

Isaac Newton Institute for Mathematical Sciences

A Course of Three Sessions on

Reasoning via Formal Models in Economics

Theme 3: Normative vs. Positive Models

Lecture 1: Malnutrition and Poverty Traps

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May 13, 2015

Readings:

Dasgupta, P. and D. Ray (1986), "Inequality as a Determinant of Malnutrition and Unemployment, 1: Theory," *Economic Journal*, 96(4), 1011-1034.

Dasgupta, P. (1993), *An Inquiry into Well-Being and Destitution* (Oxford: Clarendon Press).

Dasgupta, P. (2013), "Personal Histories and Poverty Traps," in C. Sepulveda, A. Harrison, and J.Y. Lin, eds., *Development Challenges in a Postcrisis World: Annual World Bank Conference on Development Economics, 2011* (Washington DC: World Bank).

Facts and values are commonly thought to be distinct. David Hume famously argued that one cannot derive an "ought" from an "is". Perhaps influenced by him, economists have traditionally distinguished the "positive" from the "normative" aspects of their subject. Forecasting the effects on household decisions of an increase in the rate of income taxes on people earning more than £50,000 a year involves a different sort of exercise from finding reasons why income inequality is a bad thing. Or so we economists say.

And yet, as the philosopher Hilary Putnam has argued over the years, facts and values can get entangled. (I am giving a weakened version of Putnam's position: he is uncompromising in his belief that they can't ever be separated.)

Example: Suppose someone says to you Mr. X is a cruel man. She would simultaneously be *describing* (your immediate thought would be that X probably beats his dog and mistreats his spouse) and *evaluating* (your immediate assessment would be that X is a bad man).

"Undernutrition" (as reflected in stunting and wasting), "inequality", and "unemployment" would seem to possess the same characteristic: facts and values are entangled in them. The phenomenon of undernourishment belongs would seem to belong simultaneously to positive and normative economics.

A similar ambiguity arises in analyses that try to determine whether people can be "trapped in poverty".

In studying the phenomenon of undernourishment we will focus on energy deficiency. But the analysis covers all forms of nutrition deficiencies.

Example of short run consequences of undernourishment: wasting (low BMI), listlessness.

Example of long term consequences of childhood undernourishment: stunting, retarded brain growth and development.

There is a circularity in the processes that shape a person's life: you need nutrition to be able to provide work (labour power), but in order to obtain that nutrition in a market economy, you need to work so as to earn a wage. In *equilibrium* people provide the labour power necessary for them to earn the wages that enable them to provide the labour power necessary for them to earn the wages that

Do market environments possess equilibria in which people don't suffer from undernourishment?

Deterministic Model of Energy Balance (adults)

t : time (continuous)

$S(t)$: index of nutritional status (stores of energy: adipose tissues (crudely, BMI))

S^* : nutritional status of someone at point of collapse (BMI = 13 or under)

$I(t)$: energy intake

I^* : resting metabolic rate (about 20-25% of which is expended in brain activity) - assumed constant for simplicity

$E(t)$: discretionary expenditure

Dynamics:

$$dS(t)/dt = I(t) - (I^* + E(t)), \quad S(t) \geq S^* \quad (1)$$

NB: Note the similarity of this to the dynamical systems we studied last week in connection with reproducible and natural capital. Here we are studying health. Equation (1) pertains to one aspect of human capital.

For tractability we study:

Stationary point:

$$I = I^* + E. \quad (2)$$

Suppose all E is directed at providing wage labour. If x is the number tasks the performs accomplishes at work,

$$x = \lambda(I), \quad I \geq 0 \quad (4a)$$

$$\lambda(I) = 0, \quad I \leq I^* \quad (4b)$$

$$d\lambda/dI > 0, \quad d^2\lambda/dI^2 < 0, \quad I > I^*. \quad (4c)$$

Figure 1 depicts $\lambda(I)$ in equation (4a-c).

