Lecture 5: Is there a nutrition-based poverty trap?

Abhijit V. Banerjee and Esther Duflo

14.73 Challenges of World Poverty
While famine may be history, malnutrition is not.
The UN agency FAO estimates that, worldwide a billion people are under-nourished.
Symptoms of malnutrition: anemia, low BMI (body mass index), small and thin children.
Large increase in food prices in 2006-2008, and again in 2010. Two consequences on those of the poor who are net consumer of food (i.e. they produce less than they consume, e.g. urban poor).
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Because a larger portion of their budget is spent on food, this will affects them disproportionately (the real price of their total food basket has increased more).

Price increase may lead to a decrease in the nutritional status of the poor and start a vicious circle: Pak Solhin’s story
The S-Shape curve and the nutrition-based poverty trap: reminder

- With your wage, you buy food, which gives you strength, which allows you to get wages: it creates a relationship between income today, and income tomorrow (or with wage level, and the ability of the poorest people to work: at the extremely only those who have some non-labor income and can supplement their daily wage will be able to work).

- Necessary condition for a poverty trap: the capacity curve intersects the 45 degree line from below at some point.

- The S-shape is made of two relations:
  - The relationship between wage and nutrition (how much better do you eat if you have a little more income)
  - And the relationship between nutrition and productivity (how much stronger to do you become if you have a bit more to eat).
If there was a S-Shape curve between nutrition and productivity, the poor should eat as much as they can:

- The share of food in the budget would be very high for them.
- If you have some unavoidable expense, expenditure on food would first increase more than proportionally, and then less than proportionally.

- budget: 20 rupees—5 rupees on clothing and house, 15 rupees on food
- budget: 30 rupees—5 rupees on clothing and house, 25 rupees on food
- budget: 45 rupees—10 rupees on clothing on house, 30 rupees on food, 10 rupees on movies
Do the poor eat as much as they can?

- The Food share in the budget around the world:
- While the share of food in the budget is fairly high, the poor have two margins to increase their consumption: they could spend more on food (see the share spent on other things, e.g. alcohol, tobacco, etc.) or they could spend the budget they spend on food differently.
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We do this by getting detailed information from people about food consumed last month (or last week) and using a calorie conversion table to estimate how much calories that represents.
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- So are calories increasing very rapidly with income for the very poor?

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Calorie consumption and economic well being

- The graph plots the logarithm of calorie consumption against the logarithm of total household expenses per capital (outlay).

- The slope of this graph is about 0.35.

- Interpreting this graph: when total expenditure per capita increase by 1%, the consumption of calories increase by 0.35%.
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- The calories consumed increase with overall consumption: however, not 1 for 1: when total expenditure increase by 10%, the consumption of calories increases by about 3.5%. The *Engel Curve*.
Why is the slope of the Engel curve less than 1?

- What happens:
  
  When they get a little more money, people increase the share of the budget going to other things: elasticity of overall food expenditure is 0.7.

  When they spend more on food, they also buy more expensive calories (meat instead of cereals; rice instead of coarse cereals: the elasticity is price per calorie is also about 0.35.

  In summary: a poor household who is 10% richer spends about 7% more on food, and this extra spending is shared in half: half to get more calories, half to get more expensive (better tasting) calories.

  Even among very poor people, increase in economic well-being has a positive, but not huge impact on calories consumed.
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What is a Giffen good?

- A good whose consumption decreases when the price decreases.

Two effects when the price of a good decreases:

- An substitution effect: you want to consume more of this good because it has become less expensive than other goods.
- An income effect:
  - Normal good: The income effect is positive (you consume more as income goes up)
  - Inferior good: The income effect is negative (you consume less as income goes up)

In most cases, even for inferior goods the substitution effect will dominate, because most goods are only a small part of the budget.

But for a staple food that constitutes a large part of the budget, a decrease in the price may have a large income effect: A giffen good is when the (negative) income effect is larger than the (positive) substitution effect.
Jensen and Miller: In search of a Giffen good

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How to uncover a Giffen good?

First strategy: observe that, in China, in cities where the price of rice is higher, people consume more rice.

Why did they conclude that this was not proof that rice was a Giffen good?

Second strategy: conduct a randomized experiment:

1. Take a sample of households, and randomly choose a subsample of them.
2. Distribute vouchers for reduced price of rice in Hunan, reduced price of wheat in Gangsu to the random subsample, for more than a month's supply.
3. Make sure that households do not exchange or trade them (otherwise it would be a pure income transfer, there would be no substitution).
4. After 6 months, ask households detailed questions about their consumption of rice, wheat, and other stuff.
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- What explanation do they give for the different results?
Implications for nutrition

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- What does this tell us about the effect income on calorie consumption in this population?
- It must be *negative*. 
Are the calorie Engel Curve overestimated?

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  - Those who eat more may be more productive and have more money (reverse causality)
  - Those who have more income may be have different tastes, and would may be eat more even if they were poorer (for example, people who smoke may both eat less and earn less).
The Engel Curve over time

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- What could be happening?
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- Over time, in India, need for calories have gone down: less “backbreaking work”, fewer illnesses.
- Households in China where poor urban households.
Does eating more make people more productive?

