Nutrition I: The Capacity Curve

14.740x: Foundations of Development Policy

Professor Esther Duflo

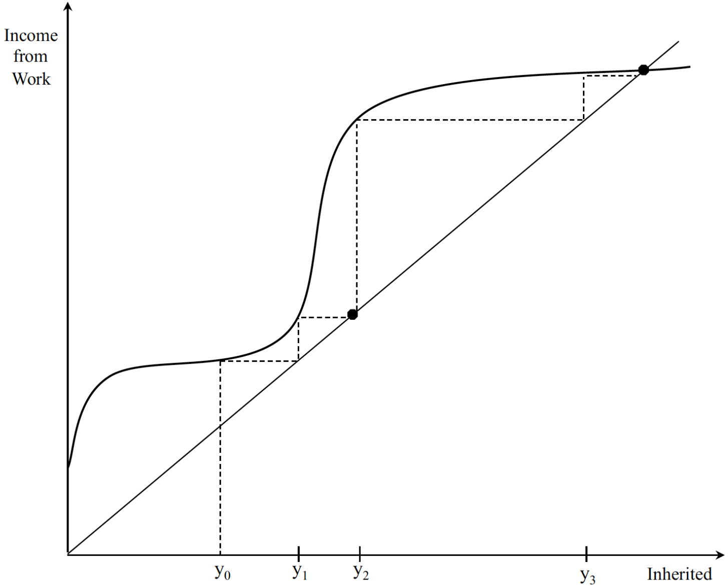
Is there a nutrition based poverty trap?

Let's use the capacity curve to build a very simple model of poverty trap.
Assume a worker eats in the morning, works all day, and is paid a piece wage v at night. The next morning he wakes up and eats again.

- nutritiontoday$=g$(incomeyesterday)
- incometoday$=v\times$(productivitytoday)$=v \times f$(nutritiontoday)

We refer to $f(.)$ as the 'capacity curve'. Then we have:
$\mathrm{incometoday} = \mathrm{v} \times (\mathrm{productivitytoday}) =$
$v \times f(nutritiontoday) = v \times f(g(\mathrm{incomeyesterday}))$

Using this relationship, we can follow his income over time: from y_0 ('yesterday'), we go to y_1 ('today') on the curve, and then horizontally to the diagonal.



