Development Microeconomics

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Preface

Tolstoy begins *Anna Karenina* with the famous sentence: 'All happy families are alike but an unhappy family is unhappy after its own fashion.' Perhaps that is also the case in the world of economic misery and well-being. The diversity of experience of the poor countries in the world is much wider and sharper than that of the rich countries. This is partly because the number of people and countries that are poor is much larger (and, socially, geographically, and institutionally, far more heterogeneous) than that of rich countries. Under these circumstances, to aim at capturing even the broad contours of this diversity of development experience in a short textbook is hopeless. To any generalization about this experience that such a textbook may venture to suggest, one can easily cite many counter-examples from different parts of the world.

In this textbook we do not even attempt any comprehensive or broad representation of the issues of development and underdevelopment. Our intention is to be selective and illustrative, to give examples of analytical thinking on some of the major issues. In the choice of issues, our focus is on those that are more relevant to the very poor countries (not so much to the middle-income developing countries, or even, in the latter countries, on issues that are more relevant to the poorest sections of their population). Hence, for example, our frequent emphasis on the rural and the more unorganized or informal sectors of the economy.

The issue of relevance should not, however, be interpreted in the sense of immediate applicability in matters of practical policy. Our treatment of problems in this book is largely theoretical (though not technically at a highly sophisticated level). We do not try to capture the variety of empirical experience in different parts of the world that have accumulated over the last few decades (and the many careful econometric estimates that are now available on the basis of the data collected). We occasionally refer to some empirical work, but more as an example to highlight the theoretical point that we happen to be making. Even in the theoretical treatment we are highly selective, not comprehensive. While in our choice of issues we have to keep analytical tractability and ease of exposition in mind, we like to think that we have not done theory for theory's sake, but have chosen problems that have some, at least faint, resonance in the more complex, real world. (With our own background of empirical work in some of the poorest parts of the world—South Asia for one author, sub-Saharan Africa for the other—we are painfully aware of the difficulty of

capturing the complexities of that real world.) In many chapters we briefly describe what we think are some of the major theoretical issues on a given problem, and then use a model or two to illustrate ways of deeper analytical probing, so that the student-readers get some experience of building models which they can then use to analyse other important problems in development. (We have presumed some familiarity with the tools and concepts of general microeconomic theory at the first-year graduate or the advanced undergraduate level.)

Lord Wavell entitled a book of poems *Other Men's Flowers*. In writing this textbook, we have essentially collected other men's and women's 'flowers', having freely borrowed their ideas and models; only the selection and the flower arrangement is ours. We express our general gratitude to all these authors (we attempt to refer to them individually in the chapters) for enriching the field of development economics and also to our respective students at Berkeley and Northwestern, the first visitors to our 'flower show', for encouraging us in this venture.

P.B.
C.U.

Contents

1
Introduction

I

In some sense, development economics used to be at the centre of all of economics. The classical economists of the seventeenth, eighteenth, and early nineteenth centuries were all development economists, as they were usually writing about a developing country (in many cases, Britain) going through a process of industrial transformation. Then, in the hundred years before the Second World War, development economics took the form primarily of protectionist arguments for industrialization in the rest of the world (List in Germany, Manoilescu in Eastern Europe, Ranade in India, and so on). In the third decade of this century it flourished briefly in the Soviet Union, dwelling on the problems of capital accumulation in a dual economy and of surplus mobilization from agriculture, and on the characteristics of the equilibrium of the family farm; the best products of this period—the dual economy model of Preobrazhenski (1926), the two-sector planning model of Feldman (1928), and the peasant economy model of Chayanov (1925)—came to be regarded as landmarks in the postwar literature when they were translated into English.

But it was only after 1940 that the subject of development economics really took off, beginning with the famous paper of Rosenstein-Rodan (1943) and the book by Mandelbaum (1945)—both, incidentally, written about the development problems of south-eastern Europe—and then with the works of Chenery, Hirschman, Kuznets, Lewis, Mahalanobis, Nurkse, Scitovsky, Sen, and others.[1] This, of course, coincided in some cases with the emergence of newly independent nation states under an anti-colonial leadership often suspicious of the historical impact of free markets and international trade and investment in their countries.

