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

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2

Household Economics

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

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

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

I

The canonical model of an agricultural household includes a utility function, defined over consumption by each member of the household, and a budget constraint, which incorporates production on assets owned by the household.[1] Consider a household with two members, each of whom gets utility from consuming a good (c_1 and c_2) and from leisure (l_1 and l_2). The most simple agricultural household models assume that each household faces a complete set of competitive markets. (This includes, in more general models than the one presented here, a complete set of markets for time- and state-indexed commodities.) Let p be the price of the good, and w be the wage of labour. (We will assume, for simplicity, that the labour of the two family members is homogeneous.) The household can produce the good on its farm according to the concave production function $F(L, A)$, where A is the area of the farm cultivated by the household and L is the amount of labour used on the farm. Let E_i^L be person i's endowment of time, E^A the household's endowment of land, and r the price of one unit of land. The household's problem, then, is to solve

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

subject to

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

$$L = L_1^f + L_2^f + L^h \tag{3}$$

$$A = A^f + A^h \tag{4}$$

$$E^A = A^f + A^m,\ E_i^L = L_i^f + L_i^m + l_i,\ i \in \{1,2\} \tag{5}$$

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

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

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

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

$$p(c_1 + c_2) + w(l_1 + l_2) \leq \Pi + w(E_1^L + E_2^L) + rE^A \tag{7}$$

$$\Pi = F(L, A) - wL - rA \tag{8}$$

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

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

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

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

subject to

$$p(c_1 + c_2) + w(l_1 + l_2) \leq \Pi^*(w, r) + w(E_1^L + E_2^L) + rE^A, \tag{7'}$$

where

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

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

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

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

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

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

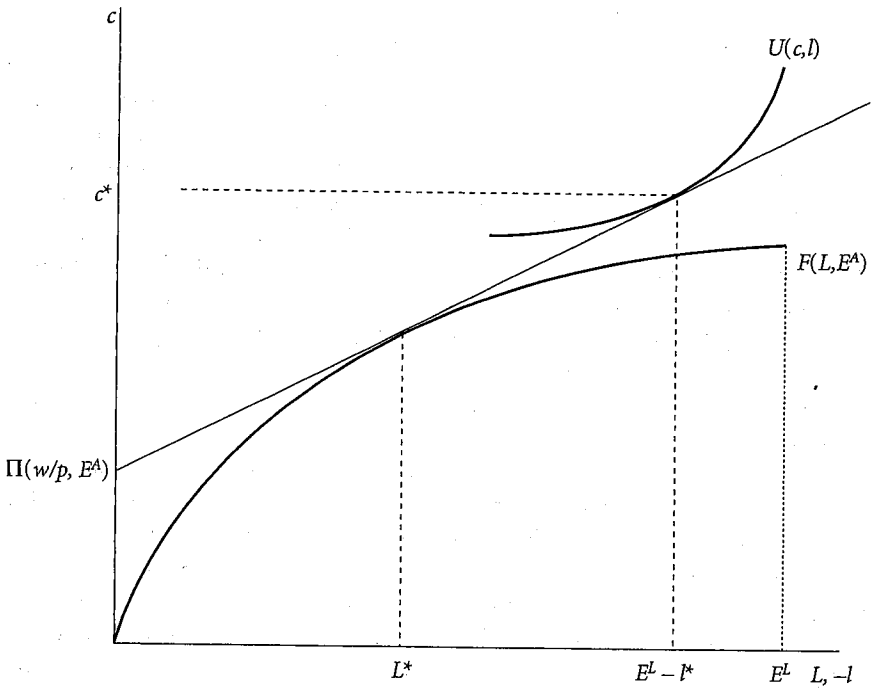

Figure 2.1

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

II

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

$$\underset{c, l, L^h, L^F \geq 0}{\text{Max}}\ U(c, l) \tag{10}$$

subject to

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

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

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

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

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

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

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

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

subject to

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

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

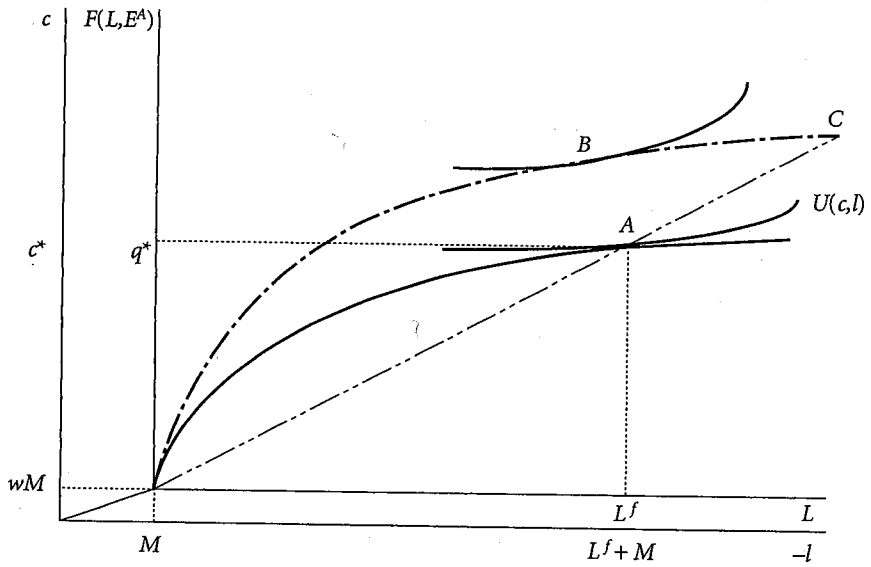

Figure 2.2

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

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

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

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

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

$$\underset{L \geq 0}{\text{Max}}\ EU(c)$$

$$\text{subject to } c = \theta E^A f\left(\frac{L}{E^A}\right) - wL + wE^L, \tag{17}$$

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

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

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

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

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

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

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

III

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

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

subject to

$$pc + wl + wL^c = F(L) - wL - wE^L \tag{21}$$

$$H = H(c, L^c), \tag{22}$$

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

IV

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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3

Population

I

The global rate of population growth over the past half century has been the highest in history. Most of this growth has occurred in poor countries. The rate of growth of the population in such countries currently is approximately 2 per cent per year, down from its 1960s peak of almost 2.5 per cent. This compares with an historical rate of population growth in Europe and North America of less than 1 per cent during the eighteenth and nineteenth centuries.

The current high rate of population growth has been driven by a large and sustained decline in mortality rates as a consequence of improved public health and rising incomes. Mortality rates in poor countries have fallen much faster over the past fifty years than was the case during the historical development of the industrial countries.[1] At the same time, fertility rates have also fallen at an historically unprecedented rate, but not fast enough to avoid a large increase in the population growth rate. Thus, the 'demographic transition'—the shift from a period of high mortality, high fertility, and relatively stable population through a period of lower mortality with still relatively high fertility and thus rapid population growth, to a period of low mortality and fertility and thus once again stable population—is still incomplete in most of the poor countries.

Simple Malthusian reasoning has proven incorrect. The rapid population growth of the past half-century has not brought falling real incomes and increasing mortality. Per capita income in poor countries has continued to rise (with the important exception of recent decades in sub-Saharan Africa). At the same time, there is a strong negative relationship (in both cross-sectional and time-series data) between national income *per capita* and aggregate fertility and population growth rates. On average, women in richer nations have one and a

[1] Birdsall (1988: 481) cites the case of India, which in 1982 had a life expectancy of 55 and a per capita income of under $300 (and a literacy rate below 40%). In contrast, life expectancy in England, Sweden, and the USA was below 50 years in 1900, while their per capita income was over $1,000 and literacy was above 80%.

half to two children over their lifetime, while women in poor countries average three and a half to four children over their lifetime. An average woman in Africa has between 6 and 7 children over the course of her life (Haab and Cornelius 1997). A similar regularity can be found in microeconomic data—richer women tend to have fewer children.

These simple correlations do not provide enough information to permit inference about the effect of population, or its growth, on income or its growth. Population growth and income growth influence each other; hence determining causality through statistical regularities is quite difficult. Nor does economic theory offer clear conclusions. To the extent that increasing returns to scale underlie growth, population growth can have a positive effect on growth. The existence of any fixed resources and diminishing returns, of course, tends to imply a negative effect of population on economic growth.

