in establishment size exceeds 2.4 for all the sectors in Table 2.3 and is at least 3.7 for four sectors. The distribution of firms is also much more skewed to the right than the distribution of households, as is evident from row (5) of Tables 2.2 and 2.3.

The distributions plotted in Figures 2.2 and 2.3 clearly reveal that large establishments are much more common than large households. The distribution of households usually rises to a peak and then declines slowly. The distribution of establishments peaks immediately, then declines very slowly in a long tail.

Presumably establishments have more incentive to expand to take advantage of the gains from increased specialization because they are more capital intensive than households: the ratio of nonhuman capital

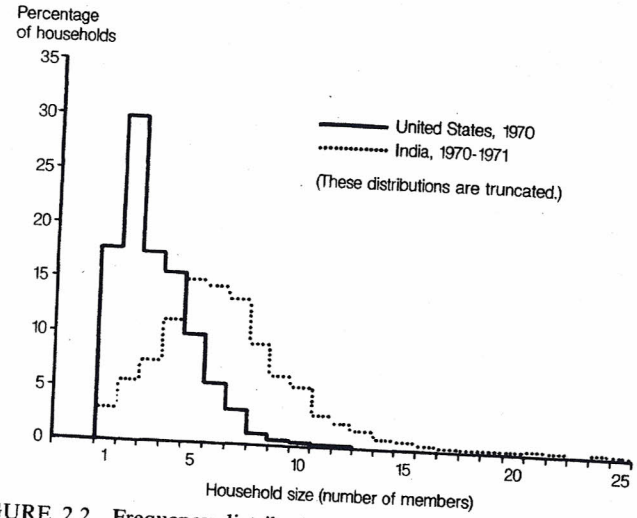

FIGURE 2.2 Frequency distributions of household sizes in the United States, 1970, and in India, 1970–1971.

SOURCES: See Table 2.2.

14. Whereas the range of average household size is from 3.1 to 6.6, or 113 percent, the range of the coefficient of variation is 75 percent. The relative inequality in household size is stable across highly diverse communities, probably even more stable than the inequality in income!

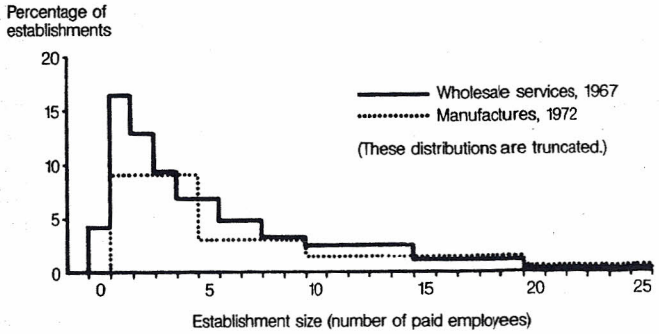

FIGURE 2.3 Frequency distributions of establishment sizes in wholesale services, 1967, and manufactures, 1972.

SOURCES: See Table 2.3.

to labor in firms is about eight times the ratio in households (Michael, 1966).[15] In addition, the diseconomies of scale that result from a loss in privacy may be less important in the marketplace than in the home.[16] Owners and other residual-income recipients of firms profit from limiting the malfeasance of employees and consumers; household members may be less inclined to engage in malfeasance, however, since altruism is more common in families than in firms (see Chapter 8). Indeed, the many firms with only a few paid employees are probably run by families that rely on altruism to organize production efficiently.

15. The capital-labor ratio is also much greater in farming than in households (based on U.S. Department of Agriculture, 1976, 1979), although the average farm has less than two paid seasonal employees.

16. In Mitchell's words, "Reluctantly we have let the factory whistle, the timetable, the office hours impose their rigid routine upon our money-making days; but our homes we have tried to guard from intrusion by the world of machinery and business" (1937, pp. 5–6).