Much of this early postwar literature originated in a clear perception of the limited usefulness, in understanding underdevelopment, of orthodox

[1] For an introduction to this formative period of development economics as well as a retrospective view by some of the pioneers themselves, see Meier and Seers (1984).

economics, particularly in its standard Walrasian form with constant returns to scale, pure competition, perfect information, insignificant transaction costs and externalities, supposed institution neutrality, price-sensitive adjustments that unambiguously clear markets, and so on. Development thinking and practice on these lines sometimes led to iconoclastic excesses, for example in the form of indiscriminate state interventionism or autarkism; the failures and disasters of regulatory and autarkic states have now been widely documented. At the same time, the pillars of orthodox Walrasian economics have become much shakier today under the onslaught of a whole generation of mainstream economists, armed with their models of information asymmetry and strategic interaction of agents, imperfect and incomplete markets, dynamic externalities and increasing returns to scale, multiple equilibria and self-reinforcing mechanisms, models with which development economists of yesteryear would have been comfortable by and large, even though some of these were beyond their own model-making capacity.

Following thus on a respected tradition in development economics and recent advances in economic theory, we shall in some of the subsequent chapters explore issues of information-based market failures and fragmentation (particularly in factor markets), coordination failures and frequency-dependent equilibria (i.e. where the profitability of adopting a particular course depends on how many others are expected to do the same), and self-reinforcing mechanisms which govern the persistence of dysfunctional institutions so common in poor countries. In particular, we shall draw upon the pre-eminent breakthrough in economic theory that has taken the form of an explicit treatment of information in two ways: information in the sense of technical knowledge and human capital (this is germane to our discussion in Chapters 2, 10, 11, 12, and 14); and information in the sense of knowledge about the actions of others not being perfectly and freely available to everyone unlike in the standard model of perfect competition (this is prominent in Chapters 4, 6, 7, 8, and 9). Imperfect information underlies why markets operate (sometimes even fail to operate) in the way that they do and it generates coordination failures (this in different ways appears forcefully in Chapters 3, 13, 16, and 17).

At the same time, we have tried to avoid the preoccupation of the earlier development literature with blanket market failures and reflexive interventionism, and its serious underappreciation of the healthy disciplining effects of market rivalry (even when those markets work imperfectly), of the importance of price-guided allocative efficiency, and of limited government capacity and individual ingenuity in manipulating public programmes for private gain. We have also emphasized the dual relationship between equity and efficiency: while equitable policies in favour of the poor cannot be sustained for long if they seriously damage efficiency, there are also many cases where efficiency and equity go together, particularly when market failures (like those common in credit and

insurance markets) block the escape routes out of poverty, suggesting that the famous equity–efficiency trade-off that is at the heart of much of mainstream economics may at times be false or exaggerated. Similarly, while studying the operation of some markets we have tried to keep a clear view of the institutional underpinnings of the market mechanism, at the same time, we have not taken the institutions as exogenous and have often tried to understand their economic rationale.

II

While the various models in subsequent chapters will illustrate our approach to markets and institutions, in the rest of this chapter we will discuss some general methodological issues relating to the principle of maximization that we have presumed throughout in these models, a principle that most economists take for granted, but one that is regarded with a great deal of suspicion by many other social scientists, particularly when talking about poor countries. Maximization, even by peasant households in traditional agriculture, is a basic presumption in development microeconomics, whereas sociologists and social anthropologists often emphasize the overwhelming importance of structural and cultural constraints, leaving little scope for freedom of action or rational choice. The economist often answers this with reference to a stylized biological model of natural selection:[2] not everybody is a maximizer, but the competitive process will tend to weed out the non-maximizers, so that we may assume that economic agents behave as if they met the conditions of maximization. However, when competition is lacking, when markets are 'thin' or highly segmented or inadequately formed, non-maximizers (e.g. large landowners in haciendas wastefully using their land) can survive for a prolonged period. The plausibility of the assumption of maximization is thus not entirely independent of the market structure or even of the mode of production.

A large empirical literature has now accumulated confirming intimations of peasant rationality, particularly when one is careful to take into account the insurance motivation underlying the pervasive uncertainty in the physical and social environment. In this empirical literature rationality has often been interpreted in the very narrow sense of price responsiveness. But even when a farmer is not very sensitive to market prices, or where the markets themselves

[2] In a survey of the recent literature on evolutionary dynamics in game theory, with the focus on understanding the extent to which evolutionary arguments can substitute rationality-based arguments as a foundation for Nash equilibrium and other non-cooperative solution concepts, Banerjee and Weibull (1992) conclude that there is an intimate connection between the attractors of evolutionary processes and Nash equilibrium even in environments that are much more general than the simple setting of the standard biological model.

are inadequately formed, there may still be ample evidence of a coherent pattern in a peasant's behaviour which indicates an attempt, by and large, to improve his or her condition under the given constraints. Even patron–client relations, which are often cited as a mark of a traditional custom-bound social system or a 'moral economy', may be viewed as a form of rational response to a situation of desperate need of subsistence insurance and protection on the part of the client, and of ready availability of cheap labour services on the part of the patron.