The remainder of this chapter examines the reproductive decisions of families in order to begin to unravel the connections between fertility, population, and income. In Section II we present a conventional model of household decision-making with respect to fertility and investment in the human capital of children. It will be seen that this household model provides a number of insights into the demographic transition. However, the assumption of a unitary household is particularly problematic in the context of fertility decisions. Explicit acknowledgement of the potentially divergent preferences of men and women is appropriate and opens up important areas of inquiry.

In the remainder of the chapter, we examine the interconnections between the fertility decisions of different families and the possibility that these interconnections give rise to multiple fertility equilibria. In Section III we argue that there may be important externalities associated with fertility decisions. People's notions of appropriate behaviour concerning the determinants of fertility are strongly influenced by cultural norms. Ideals concerning the age of marriage, births outside of marriage, birth spacing, breast feeding, and the use of modern methods of birth control are all strongly conditioned by the behaviour of other members of the community. Hence, a strategic complementarity arises in fertility decisions, and, using a model by Dasgupta (1993), we show that there may be multiple (Pareto-ranked) fertility equilibria. Finally, in Section IV we discuss another avenue through which fertility decisions are influenced by the choices of other households, even when there are no direct externalities. The link we explore (using a model by Basu and Van, 1998) is child labour. If fertility is low, labour is relatively scarce and adult wages are high; then families can afford to keep their children out of the labour force. On the other hand, an equilibrium might also exist in which families are large, wages are low, and impoverished families must send their children to work.

II

The conventional approach to understanding fertility decisions is based on the household model described in Chapter 2. The choices of a household with regard to fertility are treated in a manner analogous to all other decisions taken by the household. Most work by economists, following the seminal contributions by Becker (1960) and Becker and Lewis (1973), has focused on the trade-offs households face between the number of children, investment in these children, and current consumption of goods. Thus, let x be (parental) consumption and n be the number of children surviving (to an arbitrary, and for current purposes unspecified, age). For simplicity, we assume that each child is treated similarly, so let z be the level of human capital achieved by each child, known in this literature as 'child quality'. Household utility is described by the function $U(x, n, z; \boldsymbol{\alpha})$. We assume that $U(\cdot)$ is increasing in x and z, and increasing in n at least for small n. The human capital achieved by the household's children depends on their own consumption c and also on an input of time and effort by the parents t. Thus $z = Z(c, t; \boldsymbol{\beta})/n$. The opportunity cost of the time that the parents invest in children's human capital is the foregone wage that the parents would have earned. $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are vectors incorporating exogenous factors that influence the preferences of the household and the technology for producing child human capital in the household. The household's problem, then, is to solve:

$$\underset{x, n, c, t}{\text{Max}}\ U(x, n, z; \boldsymbol{\alpha})$$

subject to

$$z = Z(c, t; \boldsymbol{\beta})/n$$

$$w(1 - t) = p_x x + p_c c, \tag{1}$$

where we have chosen units so that the time endowment of the parents is 1. Thus, parents face a trade-off between the human capital achieved by their children, the number of children they raise, and their own consumption.

This model provides a framework in which many of the features of the demographic transition can be understood. For example, as the wage (particularly the female wage) increases with economic growth, the opportunity cost of rearing children increases, sharpening the trade-off between adult consumption and both the number and human capital of the household's children. At the same time α is likely to be changing. Part of the utility derived from children and their human capital is the expected contribution that the children will make to the parents' consumption in the future. That is, children can be seen (at least in part) as investments. As economic growth occurs, the return to skilled labour

increases relative to the return to unskilled labour. This change will be reflected in parental preferences over the number of children and the human capital embodied in each child. As a consequence, households move towards investing more resources into each of a smaller number of children. Similarly, $\boldsymbol{\beta}$ can change as a consequence of economic growth or government policy. The provision of free primary education would permit children to achieve higher levels of human capital at given inputs of c and t, and thus raise both z and n.

The conventional household model of fertility decisions also provides valuable guidance for empirical work. The household makes simultaneous and interdependent decisions regarding fertility, investment in child human capital, adult consumption, and labour market participation. It would be an error to treat any of these decisions as exogenous in an econometric exercise. Thus, for example, an analysis of the effect of household income on fertility has to be conducted with care. A simple regression in which fertility is the dependent variable and income an independent variable would be subject to simultaneity bias because income depends on the labour market decisions of the household. The household model provides a context for designing an appropriate empirical strategy; in this case it shows that the wage could serve as an instrument for the endogenous explanatory variable.

The household fertility model provides insight into the reproductive behaviour of families. Most importantly, it emphasizes the point of view that people evaluate the relative merits of their options regarding their family size and the health and education of their children. At the same time, the model is extremely incomplete and therefore can be misleading. On the one hand, this model of a unitary household obscures the potentially divergent goals of men and women regarding the number and treatment of children. On the other hand, the model neglects the potentially strong influence of the social context on fertility decisions. These comments are not mere cavils. Although it can be argued that they are true for all economic choices, they gain particular weight in the context of fertility decisions. Moreover, both lines of reasoning provide avenues through which the conventional model might be enriched to shed light on a crucial pair of questions: (1) Is the rate of population growth in the poorest countries too high? (2) Why has fertility responded so slowly to declining mortality in some areas, particularly in Africa?

The divergence between men and women in the costs and benefits of bearing and raising children is stark. Women bear all the physical risks of childbirth (which are very substantial in poor countries—1 in 100 births results in death for the mother in Africa (Haab and Cornelius 1997)). Most of the effort required to raise children is provided by women. Here, more than in virtually any other context, the fiction of 'household preferences' is inappropriate.

There is striking empirical evidence that men and women have divergent preferences with respect to fertility and investments in children's human

capital. Men and women often express different targets for total fertility (Birdsall 1988). Much of the empirical evidence (reviewed in Strauss and Thomas 1995) that casts doubt on the unitary household model concerns investments in child human capital. In a number of countries, additional income in the hands of mothers leads to larger increases in child health and education than similar additional income in the hands of fathers.

Finally, there is strong evidence that more educated women have lower fertility and are more likely to use modern methods of birth control. It is likely that there are a number of different mechanisms through which female education affects fertility. Wages increase with education, so the opportunity cost of the time spent rearing children is higher for more educated women. More educated women tend to have healthier children, lower mortality among their children, and thus lower fertility. They may also place a higher value on education, or be more efficient at 'producing' child human capital, and thus prefer fewer children with higher investment in human capital in each child (see Behrman *et al.* 1997). Finally, it may be the case that more educated women are able to negotiate or bargain more effectively within the household, so that fertility outcomes are closer to their own preferences than is the case for women with less education.

If men and women have divergent preferences with regard to fertility and investment in children, then an understanding of fertility outcomes, and thus of the determinants of population growth, rests on an understanding of the process of household decision-making. It is apparent that the process of decision-making within households is quite variable across societies, and thus general lessons are difficult to draw. However, to the extent that decisions over fertility are made or influenced by individuals who do not bear the full cost of childbearing and raising, then there exists the potential for an equilibrium in which fertility is too high.

III

Fertility decisions are made through a process of negotiation within households, but they are not made in isolation.[2] Here, more obviously than is the case with most decisions, the behaviour of households depends upon the choices of their neighbours. The proximate determinants of fertility—the use of contraceptives, the timing of breast feeding, the frequency of intercourse—are actions that are strongly influenced by cultural patterns. Put most simply, it may be the case that imitation plays an important role in fertility decisions. As long as all or most other couples engage in practices that encourage high fertility, any

[2] This section draws extensively on the discussion in Dasgupta (1993: chs. 12 and *12).

individual couple might find it difficult to do otherwise. The same couple, however, might prefer a smaller household size in a different social context. If this is the case, then choices regarding fertility generate an externality: each household's child-bearing decision helps set a cultural pattern, and this affects the preferences of all other households.

The form of the externality generated by fertility decisions involves *strategic complementarities* (Cooper and John 1988). The marginal utility to a household of having an additional child is increasing in the number of children in other households. Following the notation in Dasgupta (1993), suppose that there are M households in a society, and let $\mathbf{X} = (X_1, X_2, \ldots, X_M)$ be a vector describing the number of children in each household. Suppose that each household i has preferences over its own number of children, and also over the number of children in each other household. We ignore the obvious integer constraints, and assume that preferences can be summarized by the (twice continuously differentiable) utility function $U_i(\mathbf{X})$. For each household i, the externality we have described implies that $\partial^2 U_i(\mathbf{X})/\partial X_i \partial Xj > 0$ for $i \neq j$.

