Using Scanner Data To Answer Food Policy Questions

Conference

Wednesday, June 1 - Thursday, June 2, 2011

Economic Research Service
1800 M Street, NW
Waugh Auditorium
Washington, DC

Price and Variety in Supermarkets: Can Store Competition Hurt Consumers?

Andre Trindade - Northwestern University

ERS Scanner Data Conference - June 1, 2011

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
●○○	○	○○○○○○○	○○○	○○○○○○	○

Introduction

Traditionally, most of the IO literature (theoretical or empirical) has focused on prices.

This paper:
Competition when firms (retailers) **choose jointly prices and product variety**

I look at the Supermarket Industry, particularly relevant to study
product variety
Why?

- Consumers buy bundles
- Costly to visit multiple stores
- Huge demand spillovers

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
○○●	○	○○○○○○○	○○○	○○○○○○	○

Introduction

Preview results:

- Data Patterns

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
○○●	○	○○○○○○○	○○○	○○○○○○	○

Introduction

Preview results:

- Data Patterns

1. Competition increases store variety by 9% - New result!
   (theory has ambiguous predictions)

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| ○○● | ○ | ○○○○○○○ | ○○○ | ○○○○○○ | ○ |

Introduction

Preview results:

- Data Patterns

1. Competition increases store variety by 9% - New result! (theory has ambiguous predictions)

2. Moreover, more competition increases prices (1 to 2%) - Totally new and surprising result!

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| ○○● | ○ | ○○○○○○○ | ○○○ | ○○○○○○ | ○ |

Introduction

Preview results:

- Data Patterns

1. Competition increases store variety by 9% - New result! (theory has ambiguous predictions)

2. Moreover, more competition increases prices (1 to 2%) - Totally new and surprising result!

- Simple theoretical model of retailer competition that explains the previous patterns

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| ○○● | ○ | ○○○○○○○ | ○○○ | ○○○○○○ | ○ |

Introduction

Preview results:

- Data Patterns

1. Competition increases store variety by 9% - New result! (theory has ambiguous predictions)

2. Moreover, more competition increases prices (1 to 2%) - Totally new and surprising result!

- Simple theoretical model of retailer competition that explains the previous patterns

- Welfare Analysis: structural model of consumer behavior. Competition found to make the consumer better off.

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | ● | 0000000 | 000 | 000000 | 0 |

Literature

- **Variety / Quality competition:**

Gavazza (2010), Watson (2009), Olivares & Cachon (2009), Matsa (2010)
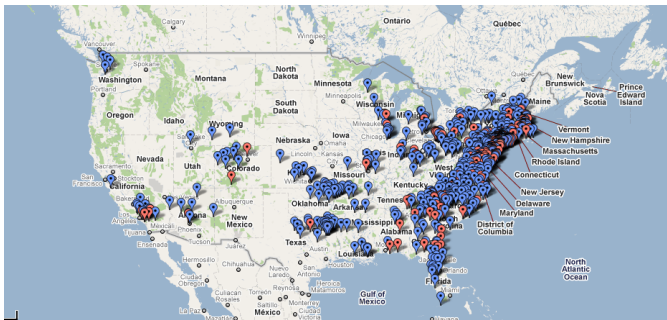
- **Free Entry and inefficiency**

Mankiw and Whinston (1986), Berry and Waldfogel (1999)

- **Store Choice Models**

Smith (2004), Dubois & Jodar-Rosell (2010)

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | ●000000 | 000 | 000000 | 0 |

Data patterns

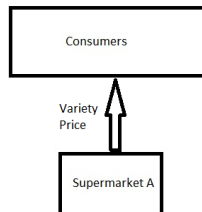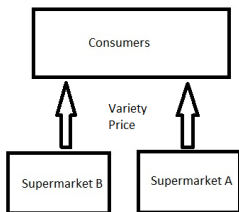Nielsen Store level scanner data on **Beverages** (prices and quantities for each store/week/product)
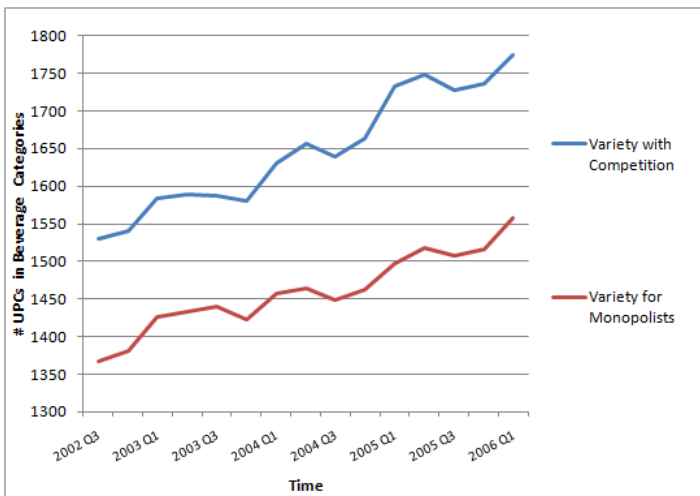
April 2002 - April 2006
707 markets of small dimension