At the same time, there is no denying the fact that individual behaviour is socially embedded and mediated by social relations; individual tastes and expectations (about others' behaviour) are socially conditioned. Social norms can act as a selection procedure in choosing among several equilibria that are common, particularly in strategic situations. Self-esteem as a major driving force in individual behaviour (as well as frequently observed other-regarding tastes, such as a sense of fairness or the urge for revenge) often follows certain culturally specific codes of honour. This social embeddedness, which is important everywhere, is particularly deep in traditional societies; when uncertainties of the physical environment are more acute, or community bonds and sanctions are easier to enforce, or the lack of understanding of natural or social causality is more pervasive in the general population, people more often look to social norms for guidance in their actions. While in the evolution of social norms functionality of a particular norm may give it staying power, many norms are not ultimately reducible to pragmatic calculations, as Elster (1989) has emphasized.

Then there are systematic cognitive errors and biases in judgement (particularly under uncertainty) that arise in individual decision-making, as the mounting experimental evidence of psychologists and economists attests—for a succinct survey of this literature, see Rabin (1998). One ubiquitous example in choice under uncertainty is provided by 'loss aversion': in a wide variety of domains, people are more averse to losses than they are attracted to same-size gains.[3] Some of these systematic errors can be accommodated with a bit of stretching within the framework of expected utility maximization, but there are many cases (for example when people are not fully adept at evaluating their own preferences, or when their wishes influence their beliefs) in which it is clearly misleading to conceptualize people as attempting to maximize stable, well-defined utility functions. In situations of extreme poverty and deprivation, one particular kind of ambiguity in individual interest perception is salient: the poor often internalize the severe constraints they face (and which their earlier generations faced), and this internalization may manifest itself in the form of fatalism, low aspirations, low perception of needs, high rate of time discount,

[3] For a review of this problem, see Kahneman *et al.* (1991).

and so on. As Sen (1984) reminds us, 'many of the inequities of the world survive by making allies out of the deprived and the abused'.

In view of the empirical anomalies and the internal contradictions[4] of the model of the hyper-rational economic man, many economists follow Simon (1957) in assuming bounded rationality with full recognition of the costs of observation, communication, and computation. Others go beyond this and admit that economic agents' behaviour is sometimes difficult or impossible to rationalize in terms of any well-defined deductive model; they fall back upon inductive means of reasoning and learning.[5] People are supposed to have working hypotheses about the problems they are dealing with, and it is assumed that in their learning process they constantly update and adapt. Whether this process ultimately converges to rationality depends, even in the favourable case of the same situation repeated sufficiently often, on the characteristics of the decision problem or the game.

Keeping all this in mind, our adherence to the principle of maximization in the models of the subsequent chapters should be regarded more as a crude heuristic device than as a definitive statement on human behavioural regularity. In view of the considerable ingenuity that even the poor peasant in a traditional society often shows in responding to material incentives, the presumption of rationality may not be a bad working hypothesis or a benchmark to start with, even if one eventually finds it to be violated in many particular cases. As Elster (1979) comments, 'This presumption is a "principle of charity" similar to the one often used in textual interpretation. One should never take textual contradictions at their face value, but [should] consider whether the context might not give a clue to consistency. Similarly, one should always look very closely at apparently irrational behaviour to see whether there could not be some pattern there after all.' Development economics is full of examples of how apparently irrational behaviour may be successfully explained as an outcome of more complex exercises in rationality, particularly with deeper probes into the nature of the feasibility constraints or the preference patterns.

Similarly, our attempt in subsequent chapters to trace the microfoundations of development analysis in postulates of individual behaviour, i.e. our approach of what is called methodological individualism, should not be interpreted as a way to undervalue the substantive role of social interaction in influencing individual behaviour or in determining the rules of the game that individuals play. In giving explanatory priority to individuals, ours is, of course, a departure from some traditional theories of history or society which rely heavily on disembodied actors or collectivities (e.g. classes, kinship, or ethnic groups) rather than on actual persons. A class or a tribe or a caste does not act by itself, but

[4] In games with dynamic structure, the very notion of rationality becomes problematic and common knowledge of rationality may even lead to logical contradictions: see e.g. Binmore (1987).

