Policy Evaluation Network

Quantifying the impact of food and lifestyle policies: Challenges, perspectives and synergies in the identification of causal effects and model-based simulations

Can agricultural and trade policies make us fatter?
A case study on sugar and the soft-drinks market in Italy

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Introduction

- The number of obese and over-weight people has been increasing significantly in Europe in recent years (WHO).
- Europe has the second highest proportion of obese and over-weight people worldwide (50%) (WHO, 2019; Eurostat, 2020).
- Obesity and poor nutrition increase the incidence of non-communicable diseases.
- Several member states introduced direct policies to tackle unhealthy diets:
  - the Danish saturated fats tax and the French soda tax in 2012;
  - the Catalonia sugar-sweetened beverages tax in 2017;
  - the UK sugar tax in 2018;
  - the upcoming Italian sugar tax in 2022.

Motivation

Economic policies with different objectives, such as agricultural and trade policies, may contribute or hinder the success of these direct policies addressing unhealthy lifestyles.

Effects on the "***food environment***"

=*what food is available, where and for what price* (Clark et al., 2012)

For example, policies that induce low prices for agricultural commodities are blamed for exacerbating over-weight and obesity problems
(e.g., agricultural and trade liberalization).

(Alston, Sumner, and Vosti 2008, Schmidhuber and Shetty 2010; Traill et al. 2014).

Objectives

- To develop an empirical framework to analyze the potential indirect effects of agricultural and trade policies on health outcomes through food prices.
- This framework is used to investigate a case study on raw sugar and the sugar-sweetened beverages (SSBs) market in Italy as:
  - consumption of SSBs is one of the most important contributors to the spread of obesity, particularly among children (Keller and Bucher della Torre, 2015);
  - sugar is an important ingredient of SSBs (Bonnet and Requillart, 2011);
  - upcoming sugar tax in Italy in 2022.
- The “health” distributional implications across different socio-economic groups are also evaluated.

Empirical framework in short

- Step 1: estimating consumers' demand for SSBs using the random coefficient logit demand (BLP) model and deriving price-elasticity (Berry, Levinshon and Pakes, 1995).
- Step 2: on the supply side, the estimated demand parameters are used to recover marginal costs.
- Step 3: the estimated marginal costs and demand parameters are used to carry out counterfactual simulations.

Demand model

- The demand for SSBs is modeled according to the random coefficient logit demand (BLP) model (Berry, Levinshon and Pakes, 1995; Nevo 2000,2001).
- The indirect utility that each household *i* can get from product *j* is:

$$U_{ij} = \alpha_i p_j + \beta x_j + \xi_j + \varepsilon_{ij}$$

- The random parameter α_i accounts for the potential heterogeneity of individual preferences for price:

$$\alpha_i = \alpha + \sigma v_i + \pi D_i, \quad v_i \sim P_v(v), \quad D_i \sim \widehat{P_D^*}$$

- Price elasticities can be derived as follows:

$$\eta_{jk} = \frac{\partial s_j}{\partial p_k}\frac{p_k}{s_j} = \begin{cases} -\frac{p_j}{s_j}\int \alpha_i\, s_{ij}\,(1 - s_{ij})\, \mathrm{dP}v(v)\, \mathrm{dP}_D(D) & \text{if } j = k, \\ \frac{p_k}{s_j}\int \alpha_i\, s_{ij}\, s_{ik}\, \mathrm{dP}v(v)\, \mathrm{dP}_D(D) & \text{if } j \neq k\,. \end{cases}$$

Supply side

- Following BLP(1995) and Nevo (2001), the profit of each multiproduct firm *f* that produces a subset J_f of the *J* products in the market is defined as:

$$\Pi_f = \Sigma_{j \in Jf} (p_j - mc_j)\ Ms_j(p, X, \xi; \vartheta) - C_f$$

- The firms' profit maximization problem leads to the following FOCs:

$$s(\bullet) - \Omega(p)\ \Lambda(p\text{-}mc) = 0$$

- The price-cost margins and marginal costs can be recovered as follows:

$$(p\text{-}mc) = (\Omega(p)\ \Lambda)^{-1}\ s(\bullet)$$

$$mc = p - (\Omega(p)\ \Lambda)^{-1}\ s(\bullet)$$

Counterfactual simulations

- Changes in the cost of raw sugar directly affect the cost and price of SSBs.
- Following Bonnet and Requillart (2013), we define the following model for mc:

$$\log mc_j = \sum_{k=1}^{K} \gamma_k log(ck) + \gamma_s log(cs) + \sum_{b=1}^{B} w_b + \sum_{r=1}^{R} d_r + \sum_{t=1}^{T} d_t + \eta_j$$

where $\boldsymbol{\gamma_s}$ is the elasticity of mc with respect to the cost of sugar.

- The new equilibrium prices for SSBs can be derived as follows:

$$\min_{\{p_j^*\}_{j=1,\ldots,J}} \quad || \, p_j^* - \Lambda(p_j^*) - mc_j' \, ||$$

Where mc_j' incorporates the new sugar cost.

Data and estimation

- Nielsen Household Panel data on SSBs purchases for over 9,000 Italian households (May 2019-July 2020).
- Products are defined based on:
  - vendor name;
  - segment (ice-tea, cola, orangeade and others);
  - sugar content (regular vs diet).
- We also include regional and seasonal fixed-effects and a COVID-19 control variable.
- The demand function can be estimated using the Generalized Method of Moments (GMM) estimator and instrumental variables (i.e., cost-shifters).

Results

- Slides showing results of ongoing work were deleted. The presented results are soon to be published.
- The full set of slides can be made available under request, please contact:

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Conclusions

- Consistently with previous studies (e.g., Bonnet and Requillart 2011 and 2013), our results confirm that agricultural and trade policies can significantly affect food consumption and health through their effects on food prices.
- This is particularly true for those agricultural commodities that are key inputs for relatively unhealthy foods and beverages (i.e., sugar and SSBs).
- The extent of price transmission along the food chain and consumers' price responsiveness may enhance or mitigate the overall effect on food consumption.
- Policy-makers should account for the interaction with broad scale economic policies when evaluating the potential effects of direct policies targeting healthier food consumption patterns (i.e., the upcoming Italian sugar tax in 2022).

Thank you for your attention