Food Access, Eating Habits and Adult Obesity in Italy

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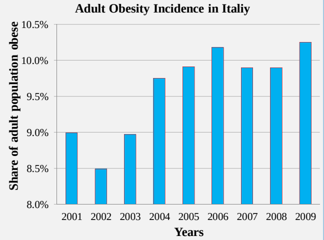
The Obesity Epidemic – Italy

- The WHO defines obesity and overweight as abnormal or excessive fat accumulation that may impair health. The Body Mass Index (BMI: weight in Kg/ heigth^2 in m^2) is commonly used to classify adult individuals as:

Normal Weight (20<BMI<25) - Overweight (25<BMI<30) - Obese (BMI>30)

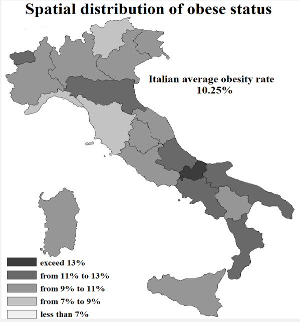
- Adult obesity has reached worrisome levels across the globe with incidence >30% in the U.S.; in some European Countries the share of overweight and obese adult population has reached 50% (WHO).
- In Italy the official adult obesity rate is close to 10%, below the OECD average (16%);
- This figure seems underestimated (Hansstein *et al*., 2009); epidemiology studies evaluates adult obesity incidence in Italy at 25% (Berghöfer, 2008).



- The direct obesity cost in Italy are € 4.7 billion, the third highest in the EU (Fry and Finley, 2005).

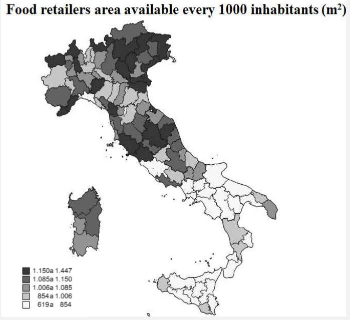
Adult Obesity Incidence and Food Retail Surface Available in Italy

Spatial distribution of obese status



Source: Elaboration from Italian National Institute of Statistics data (2007)

Food retailers area available every 1000 inhabitants (m^2)



Source: Cozzi (2008) - Italian National Institute of Statistics

Obesity and the Food Environment

- In 2007, the WHO highlighted the importance of promoting macroeconomic policies against the obesity epidemic to improve food availability and access.
- Disparity in food stores' availability influences people's diets. Consumers may adopt better (worse) diets if they have access to outlets that sell a larger variety of healthy (unhealthy) food (Morland *et al.* 2006; Hawkes, 2008).
- Does disparity in food access justifies the geographical differences in incidence of overweight and obese among the Italian population?
- Northern Italy shows a higher number of large food stores (almost twice as large) than the South, where instead there is a large concentration of fruit and vegetables stores

→ unclear patterns!!! Could other factors (i.e. eating habits) play a role?

Research Objectives

- Measure the impact of food outlets' density on adult's BMI in Italy.
- Assess synergies between consumers' eating habits and food access.

Model Specifications

Following Courtemanche and Carden (2011):

$$BMI_{ir} = \alpha_0 + \sum_{k=1}^{K} \alpha_{SESk} SES_{irk} + \sum_{l=1}^{L} \alpha_{Bel} Be_{irl} + \sum_{j=1}^{J} \alpha_{FAj} FA_{jr} + \sum_{d=1}^{D} \alpha_d A_d + e_{ir} \quad (1)$$

Where:

SE: consumers' socio-economic characteristics (household size, age, gender, income, etc..);
Be: behavioral variables (smoking, practice of physical activities, time spent watching TV);
FA: variables capturing access to alternative food stores;
A: regional fixed effect.