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

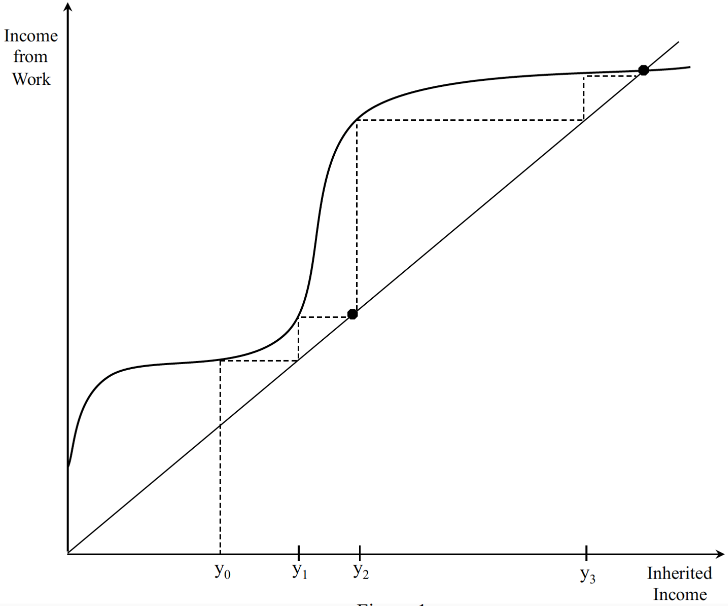


Figure 1

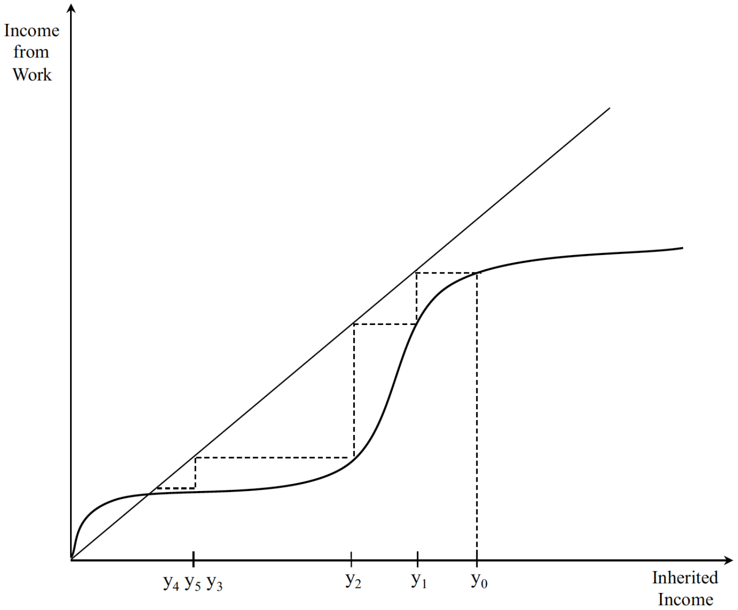


Figure 2

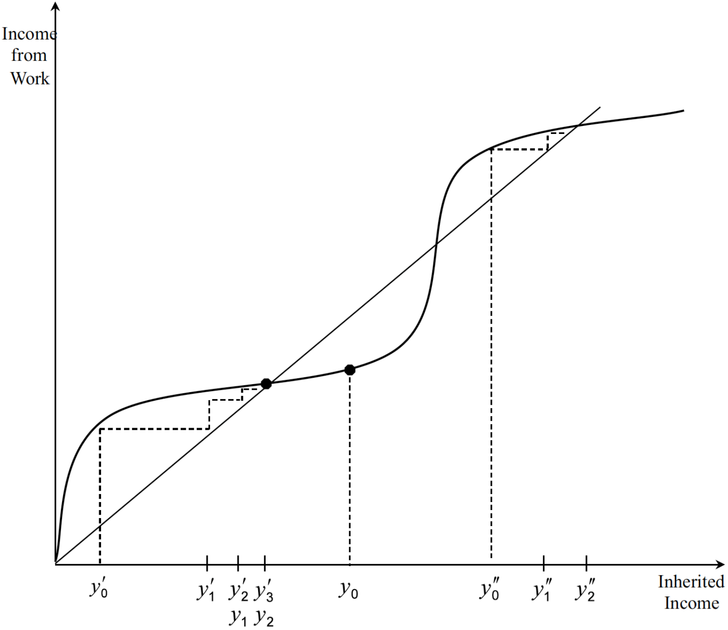


Figure 3

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

This "S-shape" is also the key condition to see a poverty trap emerge in the Das Gupta and Ray model (lecture 2).

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 C with respect to E. When E changes by 1%, C 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:

-
-

Measuring Income Elasticity of Nutrition

Deaton and Dreze, Figure 1

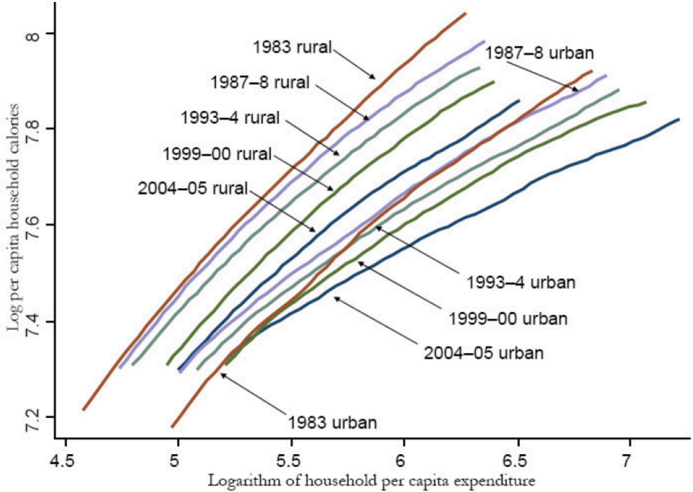


Figure 1: Calorie Engel curves, rural and urban India, 1983 to 2004–05

Interpretation

- Each curve show, in a particular year, the relationship between calories consumed per capita and total expenditure per capita: This is called an "Engel Curve"
- This is a non parametric regression: does not impose any functional form. Why do they first transform both variables in logs?
- The relationship appears nicely log-linear
- First possible estimate of the elasticity: compare across households
  - where do we read the elasticity?
  - It is the slope of the curve

- However we notice something else on the graph: What?
- Second possible estimate of the elasticity: Compare populations as they become richer over time.
  - As India becomes richer, people move up the Engel curve...
  - but the Engel curse moves down!
  - is the elasticity negative?

