Static Competition

Glenn Ellison

"Competition and Collusion in the American Automobile Industry: The 1955 Price War," Bresnahan, *JIE*, 1987

As an applied paper, Bresnahan's is at the IO/Economic History boundary, proposing an interesting hypothesis:

- The 1955 surge in US auto sales was driven in part by a temporary breakdown in collusion among the big US automakers.

The paper has had a much larger influence for its methodology.

- It has been a model for future work in "structural" empirical IO.

The paper had some glaring limitations that probably contributed to the delay in its being published. Subsequent work has improved on the methodology in many dimensions, but often falls short of Bresnahan's vision in others so I still like to cover it.

“The 1955 Price War,” Bresnahan

The paper starts by noting that 1955 auto sales were remarkably high and this had long been regarded by economists as a puzzle.

	auto production	auto sales ($)	% change in quality-adjusted price	non-auto consumer durable goods spending
1954	5.5 m	13.9 b	---	14.5 b
1955	7.9 m	18.4 b	-2.5	16.1 b
1956	5.8 m	16.2 b	6.3	17.1 b

Change in auto production really striking

The change in auto sales (in dollars) not as large, reflecting that prices were lower and more inexpensive cars were sold.

The economy was doing well in 1955, but not 40% larger in one year well.

“The 1955 Price War,” Bresnahan

One could find explanations in the popular press (the one below is from Car Talk), but Paul Samuelson, apparently was very unconvinced.

The Mickey Mouse Club is on TV, but it was also the year that Rosa Parks refused to give up her bus seat. Eisenhower is President, and Nixon is the VP. Ray Kroc hasn’t yet had his vision for a McDonald’s on every corner, so teenagers are buying their burgers from car hops at the local drive-in—and listening to doo-wop and rock on the radio. (Elvis’ first hit was in ’56, but rock and roll was already a thing—Bill Haley’s “Rock Around the Clock” reached number one on July 9, 1955.)

Given this backdrop, it’s not surprising that Americans were in a buying mood when it came to cars. In fact, the 8,338,302 sold were the high point of the 1950s. Lots of stuff was coming together: sleek new designs; such technology as reliable automatic transmissions, overhead-valve V-8s (including Chryslers Hemi), wrap-around windshields, air conditioning and modern suspensions; power steering and power brakes.

Paul Samuelson summarized the situation in his famous classroom remark that he “. . . would flunk any econometrics paper that claimed to provide an explanation of 1955 auto sales.”[2]

“The 1955 Price War,” Bresnahan

Image credits on the next slide.

1955 Mercury Montclair

1955 Chevy Bel Air

1955 Ford Thunderbird

1954 Chevy Bel Air

Slide 5 Image credits

1955 Mercury Montclair: Courtesy of Henry Figueroa on flickr. License CC: BY-NC-SA

1954 and 955 Chevy Bel Airs Courtesy of Sicnag on Wikimedia Commons. License CC BY

1955 Ford Thunderbird: Courtesy of Jeremy from Wikimedia Commons. License CC BY

“The 1955 Price War,” Bresnahan
Economic Idea

Bresnahan hypothesized that the 1955 aberration was caused by a breakdown in collusion among the “big three” (Ford, Chrysler, GM). If the firms acted as multiproduct monopolists in 1954 and 1956, and engaged in differentiated product competition in 1955, then prices would be lower and sales higher in 1955.

To argue that a theory explains a known fact, one really wants to then identify additional predictions of the theory and show that they hold as well.

Bresnahan also has a very good idea along these lines:

- A shift from collusion to competition would have differential effects on different car models. Models that were close in product space to models of other firms in product space would be more affected than models that were off by themselves.