[5] See e.g. Arthur (1994).

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 $r \neq 0$. 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.

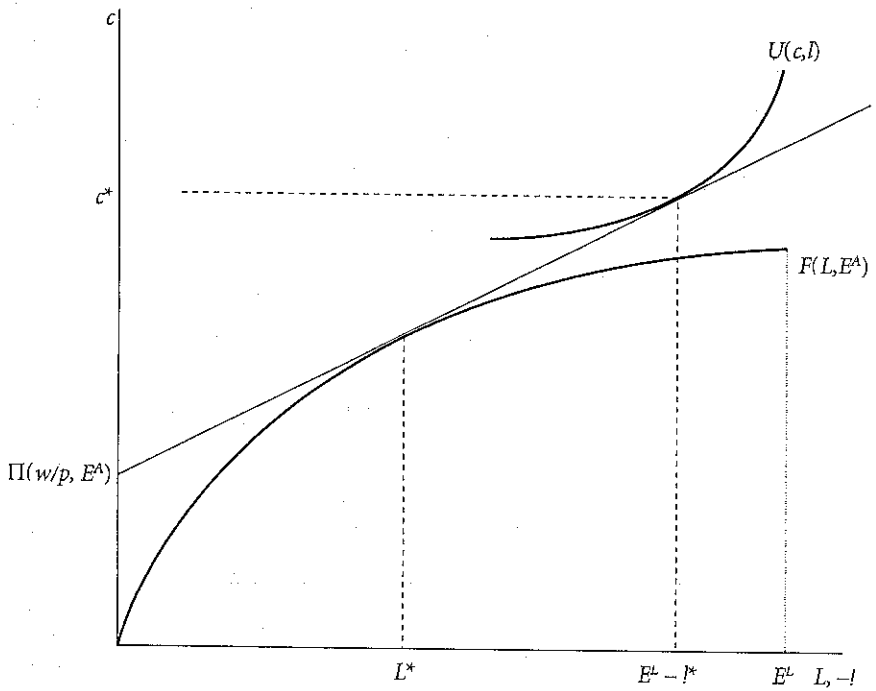

Figure 2.1

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:

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

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

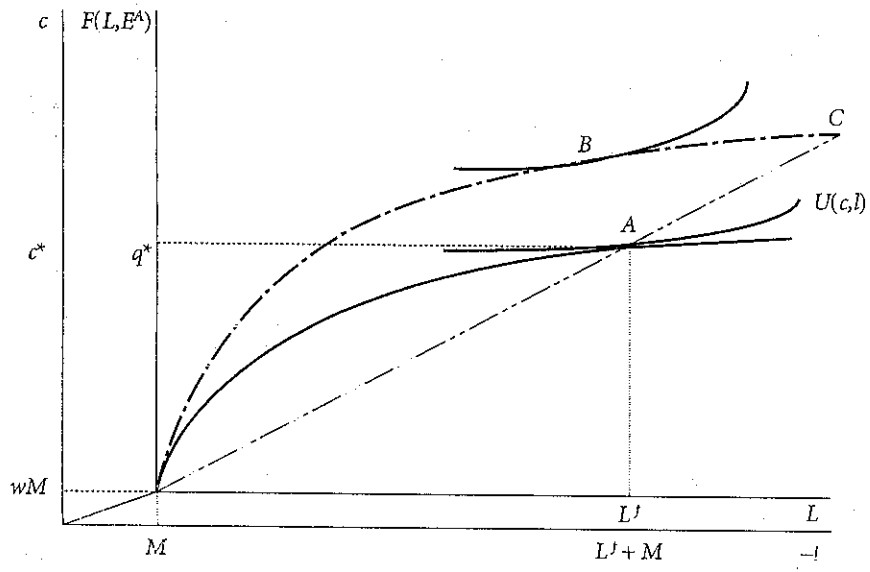

Figure 2.2

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

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

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

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

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

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

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 $f'\mathrm{cov}(U', \theta) = (w - f')EU'$. Consumption increases with θ, so $\mathrm{cov}(U', \theta) < 0$; 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

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

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

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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