Orange: Towns with two supermarkets
Blue: Towns with one supermarket

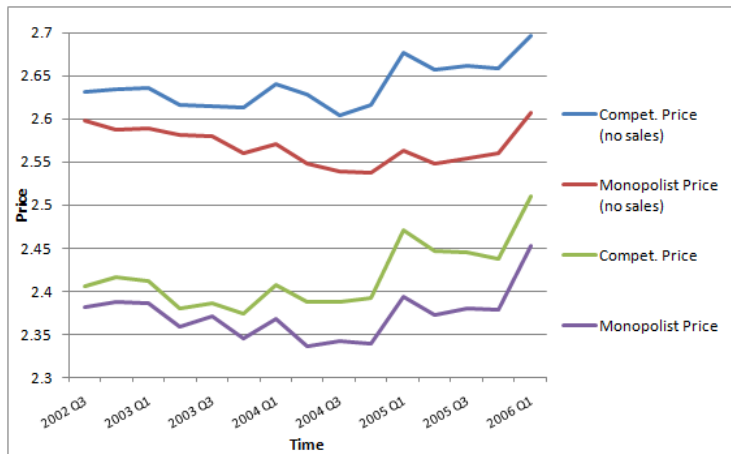| Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
ooo	o	o●ooooo	ooo	oooooo	o

Data patterns

Empirical Strategy:

Compare variety and prices from monopolist stores with those of in a duopoly (controlling for factors - observed and unobserved - that may affect both the market structure and the decisions of the firms)

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| ooo | o | ooo●oooo | ooo | oooooo | o |

Data patterns

Variety (i.e. **number of different products**) in a typical store over time:

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
○○○	○	○○○●○○○	○○○	○○○○○○	○

Data patterns

Construct a price index for each store (using the 164 UPCs present in each store):

(with sales and without)

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
ooo	o	oooo●oo	ooo	oooooo	o

Data patterns

Observable differences?

	(1) lnVariety	(2) lnregprice	(3) lnprice
monopolist	-0.0850*** (0.00480)	-0.0146*** (0.00160)	-0.00921*** (0.00134)
Quarter F.E.	Yes	Yes	Yes
N	10789	10789	10789
R-sq	0.214	0.155	0.149

Table: Linear Regressions of Variety and Prices on a monopolist dummy. It includes as controls: population, income, education, household size, age (coefficients not reported)

In the paper: further analysis (including more flexible controls and Propensity Score Matching)

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
000	0	0000000	000	000000	0

Data patterns

Unobservable differences?

A small set of markets (6%) observe change in structure. Allows controlling for market unobserved characteristics (constant over time):

	(1)	(2)	(3)
	lnVariety	lnregprice	lnprice
Monopolist	-0.0164*	-0.00924**	-0.00674*
	(0.00637)	(0.00331)	(0.00278)
Store Size	Yes	Yes	Yes
Market F.E.	**Yes**	**Yes**	**Yes**
Quarter F.E.	Yes	Yes	Yes
N	10789	10789	10789
R-sq	0.266	0.031	0.139

Table: Linear Regressions of Variety and Prices on a monopolist dummy including Market Fixed Effects

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | O | 000000● | 000 | 000000 | O |

Data patterns

In some of the duopoly markets, both stores belong to the same chain. Duopoly markets with low competition intensity.