"The 1955 Price War," Bresnahan
Economic Idea

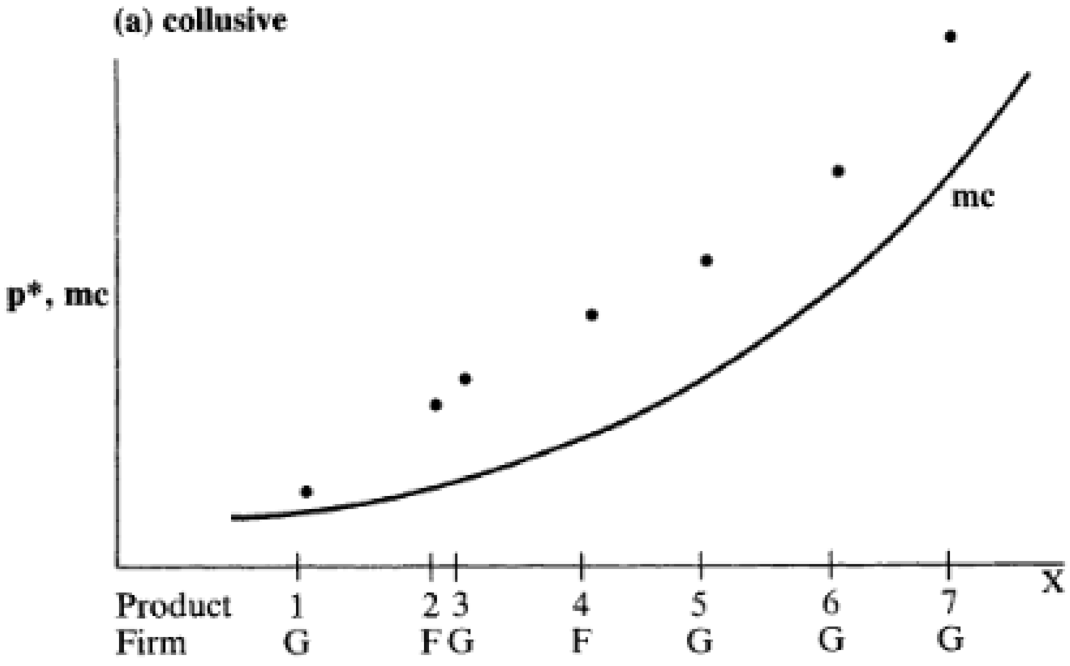


Figure 2(a)

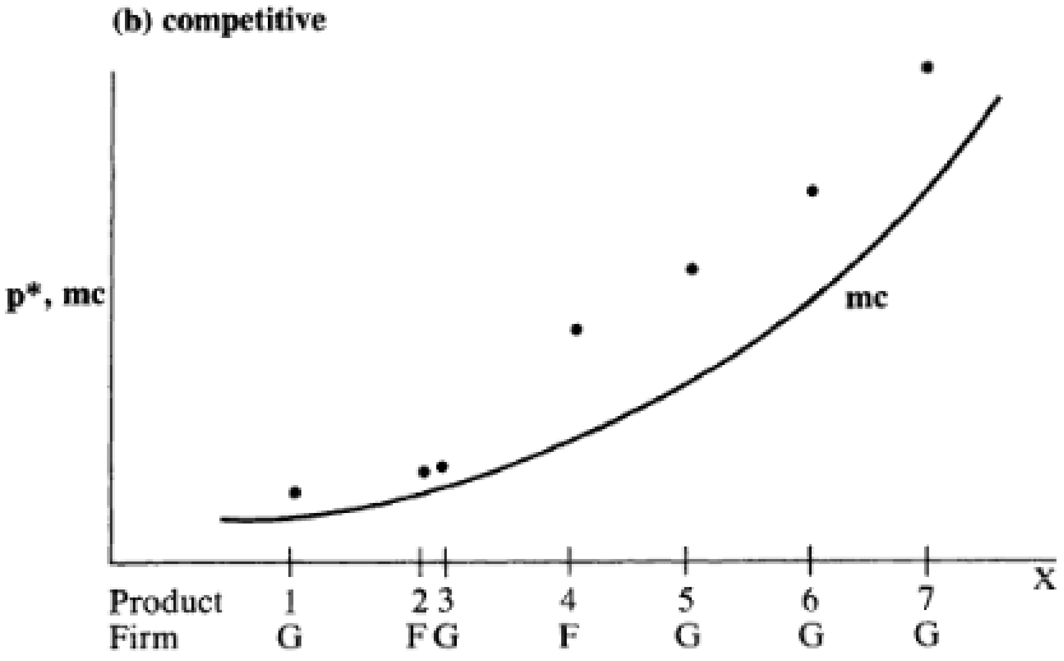


Figure 2(b)

These pictures illustrate the idea in a vertical differentiation model. Think of models in a one-dimensional quality space, where marginal cost is increasing in quality.