- A study by John Strauss: impact of calories on productivity in Sierra Leone (results do not come from an experiment, but Strauss used the fact that people eat less when the price of food goes up).

- Result: Calories makes people more productive, but it looks like an inverted L-shape curve: it is highest for the poorest: when their calorie consumption increase by 1%, their productivity increase by 0.4%, and after that it goes down.
Conclusion

- Poor people do not behave as if there were a nutrition based poverty trap
- They do not consume as much calories as they could, and when their income goes up, they don’t seem to eat that much more.
- Indeed, it seems that the benefit to consuming more calories may be positive, but perhaps not large to generate a S-Shape, especially for people who work for a wage.
- In Summary, at the maximum: when your income today increase by 10%, you calorie consumption increases by 3.5%, and that leads to an increase in productivity (and hence income tomorrow) of 3.5*0.4=1.4%: positive, but not steep enough for a poverty trap!
- However, other micronutrients may generate a poverty trap
- Things may also be very different for children
What do the poor spend their money on?

<table>
<thead>
<tr>
<th>Country</th>
<th>Food</th>
<th>Alcohol/</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living on less than $1 a day Rural</td>
<td></td>
<td>Tobacco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>64.4%</td>
<td>2.7%</td>
<td>5.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Guatemala</td>
<td>65.9%</td>
<td>0.4%</td>
<td>0.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td>India - Udaipur</td>
<td>56.0%</td>
<td>5.0%</td>
<td>1.6%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>66.1%</td>
<td>6.0%</td>
<td>6.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>49.6%</td>
<td>8.1%</td>
<td>6.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>57.3%</td>
<td>0.1%</td>
<td>2.3%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>67.3%</td>
<td>3.1%</td>
<td>3.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Panama</td>
<td>67.8%</td>
<td>2.5%</td>
<td>4.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>78.2%</td>
<td>4.1%</td>
<td>1.8%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Peru</td>
<td>71.8%</td>
<td>1.0%</td>
<td>1.9%</td>
<td>0.4%</td>
</tr>
<tr>
<td>South Africa</td>
<td>71.5%</td>
<td>2.5%</td>
<td>0.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Timor Leste</td>
<td>76.5%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Calorie and Total expenditure per capita

![Graph showing regression function for log calories and log per capita expenditure in Maharashtra, India, 1983.](image)

**Fig. 2.**—Regression function for log calories and log per capita expenditure, Maharashtra, India, 1983.
Calorie and Total expenditure per capita

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### Deaton and Subramanian, Table 1

<table>
<thead>
<tr>
<th></th>
<th>Expenditure Shares (%)</th>
<th>Calorie Shares (%)</th>
<th>Price per Calorie (Rupees per 1,000 Calories)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (1)</td>
<td>Bottom 10% (2)</td>
<td>Top 10% (3)</td>
</tr>
<tr>
<td></td>
<td>Mean (4)</td>
<td>Bottom 10% (5)</td>
<td>Top 10% (6)</td>
</tr>
<tr>
<td></td>
<td>Mean (7)</td>
<td>Bottom 10% (8)</td>
<td>Top 10% (9)</td>
</tr>
<tr>
<td><strong>A. Food Groups</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td>40.7</td>
<td>46.0</td>
<td>31.0</td>
</tr>
<tr>
<td>Pulses</td>
<td>8.9</td>
<td>10.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Dairy</td>
<td>8.1</td>
<td>4.9</td>
<td>11.8</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>9.0</td>
<td>9.2</td>
<td>9.2</td>
</tr>
<tr>
<td>Meat</td>
<td>5.1</td>
<td>3.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>10.5</td>
<td>8.5</td>
<td>12.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>6.5</td>
<td>7.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Other food</td>
<td>11.3</td>
<td>10.4</td>
<td>16.1</td>
</tr>
<tr>
<td><strong>B. Cereals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>11.6</td>
<td>9.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Wheat</td>
<td>5.6</td>
<td>3.8</td>
<td>7.9</td>
</tr>
<tr>
<td>Jowar</td>
<td>18.2</td>
<td>27.4</td>
<td>9.3</td>
</tr>
<tr>
<td>Bajra</td>
<td>3.0</td>
<td>2.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Other coarse cereal</td>
<td>1.2</td>
<td>2.8</td>
<td>.3</td>
</tr>
<tr>
<td>Cereal substitutes</td>
<td>1.1</td>
<td>.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Total food (or total calories)</td>
<td>67.4</td>
<td>73.4</td>
<td>54.1</td>
</tr>
</tbody>
</table>

**Note:** Mean refers to mean over the whole sample, bottom 10% to mean over households in the bottom decile of per capita household expenditure, and top 10% to mean over households in the top decile of per capita household expenditure. The figures in the last row of panel B are unadjusted and adjusted total calories, respectively, where the adjustment corrects for meals given to others or not received from others; see the text for a full description. Shares of calories and of expenditures are calculated on an individual household basis and are averaged over all appropriate households. Calorie prices are averages over consuming households.
How the food budget changes with wellbeing