The causality problem

- Why do we have this problem?
  - Comparing households does not give us the causal effect of extra income on calorie purchased
  - why? What else may be different?
  - Comparing household over time does not give us the causal effect of extra income on calorie purchased either
  - Why? What else may be different?

The Causality problem in mathematical terms

(Reference: Imbens and Woolridge, 2008).

- Consider a binary treatment W: 1 for treated, 0 for control, and an outcome Y (e.g. the treatment is : received some money, the outcome could be: anemia, or earnings).
- Ex-ante, each individual i has two *potential outcomes*, $Y_i(1)$ if treated, $Y_i(0)$ if non-treated.

$$Y_i = Y_i(1)W_i + Y_i(0)(1 - W_i)$$

- The *treatment effect* for individual i is $Y_i(1) - Y_i(0)$.
- Ex-post, only one of the outcomes is realized: individual is treated or non-treated. Since no individual is observed both in the treated and non-treated state, we will not be able to estimate the treatment effect for each individual. All we can hope to estimate are some statistics concerning the treatment effect for a sample of individuals.

Estimating Average Treatment Effect

Suppose we have a population, with N_1 treated individual, and N_0 non treated individuals. Consider the difference between treated and control population:

$$E[Y_i(1)|W_i = 1] - E[Y_i(0)|W_i = 0]$$

$$= E[Y_i(1)|W_i = 1] - E[Y_i(0)|W_i = 1]$$
$$+E[Y_i(0)|W_i = 1] - E[Y_i(0)|W_i = 0]$$

$$= E[Y_i(1) - Y_i(0)|W_i = 1] + E[Y_i(0)|W_i = 1] - E[Y_i(0)|W_i = 0]$$

First term: ATT. Second term: difference in the underlying characteristics of the treated and non treated population (selection effect).

Selection mechanisms

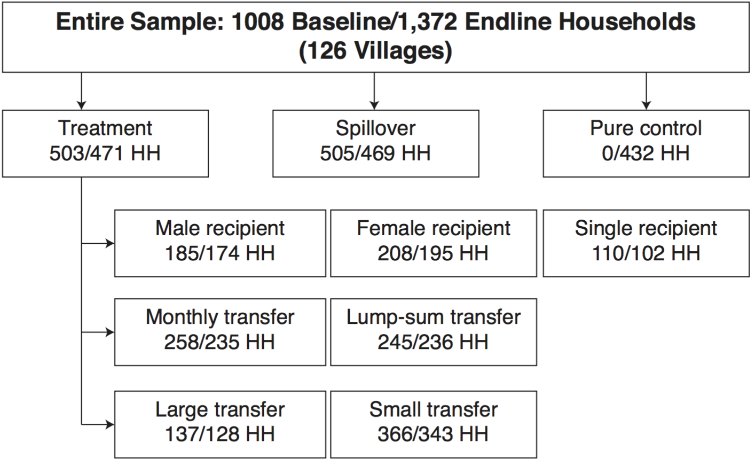
Three cases:

- Random assignment: $E[Y_i(0)|W_i = 1] = E[Y_i(0)|W_i = 0]$ and $E[Y_i(1)|W_i = 1] - E[Y_i(0)|W_i = 0]$ is an unbiased estimate of the effect of the treatment on the treated.
- The probability of assignment does not depend on potential outcomes, but it may be an unknown function of covariates (e.g. people from a given region earn more income).
- The probability of assignment depends on potential outcomes: there is a selection bias of unknown size: This is the case we are in here!

Measuring the elasticity of calorie consumption using a randomly assigned income treatment

- Income is not randomly assigned: in what way people who have more income are different, which may be related to their nutritional status?
  - Endogeneity
  - Omitted variable
- The solution: randomly assign income!
- GiveDirectly: an NGO that gives cash grants to poor household in Kenya, using mobile phone money that is prevalent in Kenya (MPESA).
- Haushofer and Shapiro conducted a Randomized controlled trial of GiveDirectly

Figure 1: Treatment arms



Notes: Diagram of treatment arms. Numbers designate baseline/endline number of households in each treatment arm. Pure control households were added at endline to allow identification of spillover effects. Male and female recipient was randomized only for households with co-habitating couples. Large transfers were administered by making additional transfers to households that had previously been assigned to treatment.