"The 1955 Price War," Bresnahan

Economic Idea

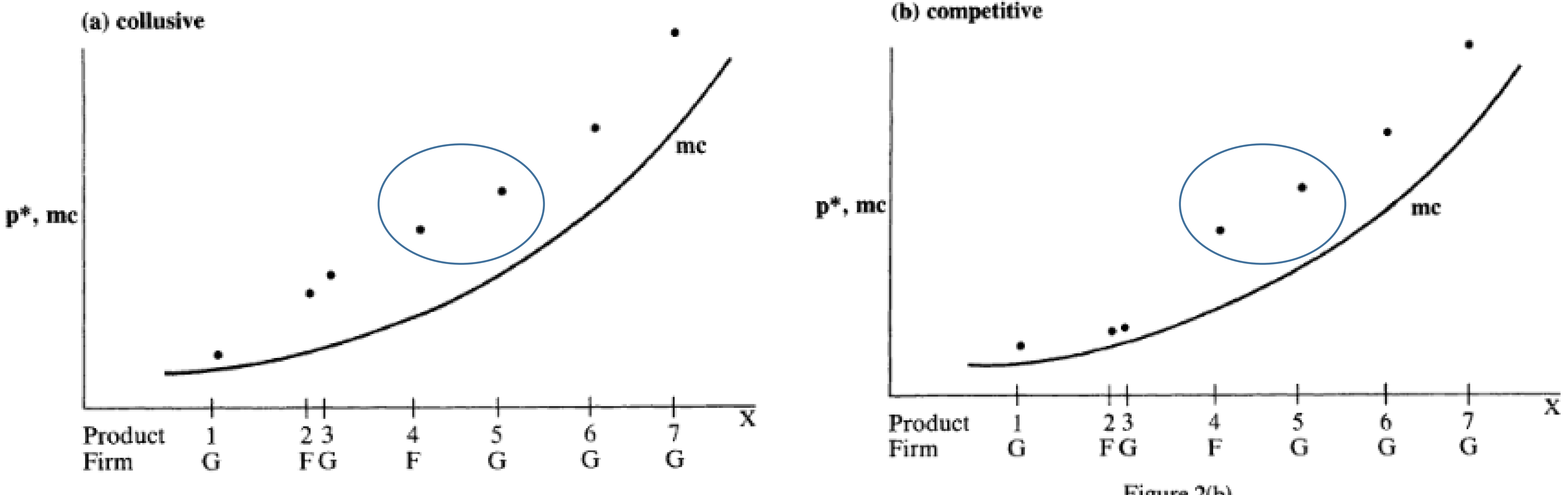


Figure 2(a)

Figure 2(b)

Models 4 and 5, produced by different firms, are pretty far apart in product space. A shift from collusion to competition does not make too much difference in their margins.

"The 1955 Price War," Bresnahan
Economic Idea

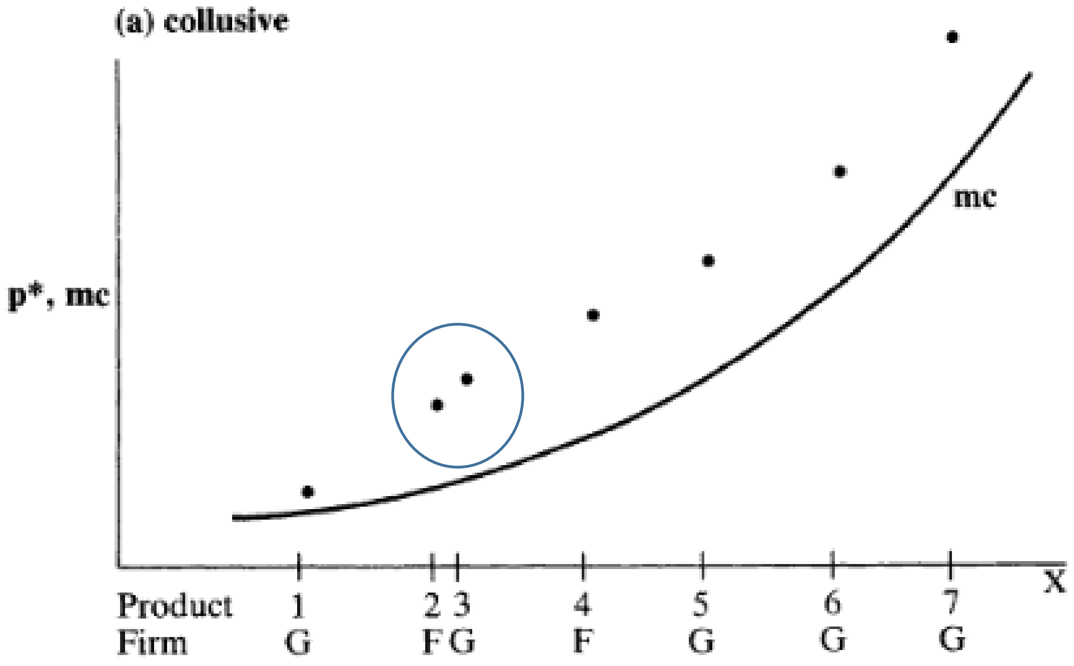


Figure 2(a)

