Promoting Green Consumption in Retail Markets: Non-Price Interventions under Strategic Pricing

Damien Mayaux, Paris School of Economics

Background and motivation

- Food systems responsible for 30% of the world greenhouse gas emissions
- Major drivers of water use and pollution, deforestation and biodiversity loss.

- Behavioural interventions (advertisement, marketing, nudges, labelling, boycotts) can shift consumption to greener alternatives, but :
  - **demand saturates among green consumers**
  - **new consumer segments are hard to reach**
  - retailers respond by pricing green products as a **niche market**

Hypotheses

- Behavioural interventions change not only consumption choices at current prices but also consumers' demand function

- **Consumers affected by pro-environmental interventions** often **have a low price sensitivity and are** already **willing to pay** a lot for green products

- **Retailers set their prices strategically**, taking consumer demand into account

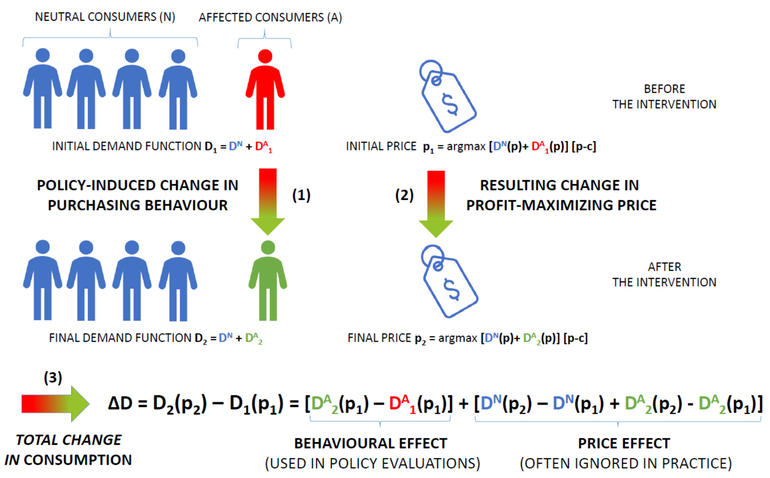
- Higher retail margins are unlikely to benefit upstream green industries, since large generalist food stores enjoy a tremendous market power as buyers

Outline

1. **I ask theoretically what purchasing behaviour should be induced by interventions to support green consumption**
2. **I compare several intervention formats using simulations**

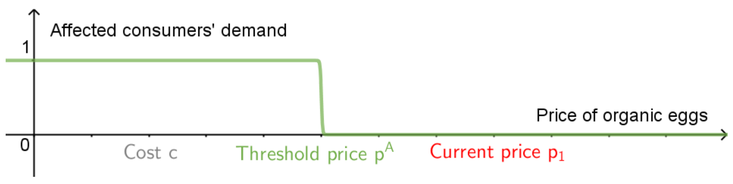
Theoretical model

Notations



Theorem

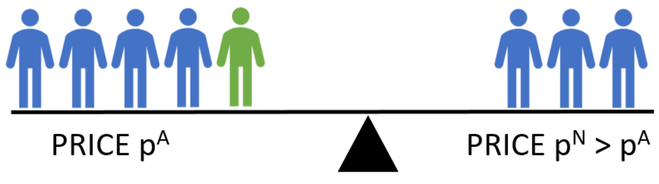
$D_2(p_2)$ is maximized when D_2^A is $1_{]-\infty,p^A]}$ for a well-chosen p^A



Intuition

***"Affected consumers can trade the value of their consumption for a lower price**, which benefits non-affected consumers"*

$$[D^N(p^A) + \varepsilon] \times [p^A - c] \quad = \quad D^N(p^N) \times [p^N - c]$$



- The theorem extends to multiproduct monopolist or symmetrical Nash-Bertrand oligopolists.
- With an optimal intervention, affected consumers would stop consuming at current price

Sufficient statistics

$$\Delta p \underset{\epsilon \to 0}{\sim} \frac{\frac{\partial \Pi_1^A}{\partial p}(p_1) - \frac{\partial \Pi_2^A}{\partial p}(p_1)}{\frac{\partial^2 \Pi^N}{\partial p^2}(p_1)} \times \epsilon$$

Any smooth intervention

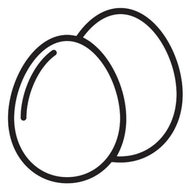
What drives the price effect is the change in slope in the profit curve

$$\Delta p^* \underset{\epsilon \to 0}{\sim} \sqrt{\frac{2(p_1 - c)}{\frac{\partial^2 \Pi^N}{\partial p^2}(p_1)}} \times \sqrt{\epsilon}$$

Optimal intervention

The price effect (in $\sqrt{\epsilon}$) **dominates the behavioural effect** (bounded by ε)

Empirical strategy



Data home-scanned **egg consumption** at French **generalist food stores** (14 retailers, 111 products) in 2012 from a **representative panel** of 3000 households,

Demand model

Multinomial logit with random coefficients α and β

- **Price sensitivity = α**
- Valuation of organic eggs = β
- **Willingness to Pay (WTP) =** $\frac{\beta}{\alpha}$

1. Estimate the population-level distribution of α and β (assumed to be jointly normal)
2. Compute the household-level bayesian mean for α and β
3. Simulate household-level demand functions

Supply model

- **Nash-Bertrand competition**
- Marginal costs identified from current prices and elasticites

SHOULD GREEN CONSUMERS BE **MORE WILLING TO PAY (A)**

OR RATHER **MORE CAREFUL ABOUT PRICES (B) ?**

A monopolist sells a green good with constant marginal cost c to heterogeneous consumers

1. the intervention affects the demand function of **a fraction ε of the consumers**.
2. the firm sets a new price
3. consumption is realized