I^* is a fixed cost. This has implications for the way poverty and inequality are interconnected:

(i) Two people are marooned in a boat on the high seas. There is food enough for only one person. Equal sharing means neither will survive. Efficient response: toss a fair coin to decide who gets to eat. There is ex ante equality but ex post inequality.

(ii) Poor household. Equal sharing means putting the entire family to the risk of extinction. Unequal sharing (favouring those members who are more likely to emerge out of the scarcity) ensures survival of at least one member.

Moral: Poverty can be a reason for inequality in the allocation of resources.

Does this insight translate to market allocations? To study the question we should consider a model in which a large number of people have no other asset than their potential labour power. For a complete model we need another factor of production, say, land. In this lecture we assume it is fixed in quality.

Aggregate output in the economy is:

$$Y = AF(X), \tag{5}$$

where $A > 0$, and X is total number of tasks supplied. $dF(X)/dX > 0$ and $d^2F/dX^2 < 0$.

A is a scale factor that measures the productivity of the remaining factors of production (e.g. land).

A Timeless Model

Let \bar{I} be the solution of

$$d\lambda(I)/dI = \lambda(I)/I. \quad (6)$$

(Fig. 1)

\bar{I} is known as *efficiency wage*.

Key assumption:

A person's reservation wage is less than \bar{I} . Should a person not find employment, he lives off the commons or in the informal market.

In studying a set of markets for labour, it transpires that we may as well assume there is a single employer. Let N^* be the size of the economy wide labour force. Suppose the employer hires N workers at wage I . Then, using equation (4a),

$$X = Nx = N\lambda(I). \tag{7}$$

The employer's profit is

$$\pi = AF(N\lambda(I)) - NI. \tag{8}$$

Case 1 (small A): Maximizing (8) with respect to N and I , subject to the constraint $N \leq N^*$, yields the conditions that,

$$I = \bar{I}, \tag{9a}$$

and

$$AF(X)/dX = \bar{I}/\lambda(\bar{I}). \tag{9b}$$

Using equation (7) in equation (9b) yields:

$$\lambda(I)/I = d\lambda(I)/dI. \tag{10}$$

(Figure 1)

Equations (7) and (9a-b) are three in number and there are three unknowns (N, X, I). Equilibrium N is less than N^* . There is rationing in the labour market. Market equilibrium violates a horizontal equality (identical people are treated differently by the market).

Case 2 (large A)

Equilibrium:

$$(i) N = N^* \tag{11a}$$

$$(ii) X = N^*\lambda(I) \tag{11b}$$

$$(iii) AdF(X)/dX = 1/d\lambda(I)/dI. \tag{11c}$$

There is (i) full employment, (ii) horizontal equity, and (iii) workers enjoy a wage that exceeds their efficiency wage.

Case 2 is the one that is implicitly invoked by market fundamentalists.

Extensions

1. Two groups of workers, of size N^* and N^{**} , respectively. The latter group enjoys unearned income, say, W . Then, if wage is I , the latter group's productivity is $\lambda(W+I)$. Efficiency wage is lower. The latter group outbids the former group for employment.

2. Redistribution from rich to poor, suitably chosen, raises employment and output.

3. Figure 2 suggests what can happen over time. Slight initial differences among people get magnified over time. The differences can be traced back to nutritional differences in early childhood, to experiences in the womb, back to maternal experiences even before conception. Personal history matters.

