The Long-Term Effect of Poverty on Obesity

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The Poverty-Obesity Paradox

From the New York Times (March 12, 2010), *The Obesity-Hunger Paradox*

When most people think of hunger in America, the images that leap to mind are of ragged toddlers in Appalachia or rail-thin children in dingy apartments reaching for empty bottles of milk. Once, maybe. [..] the **hungriest people in America today, statistically speaking, may well be not sickly skinny, but excessively fat**.

Hunger is certainly almost an exclusive symptom of poverty, but **also obesity can be considered one flip side of the same malnutrition coin**, especially in developed countries.

Does poverty increase the chances of being obese?

Introduction

- Obesity has drawn the attention because it has registered epidemic proportions and relevant economic and public health consequences (Cutler et al., 2003, Philipson & Posner, 2008, Brunello et al., 2009, Bhattacharya & Sood, 2011, World Health Organization, 2007).

- OECD (2012) reports that, since 1980, obesity rates have doubled or even tripled in many countries and in more than half of OECD countries, 50% or more of the population is now overweight, if not obese.

- If governments aim to tackle the phenomenon, the true causes, either sociodemographic or economic, have to be assessed.

Introduction

The economic literature analysed $BMI = weight / height^2$, and overweight ($25 < BMI < 30$) and obesity ($BMI > 30$).

Education, information and income identified as main determinants where policy interventions are possible.

According to Brunello et al. (2011) the main public interventions proposed so far are information campaigns, advertising and labelling rules and regulations on nutritional claims. But it is still not clear whether information can effectively induce people to make healthier choices.

- Information deficiencies are not a major issue (Brunello et al. 2009).
- Obesity seems to be **concentrated among disadvantaged persons**, who are aware that obesity is bad for their health but have less incentive to invest in their health Philipson & Posner (2008).
- Policy interventions in this context, based on **equity considerations**, are justified only if aimed at reducing inequalities, **driven by circumstances, beyond individuals' control**, that make people more likely to be obese.

Literature I

According to the economic models of body weight (Lakdawalla and Philipson, 2002, Cawley, 2004), the effect of income on weight depends on how income affects food consumption and time allocation (Cawley et al., 2010):

- Caloric food could be an inferior good because of its quality
- Health and slimness are normal goods so as income rises people consume less energy-dense food in order to lose weight

In the literature: the effect of income and obesity (or BMI[1]); causality very rare:

- Cawley et al. (2010):
  - Low-income elderly;
  - Natural experiment in the US (Social Security Benefits Notch - automatic double indexation of credited earnings in a period of high inflation)
  - No effects for the elderly on the probability to be overweight or obese
  - Main problems: The outcome is weight (the stock of past consumption) so lifetime income streams are likely to have some effects rather than contemporaneous income

[1] Computed as kg/m^2

Literature II

- Schmeiser (2009):
  - Variation across states in the generosity of the Earned Income Tax Credit (EITC)
  - Income is found to significantly decrease BMI and probability of being obese for women with EITC-eligible earnings, and have no appreciable effect for men with EITC-eligible earnings
  - Main problems: Rather specific group of low income workers
- Quintana-Domeque (2005):
  - European Community Household Panel;
  - exogenous variation in family income resulting from receipt of inheritance, gifts, or lottery winnings of 2000 Euros or more as (weak) instrument for income;
  - In Denmark and Italy (women) and Finland (men) the estimated BMI-income elasticity is negative.
  - Main problems: Weak instrument

Data

We use data from various sources:

1. For individual level data we use SHARE (Survey on Health Ageing and Retirement in Europe) wave 2 (2006) and wave 4 (2010) and ELSA (English Longitudinal Survey on Ageing) wave 2 (2006) and wave 4 (2010).
2. We also used SHARE and ELSA waves 3 (2008) to merge information about individual early-life conditions.
3. For regional level data we merged information from EUROSTAT, the ESPON Database, Eurobarometer and Cambridge Econometrics.

Empirical Strategy I

Let's consider the following standard specification:

$$obese_{it} = \beta_0 + \beta_1 poor_{it} + X^T \boldsymbol{\beta} + \epsilon_{it} \tag{1}$$

we are interested in β_1, the coefficient that captures the effect of *being poor* on the probability to be obese.

OLS estimates of β_1 are unbiased if $E\left[poor_i \epsilon_i\right] = 0$ but unlikely to be true because of:

- unobservable individual factors (e.g., self-control, motivation, risk attitude);
- reverse causality (high health expenditures or productivity);
- measurement errors (self-reported Body Mass Index - BMI).

