14.74

Lecture 3: Is there a nutrition based poverty trap (lecture 1)

Prof. Esther Duflo

February 2011

Is there a nutrition based poverty trap?

Let's use the capacity curve to build a very simple model of poverty trap.

Assume a worker eats in the morning, work all day, and is paid a piece wage v at night. The next morning he wakes up and eats again.

incometoday = v $*$ workcapacity = $v * \phi$(income) = $f(g$(incomeyesterday)) where:

- nutrition=g(income)
- income=v*productivity=f(nutrition)

This creates a relationship between income today, and income tomorrow.

Using this relationship, we can follow the following of his income over time: from y_0, we go to y_1 on the curve, and then horizontally to the diagonal.

Why?

See the three possible situation in pictures (pictures 1, 2, and 3). There is a poverty trap in case 1, but not 2 or 3.

In order to have a proverty trap, the capacity curve which links today's income to tomorrow income must intersect the 45 degree line from below.

This is also the key condition to see a poverty trap emerge in the Das Gupta and Ray model.

When will we be in a situation where the capacity curve intersect the 45 degree line from below?

A poverty trap will emerge if $f'g' > 1$. Let's denote income by y and do some algebra:

$$f'g' = gf' * \frac{g'}{g} = \frac{f'}{f}g * \frac{g'}{g}y * \frac{f}{y} \tag{1}$$

The expressions $\frac{f'}{f}g$ and $\frac{g'}{g}y$ are called"elasticities".

Definition of an elasticity of Y with respect to E. When E changes by 1%, Y changes by η %.

$$\eta = \frac{\frac{\partial C}{\partial E}}{\frac{C}{E}}$$

Elasticity is an important concept because it is unit-free: you do not need to know in what unit expenditures and calories are measured. It is much easier to make comparisons across countries and samples.

On the 45 degree line, $f = y$. Expression 1 tells us that there can be a nutrition-based poverty trap *only* if the product of the elasticities of the income-nutrition and nutrition-productivity relationships is greater than 1. It gives us two clear empirical facts to look for:

-
-

1 The relationship between income and nutrition

We seek to estimate the elasticity of calories (or other nutrients) consumed with respect to total resources available.

Several things to keep in mind:

1.
2.
3.

1.1 Endogeneneity Issues

We know that calories (or other nutrients) consumed may lead to more resources (through the effect of nutrition on productivity). When we observe the relationship between nutrition and resources, we may be picking this up as well.

For now, we will ignore this issue (because the literature has not dealt with it) but we should keep it in the back of our mind

1.2 Functional Form Issues

We know that the elasticity is unlikely to be the same everywhere: in fact, this is the basis for the poverty trap.
We want to estimate:

$$\ln(\text{Calories per capita}) = g(\ln(\text{Expenditures per capita})) + \epsilon$$

$$y = g(x) + \epsilon$$

And we want to be agnostic on the shape of $g(.)$
Two questions:

- Why do we run the relationship in logs?
- Once we have estimated this function $g(.)$, where can we read the elasticity? (hint: think of a log-log regression)

To estimate this relationship, we use a *non-parametric method*: we are looking for the $g(.)$ that follows as closely as possible true shape of the function, while not being driven by the cloud of point: there is a trade off between bias and variance.
Three possible methods:

- Approximate the $g()$ with a series of polynomial, and run a familiar linear regression.
- Chose a grid of point for x (x_1, x_2, ...) and at each of point x_k, compute a weighted average of y, giving more weight to the points that are closer to x_k: kernel regression.
- Same method, but at each point x_k, run a weighed regression, and take the predicted value: local linear regression $y = \alpha x + \epsilon$. Advantage: since we run a regression, we can immediately read the local elasticity at x_k: it is α!

1.3 Measurement issues

• Measurement of the calories

- Can we observe the calories directly?

- How can we infer them?
- When you become richer, do you spend more or less per calorie?
- What does it do to our estimate of the reltionship between calorie and expenditure if we are not careful to correct for the price of calories?

1.4 The nutrition-income relationship in India

Deaton and Subramanian: Maharastra, India

- The relationship between expenditure and calories
  - Figure 2: More expenditures → better nutrition.
  - Figure 3: Elasticity: derivative of the curve in figure 2. It is declining with expenditures (the curve is concave), but not very fast.
- The relationship between quality and expenditures
  - An indicator of quality: price paid per calorie.
  - Figure 4: Log of price per calorie increases with expenditures.
  - Figure 5: Elasticity is fairly constant with expenditures.

• Parametric results
The regression is:

$$\ln(\text{Calories per capita}) = \alpha \ln(\text{Expenditures per capita})) + X\beta + \epsilon$$

What do they find for α? What is the standard error of α? What is the confidence interval of α?

1.5 More puzzles

Look at table 1: What are people buying for calories, even the very poorest? Could they consume more calories within the same budget?

Dreze and Deaton: The evolution of the income-calories relationship in India over time.
See the pictures.

- What do you observe?
- Isn't that puzzling?? What are your explanations?
  - –
  - –

Jensen and Miller: Giffen goods in China.

Jensen and Miller conducted an experiment in China. They gave to very poor households (randomly selected) discount vouchers for a reduction in the price of the staple goods (rice in Hunan, and wheat in Gansu). They made sure that the vouchers could not be re-sold and they were indeed used by the people who received them.

14.01 reminder: What are the two effects when the price of a good drops:

-
-

What is :

- A normal good?
- An inferior good?
- A Giffen good?

Let's look at table 4, Hunan: What type of good is rice in Hunan? The regression run is the change in rice consumption between period 1 and 2 (before and after the subsidy) regressed on the change in price experienced by the household (thanks to the voucher) between period 1 and 2.

$$\%\Delta staple = \alpha + \beta \%\Delta p_{i,t} + X\beta + \epsilon_{it}$$

what is β. What is the standard error of β. Can we sign β?

Let's look at table 2, Hunan: Are people hungry for extra calories?

2 Conclusion

The poor do not seem very hungry for extra calories. A priori, it should already make us a bit suspicious that they can be a poverty trap based on (adult) nutrition: if they could step outside of the poverty trap just by eating more, they would.