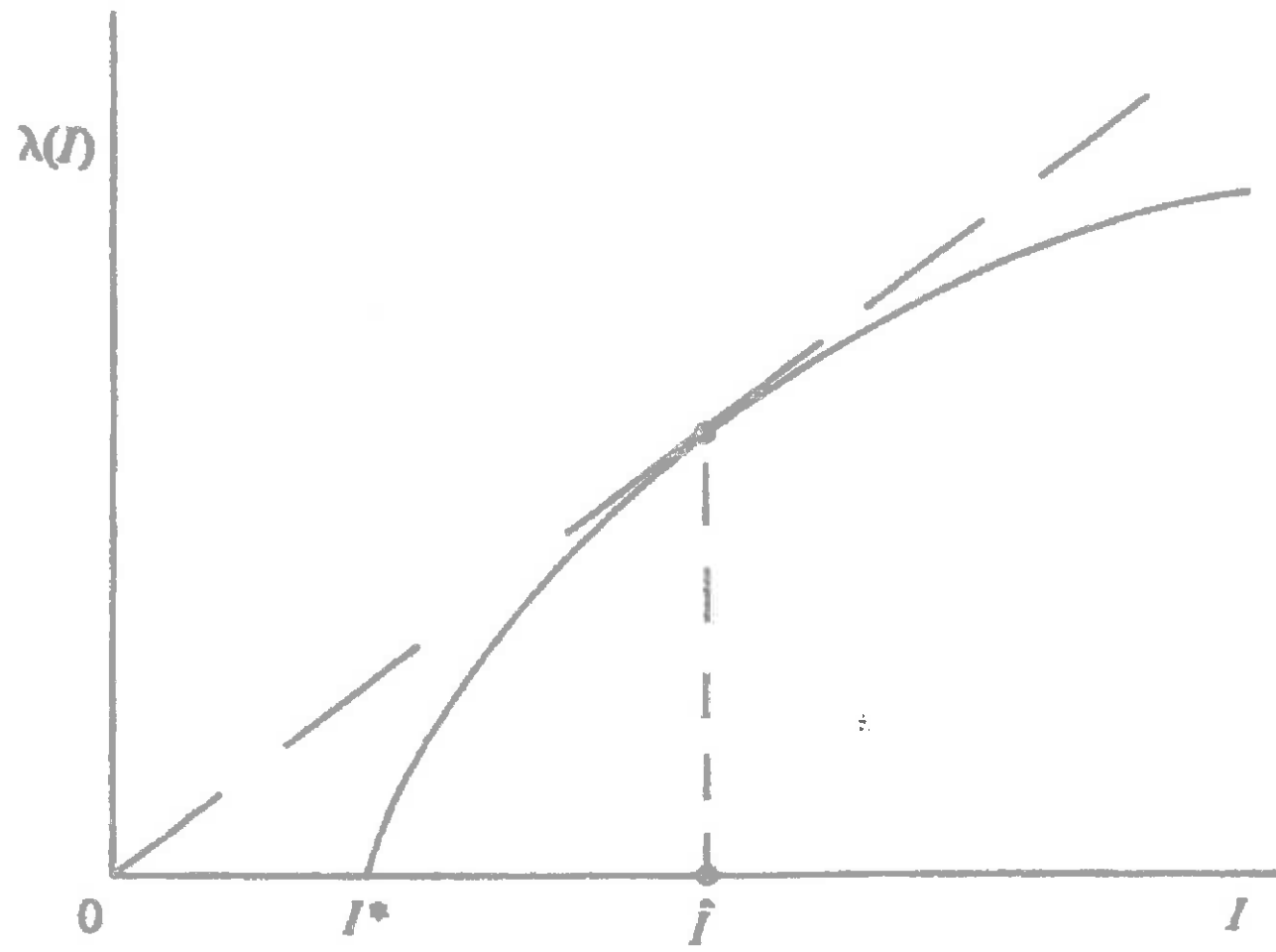


Figure 1

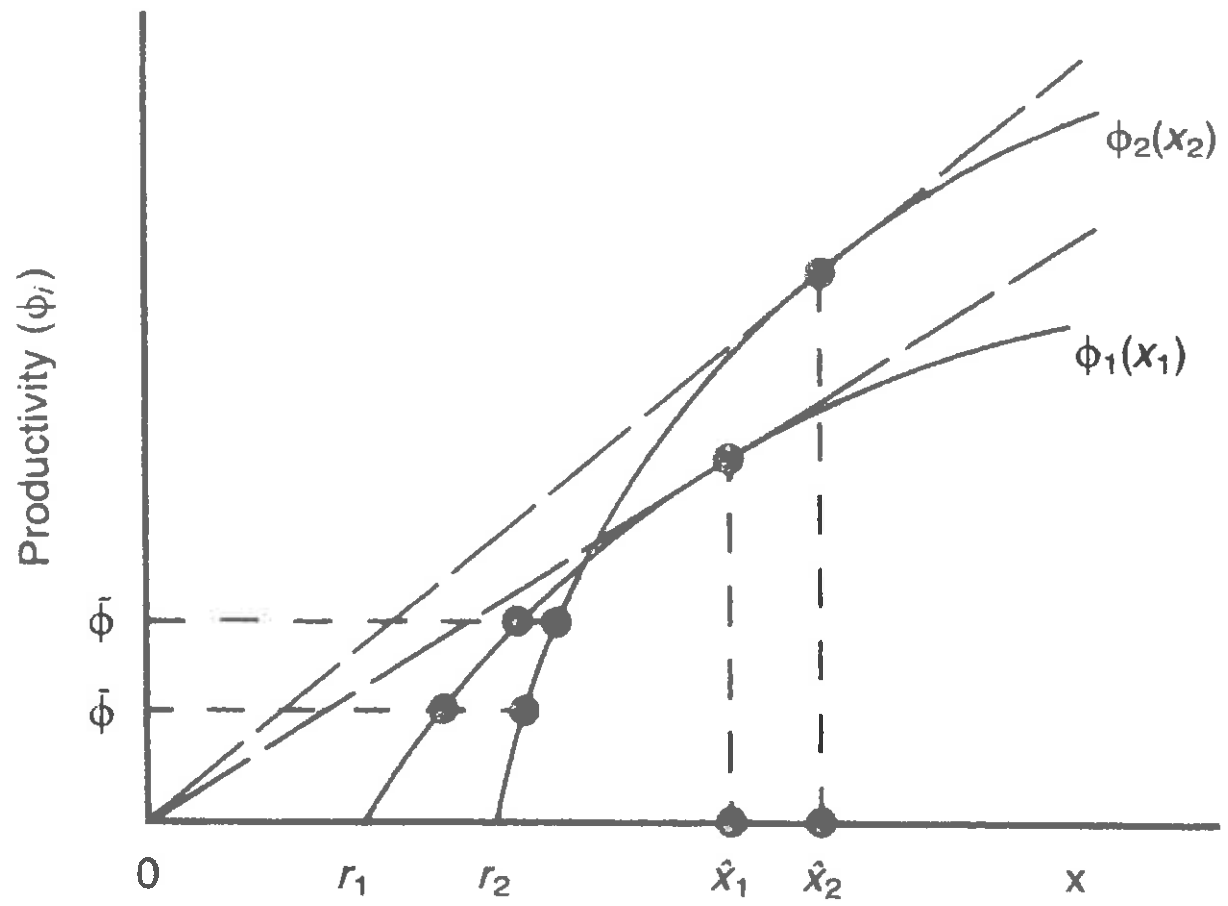


Fig. 15.1² Nutrition productivity curve as a function of nutritional status

"But it was only in the last generation that a careful study was begun to be made of the effects that high wages have in increasing the efficiency not only of those who receive them, but also of their children and grandchildren ... the application of the comparative method of study to the industrial problems of different countries of the old and new worlds is forcing constantly more and more attention to the fact that highly paid labour is generally efficient and therefore not dear labour; a fact which, though it is more full of hope for the future of the human race than any other that is known to us, will be found to exercise a very complicating influence on the theory of distribution."

Alfred Marshall: *The Principles of Economics* (London: Macmillan, 1920, p. 510)