Data collection

- Detailed data collected on a number of outcomes, including consumption of various items after a few months.
- Randomly assigned transfers of different sizes, give us randomly assigned variation in income
- First step: Simply compare various treatment groups to see if people who got the transfer have more overall consumption and buy more food!

Table 2: Treatment effects: Consumption

	(1) Control mean (SD)	(2) Treatment effect	(3) Spillover effect	(4) Female recipient	(5) Monthly transfer	(6) Large transfer	(7) N
Food total (USD)	104.46	19.60***	−3.48	−2.26	1.76	7.71	1372
	(58.50)	(4.22)	(4.66)	(7.43)	(7.51)	(7.62)	
Food own production (USD)	13.64	2.45**	−2.09*	0.16	3.94**	−0.23	1372
	(14.79)	(0.96)	(1.18)	(1.72)	(1.77)	(1.48)	
Food bought (USD)	90.82	16.98***	−1.39	−3.11	−3.03	7.49	1372
	(52.77)	(3.81)	(4.31)	(6.61)	(6.73)	(6.84)	
Cereals (USD)	22.55	2.24**	0.30	0.24	−1.24	2.45	1372
	(17.18)	(1.14)	(1.58)	(1.87)	(1.87)	(2.08)	
Meat & fish (USD)	12.97	5.10***	−0.35	0.76	−3.12	2.41	1372
	(13.75)	(1.02)	(1.22)	(1.83)	(1.95)	(1.64)	
Fruit & vegetables (USD)	23.50	3.46***	0.20	−0.95	0.13	2.29	1372
	(17.06)	(1.15)	(1.39)	(1.96)	(2.05)	(1.99)	
Dairy (USD)	7.26	1.71***	−0.16	−0.73	0.82	0.49	1372
	(9.43)	(0.64)	(0.74)	(1.10)	(1.09)	(1.09)	
Fats (USD)	6.84	0.80**	0.01	−0.28	−0.27	0.91	1372
	(5.51)	(0.37)	(0.46)	(0.62)	(0.64)	(0.58)	
Sugars (USD)	11.25	1.05**	−0.52	−0.53	0.10	0.41	1372
	(7.18)	(0.48)	(0.56)	(0.81)	(0.84)	(0.78)	
Other food (USD)	42.42	5.98***	−0.36	−1.55	−0.86	3.31	1372
	(28.28)	(1.94)	(2.40)	(3.24)	(3.23)	(3.43)	
Alcohol (USD)	6.38	−0.93	−0.41	1.50	1.00	−1.55	1372
	(16.56)	(1.00)	(1.26)	(1.64)	(1.65)	(1.35)	
Tobacco (USD)	1.52	−0.16	−0.00	0.11	0.43	−0.31	1372
	(4.13)	(0.22)	(0.29)	(0.34)	(0.34)	(0.30)	
Medical expenditure past month (USD)	6.56	2.83***	1.52	2.06	−1.49	−0.35	1372
	(13.17)	(0.98)	(0.93)	(1.86)	(1.87)	(1.73)	
Medical expenditure, children (USD)	3.52	0.66	1.03*	0.63	−0.37	−0.10	1203
	(8.52)	(0.60)	(0.60)	(1.06)	(1.09)	(0.97)	
Education expenditure (USD)	4.71	1.08**	0.32	0.44	−0.10	1.10	1372
	(8.68)	(0.51)	(0.61)	(0.89)	(0.88)	(0.92)	
Social expenditure (USD)	4.36	2.46***	−1.42***	−2.06**	−0.46	0.67	1372
	(5.38)	(0.49)	(0.46)	(0.98)	(1.01)	(0.90)	
Other expenditure (USD)	34.36	10.06***	−3.72	−2.05	−3.56	11.76***	1372
	(24.62)	(1.74)	(2.27)	(3.05)	(3.17)	(3.01)	
Non-durable expenditure (USD)	157.40	36.18***	−7.53	−2.74	−4.40	20.37*	1372
	(82.18)	(5.91)	(7.24)	(10.35)	(10.82)	(10.55)	
Joint test (*p*-value)		0.00***	0.15	0.81	0.39	0.03**	