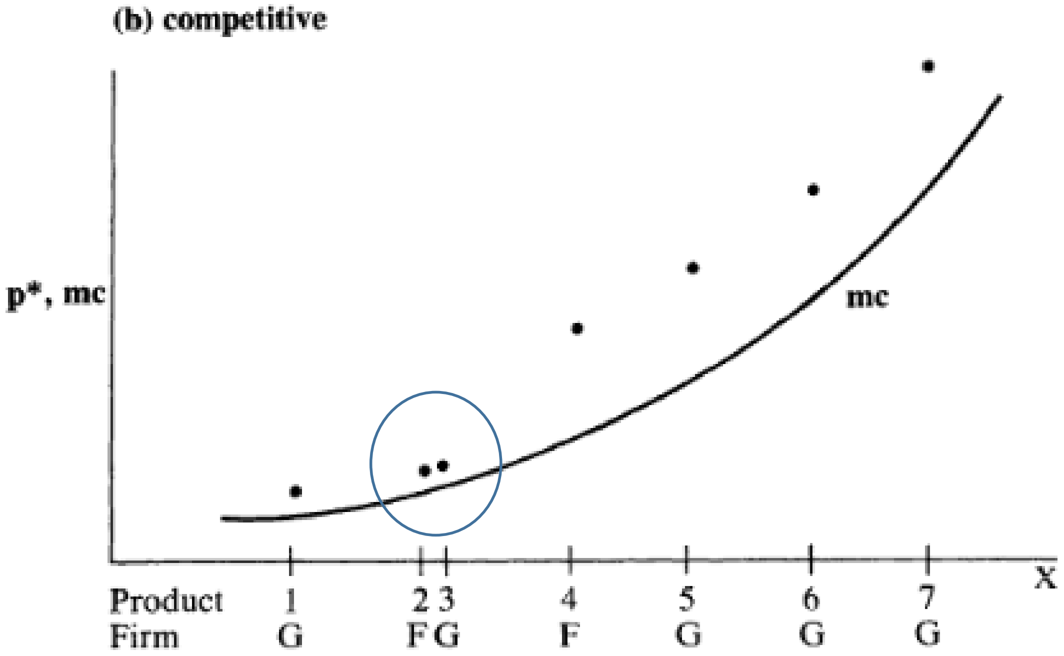


Figure 2(b)

Models 2 and 3, also produced by different firms, are very close in product space. A shift from collusion to competition makes a big difference in their margins.

“The 1955 Price War,” Bresnahan
Economic Idea

Bresnahan could have tested his model in a “reduced form” manner, directly examining qualitative predictions of the theory.

- Are price drops from 54 to 55 (and increases from 55 to 56) larger for car models that are closer in product space to a car produced by a rival firm?

But Breshnahan aspired to do more:

- We know from theory that what should happen is more complicated. All N models’ prices are jointly determined and it’s not only the closest rival model that matters.
- Our theories make quantitative predictions about the amount by which all N prices change with a shift from competition to collusion. Can the theory quantitatively account for everything we see in the data?

"The 1955 Price War," Bresnahan
Model and Estimation

Bresnahan explores whether the data are consistent with his hypothesis in a fully specified model based on the classic model of vertically differentiated products.

- N models with quality $v_1 \leq v_2 \leq \ldots \leq v_N$
- Mass δv_{max} of consumer types with types $\theta \sim U[0,v_{max}]$. Utility of type θ from model i is $\theta v_i - p_i$.
- Cost of producing Q units of quality v is $c(v,Q) = A(v) + Q\mu e^v$

$$v_i = \sqrt{\beta_0 + \sum_j X_{ij}\beta_j}$$

X's are observable car characteristics

For any choice of parameters fully specifying the production function (β, μ) and consumer preferences (δ, v_{max}) we can calculate the prices and quantities that would result from

- Collusive pricing (multiproduct monopoly)
- Static competition (vertical differentiation model)
- Noncooperative static competition between all products
- A fourth model not based on the same cost/preference structure ("hedonic")

"The 1955 Price War," Bresnahan
Estimation and Model Assessment

For any choice of parameters fully specifying the production function (β, μ) and consumer preferences (δ, v_{max}) we can calculate the prices and quantities that would result from

$$v_i = \sqrt{\beta_0 + \sum_j X_{ij}\,\beta_j}$$

- Collusive pricing (multiproduct monopoly)
- Static competition (vertical differentiation model)
- Noncooperative static competition between all products
- A fourth model not based on the same cost/preference structure ("hedonic")

Bresnahan estimates the parameters that made each model fit best in each year, then assesses which model fits best by asking whether each model can be rejected in a non-nested hypothesis test considering whether other models explain the residuals too well.