Empirical Strategy II

- Obesity: recursive bivariate probit model

$$\begin{aligned} obese_{it} &= \alpha_0 + \alpha_1 poor_{it} + X^T \alpha + \epsilon_{1,it} \\ poor_{it} &= \beta_0 + Z^T \beta' + X^T \beta'' + \epsilon_{2,it} \end{aligned} \tag{2}$$

$E[\epsilon_{1,it}] = E[\epsilon_{2,it}] = 0$, $Var[\epsilon_{1,it}] = Var[\epsilon_{2,it}] = 1$ and that $Cov[\epsilon_{1,it}] = Cov[\epsilon_{2,it}] = \rho$

- BMI: two stages least squares

$$\begin{aligned} BMI_{it} &= \alpha_0 + \alpha_1 poor_{it} + X^T \alpha + \epsilon_{1,it} \\ poor_{it} &= \beta_0 + Z^T \beta' + X^T \beta'' + \epsilon_{2,it} \end{aligned} \tag{3}$$

Identification I

We need to define a theory of how poverty is determined:

$$poor_{it} = \lambda_0 + poor_0^T \lambda' + X^T \lambda'' + \epsilon_{it} \tag{4}$$

- According to the literature poverty is path-dependent.
- Current poverty status is the result of **circumstances** (e.g. region of residence or family background) and effort (Checchi et al., 2010, Fleurbaey 2008). Circumstances are determinants **external to, and coercive over individuals** (Beeghley 1988), that constrain the range of options available to people (Cotter 2002).
- $poor_0$ is ideally composed by family and regional poverty at birth and is a natural instrument for poverty at time t, because it can reasonably be excluded from the obesity equation, after controlling for current individual and regional characteristics.

Identification II

Unfortunately we do not observe $poor_0$, but using a strategy similar to that applied by Tabellini (2010), we can substitute $poor_0$ with X_0, where X_0 are past values of X variables, which by construction are correlated with $poor_{it}$.

Our final specification for the poverty equation will be the following:

$$poor_{it} = \lambda_0 + X_0^T \eta + X^T \lambda + v_{it} \tag{5}$$

X_0 is the matrix of instruments including:

1. the logarithm of regional gross value added in 1977 (LGVA77)
2. a dummy equal to one if the number of books available in the household when the individual was 10 years old was lower than 10 (Few books).

Covariates I: Individual variables

Variables		%	Mean	Source
Age			65.93	ELSA/SHARE
Education	Low	0.63		ELSA/SHARE
	Secondary	0.26		ELSA/SHARE
	High	0.11		ELSA/SHARE
Occupation	Employed	0.46		ELSA/SHARE
	Unemployed	0.04		ELSA/SHARE
	Retired	0.5		ELSA/SHARE
Smoker	No	0.91		ELSA/SHARE
	Yes	0.09		ELSA/SHARE
Chronic diseases	No	0.29		ELSA/SHARE
	Yes	0.71		ELSA/SHARE
Limitations	No	0.98		ELSA/SHARE
	Yes	0.02		ELSA/SHARE
Poor Health	No	0.91		ELSA/SHARE
	Yes	0.09		ELSA/SHARE
Sick or disable	No	0.96		ELSA/SHARE
	Yes	0.04		ELSA/SHARE
Physical activity frequency	Less than once a week	0.71		ELSA/SHARE
	At least once a week	0.29		ELSA/SHARE
Children	No	0.65		ELSA/SHARE
	Yes	0.35		ELSA/SHARE
Wave	2	0.45		ELSA/SHARE
	4	0.55		ELSA/SHARE
Country of residence	Germany	0.12		SHARE
	Netherlands	0.12		SHARE
	Spain	0.12		SHARE
	Italy	0.13		SHARE
	France	0.14		SHARE
	Belgium	0.13		SHARE
	England	0.24		ELSA

Covariates II: Regional and Instrumental variables

Variables	Modalities	%	Mean	Source
Regional growth rate between 1977-2006			0.09	Cambridge Econometrics
% of people who think that overweight and obesity are bad for health			0.79	Eurobarometer
% of people who think that overweight and obesity are mainly inherited			0.23	Eurobarometer
% of individuals do not eat healthy because of lack of information on food labels			0.08	Eurobarometer
% of individuals do not eat healthy because of lack of lack of control			0.08	Eurobarometer
% of people who enjoy eating			0.60	Eurobarometer
% of people who eat healthy			0.36	Eurobarometer
Accessibility index			0.43	ESPON Db
% of people who are satisfied with health services			0.53	ESPON Db
Climate index			52.77	ESPON Db
Number of hospital beds /10,000 individuals			562.32	Eurostat
Log of regional gross value added in 1977			4.55	Cambridge Econometrics
Number of books in household at age 10 lower than 10		0.39		ELSA/SHARE