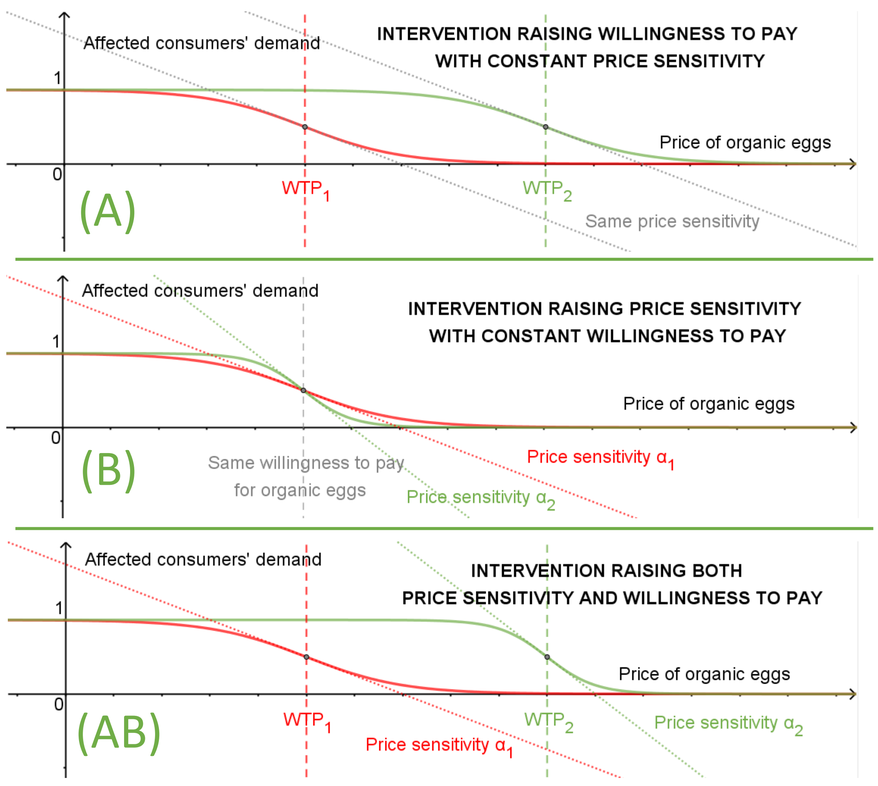
Methods

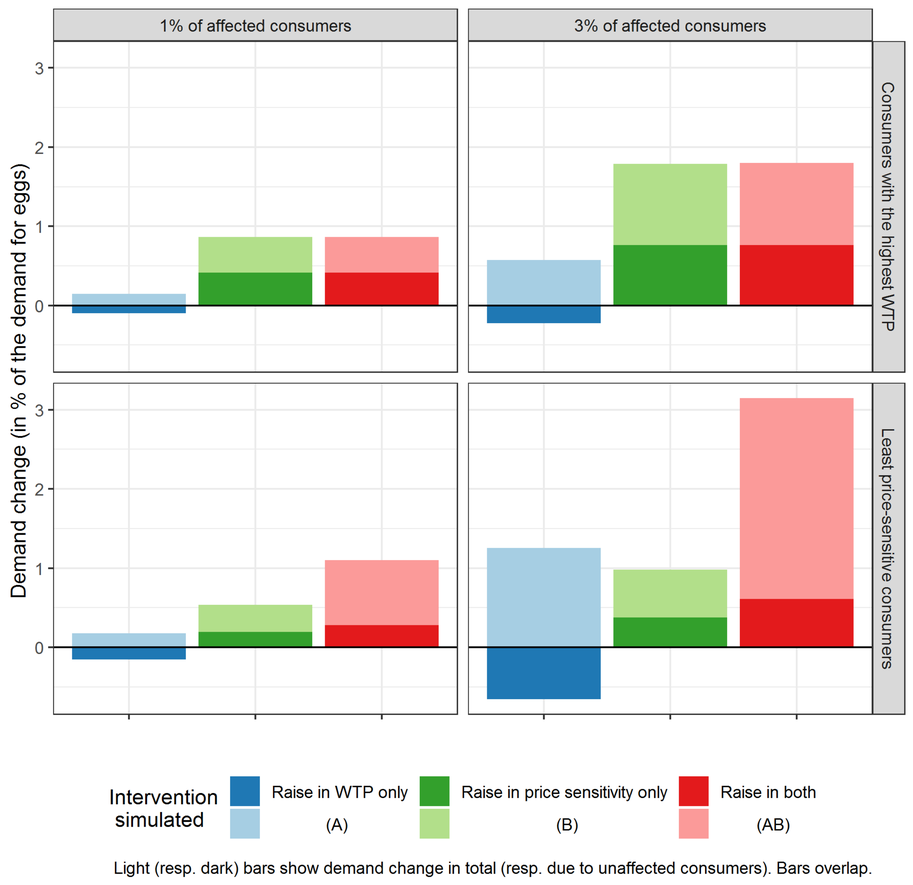
1. Change WTP and/or price sensitivity for affected consumers
2. Compute the new equilibrium in price
3. Deduce the new consumption in each consumer group

Main results

- **Price effects matter** (see darker bars)
- **Raising WTP (A) may be counterproductive**
- **Raising price sensitivity (B) (AB) has positive spillovers on passive consumers**

Policy Simulations





Light (resp. dark) bars show demand change in total (resp. due to unaffected consumers). Bars overlap.

Implications

Intervention design

- Encouraging green consumption no matter its price is a bad idea
- NGOs could suggest indicative prices for green products

Policy evaluation

- Experiments should **measure how interventions affect the full demand curve**
- **ATE overestimates future consumption**