Strategic complementarities raise the possibility of multiple Nash equilibria. Suppose each household decides on the number of children taking the decisions of other households as given. Then household i solves a problem of the form $\max_{X_i} U_i(X)$. Let $X_{-i} \equiv (X_1, \ldots, X_{i-1}, X_{i+1}, \ldots, X_M)$. If we make the conventional assumption of diminishing marginal utility over the number of the household's own children, then, for each vector $\mathbf{X}_{-i}$, there is a unique value of X_i, say X^*, which solves household i's problems. The function $X^*(\mathbf{X}_{-i})$ is the household's reaction function, describing its decision given the actions of all other households. The implicit function theorem implies that $\partial X^*(\mathbf{X}_{-i})/\partial X_j \geq 0$. The number of children chosen by a household is an increasing function of the number of children in any other household.

Let's suppose that all households have identical preferences, and consider symmetrical Nash equilibria. Let Z be the number of children in all other households. Thus, $\mathbf{X}_{-i} = (Z, Z, \ldots, Z) \equiv \mathbf{Z}$. A symmetrical Nash equilibrium is a fixed point in which $X^*(\mathbf{Z}) = Z$; that is if all other households have Z children, a representative household would also choose Z children. In Figure 3.1, the horizontal axis is Z, the number of children in each other household, and the vertical axis is X^*, the optimal choice of the representative household conditional on the choices of the other households. The number of children in a household must be between 0 and X^{max}. We know that the reaction curve $X^*(Z)$ is upward-sloping—one example is drawn in the figure. Any intersection of the reaction function with the 45° line represents a symmetrical Nash equilibrium. We have drawn the reaction function so that there are three symmetric equilibria, corresponding to three different levels of fertility. Because the equilibria are symmetric and the households are identical, they can be Pareto-ranked—(generically) one is better than the others. There may be asymmetric equilibria as well, but

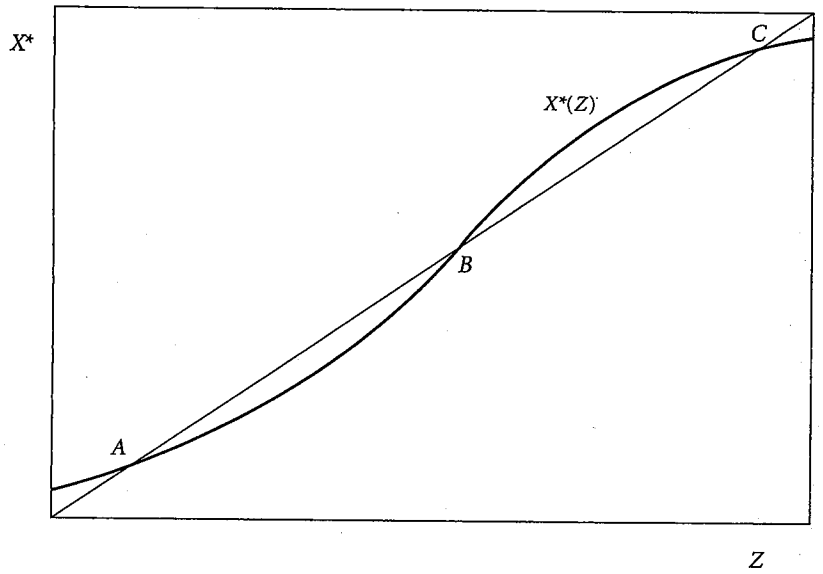

Figure 3.1

the general point has been made: when there are strategic complementarities, it is possible that there are multiple equilibria and that some of these equilibria are better than others.

Two similar societies (composed of households with similar preferences) therefore, might be found at different equilibria. Why should one society find itself in equilibrium at point *A*, while another is in equilibrium at the (say) Pareto-dominated point *C*? To answer this question, it is necessary to move outside the model as we have constructed it so far. The notion of Nash equilibrium rests on *expectations*. Given household *i*'s expectation of the fertility choices of other households, it selects its preferred number of children. When this selection matches the expectations of all other households, and the same is true for each household's selection, then the society is at a Nash equilibrium.

In the context of fertility decisions, it is most useful to focus on the role of history in forming expectations. Suppose that a society is characterized by high fertility for conventional reasons (perhaps a high rate of infant mortality). Consequently, a set of practices (e.g. polygyny and a low age of marriage for women) that encourages high fertility is common. These practices are the empirical embodiment of the strategic complementarity that we have hypothesized, and they shape the expectations of each household. Even after infant mortality declines, these practices remain and as a consequence each household continues to choose high fertility. Thus, the type of externality that we have hypothesized to be important with respect to fertility decisions raises the possi-

bility of a social equilibrium that is sub-optimal and requires coordinated effort to change.

IV

Household choices with regard to fertility are strongly conditioned by the social environment even when there is no direct interconnection between preferences and the choices of one's neighbours. The fertility decisions of households affect the demographic structure of the society, and this in turn can influence relative prices and thus other households' fertility decisions. In this section we present a simplified version of a model by Basu and Van (1998) which starkly illustrates the possibility of multiple fertility equilibria. In this model, if the economy is characterized by small families, labour is relatively scarce, adult wages are high, families can afford to keep children out of the labour force, and all families prefer to remain small. An alternative equilibrium might exist in which adult wages are low, families are so poor that all children must work, and each family decides to have many children (hence labour is abundant and wages are low).

The model is driven by three crucial assumptions. First, preferences are such that a family will send its children to work only if income from adult labour is very low; thus, child leisure is a luxury good. Second, technology is such that adult and child labour are substitutes. Third, children are capable of providing economic benefits to the family; if children do work, they can contribute more than their consumption needs to the family. This final assumption is more likely to be valid in poor countries, where productivity is less tied to human capital than in rich countries. Children who work in poor countries are able to produce more than they consume at an earlier age than is the case in rich countries. (See Dasgupta 1993 for a discussion.)

These three assumptions are sufficient to generate the possibility of multiple fertility equilibria. For the remainder of this section, we will make a series of further (draconian) assumptions to simplify and clarify the analysis, but the general message that the interaction between fertility decisions and labour market outcomes might generate the possibility of multiple equilibria rests on these three assumptions.

Suppose that there are N families, each of which has one adult and m children (the adult, of course, could be interpreted as a husband–wife couple). There is one good, and we will not examine issues of intra-household distribution. Instead, we assume that, if the adult consumes c, then each child consumes βc, with $\beta < 1$. Thus, β is an 'adult-equivalence' rating. Adult labour is supplied inelastically, but the household chooses child labour supply (e). Again abstracting from distributional issues within the household, we assume that all the children supply the same amount of labour. For simplicity, we restrict

the available choices of child labour to 0 or 1. Continuing to assume away issues of negotiation and power within the household, let there be a household preference ordering over pairs of consumption (c) and child labour effort (e). These preferences exhibit a particularly strong form of the 'child labour as luxury good' assumption: the household prefers that children work only if consumption would fall below some exogenously specified subsistence level in the absence of income from child labour. Household preferences are defined over pairs (c, e) for $c \geq 0$ and $e \in \{0, 1\}$. (Recall that child consumption is simply βc.) Preferences are:

$$\begin{aligned} &(c+\delta, e) > (c, e), \\ &(c+\delta, 1) > (c, 0) \text{ if } c < s, \\ &(c+\delta, 1) < (c, 0) \text{ if } c \geq s, \end{aligned} \tag{2}$$

for $\delta = 0$, $c \geq 0$, $e \in \{0, 1\}$. Thus, preferences are such that higher (average) consumption is preferred to lower, but children work only if the family would be destitute in the absence of the income from their labour.

The household budget constraint is

$$c + m\beta c = mew_c + w_a, \tag{3}$$

where w_a is the adult wage and w_c is the child wage. The household chooses its preferred combination of m, c, and e subject to the budget constraint (3).

To begin with, consider the choice of c and e conditional on a given family size. Given m, children work only if the adult wage is too low to provide sufficient adult income for the family to avoid destitution. Thus,

$$c = \begin{cases} \dfrac{w_a}{1+m\beta} & \text{if } w_a \geq (1+m\beta)s \\ \dfrac{w_a + mw_c}{1+m\beta} & \text{if } w_a < (1+m\beta)s, \end{cases} \tag{4}$$

and

$$e = \begin{cases} 0 \text{ if } w_a \geq (1+m\beta)s \\ 1 \text{ if } w_a < (1+m\beta)s. \end{cases} \tag{5}$$

The aggregate supply of adult labour is $S_a = N$, and of child labour is $S_c = 0$ if $w_a \geq (1+m\beta)s$, and $S_c = mN$ if $w_a < (1+m\beta)s$.