Percentage of obese individuals 2006-2010, by decile and gender

	Men		Women	
Decile	Average BMI	% of obese	Average BMI	% of obese
1	27.31	0.23	27.08	0.26
2	27.36	0.23	27.13	0.26
3	27.26	0.23	26.99	0.26
4	27.03	0.2	26.74	0.23
5	27.03	0.21	26.65	0.23
6	27.08	0.21	26.36	0.2
7	26.96	0.19	26.09	0.19
8	26.76	0.17	25.7	0.17
9	26.92	0.19	25.61	0.16
10	26.81	0.17	25.6	0.15

Notes: Deciles based on equivalent income by country

Impact of poverty on obesity, univariate probit

	Men		Women	
	(1)	(2)	(1)	(2)
poor	0.030***	0.029***	0.035***	0.034***
	(0.0089)	(0.0092)	(0.0088)	(0.0089)
Observations	12,573	12,573	15,125	15,125
group1	yes	yes	yes	yes
group2	no	yes	no	yes

Impact of poverty on obesity, bivariate probit

	Men		Women	
	(1)	(2)	(1)	(2)
Impact of instruments on poverty				
Log GVA 1977	-0.097**	-0.096***	-0.122***	-0.133***
	(0.0394)	(0.0276)	(0.0297)	(0.0241)
Few books	0.0799***	0.081***	0.055***	0.054***
	(0.0104)	(0.0103)	(0.0104)	(0.0103)
Impact of poverty on obesity				
poor	0.174**	0.168**	0.221***	0.226***
	(0.0735)	(0.0686)	(0.0437)	(0.0429)
ρ	-0.293	-0.303	-0.398	-0.413
Wald test of $\rho = 0$:	4.018	3.713	14.251	15.433
Prob > Chi-squared	0.0451	0.0541	0.0002	0.0001
Observations	12,612	12,612	15,106	15,106
group1	yes	yes	yes	yes
group2	no	yes	no	yes

Impact of poverty on BMI, OLS

	Men		Women	
	(1)	(2)	(1)	(2)
poor	0.0004	0.015	0.034	0.032
	(0.0411)	(0.0406)	(0.0359)	(0.0352)
Observations	13,071	13,071	15,629	15,629
group1	yes	yes	yes	yes
group2	no	yes	no	yes

Impact of poverty on BMI, IV

	Men		Women	
	(1)	(2)	(1)	(2)
Impact of instruments on poverty				
Log GVA 1977	-0.102**	-0.107***	-0.122***	-0.134***
	(0.0398)	(0.0341)	(0.0324)	(0.0277)
Few books	0.0846***	0.0851***	0.052***	0.051***
	(0.0122)	(0.0123)	(0.0108)	(0.0108)
F-statistic	32.81	36.45	22.61	26.54
Impact of poverty on BMI				
poor	0.458	0.471	0.626	0.679
	(0.4135)	(0.367)	(0.483)	(.4221)
Observations	12,612	12,612	15,106	15,106
Overidentification test (Hansen)	0.0000	0.1235	0.4003	0.4731
group1	yes	yes	yes	yes
group2	no	yes	no	yes

Robustness checks

Potential problems:

- Migration effects: individuals who moved among regions could bias our results. $\rightarrow$ we performed the analysis on a subsample of individuals who lived in the same region for at least 30 years. Results do not change significantly.
- Other regional factors, beyond those included in the model. $\rightarrow$ A strategy to evaluate the presence of regional omitted factors can be multilevel analysis.
- Multilevel models allow to estimate the fraction of variance due to regional characteristics left unexplained, after controlling for group 2 covariates.

Robustness checks: individuals who lived in the same region for more than 30 years

	Men	Women
	(2)	(2)
Univariate Probit	0.027**	0.036***
	(0.0125)	(.0129)
Bivariate Probit	0.189***	0.245***
	(0.0618)	(0.0638)
ρ	-0.346	-0.449
Wald test of $\rho = 0$:	5.928	7.497
Prob > Chi-squared	0.0149	0.0062
OLS	0.006	0.007
	(0.0582)	(0.0543)
IV	0.326	0.608
	(0.4895)	(0.7513)
F-statistic	26.28	15.89
Overidentification test (Hansen)	0.067	0.4467
Observations	5,056	6,168

Robustness checks: Multilevel Logistic regression

	Men		Women	
	(1)	(2)	(1)	(2)
σ_u	0.0573	< 0.0001	0.0998	0.0015
ρ	0.01	< 0.0001	0.0031	< 0.0001
LR-test of $\rho = 0$ Prob $>$ Chi-squared	0.394	0.99	0.168	0.492
Observations	12,573	12,573	15,125	15,125

Thanks for your attention!