
Household Resources and Investments in Human Capital: The relationship between income and nutrition

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14.771-lecture 2

INTRODUCTION

- historical data - cf handout figure 2 (Fogel).
 - Heights have risen over time
 - Good nutrition as an investment Slaves better fed than poor London boys
- today: in developing countries, what is the relationship between income and nutrition?

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"Conventional" wisdom was that there is a strong link between household income and nutrition. This has been challenged by a series of papers in the late 1980s and this "revisionist" view has been challenged again more recently

cf. table 1: Wide variety in the estimates of the elasticities of calorie demand with respect to household resources (0.01 to 0.82)

NON-CLASSICAL MEASUREMENT ERROR IN FOOD INTAKE

- ① Meals taken out and given to people
 - Who tends to eat out?
 - Who tends to feed people?
 - In what direction does that bias the relationship between income and actual nutrition if you do not observe meals taken out and given to people but only total expenditures on food?
- ② Food waste
 - Who tends to waste more?
 - In what direction does that bias the relationship between income and actual nutrition if you do not observe waste but only total expenditures on food?

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Difference in elasticity: intake vs. availability. Intake conceptually better, but it can be noisy, if based on recall data, and intrusive if based on direct observation.

2. FOOD QUALITY

Measurement problem (2): Even if expenditures were correctly measured, they do not give a correct representation of quality. As people get richer, they buy better tasting food. Refer to table 1 in the handout: Deaton.

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Expenditure = number of calories*price of calorie
 $\log(\text{food expenditure}) = \log(\text{number of calories}) + \log(\text{price of calories})$

You are interested in the relationship:

$$\log(\text{Calories per capita}) = \alpha * \log(\text{Expenditures per capita}) + \epsilon$$

Imagine running the regression:

$$\log(\text{food expenditure per capita}) = \alpha * \log(\text{Expenditures per capita}) + \epsilon$$

This can be rewritten:

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$$\log(\text{Calories per capita}) + \log(\text{Price per calorie}) = \alpha * \log(\text{Expenditures per capita}) + \epsilon$$

There is a positive correlation between the price of calories and the expenditures per capita. In what direction does that bias α ?

3. INCOME VS. EXPENDITURE

Expenditures are a better measure of long term resources. True model:

$$c = \alpha y^* + \epsilon.$$

You run: $c = \alpha y + \epsilon$ and $c = \alpha y_\epsilon + \omega$

where: $y = y^* + u_1$ and $y_\epsilon = y^* + u_2$, with $\sigma_{u_1} > \sigma_{u_2}$

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$$\text{Plim}(\hat{\alpha}_{OLS}) = \text{Plim} \left(\alpha \frac{\frac{1}{N} \sum_{i=1}^N y_i^{*2}}{\frac{1}{N} \sum_{i=1}^N y_i^{*2} + u_{1i}^2} \right) = \alpha \frac{\sigma_{y^*}^2}{\sigma_{y^*}^2 + \sigma_{u_1}^2},$$

Attenuation bias is smaller when the variance of the measurement error is smaller (see the handout on empirical methods for more). So expenditure elasticities are in general higher (e.g. Brazil).

"SUBSTANTIAL" PROBLEMS

- Increase in nutrients availability raises income → the estimated elasticity is biased upward and the bias is greater for lower income households.
- Functional form. Elasticities may be much larger at lower income levels.
- Other omitted variables (e.g. rich people have access to better health care)

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"Revisionists" authors (e.g. Behrman Deolalikar, 87) have tried to solve these problems by computing calories intake and introducing fixed effects or first differences (e.g. regress changes in calories intake on changes in income). However, fixed effects:

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- ① Exacerbate the measurement error problem (most of the "useful" variation is gone, and we are left with the noise!)

$$\text{Plim} \hat{\alpha}_{FD} = \alpha \frac{\sigma_{\Delta w}^2}{\sigma_{\Delta w}^2 + \sigma_{\Delta v}^2}$$

- ② Make standard error larger: very noisy estimates.

NON PARAMETRIC APPROACH: DEATON AND SUBRAMAMIAN(1996)

Data set = 5630 households in 563 villages. Recall data on 149 food items, meals taken out and given away, etc.

From those 149 food items, they calculate caloric intake using a conversion table. Also correct for meals taken out and meals given to people.

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Interesting aspect of this work = non-parametric estimate.

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

How can we estimate $g(x)$?

- Kernel regression
 - Fan (1992) locally weighted regression
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KERNEL REGRESSION

Model:

$$g(x) = E[y|x] = \int y f_c(y|x) dy = \int y \frac{f_j(y, x)}{f(x)} dy$$

$$g(x) = \frac{\int y f_j(y, x) dy}{f(x)}$$

Slide 10 Idea of the Kernel regression: at any given point x , calculate a weighted average of the value of y , giving more weight to the observations close to x .

$$\hat{g}(x) = \frac{\sum_{i=1}^n y_i K\left(\frac{x-x_i}{h}\right)}{\sum_{i=1}^n K\left(\frac{x-x_i}{h}\right)} = \sum_{i=1}^n y_i w_i(x)$$

$K(\cdot)$ is a weighting function symmetric around 0, and integrating to 1, e.g. $K(z) = 0.75(1 - z^2)$ for $|z| < 1$, 0 otherwise

LOCALLY WEIGHTED REGRESSION

- Use the same weighing function $K(\cdot)$
 - Instead of computing the weighted average at each point x , run a weighted regression of y on x , using the weight $\theta_i(x) = \frac{1}{h} K\left(\frac{x-x_i}{h}\right)$.
 - Obtain constant $\hat{\beta}_{1x}$ and coefficient of x at point $\hat{\beta}_{2x}$.
 - $\hat{g}(x) = \hat{\beta}_{1x} + \hat{\beta}_{2x}x$ (predicted value of y).
 - Stata code on Deaton's book web site on the World Bank web site.
<http://www.worldbank.org/lms/tools/deaton/index.htm>
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RESULTS:

- Positive relationship between income and nutrition, precisely estimated even non-parametrically
 - The elasticity declines with outlay, but not dramatically (\neq Strauss and Thomas). Sample of poor people.
 - Price per calories paid increase with outlay. Richer households pay each calories more. Rich=1.50 rupees per 1000 calories, Average 1.14 rupees per 1000 calories, Poor=88 rupees
 - Elasticity of calories price seems constant
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PARAMETRIC ANALYSIS

Problem with non-parametric analysis: introducing control variables is difficult \implies move to parametric analysis

$\text{Log}(\text{calorie per capita}) = \alpha \text{Log}(\text{Exp. per capita}) + X\beta + \epsilon$ (x is vector of control variable)

Coefficient (elasticity) = 0.37 for calorie($t=29$) 0.38 for price per calorie ($t=25$)

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Summary: There seems to be a clear relationship between income and nutrition, even if the magnitude depends on the sample, the variables used, etc...

However:

1. Elasticity is much lower than one.
 2. Endogeneity of income with respect to nutrition is not solved.
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OTHER "INCOME TO HEALTH" EVIDENCE

- See references in Strauss and Thomas handbook chapter (page 1928).
 - "gradient" of adult and child health with respect to income (Case, Lubotsky and Paxson, 2001, NBER WP 8344).
 - Effect of pension income on child nutrition (South Africa): Duflo (2000), Case (2002).
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