![Graph showing the relationship between log of per capita outlay and log of price per calorie.](image)

**Fig. 4.** Log of price per calorie and log of per capita expenditure, Maharashtra, India, 1983.
### Elasticity of consumption of various items with respect to price subsidy: Hunan

#### Table 4. Consumption Response to the Price Subsidy

<table>
<thead>
<tr>
<th></th>
<th>Rice</th>
<th>Other Cereal</th>
<th>Fruit &amp; Veg</th>
<th>Meat</th>
<th>Seafood</th>
<th>Pulses</th>
<th>Dairy</th>
<th>Fats</th>
<th>Food Out</th>
<th>Non-Food</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>%Subsidy(rice)</strong></td>
<td>-0.235***</td>
<td>0.397</td>
<td>-0.623***</td>
<td>0.377</td>
<td>0.482**</td>
<td>-0.791*</td>
<td>-0.054</td>
<td>-0.567*</td>
<td>0.117</td>
<td>0.200</td>
</tr>
<tr>
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<td>-0.001</td>
<td>0.058***</td>
<td>0.002</td>
<td>0.036</td>
<td>-0.052</td>
<td>-0.006</td>
<td>0.022</td>
<td>0.059</td>
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<td>(0.021)</td>
<td>(0.043)</td>
<td>(0.022)</td>
<td>(0.050)</td>
<td>(0.004)</td>
<td>(0.031)</td>
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<td><strong>%ΔUnearned</strong></td>
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<td>-0.018</td>
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<td>-0.004</td>
<td>-0.037</td>
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<td>0.63***</td>
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<td>0.06</td>
<td>0.11</td>
<td>0.07</td>
<td>0.02</td>
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<td>0.02</td>
<td>0.09</td>
<td>0.02</td>
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Notes: Regressions include county*time fixed-effects. The dependent variables are the arc percent change in household consumption of the good listed at the top of the column. Standard errors clustered at the household level. %Subsidy(rice/wheat) is the rice or wheat price subsidy, measured as a percentage of the average price. %ΔEarned is the arc percent change in the household earnings from work; %ΔUnearned is the arc percent change in the household income from unearned sources (government payments, pensions, remittances, rent and interest from assets); %ΔPeople is the arc percent change in the number of people living in the household. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.
Elasticity of consumption of various items with respect to price subsidy: Gansu

<table>
<thead>
<tr>
<th></th>
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<th>Fruit &amp; Veg</th>
<th>Meat</th>
<th>Seafood</th>
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<th>Fats</th>
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<td>0.085*</td>
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<td>-0.025</td>
<td>0.091***</td>
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<td>(0.091)</td>
<td>(0.097)</td>
<td>(0.070)</td>
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<tr>
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<td>0.52*</td>
<td>1.01***</td>
<td>-0.10</td>
<td>-0.01</td>
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<td>(2.8)</td>
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Notes: Regressions include county*time fixed-effects. The dependent variables are the arc percent change in household consumption of the good listed at the top of the column. Standard errors clustered at the household level. %Subsidy(rice/wheat) is the rice or wheat price subsidy, measured as a percentage of the average price. %ΔEarned is the arc percent change in the household earnings from work; %ΔUnearned is the arc percent change in the household income from unearned sources (government payments, pensions, remittances, rent and interest from assets); %ΔPeople is the arc percent change in the number of people living in the household. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.
Table 2. Calorie Response to the Price Subsidy

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<tr>
<th></th>
<th>HUNAN</th>
<th>GANSU</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td></td>
<td>Full Sample (Calories)</td>
<td>Below Median (Calories)</td>
</tr>
<tr>
<td>%Subsidy(rice/wheat)</td>
<td>-0.206*</td>
<td>-0.042</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.144)</td>
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<td>%ΔEarned</td>
<td>0.031***</td>
<td>0.026*</td>
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<tr>
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<td>(0.011)</td>
<td>(0.014)</td>
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<td>%ΔUnearned</td>
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<td>-0.025</td>
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<tr>
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<td>(0.027)</td>
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</table>

Notes: Regressions include county*time fixed-effects. The dependent variable in columns 1-4 and 6-9 is the arc percent change in household caloric intake and in columns 5 and 10 it is the arc percent change in household protein consumption. Standard errors clustered at the household level. %Subsidy (rice/wheat) is the rice or wheat price subsidy, measured as a percentage of the average price. %ΔEarned is the arc percent change in the household earnings from work; %ΔHH Unearned is the arc percent change in the household income from unearned sources (government payments, pensions, remittances, rent and interest from assets); %ΔPeople is the arc percent change in the number of people living in the household. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.
Calorie Engel curves, Rural and Urban India, 1983 to 2004-05

Figure by MIT OpenCourseWare.
<table>
<thead>
<tr>
<th>Year</th>
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<th>All India</th>
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</table>

Source: Authors’ calculations based on NSS data.

Figure by MIT OpenCourseWare.
Fig. 2.—Estimated efficiency labor function