Now we turn to our second assumption, regarding the demand for labour. We have assumed that child and adult labour are substitutes in production. Let us go further to assume that they are perfect substitutes, so that output in any firm i is determined by $f(A_i + \gamma c_i)$ where A_i is the amount of adult labour used in firm i, C_i is the amount of child labour used in firm i, and $\gamma < 1$. So $1/\gamma$ children can do the same work as 1 adult. Let there be n identical price-taking firms. If $\gamma w_a < w_c$, then adult labour is cheaper than child labour and no firm

demands child labour. The aggregate demand for child labour $D_c = 0$, while the aggregate demand for adult labour D_a is determined implicitly by $f'(D_a/n) = w_a$. Similarly, if $\gamma w_a > w_c$, child labour is cheaper than adult labour and no firm demands adult labour. Thus, $D_a = 0$ and D_c is determined by $f'(\gamma D_c/n) = w_c$. Finally, if $\gamma w_a = w_c$, firms are indifferent between hiring adults or children. In this case, each firm only cares about the effective labour ($= A_i + \gamma C_i$) it hires; the composition of L_i is a matter of indifference. Thus, in this case $D \equiv D_a + \gamma D_c$ is determined implicitly by $f'(D/n) = w_a = w_c/\gamma$.

Conditional on fertility choices (that is, given m), the labour market will clear if there is a pair of wages (w_a, w_c) such that at those wages $D_a = S_a$ and $D_c = S_c$. We consider only wage pairs such that $\gamma w_a = w_c$, so that firms are indifferent between hiring adults or children. We set the level of fertility at $m = m^l$ for the purposes of this illustration. In Figure 3.2 we graph the the supply of effective labour $S \equiv S_a + \gamma S_c$ against the adult wage (remembering that, as the adult wage is changed, the child wage also changes to maintain $\gamma w_c = w_a$). If $w_a < (1 + m^l\beta)s$, the supply of effective labour is restricted to the adult labour and so equals N. However, if the wage drops to $w_a < (1 + m^l\beta)s$, then families with destitution send their children to work and the labour supply increases to $(1 + \gamma m^l)N$. Our assumptions on preferences suffice to guarantee that economy is characterized by a 'backward-bending' supply of labour. At low wages, less labour is supplied. Obviously, we have made an extreme assumption for the sake of simplicity. Such stark behaviour is not required for

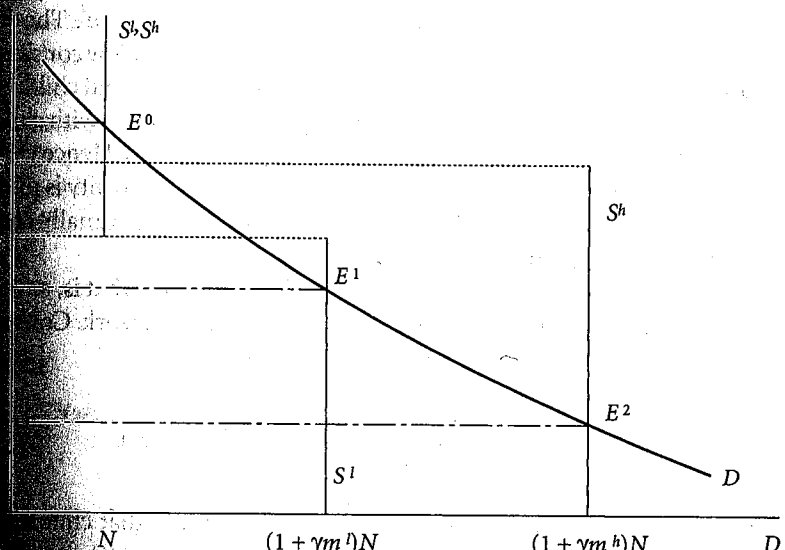

Figure 3.2

the conclusions we will draw. Any preferences that incorporate the assumption that child labour is withdrawn once adult wages are high enough, and that the rate at which child labour is withdrawn exceeds the rate at which adults increase their own supply of labour, will suffice to raise the possibility of multiple equilibria.

In Figure 3.2 we also graph the demand for effective labour (still restricting attention to the case in which $w_a = w_c/\gamma$), which is determined by $w_a = f'(D/n)$. We have drawn the supply of and demand for labour such that there are two equilibria. At E^0, adult wages are high, children do not work, and the demand for labour is met entirely by adults. At E^1 the adult wage is low, the child wage is very low ($w_c = \gamma w_a$), and both children and adults work. There are also equilibria at which $w_a \neq w_c/\gamma$. It cannot be the case that in equilibrium $w_a > w_c/\gamma$, for in that case the demand for adult labour is zero while its supply is positive. However, if $w_a = w^0$ (as at E^0), then any child wage such that $w_c \geq \gamma w^0$ is an equilibrium, for at those wage pairs both the demand for and the supply of child labour is zero.

Conditional on m, therefore, it is possible that there are multiple labour market equilibria. We now show that these multiple labour market equilibria might correspond to multiple equilibria with respect to the fertility choices of households. Suppose that households have a choice of two levels of fertility: $m \in \{m^h, m^l\}$, with $m^h > m^l$. We have drawn the labour market equilibria conditional on an assumed (low) level of fertility. We now ask the question: given these labour market outcomes, would the households voluntarily choose the assumed level of fertility?

In Figure 3.2, the supply function S^l is drawn with $m = m^l$. The supply of labour with m exogenously assumed to be m^h would be S^h. Now consider labour market equilibrium E^0, where $m = m^l$, the adult wage is w^0, and children do not work. Would households choose the level of fertility m^l? At E^0, with children not working, $c(m^l) = w^0/(1 + m^l\beta) > w^0(1 + m^h\beta) = c(m^h) > s$. Hence children do not work (regardless of the choice of fertility), and lower fertility is preferred to higher fertility. Hence E^0 is an equilibrium: households optimally choose low fertility, wages are high, and only adults work.

Now consider E^1. At E^1, we assumed that fertility is low (that is, $m = m^l$). The labour market clears with $w_a = w^1$, $w_c = \gamma w^1$, and children work. Consumption, therefore, is given by

$$c(m^l) = \frac{w^1(1+m^l\gamma)}{1+m^l\beta} < \frac{w^1(1+m^h\gamma)}{1+m^h\beta} = c(m^h).$$

The inequality is true because of our third assumption: that children provide net economic benefits to their families (that is, that $\gamma > \beta$). At E^1 children are working, and so families prefer high to low fertility in order to capture the

economic benefits offered by the additional children. E^1, therefore, is not an equilibrium.

Instead, consider E^2, where it is assumed that fertility is high ($m = m^h$). The labour market is in equilibrium with $w_a = w^2$ and $w_c = \gamma w^2$, and children are supplying labour. In this case,

$$c(m^l) = \frac{w^1(1+m^l\gamma)}{1+m^l\beta} < \frac{w^2(1+m^h\gamma)}{1+m^h\beta} = c(m^h),$$

and high fertility is chosen by the household.

Thus, E^2 is an equilibrium, and this economy has multiple fertility equilibria. In E^0 there is low fertility, high adult wages, and a low supply of labour; in E^2 there is high fertility, low wages, and children work.

The high-fertility equilibrium is clearly inferior to the low-fertility equilibrium for each labouring household.[3] Yet it is individually optimal for each of these households to choose high fertility, given that the other households are each choosing high fertility. The demographic structure generated by the fertility choices of the rest of the population yields low wages, and drives households to send their children to work. Given this environment, it is individually optimal to have many children. The general point is that, once again, there is a possibility of a *coordination failure*, and thus a potentially valuable role for public policy. The design of appropriate policy, obviously, is not trivial. It could be easy to slip into the worst excesses of Indian or Chinese population policy using the argument that population has a natural tendency to be too large as a consequence of these and related coordination failures. Even focusing more carefully on particular mechanisms through which the coordination failure arises does not always lead to simple policy recommendations. Basu and Van (1998), for example, demonstrate the complexities of policy towards child labour in the model we have just described. Even in this model, a ban on child labour can have dramatically positive or negative effects on household welfare, and various forms of partial bans can raise or lower child welfare depending upon the specific characteristics of the economy.

