# The Economics of Reducing Package Size: Consumer response and returns to manufacturers

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# The Economics of Reducing Package Size: Consumer Response and Returns to Manufacturers

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## Introduction

- Reducing package size, or package downsizing, is a widely used strategy among manufacturers of consumers goods.
- However, downsizing as a strategic tool has not been analyzed previously and its causes and economic implications are unknown.
- A manufacturer may choose downsizing to
  - effectively raise the unit price of the good as a response to an increase in input price.
  - differentiate its product, i.e. targeting consumers who prefer products in smaller packaged products.
- **Objective:** To provide empirical evidence on the economic reasons and consequences of downsizing.
- **Data:** We use a panel of household purchase data on the ice cream category compiled by Nielsen Homescan.
- **Method:** Specify and estimate an equilibrium model of differentiated product markets which accounts for competition in both prices and package size.

## Research Questions

- **Why do (some) manufacturers downsize?**
- **What are the effects of downsizing on market shares and mark-up?**
- **Do consumers have differential sensitivity to changes in unit price and package size?**
- **Do demographics matter in consumers response to downsizing?**

## Contribution to the Literature

- First to analyze reducing package size as a strategic tool
- First to estimate a random coefficient logit model with endogenous product characteristics using a Bayesian estimation approach

## The Data

- We use a panel data consists of detailed purchases of household over 1998-2007 in 52 major cities.
- Information is available on:
  - Purchase price and quantity of products.
  - Product characteristics: Variety, package size &promotion.
  - Demographics: Income, employment, education, race, martial status, household size and household composition

## The US Bulk Ice Cream Industry

- Typical of oligopolistic differentiated product markets marked by concentration and brand proliferation.
  - In 2007, 250 manufacturers produced over 400 brands.
  - Top 3 manufacturers shared over 50% of the market.
- Downsizing is frequently observed, but not for all manufacturers.
  - Downsizing may be used strategically.

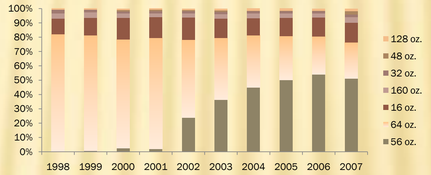
Average National Shares of Major Brands Between 1998-2007

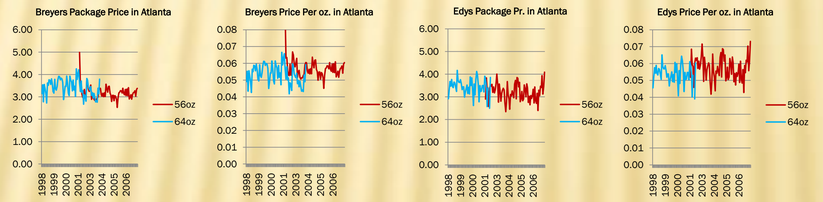
| Brands | Size | Share |
|---|---|---|
| Top 4 | | 0.342 |
| Top 10 | | 0.572 |
| Top 20 | | 0.707 |
| Ben & Jerry | Pint | 0.043 |
| Haagen Dazs | Pint | 0.041 |
| Blue Bell | Pint | 0.016 |
| Dreyer's/Edys | Pint | 0.016 |
| Breyers | Half Gallon | 0.164 |
| Dreyer's/Edys | Half Gallon | 0.156 |
| Kroger | Half Gallon | 0.055 |
| Turkey Hill | Half Gallon | 0.039 |
| Blue Bell | Half Gallon | 0.037 |
| Wells Blue Bunny | Half Gallon | 0.032 |
| Safeway | Half Gallon | 0.026 |
| Publix | Half Gallon | 0.019 |
| Friendly | Half Gallon | 0.017 |
| Dean's | Half Gallon | 0.012 |
| Wal Mart | Half Gallon | 0.011 |
| Mayfield | Half Gallon | 0.010 |

Volume and Expenditure Shares of Leading Manufactures in the US Bulk Ice Cream Industry

| Manufacturer | Volume Share | Expenditure Share |
|---|---|---|
| Unilever | 18.51 | 22.81 |
| Nestle | 17.09 | 22.16 |
| Kroger | 13.68 | 10.48 |
| Wells Dairy | 7.55 | 6.50 |
| Blue Bell | 4.56 | 5.95 |
| Top 3 | 49.28 | 55.45 |
| Top 6 | 64.73 | 70.67 |
| Private Brands | 25.79 | 20.04 |

Ice Cream Expenditure Shares by Size




## Preliminary Evidence from Descriptive Analysis

- Downsizing effectively increases the unit price of the product.
- Household demographics matter in the choice of product.
  - i.e. low income-education households prefer Wal Mart.
  - i.e. small size households prefer Haagen Dazs.

## The Econometric Model

- **Demand Side:** A random coefficient logit model that incorporates both observed and unobserved consumer heterogeneity.
- The probability of person *i* choosing brand *j* in market *t* is:
- $s_{ijt} = \exp(V_{ijt})/(1+\sum_k \exp(V_{ijt}))$ where;
  - $V_{ijt} = \beta_i' x_{jt} + \xi_{jt}$
- $x_{jt}$ is the vector of observed product characteristics including price, package size, promotion, variety and brand fixed effects.
- $\xi_{jt}$ is the unobserved product characteristics.
- $\beta_i = \beta_0 + \alpha d_i + \delta v_i$, is individual level response coefficients.
  - $d_i$ is observed, $v_i$ is unobserved consumer heterogeneity.

- **Supply Side:** A two stage model of competition in order to characterize both short-run and medium-run decisions.
  - **1st stage:** Firms choose product package size.
  - **2nd stage:** Firms compete in prices.
- Retailers assumed to have constant mark-up pricing policy.
- Manufacturers assumed to be price-takers in input markets.
- The manufacturers cost structure is specified as:
  - $C^{mr}(s_j(.), w_j \mid r_j, \kappa_j) = C^{sr}(s_j(.) \mid w_j, r_j, \kappa_j) + r_j w_j$
- The profit maximization problem at each stage is given as:
- 2nd stage: $\max_p \pi_f = \sum_{j \in \Theta} (p_j s_j(p) - C^{sr}(s_j(p) \mid w_j, r_j, \kappa_j))$
- 1st stage: $\max_w \pi_f = \sum_{j \in \Theta} (p^*_j s_j(p^*) - C^{sr}(s_j(p^*) \mid w_j, r_j, \kappa_j) - r_j w_j)$
- p is price, w is package size, $p^*$, is the second stage optimal prices, κ is the other fixed cost prices and Θ is the set of products produced by manufacturer *f*.

- **Estimation:** We employ a Markov Chain Monte Carlo, MCMC, procedure to estimate demand equation together with the two first order conditions derived from supply side simultaneously.

## Preliminary Evidence from Regression Analysis

- Our preliminary results suggest that consumers are less responsive to changes in package size than to changes in price. This finding has important implications for competition in the ice cream category, welfare of consumers, and potentially population health and nutrition related to ice cream consumption.