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Food Access, Eating Habits and Adult Obesity in Italy

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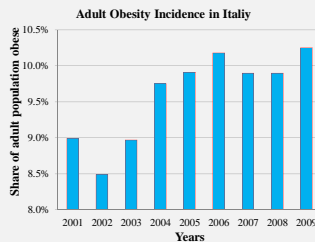
The Obesity Epidemic – Italy

- The WHO defines obesity and overweight as abnormal or excessive fat accumulation that may impair health. The Body Mass Index (BMI: weight in Kg/ height² in m²) 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).

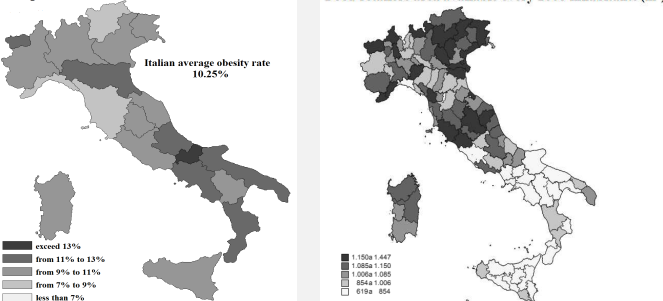
- The direct obesity cost in Italy are € 4.7 billion, the third highest in the EU (Fry and Finley, 2005).



Adult Obesity Incidence and Food Retail Surface Available in Italy

Spatial distribution of obese status

Food retailers area available every 1000 inhabitants (m²)



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

$$BMI_{it} = \alpha_0 + \sum_{k=1}^K \alpha_{SES_{itk}} SES_{itk} + \sum_{l=1}^L \alpha_{Be_{itl}} Be_{itl} + \sum_{j=1}^J \alpha_{FA_{jt}} FA_{jt} + \sum_{d=1}^D \alpha_d A_d + e_{it} \quad (1)$$

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:

$$BMI_{it} = \beta_0 + \sum_{k=1}^K \beta_{SES_{itk}} SES_{itk} + \sum_{l=1}^L \beta_{Be_{itl}} Be_{itl} + \sum_{j=1}^J \beta_{FA_{jt}} FA_{jt} + \sum_{m=1}^M \beta_{EH_{mt}} EH_{mt} + \sum_{d=1}^D \beta_d A_d + e_{it} \quad (2)$$

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

$$BMI_{it} = \beta_0 + \sum_{k=1}^K \beta_{SES_{itk}} SES_{itk} + \sum_{l=1}^L \beta_{Be_{itl}} Be_{itl} + \sum_{j=1}^J \beta_{FA_{jt}} FA_{jt} + \sum_{m=1}^M \beta_{EH_{mt}} EH_{mt} + \sum_{d=1}^D \beta_d A_d + e_{it} \quad (3)$$

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)

- Hypermarkets and supermarkets – LOD [(G47111+G47112) / Pop*100,000]
- Minimarkets and peddler – LOS [(G4781+G472 - G4721) / Pop*100,000]
- Restaurants, fast food restaurants and pubs – FSS [I5610/ Pop*10,000]
- Bakeries –BA [CA1071/Pop*10,000]
- 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/1000Km²), % of land in public parks and gardens; number bus/1000 people; density of coasts (Km/Km²); secondary roads density (Km/1000Km²), crime rate (theft and robbery); population density (People/1000Km²).
- 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) |
| Fruit 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 (0.298) | 2.259 (0.323) |
| p-value | | 16.5365 (0.0055) | 15.5506 (0.0083) |
| GMM C-statistic | | | |
| F-stat | | 2966.31 | 2864.56 |
| LDO density | | 28004.22 | 25043.52 |
| LOC density | | 65288.26 | 65005.16 |
| FSS density | | 18534.71 | 16867.90 |
| BA density | | 11409.4 | 10906.4 |

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.

$$\frac{\partial BMI}{\partial FA_{jt}} \Big|_{EH_{mt}=1} = \beta_{FA_{jt}} + \sum_{m=1}^M \beta_{EH_{mt}} EH_{mt}$$

| 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) | 0.0247* (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.