Accounting for consumers' eating habits (vector EH) one has:

$$BMI_{ir} = \beta_0 + \sum_{k=1}^{K} \beta_{SESk} SES_{kir} + \sum_{l=1}^{L} \beta_{Bel} Be_{lir} + \sum_{j=1}^{J} \beta_{FAj} FA_{jr} + \sum_{m=1}^{M} \beta_{EHm} EH_{mjr} + \sum_{d=1}^{D} \beta_d A_d + e_{ir} \quad (2)$$

To synergic role of EH and FA on BMI is captured via the specification:

$$BMI_{ir} = \beta_0 + \sum_{k=1}^{K} \beta_{SESk} SES_{kir} + \sum_{l=1}^{L} \beta_{Bel} Be_{lir} + \sum_{j=1}^{J} \beta_{FAj} FA_{jr} + \sum_{m=1}^{M} \beta_{EHm} EH_{mjr} + \sum_{m=1}^{M}\sum_{j=1}^{J} \beta_{FAjEHm} FA_{jr} EH_{mr} + \sum_{d=1}^{D} \beta_d A_d + e_{ir} \quad (3)$$

Data Sources

- Multipurpose Household Survey (MHS) year 2007. Cross-sectional database of individual/household characteristics, adults (age>18) only ; [N=21,511]
- Eating habits: frequency of consumption for 15 food and beverage categories from the MHS; reduced to 4 via PCA, then rescaled to binary indicators:
  - *alcoholic beverages* (beer, wine, amaro, liquors),
  - *fruit and vegetables* (fruit, vegetables, leafy vegetables),
  - *junk food* (salted snacks, sweets, carbonate soft drinks),
  - *protein-rich food* (meats, dairy, eggs, fish, and cold cuts).

Food Access variables – Regional aggregates (N stores/Population)

1) Hypermarkets and supermarkets - LOD [(G47111+G47112) / Pop*100,000]
2) Minimarkets and peddler - LOS [(G4781+G472 - G4721) / Pop*100,000]
3) Restaurants, fast food restaurants and pubs – FSS [I5610/ Pop*10,000]
4) Bakeries –BA [CA1071/Pop*10,000]
5) Fruit and vegetable stores - FVS [G4721/Pop*100,000]

Sources: 3), 4) and 5) National Institute of Statistics - Unità economiche dell'industria e dei servizi; 1), 2) Osservatorio Nazionale Del Commercio (ATECO 2007 industry codes)

Identification Strategy and Estimation

- Store location is an equilibrium outcome: food stores density endogenous
- Tests for spurious correlation and IV methods (**GMM**) necessary.
- **Instruments** chosen are aggregate market-level measures impacting store's location decision: Highways density (Km/1000Km^2), % of land in public parks and gardens; number bus/1000 people; density of coasts (Km/Km^2); secondary roads density (Km/1000Km^2), crime rate (theft and robbery); population density (People/1000Km^2).
- Data manipulation and estimation performed in STATA v.10

Empirical Results – *SES* & *Be* variables

Results consistent with previous literature; show similar magnitude and significance across specifications.

Selected Empirical Results - FA & EH

	OLS Eq(1)	IV-GMM Eq(1)	IV-GMM Eq(2)
LDO	0.005 (0.008)	-0.086*** (0.032)	-0.080** (0.031)
LOC	-0.002* (0.001)	-0.013*** (0.003)	-0.012*** (0.003)
FSS	-0.018*** (0.005)	0.021 (0.013)	0.021 (0.013)
BA	0.042* (0.022)	0.108*** (0.034)	0.100*** (0.034)
FVS	0.002 (0.004)	-0.042*** (0.014)	0.040*** (0.014)
Alcoholic Beverages			0.119** (0.048)
Fuit and Vegetables			-0.214*** (0.040)
Junk Food			0.394*** (0.045)
Protein Foods			-0.086* (0.040)
R.Squared	0.309	0.303	0.308
Hansen J		2.418	2.259
p-value		(0.298)	(0.323)
GMM C-statistic		16.5365 (0.0055)	15.5506 (0.0083)
***F*-stat**			
LDO_density		2966.31	2864.56
LOC_density		28004.22	25043.52
FSS_density		65288.26	65005.16
BA_density		18534.71	16867.90
FVS_density		11409.4	10506.4