Notes: OLS estimates of treatment and spillover effects. Outcome variables are listed on the left. All variables are reported in PPP adjusted USD. Food bought includes all sub-categories except alcohol and tobacco. Education expenditures include tuition and other costs (e.g., uniform, supplies). Social expenditures include charitable donations, dowry, fees paid to village elder or chiefs, religious ceremonies, weddings, funerals and recreation (e.g., books, music). Other expenditures include airtime, travel and transportation, clothing, personal items (e.g., toiletries), household items (e.g., soap, candles), firewood, electricity and water. Non-durable expenditures are the sum of expenditures on food (own production and purchased), alcohol and tobacco, medical, education, social activities and other goods. Variables in PPP adjusted USD are topcoded for the highest 1 percent of observations. For each outcome variable, we report the coefficients of interest and their standard errors in parentheses. Column (1) reports the mean and standard deviation of the control group for a given outcome variable. Column (2) reports the basic treatment effect, i.e. comparing treatment households to control households within villages. Column (3) reports the spillover effect, i.e. the treatment effect on spillover households compared to pure control households. Column (4) reports the relative treatment effect of transferring to the female compared to the male; column (5) the relative effect of monthly compared to lump-sum transfers; and column (6) that of large compared to small transfers. The unit of observation is the household. All columns except the spillover regressions include village-level fixed effects, control for baseline outcomes, and cluster standard errors at the household level (in the spillover column, at the village level). The last row shows joint significance of the coefficients in the corresponding column from SUR estimation. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

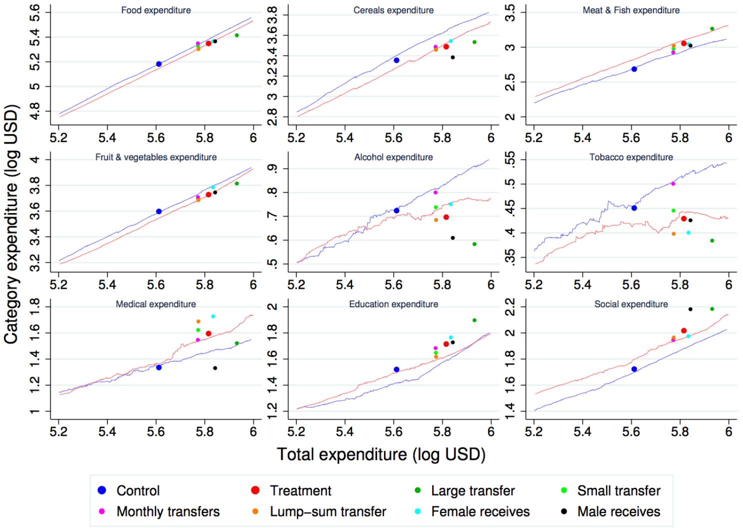
Reading the table

- Column 1: the mean for the control group.
- Column 2: the difference between the treatment group (any transfer) and the control group.
- Below each number: the standard error of the difference.
- The little stars next to the number ?
- Column 4: compare female/male recipients, etc.

Going from the treatment effect to an elasticity

- The transfer is a very temporary income shock: you would not expect households to eat all of it.
- In general we consider *expenditure* elasticity: e.g. the elasticity of food consumption wrt to total expenditure.
- In this case, each transfer size give rise to an increase in expenditure: We can plot on the X axis how much people in each group consume, and on the Y axis how much they spend on food.
- The blue line on the figures is the relationship between total expenditure and food expenditure in the control group (not well identified).

Figure 4: Cross-sectional and experimental Engel curves for different categories of consumption and expenditure



Notes: Cross-sectional and experimental Engel curves for different categories of consumption and expenditure. We plot the log of total monthly nondurable expenditure on the horizontal axis, and the log of monthly expenditure on sub-categories on the vertical axis. Because both axes are on log scales, slopes correspond to elasticities. Total expenditure includes spending on food, education, health care, and social expenses, but not investment in business and agriculture and spending on durables. The red and blue lines represent cross-sectional Engel curves, estimated with local linear regressions of the log of each category's expenditure on the log of total expenditure for the treatment and control groups at endline, respectively. The large red and blue dots represent the experimental Engel curve; the blue dot shows the average total and category expenditure for the control group, and the red dot for the control group. The smaller colored dots represent subgroups of the treatment group (transfers to male vs. female, monthly vs. lump-sum transfers, and large vs. small transfers).

