Beyond Plain Vanilla: Modeling Joint Product Assortment and Pricing Decisions

Michaela Draganska

GSB, Stanford University

Michael Mazzeo

Kellogg School of Management

Katja Seim

Wharton School of Business

Introduction

- Product assortment adjustments important by-product of changes in market structure (due to, e.g., mergers)
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Model Overview

- Two-stage game
  - Stage 1: B brands (firms) decide which flavors (products) to offer
  - Stage 2: conditional on flavor choices, brands set prices
- Demand
  - Discrete choice model to obtain consumer preference parameters based on brand-flavor utility.
    - Random-coefficients specification
    - Logit demand shock
  - Control for unobservable attributes of flavors with market characteristics and time & flavor effects.

Model Overview, II

- Costs
  - Brand-specific marginal costs are common knowledge
  - Fixed costs of offering assortment are private information

Two-firm/Two-flavor Example

Overview of Estimation Algorithm

- For a given set of parameters:
  - Calculate predicted market shares and prices.
  - Recover shocks to marginal cost from shares and prices at observed assortment using pricing FOC.
  - Calculate variable profits for all possible assortments.
  - Compute Perfect Bayesian Nash equilibrium as fixed point in probabilities.
- Combine moment conditions into objective and minimize to update parameters.

Monte Carlo Simulation

	truth	mean	bias	std. dev.	RMSE
Mean					
brand 1, flavor 1	0.0100	0.0086	-1.36E-03	6.32E-03	6.47E-03
brand 1, flavor 2	0.0250	0.0220	-2.95E-03	1.65E-02	1.68E-02
brand 2, flavor 1	0.0100	0.0110	1.01E-03	7.14E-03	7.22E-03
brand 2, flavor 2	0.0200	0.0170	-3.05E-03	1.24E-02	1.27E-02
Standard deviation					
brand 1, flavor 1	0.1000	0.1061	6.13E-03	4.22E-02	4.26E-02
brand 1, flavor 2	0.2500	0.2758	2.58E-02	1.47E-01	1.49E-01
brand 2, flavor 1	0.1000	0.1052	5.19E-03	4.77E-02	4.80E-02
brand 2, flavor 2	0.2000	0.2133	1.33E-02	9.76E-02	9.85E-02

- 100 runs, 256 simulated markets
- Estimation recovers fixed cost parameters

Our Focus

- Demand is modeled for all brands in the market.
- Decisions of Breyers and Dreyers considered in the product choice stage.
- Offering of optional flavors versus staples.

Demand Estimates

Marginal Cost Estimates

[redacted]

Fixed Cost Estimates – Implied Moments

[redacted]

Merger Analysis

	All Flavors & Firms		
		Merged Firm	
		Fixed	Endog.
	Duopoly	Products	Choices
Price, Breyers	3.785	3.846	3.846
Price, Dreyers	3.427	3.530	3.530
Total profits, Breyers	8.379	8.392	8.392
[illegible]	8.379	[illegible]	[illegible]
[illegible]	[illegible]	8.392	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Number of flavors offered	1.9[illegible]	[illegible].999	[illegible]
Share of time offered:			
Natural Vanilla	0.865	0.863	[illegible]
Homemade Vanilla	0.628	0.625	[illegible]
Vanilla Custard	0.507	0.567	[illegible]
Consumer surplus	14.73[illegible]	14.651	14[illegible]

Small effects due to:

- Share of vanilla (and especially optional vanilla) flavors small in potential ice cream market
- Relatively low cost of offering flavor

Merger Analysis – Alt. Scenarios

	Breyers & Dreyers' Optional Flavors Only					
	Estimated Fixed Cost			High Fixed Cost		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Price Breyers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Price Dreyers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total profits Breyers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total profits Dreyers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Number of flavors	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Conclusion

- Model allows us to evaluate empirically both price and product variety effects of mergers.
- Value of jointly modeling product market competition and entry decisions:
  - Consumer surplus changes represents net effect of price and assortment effects.
  - Under reasonable conditions, consumer welfare increases because of increased variety.
- Future work:
  - Here, assortment choices driven by cost considerations
  - Alternative model focuses on selection