Note: *, ** and *** are 10, 5 and 1% significance levels - Standard errors in parenthesis

Food Access

- GMM estimates all statistically significant except food service stores; signs consistent with previous research (Morland et al.,2010; Anderson and Matsa, 2010).
- Doubling LDO, LOC and FVS, results in BMI reduction equal to 1.37, 0.60 and 1.214 points, respectively;
- Doubling BA would lead to an increase of BMI among adult Italians of 0.576 points
- Once eating habits are controlled for, the coefficients of the food access variables' become smaller.

Eating Habits

- Have statistically significant impact on BMI;
- Consuming alcohol and junk food more frequently than the average has a positive effect (0.119 and 0.394, respectively) on adult Italians' BMI,
- Consuming fruit and vegetables and proteins more frequently than the average has a BMI decreasing effect (-0.214 and -0.086, respectively);

Model performance and instruments' test:

- Low *p*-values of C statistics indicate that the FA variables should be treated as endogenous;
- Instruments satisfy the orthogonality condition: *p*-value of Hansen *J* = 0.298 (equation 1); 0.323 (equation 2).
- The *F*-stat for the joint significance of the instruments' parameters in first stage equations are large enough to discard weak instruments' problems.

Empirical Results-Eq.3: Marginal Effects of FA on BMI conditional on EH

*LDO, LOC and FVS have a negative impact on BMI; frequent consumption of fruits and vegetables and proteins shows a **synergic effect** with these stores; above average frequency of consumption of alcohol and junk food mitigates their beneficial impact on BMI.*

FSS have a BMI increasing effect only for those people who consume alcohol or protein more frequently than the average

BA has a BMI increasing statistically significant effect for those individuals consuming fruits and vegetables and protein more than the average → ***"compensation effect"*** *: some may indulge in the consumption of high caloric food if they feel they are consuming enough of other "healthier" foods.*

$$\left.\frac{\partial BMI_{ir}}{\partial FA_{jr}}\right|_{EH_{mir}=1,\forall m,r} = \beta_{FAj} + \sum_{m=1}^{M} \beta_{FAjEHm} EH_{mir}$$

Food Access \ Eating Habits	Junk Food	Fruits & Vegetable	Alcoholic Beverages	Protein Foods	Food Access Alone
LDO	-0.0911* (0.0520)	-0.1303*** (0.0484)	-0.0989* (0.0597)	-0.1683*** (0.0571)	-0.1049** (0.0485)
LOC	-0.0199* (0.0103)	- 0.0307*** (0.0098)	-0.0170 (0.0119)	-0.0334*** (0.0117)	-0.0220** (0.0096)
FSS	0.0230 (0.0168)	0.0196 (0.0156)	0.0323* (0.0190)	0.0385** (0.0186)	0.02477 (0.0158)
BA	0.1822 (0.1563)	0.3652** (0.1471)	0.1840 (0.1810)	0.3833** (0.1809)	0.2744* (0.1440)
FVS	-0.07039** (0.0345)	- 0.0916*** (0.0322)	-0.0660* (0.0393)	-0.0958** (0.0370)	-0.0760** (0.0324)
EH marginal Effect	0.3959*** (0.0440)	-0.210*** (0.0411)	0.116*** (0.0504)	-0.0761 (0.0479)	

Note: *, ** and *** are 10, 5 and 1% significance levels; standard errors in parenthesis

Conclusions

- Results confirm a causal relationship between different food outlets' density and adult BMI in Italy;
- Synergic effects of food access and eating habits on adult BMI emerge;
- **Policy implications**: policymakers may consider adopting an integrated approach to fight obesity, creating measures to improve the quality of the food environments.