Calculating an elasticity

- How do we compute the slope of the implied curve?
- It is simply the ratio of the increase in food expenditure we read on the Y axis to the ratio in overall expenditure we see on the X axis.
- Or alternatively the ratio between the proportional increase in food expenditure (or any other you are interested) in table 2 to the ratio in total non durable expenditure (also in table 2)

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Fats (USD)	6.84	0.80**	0.01	−0.28	−0.27	0.91	1372
	(5.51)	(0.37)	(0.46)	(0.62)	(0.64)	(0.58)	
Sugars (USD)	11.25	1.05**	−0.52	−0.53	0.10	0.41	1372
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	(5.38)	(0.49)	(0.46)	(0.98)	(1.01)	(0.90)	
Other expenditure (USD)	34.36	10.06***	−3.72	−2.05	−3.56	11.76***	1372
	(24.62)	(1.74)	(2.27)	(3.05)	(3.17)	(3.01)	
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- Or alternatively the ratio between the proportional increase in food expenditure (or any other you are interested) in table 2 to the ratio in total non durable expenditure (also in table 2)

$$\frac{\frac{104}{19}}{\frac{157}{36}} = \frac{18}{22} = 0.8$$

Table 3: Elasticity of different expenditure categories with respect to total expenditure

	Entire sample			Monthly vs. lump-sum transfers			Female vs. male recipient			Large vs. small transfer		
	(1) OLS	(2) IV	(3) Hausman p-value	(4) Monthly transfers	(5) Lump-sum transfers	(6) Difference p-value	(7) Female recipient	(8) Male recipient	(9) Difference p-value	(10) Large transfers	(11) Small transfers	(12) Difference p-value
Food total	1.00***	0.83***	0.05**	1.19***	0.69***	0.08*	0.88***	0.77***	0.62	0.68***	1.04***	0.10
	(0.02)	(0.08)		(0.20)	(0.20)		(0.14)	(0.12)		(0.12)	(0.16)	
Food own production (USD)	0.92***	1.10***	0.53	2.64**	0.38	0.10*	1.11**	1.29***	0.81	0.63*	1.72**	0.21
	(0.09)	(0.31)		(1.17)	(0.64)		(0.54)	(0.43)		(0.35)	(0.74)	
Food bought (USD)	1.03***	0.87***	0.18	1.03***	0.84***	0.57	0.90***	0.76***	0.58	0.76***	1.03***	0.30
	(0.04)	(0.10)		(0.22)	(0.21)		(0.17)	(0.14)		(0.12)	(0.21)	
Cereals (USD)	1.20***	0.75**	0.29	0.98	0.63	0.77	1.43***	−0.25	0.05*	0.64*	0.89	0.77
	(0.09)	(0.33)		(0.83)	(0.68)		(0.54)	(0.62)		(0.35)	(0.70)	
Meat & fish (USD)	1.17***	2.07***	0.01**	1.61*	2.52***	0.48	2.04***	1.35***	0.40	2.02***	2.14***	0.90
	(0.09)	(0.37)		(0.89)	(0.77)		(0.58)	(0.44)		(0.39)	(0.79)	
Fruit & vegetables (USD)	0.95***	0.76***	0.30	1.11**	0.49	0.35	1.10***	0.58*	0.29	0.74***	0.78*	0.93
	(0.06)	(0.19)		(0.45)	(0.43)		(0.30)	(0.31)		(0.22)	(0.40)	
Dairy (USD)	1.44***	1.41***	0.95	3.03**	0.97	0.21	1.65**	1.71***	0.95	0.45	2.70**	0.09*
	(0.11)	(0.45)		(1.28)	(0.88)		(0.77)	(0.63)		(0.59)	(1.09)	
Fats (USD)	0.89***	0.62***	0.32	0.49	0.61	0.89	0.79**	0.68**	0.85	0.76***	0.43	0.59
	(0.07)	(0.24)		(0.56)	(0.48)		(0.38)	(0.33)		(0.25)	(0.51)	
Sugars (USD)	0.89***	0.68***	0.46	1.14**	0.55	0.45	0.60	0.75**	0.79	0.43	1.00*	0.39
	(0.08)	(0.25)		(0.56)	(0.47)		(0.38)	(0.34)		(0.30)	(0.52)	
Other food (USD)	1.14***	0.80***	0.16	1.06***	0.66*	0.52	0.98***	0.57**	0.32	0.69***	0.95***	0.54
	(0.06)	(0.18)		(0.40)	(0.38)		(0.28)	(0.26)		(0.18)	(0.36)	
Alcohol (USD)	0.53***	−0.13	0.36	0.98	−0.59	0.43	0.27	−0.61	0.54	−0.57	0.47	0.46
	(0.13)	(0.56)		(1.46)	(1.14)		(0.98)	(0.83)		(0.59)	(1.16)	
Tobacco (USD)	0.24**	−0.19	0.35	0.07	−0.10	0.89	−0.61	−0.19	0.66	−0.49	0.19	0.46
	(0.09)	(0.36)		(0.85)	(0.70)		(0.66)	(0.53)		(0.41)	(0.74)	
Medical expenditure past month (USD)	0.36***	1.47**	0.12	1.27	2.61*	0.54	3.16**	−0.99	0.01**	0.35	2.96*	0.15
	(0.13)	(0.58)		(1.42)	(1.37)		(1.29)	(0.97)		(0.67)	(1.57)	
Medical expenditure, children (USD)	0.18	0.86*	0.38	0.38	1.86	0.41	1.93**	−0.95	0.05*	0.17	1.89	0.25
	(0.12)	(0.47)		(1.12)	(1.14)		(0.97)	(0.95)		(0.54)	(1.27)	
Education expenditure (USD)	0.75***	0.84**	0.88	1.22	0.55	0.62	1.12*	0.42	0.45	0.88**	0.78	0.92
	(0.10)	(0.37)		(0.93)	(0.77)		(0.63)	(0.52)		(0.42)	(0.80)	
Social expenditure (USD)	0.74***	1.60***	0.02**	1.48*	1.61**	0.91	0.71	2.44***	0.06*	1.71***	1.45**	0.78
	(0.07)	(0.35)		(0.87)	(0.71)		(0.57)	(0.65)		(0.42)	(0.73)	