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[3] It is not true that this equilibrium is Pareto-dominated by the low fertility equilibrium, however. We have not completely characterized this economy, as we have not described the consumption choices of the owners of the firms (which are making profits). If we assume that they are a separate population that consumes all the profits, then they are better off in the high-fertility equilibrium.

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4

...mented Markets: Labour

I

...ead from a famous paper by Arthur Lewis (1954), it has been a ...nomic theory to differentiate the modelling of less developed ... that of industrially advanced economies primarily by referring ...functioning of the labour markets. Until very recently, a distin... ...k of models of the former set of economies was the assumption of ...pply curve of labour at an exogenously given wage rate. While the ...ature has cast serious doubts on horizontal labour supply curves ...geneity of the wage rate even in the densely populated agriculture ...nies, the theoretical puzzle of explaining the coexistence of a ...tive and often (though not always) downwardly rigid wage, even ...ions of severe unemployment and underemployment, which exer... ...development economists in the 1950s and 1960s, has not been com... ...ved. When in recent years high and persistent unemployment in ...untries became a focus of serious attention, macroeconomists and ...omists in search of the micro foundations of this disturbing phe... ...turned their attention to the paradox. The puzzle, of course, is ...rking for the densely populated agriculture of poor countries, ...tions (and unemployment benefits) are weak or non-existent and ...ge legislation is hardly enforced.
...ttempt to tackle the puzzle theoretically was made independently ...n (1957) and Mazumdar (1959), building on a presumed link ...tion intake and work efficiency, and exploring the effects of this ... and involuntary unemployment: at too low a wage, the produc... ...er may also be too low for the employer to be interested in hiring ... This is the earliest version of the efficiency wage theory, which was ...later to the case of industrially advanced countries.

[1] See e.g. Hansen (1969), Bardhan (1984), and Rosenzweig (1984).

Suppose the production function is given by:

$$Q = F(n\lambda(W)),\ F' > 0,\ F'' < 0,\ \text{and}\ \lambda'(W) > 0,$$

where Q is quantity produced, n is the number of standard units (say, hours) of labour employed, W is the time wage rate, and λ is a measure of labour efficiency. We shall take the $\lambda(W)$ function to be given by Figure 4.1. Maximizing the employer's profits, $F - nW$, with respect to n and W respectively, we get:

$$F'(n\lambda(W))\,\lambda(W) - W = 0$$

and

$$F'(n\lambda(W))\,\lambda'(W) - 1 = 0.$$

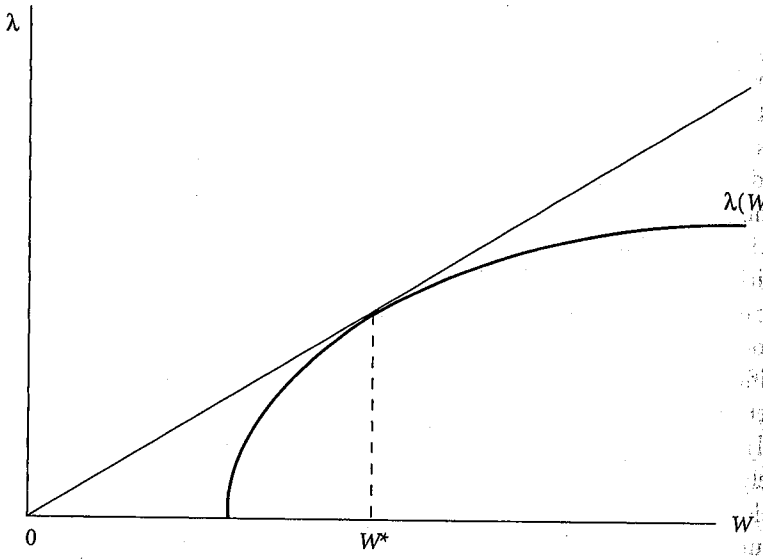

Figure 4.1

Equations (2) and (3) determine W^*, the efficiency wage. $W/\lambda(W)$ is the cost of buying one efficiency unit of labour, and the efficiency wage, W^*, minimizes this cost. If all employers are identical, Figure 4.2 shows the aggregate demand curve for labour, $D(W)$. Note that the employers will not hire any extra workers even if the wage rate offered by the worker is below W^*. On the other hand, the demand for labour is downward-sloping for all W exceeding W^*. This is because, as W rises above W^*, $W/\lambda(W)$ also rises (as can be checked from Figure 4.1). From (2) and (3), this implies a rise in $F'(n\lambda(W))$, which in turn implies a lower n. If now the aggregate supply curve $S(W)$ is as in Figure 4.2, then there is involuntary unemployment in equilibrium at the efficiency wage W^*.

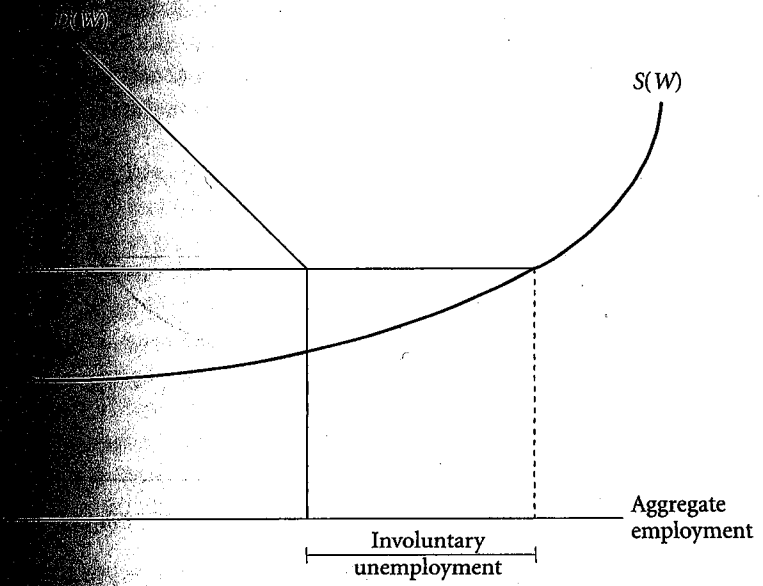

Figure 4.2

...ripping extension of this basic model to the case where workers have ...access to alternative income (say, from ownership of land or other ...s carried out by Dasgupta and Ray (1986), and again in Dasgupta ...The main argument is that the minimum cost of buying an efficiency ...labour—let us call it μ—is relatively high for labour supplied by the ...compared with that by the landed small peasants, who have access to ...come from cultivation or rentals), so that the latter may undercut the ...the labour market; μ is also high for large landowners whose alterna... ...s of income keep the opportunity costs of their labour high. In Figure ...horizontal axis represents a continuum of workers along the unit inter... ...each with a landownership label, m, in a land-scarce economy; the ...the m-value of a worker, the larger is the amount of land owned by him ...The μ curve traces out the minimum cost of buying an efficiency unit of ...across workers from different land classes. For the landless, μ is given by ...have described above as the efficiency wage. It is higher than the corre... ...g μ for small landed peasants, and so the curve dips down, only to rise ...the wealthy landowners. Now superimpose on Figure 4.3 a horizontal ...representing the aggregate marginal product of effective labour, so ...workers whose μ exceeds $\bar{\mu}$ there is no demand for them in the labour ...If the μ line is as in Figure 4.3, clearly workers with land labels in the