	(1)	(2)	(3)
	lnVariety	lnregprice	lnprice
Monopolist	-0.0939***	-0.0178***	-0.0112***
	(0.00568)	(0.00177)	(0.00148)
Same Chain duopolists	-0.0555***	-0.0199***	-0.0121***
	(0.0122)	(0.00380)	(0.00317)
Quarter F.E.	Yes	Yes	Yes
N	10789	10789	10789
R-sq	0.216	0.157	0.150

Table: Separate effect of 2-store markets with no competition

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | 0000000 | ●00 | 000000 | 0 |

Model

Consumers:

1) Maximize utility: buy one of two goods: A and B or none (with $u_o = 0$)

2) $u = v - p$ where $v_{ij} \in \{v_L, v_H\}$
    Heterogeneous preferences: half prefer good A, and the remaining prefer good B.

3) One store visit

4) Informed about assortment but not prices before visiting the store
This assumption reflects the fact that assortment is usually a quarter decision while prices change every week.

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | 0000000 | 0●0 | 000000 | 0 |

Model

Firms:

1) Maximize profits.

2) In the first stage, choose the set of products to sell
$(q \in \{A, B, (A, B)\})$.
Then, compete in prices (knowing the assortment of the rival)

3) To carry a second product, a firm will have to pay a fix
(storage) cost F.

=> **Competition induces higher Variety and Prices in equilibrium**

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | 0000000 | 00● | 000000 | 0 |

Model

Intuition?

- Each Store compares benefits of increasing variety with costs
- Duopolist stores benefit more from increasing variety because of the Business Stealing Effect
- Increase in Variety allows increase in Prices (on average consumers find products available for which they are willing to spend more money)
- Monopolist stores do not find it profitable to increase variety (even though it allows higher prices) because of the higher storage costs

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
000	0	0000000	000	●00000	0

Consumer Welfare

Are consumers better-off in cities with supermarket competition?
(I abstract away from any other impact of competition, e.g.:
service,...)

Need to learn how consumers choose stores

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | 0000000 | 000 | 0●0000 | 0 |

Consumer Welfare

A Consumer Choice Model

$$U_{ijt} = \sum_c \left(\theta_{ic} * E\left(V_{ijct}\right)\right) + \gamma_{ij} + u_{ijt}$$

Consumer i utility of going to store j at time t depends on 3 components:

1) utility from the bundle chosen

2) utility derived from store characteristics (distance, taste for store music, parking lot,...)

3) random shock (logit)

Also...model product choice to compute $E\left(V_{ijct}\right)$ exactly...

The utility of the bundle depends on the products purchased and the prices paid. Let Ω_{cjt} denote the set of products available at store j, category $\dot{c}$. Then:

$$V_{ijct} = \max_{b \in \Omega_{cjt}} \left(\delta_{ib} - \alpha_{ic} p_{jbt} + e_{ibt}, 0 \right)$$

$$E\left(V_{ijct}\right) \equiv E\left(V_{ijct}(\Omega_{jct}, p_{jct})\right) = \int_{e,p} V_{ijct} dF(e, p)$$

Estimation

Use sample of 5345 Households (Nielsen Homescan) **matched**
with the store level data

I observe choices (store and products) and non-choices! (not
always available)

Recover consumer preferences (for products and store
characteristics) using Maximum Simulated Likelihood

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | o | 0000000 | 000 | 000000 | o |

Consumer Welfare

Counterfactual experiment:
$p_D => p_M$ and $\Omega_D => \Omega_M$
and compute consumer new choices (of store and products)

Use predicted causal effect of competition estimated from first part
of the paper.

Introduction	Literature	Data patterns	Model	Consumer Welfare	Conclusion
000	0	0000000	000	00000●	0

Consumer Welfare

	Duopolist (real)	Monopolist (counterfactual)
All Consumers	2.97	2.83
Low Inc, small size	1.75	1.65
Low Inc, big size	5.02	4.83
Med Inc, small size	1.79	1.68
Med Inc, big size	4.72	4.52
High Inc, small size	2.36	2.24
High Inc, big size	5.04	4.84

Table: Welfare simulation

| Introduction | Literature | Data patterns | Model | Consumer Welfare | Conclusion |
| 000 | 0 | 0000000 | 000 | 000000 | ● |

Conclusion

- The impact of competition may not be so clear when price is not the only variable of choice
- Implications for Merger Analysis, Entry simulation, etc.
- Careful:
  -Only looking at move from 1 to 2 stores (not clear how the effect extends beyond)
  -Only looking at Beverages/Supermarkets