Notes: Elasticity of different expenditure and consumption categories with respect to total expenditure, for different subsets of the treatment group. Column (1) presents cross-sectional OLS estimates in the control group; column (2) presents IV estimates across both treatment and control groups when total expenditure is instrumented with treatment. Column (3) shows the p-value of the Hausman test comparing OLS and IV specifications. Columns (4) and (5) present IV estimates for the effect of monthly and lump-sum transfers, respectively; column (6) shows the p-value of the difference. Analogously for the remaining columns.

From Food expenditure elasticity to calories elasticity?

- Is Food expenditure what we would like to see?
- No: what matters is calories.
- What happens as you become richer?
- You will start spending more on tastier food: the price per calorie increases at the same time as the number of calories, so the food expenditure elasticity is an upwards biased estimate of what we care about
- Unfortunately they don't have price paid per calorie here. In other data set, the food expenditure elasticity is about half calories, and half price per calories. Here we have some inkling that there is some substitution going on. Where?

Conclusion

- Even after controlling for endogeneity we find a pretty robust response of food expenditure to total expenditure.
- But the headline number is below one (0.83 is the upper bound)
- As people become richer, they don't increase calorie consumption proportionally (perhaps not surprising).
- This will tend to make the capacity cure more shallow.
- We will need to see a very strong slope of the relationship between nutrition and productivity to generate a poverty trap from the basic adult capacity curve mechanism.

References

- Deaton, A., and Dreze, J. (2009). Food and nutrition in India: facts and interpretations. *Economic and political weekly*, 42-65.
- Imbens, G. M., and Wooldridge, J. M. (2008). Recent developments in the econometrics of program evaluation. National Bureau of Economic Research.
- Haushofer, J., and Shapiro, J. (2013). Household response to income changes: Evidence from an unconditional cash transfer program in Kenya. Massachusetts Institute of Technology.