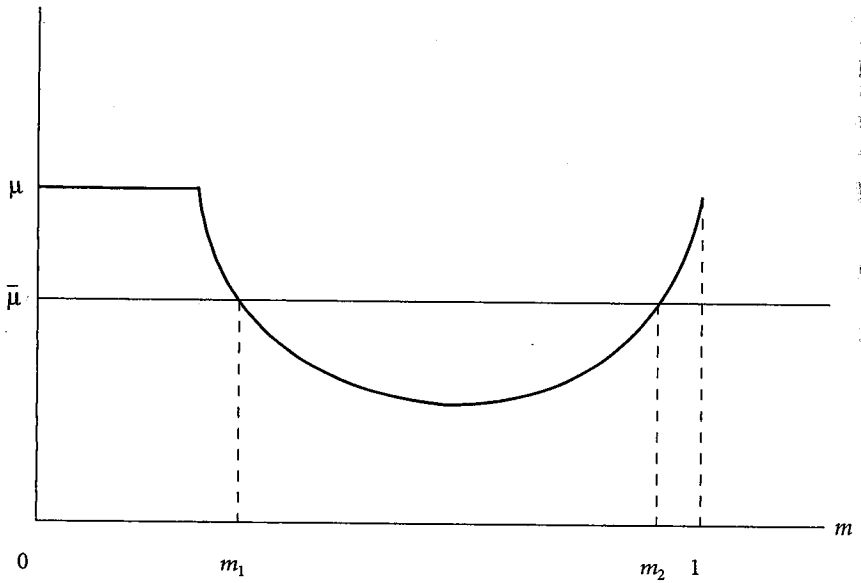

Figure 4.3

range 0 to m_1 (the landless plus some marginal farmers) are rationed out of the labour market, because they are too costly to hire in terms of efficiency units (even if they are prepared to work for a low hourly or daily wage rate). These are the involuntarily unemployed. The workers (the 'gentry' is a more appropriate term) in the land range m_2 to 1 are also unemployed in agriculture, but voluntarily so. An important policy conclusion of Dasgupta and Ray (1986) is that land reform can lower parts of the μ curve in Figure 4.3 and thus can add to aggregate output. (Some of the previously unemployed may become employable now, the employed small peasants may become more productive than before with better nourishment, and even some of the gentry may now work.)

While the nutrition-based efficiency theory of wages is one of the more elegant theories of wages and unemployment in the rural sector of poor countries, some of its testable implications run counter to the limited evidence that is available. For example, the evidence on employment probabilities (see Datt 1989) is not at all consistent with the idea suggested in the preceding paragraph that the landed labourers enjoy an employment advantage over the landless. Furthermore, even at very low levels of nutrition intake (when the efficiency wage should be binding), the observed variations in agricultural wage rates in response to variations in supply and demand parameters run quite contrary to the wage rigidity suggested by the stability in the physiological nutrition–

productivity relationship of the theory.[2] This applies not just to the wage rates of casual labourers, but also to the case of long-term contract labour where the employer has time to capture the benefits of higher productivity of the better-fed workers (see e.g. Bardhan 1984: ch. 4). The prediction of the theory on wage diversity for labourers belonging to different asset groups is also often belied by the evidence.[3]

In the context of labour markets in developed countries, the link between wage and efficiency has been generalized to cases where paying wages above market-clearing levels is justified on the grounds of boosting worker morale, loyalty, and effort-intensity, of reducing the incentive to shirk (when direct monitoring is costly), of improving the average quality of the pool of job applicants, of raising norms of gift-exchange between employers and employees, and so on. The standard papers modelling these grounds are collected in Akerlof and Yellen (1986). These grounds are valid to some extent in developing countries as well, although in the small neighbourhood community of the village or the urban informal sector, efficiency wage stories based on screening (for unobserved ability) or shirking (for unmonitored effort) are sometimes less compelling.[4]

In the context of a developing country a particularly important variant of the efficiency–wage story may be related to the problem of ensuring a steady work-force with low turnover and absenteeism (as the growing industrial sector tries to shape a disciplined work-force out of a ragtag army of peasant migrants), or even, in the agricultural sector, to the problem of reducing the costs and risks of delay in labour recruitment when weather dependence in the crop cycle makes the employer place a high premium on quick and ready availability of labour in some operations.[5]

In a highly simplified version of this model, let us suppose that the profits of the employer are given by $[F(L) - WL - AR(W)L]$, where F is output which depends only on labour employed, L, W is the wage rate, R is the cost of recruiting labour and A is a shift parameter. We shall assume that a higher wage paid by the employer makes recruitment easier, so that $R'(W) < 0$. This is to capture the idea of the wage premium the employer is prepared to pay for readily

[2] Dasgupta (1993) attempts to explain variations in wages by extending the model to incorporate a case where there are differences in the productivity of the village common property which the landless workers fall back upon. This is, however, too tenuous a base to support variations in efficiency wages in response to general changes in demand or productivity parameters.

[3] For a discussion of the evidence, see Bardhan (1984) and Rosenzweig (1988).

[4] Esfahani and Mookherjee (1995) show in a theoretical model that in poor countries with a relative abundance of labour and high effective time discount rates it may not be worthwhile for firms even in the formal sector to pay the 'informational rents' (i.e. premiums in excess of the reservation wage) required for creating strong performance incentives or offering high-powered incentive contracts.

[5] A labour turnover model can be found in Stiglitz (1974), and a recruitment cost model in Bardhan (1984: ch. 4).

available or steady labour. Maximizing the employer's profits with respect to L and W, we get:

$$F'(L) - W - AR(W) = 0 \quad (4)$$

$$1 + AR'(W) = 0. \quad (5)$$

Equation (5) determines the efficiency wage W^*, and putting that into (4) we determine L. If all employers are identical, and if the recruitment cost function is convex (i.e. if $R'' > 0$)—just as we assumed convexity of the nutrition-productivity set in Figure 4.1—we get a demand and a supply curve exactly as in Figure 4.2, and again there can be involuntary unemployment in equilibrium at the efficiency wage W^*.

Now suppose the shift parameter A depends on the tightness or slackness of the market in general (over and above the particular labour market under consideration), so that, for example, a larger general unemployment rate, u, in the surrounding area shifts the parameter A of the recruitment cost function downward, i.e., $A'(u) < 0$. In this case, it is easy to show that W^* is higher the tighter is the general labour market (or the lower is u). In this way we can introduce some sensitivity to the general market conditions into the efficiency wage.

II

One implication of all variants of the efficiency theory of wages is that it is the employer who resists the possible undercutting of the wage by the involuntarily unemployed. This is not adequate to account for the frequently observed phenomenon, both in urban and rural labour markets, that attempts to undercut wages on the part of unemployed or underemployed labourers are not as common as one would expect from their desperate conditions. The social norm that forbids such undercutting is part of what Solow (1990) describes as the social institutions in the labour market. The persistence of such a norm against Hobbesian competition in the labour market is explained in terms of an individualistic rationale for implicit cooperation among workers, in the context of industrially advanced countries, by Solow (1990) and in terms of rural labour markets of poor countries by Osmani (1990). We shall follow here the latter's model of self-enforcing cooperation in an infinitely repeated non-cooperative game situation, even when formal institutions of collective bargaining are absent.

Each worker takes a decision on which wage rate to bid, and in doing so takes into account what he or she expects the others to do. A Nash equilibrium is established when each worker finds that it does not pay to revise his or her bid. Suppose a perceived wage vector $w = (W_1, \ldots, W_i, \ldots, W_N)$ for a worker i (who

...N such workers) consists of his or her own bid W_i as well as the ...ved bids of others. On the basis of w, the worker estimates his or her probability of employment, $p_i(w)$, which goes down (up) as own (others') wage bid increases. His or her expected pay-off P_i is given by:

$$P_i(w) = p_i(w) W_i + (1 - p_i(w)) W_0, \quad (6)$$

where W_0 is the reservation wage.

...workers have the same reservation wage and the competitive market-...wage rate is also given by W_0, any wage rate above W_0 is collectively ...ior to W_0 for positive p. Such a collectively superior outcome is feasible if ...worker could make sure that no one will resort to undercutting. This is ...ble if in a repeated game one can punish deviant behaviour by imposing a ...trigger future loss on the deviant. One such strategy for a self-enforcing ...ative outcome is the well-known 'trigger-strategy' in the context of an ...itely repeated game. A trigger-strategy equilibrium will be established if ...body continues to bid a wage rate $W^* > W_0$ every day as long as everybody ...ued to bid W^*; however, if anyone ever bids a lower wage, everybody else ...W_0 in the next period and continue to do so for ever. The threat of this ...action is credible, since, if everybody other than i is bidding W_0, then i ...no better than bid W_0 and the wage rate is actually forced down to that ...for the deviant, whether this is too costly or not depends on the time dis-...e that is used to balance the immediate gain and the future loss. If $\rho < 1$ ...discount factor, then the discounted value of all payoffs from the trigger-...y wage rate W^* is given by

$$\pi(W^*) = P(W^*)(1 + \rho + \rho^2 + \ldots) = \frac{P(W^*)}{1-\rho}, \quad (7)$$

...$P(W^*) = p(W^*) W^* + [1 - p(W^*)] W_0$. Any worker contemplating ...on on day t by bidding a wage rate $W' < W^*$ can calculate that his or her ...ted income stream will be:

$$\left[\frac{1-\rho^t}{1-\rho} P(W^*) + \rho^t W' + \frac{\rho^{t+1}}{1-\rho} W_0\right].$$

...is less than or equal to $\pi(W^*)$ in (7) for all workers at all t, then W^* ...trigger-strategy. This defines a feasible range for the wage rate W^*, ...on the time discount rate. It can be shown that the greater the impa-...present consumption (i.e. the lower is ρ), as is more likely in the case ...poverty, the lower is the limit of the viable trigger-strategy wage. ...feasible range, one can get an interior-maximum equilibrium wage ...izing $\pi(W^*)$ in (7) with respect to W^*. Measuring $p(W^*)$, the proba-...employment, by the fraction of the labour supplied that is actually

demanded, one can easily show from the first-order condition of this maximum that, the higher is the elasticity of labour demand, the lower is the equilibrium W^*.

As Osmani (1990) points out, this model presumes 'common knowledge', particularly about the factors determining the choice of W^*. While this presumption is generally constricting, as in most game-theoretic models, it may be somewhat less so in the context of the small closed community of a village labour market with settled technology. For the same reason, common knowledge may break down in transitional periods after some technical change or migration of outsiders.

There are two other problems with this model. (1) The threat to bid W_0 forever once someone defects is implausible, and there are subtle issues of the possibility of renegotiation (and its attendant incentive effects) here. (2) It is not clear what prevents an employer and a worker from entering into personalized relations instead of going through the daily job lottery, the employer assuring the worker job security (converting p into unity) in exchange for the latter accepting (slightly above) the market-clearing wage rate.

Besides, the model attempts to formalize implicit cooperation only among workers, i.e. on the supply side of the labour market. There are reasons to believe that the collective action problem for cooperation among employers may often be less acute. Allowing for some cooperation on both sides of the labour market, Datt (1989) has characterized the outcomes in the (agricultural and, *a fortiori*, non-agricultural) labour market in terms of the asymmetric version of the well-known two-party Nash bargaining solution. It is assumed that the two parties bargain only over the wage rate, leaving the employers free to determine employment at the bargained wage. (This is not implausible when formal unions are weak or non-existent.) The disagreement payoff of the employers is taken to be zero profit (foregoing production), and that of the workers is taken to be equal to the reservation wage. Maximizing the usual Nash product of the surplus of the profits and wage incomes over the respective disagreement payoffs (with the coefficients of bargaining power as exponents), one can get from the first-order condition the standard result that the workers' wage earnings relative to the employers' profits depend on the ratio of the coefficients of bargaining power, the wage elasticity of labour demand, and the workers' reservation wage. This model is consistent with the existence of involuntary unemployment as an equilibrium phenomenon (as the rent-sharing between the employer and the employees rations out other potential workers), along with some sensitivity of the bargained wage rate to changes in demand and supply parameters. An extended (three-party) wage bargaining model

[6] In the literature on inter-industry wage structure, rent-sharing is an obvious candidate for explaining the widely observed correlation between industry wage premiums and industry profitability.

male and female labour are imperfectly substitutable inputs in production, can be used to explain the prevalence of gender disparities in wages as a possible outcome of differences in bargaining powers, in disagreement payoffs, and in wage elasticities of demand for male and female labour.

It may be also important to consider an implication of the labour market as a social institution in the context of gender disparity in wages and occupational segmentation of women. In a patriarchal society, standards of 'fairness' in wages and jobs and the nature of expected collusive behaviour, the social sanctions on wage undercutting, and the domain of enforcement of social norms in general may be gender-specific. Both men and women internalize these and help to perpetuate the disparities.

While distinctions by visible group characteristics like gender (or in some cases ethnicity or caste) are more easily accepted, employer-made distinctions in wage payment on the basis of unobserved individual-specific characteristics such as ability are likely to be more controversial. For a given task, the spread in wage rates is thus often narrower than that in ability of workers.[7] Employers may be unwilling to create invidious distinctions among their workers which may lead to problems of morale and tension. Workers may also use a uniform wage as a focal point in their efforts at implicit cooperation to raise wages. (In the case of explicit collusion, this has been observed in a much enhanced form in egalitaristic wage bargaining in Scandinavia.)

Another example of how labour market transactions are often embedded in social processes of poor countries relates to the domain of the localized or segmented labour market. Village employers sometimes (though not always) preferentially hire local labourers even when cheaper labour by 'outsiders' is available; in hiring 'outsiders', they may not be able to draw upon the considerable reservoir of village loyalty and goodwill they utilize in maintaining their social control over the labour process. Urban labour contractors and 'jobbers' often recruit from certain communities and neighbourhoods in preference over others, as they have developed over the years a network of territorial affinities and social control over the dependability characteristics of the workers. The workers on their part look up to their local employers or recruitment agents (even when the wages offered are not competitive) as providers of sustained job opportunities, an information network, regular credit, and emergency help over the years. The daily or monthly wage rate in the labour market (on which usual supply–demand models concentrate) is only one aspect of a complex social and economic transaction that takes place.[8]

[7] Foster and Rosenzweig (1996) have argued, on the basis of data from the Philippines, that productivity differences of different workers are not fully reflected in different wages on account of information asymmetry, except in the case of certain visible group characteristics (like gender, where there is evidence of 'statistical discrimination', i.e. wage based on perceived *average* productivity of the group as a whole).

[8] For a discussion of labour mobility in the context of 'the boundaries of the village moral economy'

The particularistic modes of recruitment sometimes turn the factory labour market in poor countries, even with weak trade unions, into an 'insider–outsider' mould (although in a somewhat different sense compared with the way the term is used in the unionized labour world of industrially advanced countries: see e.g. Lindbeck and Snower 1988). Employers sometimes informally use their long-term employees to recommend and screen new recruits and hold them responsible for any subsequent 'misbehaviour' on the part of the latter. In this system, the employer gets 'dependable' hires at a low recruitment and monitoring cost and the 'insider' employees establish a network of patronage and influence in their community and kinship groups; the unconnected 'outsiders' face formidable barriers to entry, and their possible attempts at wage undercutting can be rendered largely irrelevant by the system.

III

In this section we discuss different aspects of a multi-tiered labour market. One way of distinguishing the tiers is in terms of differences in the duration of contract: the terms of contract may vary between long-term (say, annual in the case of agriculture) contract labourers and daily casual labourers, even when they are of similar ability and carry out similar tasks.[9] In the industrial sector, protective labour legislation often creates small pockets of tenured factory workers surrounded by a 'floating mass' of temporary or casual labourers. Over time, of course, the former accumulate firm-specific skills which then differentiate them from their casual cohorts and offer them opportunities for rent-sharing and promotion in the 'internal labour market' of the firm. In the smaller-scale agricultural sector, where the reach of such labour legislation is tenuous, a two-tiered labour market for similar tasks is often the outcome of sharp seasonality in the crop cycle. Let us explore three kinds of rationale for the phenomenon of labour-tying in agriculture, all following from seasonality.

First, we have noted in Section I that the employer often puts a high premium on quick and ready availability of labour for some operations in the peak season: weather dependence not only makes the timing of these operations somewhat unpredictable, it also means that when the time comes the job has to be done very quickly, and there are various risks and costs of delay. This is a reason why the employer may be prepared to enter into contracts with labourers in the

in India, see Bardhan and Rudra (1986); for a discussion of how 'non-market' institutions for allocating labour such as the communal work party in Africa embody networks and clientage relations that mediate access to resources, reciprocity, and outside employment opportunities, see Kevane (1994).

[9] For examples of finer variations in the duration (and exclusiveness) of labour contracts in agriculture, see Bardhan and Rudra (1981).

season (even if they were to be paid a wage rate higher than their marginal product in that season) in exchange for a commitment to providing ready labour in the peak season as soon as the employer needs it. The residual labour need in the peak season is supplied by casual labourers involving a recruitment cost on the part of the employer. (For a simple model of this, see Bardhan 1984: ch. 5, sec. V.)

A second rationale for labour tying in agriculture, provided in Bardhan (1984: ch. 5), is in terms of insurance against wage fluctuations and implicit contract theory, taking labourers to be more risk-averse than employers. Suppose there is no work to be done in the lean season and the peak-season labour requirement per unit of output is given by a fixed coefficient β. Mean output level is given by F, while the actual yield is θF, where θ is a random factor (representing weather and other production uncertainties) with an expected value of unity. If the total labour requirement in the peak season, $\beta\theta F$, exceeds the amount of tied labour, L_t, hired in the lean season, the employer then enters the spot or casual market, hiring the additional labour at the uncertain wage rate $W(\theta)$ of that time. If the employer is risk-neutral and the labourers risk-averse, then optimal risk-sharing will imply a smoothing of worker consumption across seasons at a given consumption level $\bar{c}$, which is what the tied labourers get paid in each season. Ignoring across-season time discounting, the employer's expected profits are then given by

$$E\pi = F - 2\bar{c}L_t - \int_{z}^{\bar{z}} (\beta\theta F - L_t)\, W(\theta)\, f(\theta)\, d\theta, \tag{8}$$

where $z \equiv L_t/\beta F$, $\bar{z}$ is the maximum value taken by θ, and $f(\theta)$ is a density distribution of θ.

The first-order condition of maximizing (8) with respect to L_t gives demand for tied labour which in equilibrium is equal to supply. Casual labour exists in the model because 'labour-hoarding' is costly.

As in both of the rationales for labour-tying mentioned above, casual labour is a residual category with its extent depending on the state of labour demand in the peak season. Mukherjee and Ray (1995) modify this implicit contract model by introducing an incentive constraint which makes labour-tying optimal if and only if seasonal fluctuations in the labour market exceed a certain threshold. The smoothing of wage across seasons implies that in situations where the casual wage exceeds the tied wage the tied labourer may be tempted to breach the contract, which will then incur a punishment in terms of contract termination by the employer. If the worker can return to the tied labour market in the next season relatively unscarred by this incident, incentive compatibility requires that the employer offers a premium in the tied contract to discourage such reneging by the tied worker. This is costly to the employer, but in equilibrium this cost is balanced against the gain to the employer from the insurance

contract in the face of seasonal fluctuations. In equilibrium, there will always be an active casual labour market in this model.

A third kind of rationale for labour tying, again depending on seasonality, but now in terms of the efficiency theory of wages, is provided by Guha (1989). Suppose again there is no work in the lean season and there is also a one-period lag with which the nutrition–efficiency link that we have discussed in Section I works. So only in the peak season can the employer capture the higher productivity effect of paying an efficiency wage to the tied labourer in the lean season. This, of course, requires costly labour-hoarding on the part of the employer. Casual labourers need to be paid only in the peak season, and they have to survive the lean season scrounging in the village commons (where their income depends on the pressure of the casual working population on the commons for that season). The working efficiency of tied and casual labourers differs according to their different consumption histories in the lean season. The coexistence of tied and casual labour is thus brought about by a trade-off between the positive effects of tied contracts on productivity and the costly seasonal idleness of tied labour.

The three kinds of rationale for labour-tying in agriculture all refer to cases where tied and casual labourers differ in the duration of their labour contract but not in the tasks they carry out. Now let us refer to some cases where the rationale involves different tasks and functions. Take, for example, the model of Eswaran and Kotwal (1985). They also have a two-season model, but there is work of different kinds in the two periods. The work in the first period requires a lot of discretion and responsibility (e.g. in crop choice, water management, animal care) and is inherently difficult to monitor (although bad decisions and irresponsibilities in the first period become discernible by the end of the second period, i.e. at the completion of the crop cycle). The work in the second period involves more mechanical or repetitive work (like weeding, harvesting, or threshing) that is less difficult to monitor. Tied labour works for the employer in both periods, but casual labour is hired only for the second period. A tied labourer risks contract termination at the end of the second period if he or she has been lax in the first period. The threat is *real* if the tied labourer is rendered worse off by the contract termination; this will be the case if the tied labour contract includes an incentive premium over and above his or her opportunity income. (This is akin to the incentive compatibility constraint in shirking models in the efficiency theory of wages: the employer has to make sure that the discounted stream of expected utility of the shirker is not more than that of the honest worker.) The threat of termination is *credible* because the employer, with a relatively easy access to a pool of workers at the beginning of the crop cycle, is usually made no worse off. In fact, on account of the incentive premium (or what is sometimes called the informational rent in models of imperfect information) there will be an excess supply of workers in the tied labour market

will not succeed in bidding it away. The excess supply may be absorbed in the casual labour market, the analog of involuntary unemployment in the usual shirking model.

Another case of task differential between the two types of worker takes place when the employer finds it useful to mobilize the services of a small band of tied labourers in overseeing the work of the more numerous casual labourers working on the farm and reporting on cases of delinquency or rebelliousness. The two-tiered labour system with its policy of selective exclusion in one tier can be an effective divide-and-rule device on the part of the employer.

Once the equilibrium in these various models of labour-tying is described, some interesting comparative-static questions may be answered. For example, does agricultural development and commercialization tend to increase or decrease the incidence of tied labour? This depends on the interplay of a conflicting set of forces. If development is associated with tighter labour markets in the peak season (raising recruitment costs), with a larger interseasonal fluctuation in the spot wages, with a larger number of crops raised in the year (thus reducing seasonal underutilization of tied labour and the cost of labour-hoarding), and with an increase in the number of tasks that are more complex and require more responsible decision-taking on the part of the workers and are less monitorable on the part of the employer, then the models discussed above suggest an increase in the incidence of labour-tying. On the other hand, if it is associated with increased mobility and outside opportunity for workers (raising the necessary incentive premium for tied labour) and with a reduction in asymmetrized information regarding worker history (making worker default easier), or if technological progress is labour-saving, or if it is associated with greater access to financial markets (making it less necessary for the worker to use labour-tying contracts as a consumption-smoothing device), then development may reduce labour-tying in terms of those models. Also, the models above have assumed homogeneity of tied and casual labourers. If, as is usually the case, the employer also looks for some behavioural traits like docility in a tied labourer, with the increased opportunities for 'voice' as well as 'exit' that modernization may bring about, such traits may be less easily available (particularly since people act docile when they have no alternatives), lowering the incidence of labour-tying.

It should also be noted that in the discussion above we have assumed that the labourer voluntarily enters long-duration contracts with the employer and has the right to leave unconditionally at the end of the specified period. Historically, of course, agrarian labour-tying brings to mind the blatant cases of involuntary service by the tenant-serf to the lord of the manor (as in the classic cases of European feudalism), or of debt–paeonage to moneylender-landlord as observed in many parts of the world. These are clearly cases in which tying involves a continuing lack of freedom on the part of the labourer

and the sanctions underlying the employer's authority are based primarily on social or legal compulsion or what is sometimes called *extra-economic* coercion. Although circumstances obviously vary from country to country, it is probably correct to say that today in most parts of the world labour-tying in the sense of bonded and unfree labour is quantitatively not very important and/or is on the decline. Yet there are many cases where the current so-called voluntary long-duration contract is an evolution from older unfree arrangements and to this day may contain some lingering traces of degrees of unfreedom which are not openly or formally coercive but are socially embedded in the form of norm-guided context-specific rules of behaviour.

In the non-agricultural sector, the multi-tiered nature of the labour market is particularly salient in view of the 'closed shop' practices of unions, which sometimes create an island of privileged 'labour aristocracy', with job security and relatively high wages, in an ocean of unorganized, job-insecure, and low-paid workers. But, as Freeman (1992) points out, the empirical case of negative effects of unions and other 'distortions' in the labour market is rather weak, and the positive effects associated with collective bargaining in terms of higher productivity, lower labour turnover, workplace safety, and job training are not insignificant. Besides, as we noted at the end of the last section, the particularistic models of labour recruitment and internal promotion systems imply that a 'closed shop' often operates even without unions.

Another way in which the urban (non-manual) labour market gets splintered into non-competing groups is through the widespread practice in the dominant public sector, and also in some large private firms, of using minimum educational qualifications as a rationing criterion when there is an over-supply of job applicants.[10] Not only does this practice of 'education credentialism' block chances of upward mobility for workers with low education (but possibly high ability), but the latter also get 'bumped' or crowded out of their existing jobs as the employers respond to the excess supply by raising the minimum educational qualifications for those jobs when the salary levels are not flexible. Under these circumstances, if the uneducated have very few places to go, inequality may increase as a paradoxical result of educational expansion.

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[10] See the useful discussion on education and the labour market in Mazumdar (1989).

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