Bresnahan also introduces the idea of a "counterfactual". Once we have estimated the cost/preference primitives and which model of firm behavior applies, we can predict what would have happened under alternate policies/behaviors.

“The 1955 Price War,” Bresnahan
Results

The main applied results of the paper are:

- The collusive model “fits best” in 1954 and 1956. The static competition model “fits best” in 1955.
- If we estimate the collusive model in the 1954 and 1956 and the static competition model in 1955, then the cost/preference parameters are similar across years.
- If we estimate any one model in all three years, then cost/preference parameters are very different across years.
- Counterfactual: If the firms had colluded in 1955 then prices would have been 6% higher and sales 11% lower.

A number of aspects of the paper (pure vertical model, functional forms, measurement errors, nonnested hypothesis tests) seem quite primitive today and must have contributed to Bresnahan having a difficult time publishing the paper.

The big-picture vision of the paper still seems spot on, and even today most structural papers are not as ambitious in assessing multiple potential models and comparing them to make the case for the chosen model.

Oligopoly Price Discrimination

Price discrimination is typically taught as a monopoly topic. With perfectly competition p = MC, so there is no price discrimination. But we can easily see price discrimination given any differentiation.

- Borenstein-Rose (*JPE* 1994) study of airline markets gives evidence of price discrimination (i) in pretty competitive city-pair markets, and (ii) greater price discrimination in more competitive markets.

Oligopoly Price Discrimination

3rd Degree

- Firms 1, 2 compete in markets m=1, 2 with no cross-market arbitrage.
- *Example*. Each market has Hotelling preferences. Type θ consumers in market m get utility $v - p_{1m} - t_m\theta$ if they buy from 1 and $v - p_{2m} - t_m(1-\theta)$ if they buy from 2.

If the firms can discriminate the outcome would be $p_{jm}^* = c + t_m$. If discrimination in banned we get $p_j^* = c + \frac{2t_1t_2}{t_1+t_2}$.

More generally, banning price discrimination has several effects:

- Typically "high types" better off. ("High types" means population with more differentiated preferences.)
- Typically "low types" worse off.
- Misallocation across markets eliminated.
- Welfare can go either way.

Note: The Hotelling example doesn't bring out the the 3rd or 4th because there is no DWL in either market (provided v is large enough). Profit is higher with discrimination in the example by the arithmetic-harmonic mean inequality.

Oligopoly Price Discrimination

3rd Degree

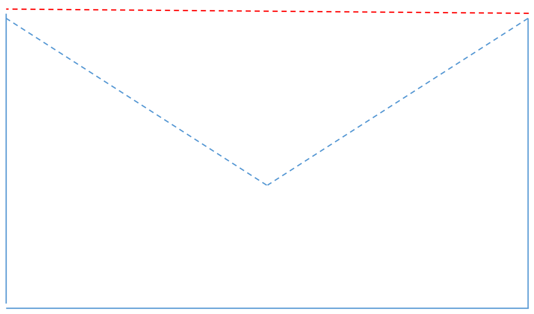
The “typical” price effects don’t need to hold.

Thisse and Vives (*AER* 1988) noted that allowing price discrimination can make prices lower for *all* consumers: allowing firms to aggressively target a rival’s natural consumers can intensify price competition.

- *Example*. Consider again the Hotelling model. Suppose that each θ is a different market. Firms can observe θ and charge θ-dependent prices without arbitrage.

Without discrimination the outcome is $p_j^* = c + t$.

With discrimination we get asymmetric Bertrand competition at each θ. Consumers buy from the closer firm at $p_j^*(\theta) = c + t|\theta - (1 - \theta)|$. The distant firm sets $p_k^*(\theta) = c$.



Oligopoly Price Discrimination

3rd Degree

Corts (*Rand* 1998) noted that allowing price discrimination can also make prices *higher* for all consumers: a second effect is that firms can more effectively exploit captive consumers.

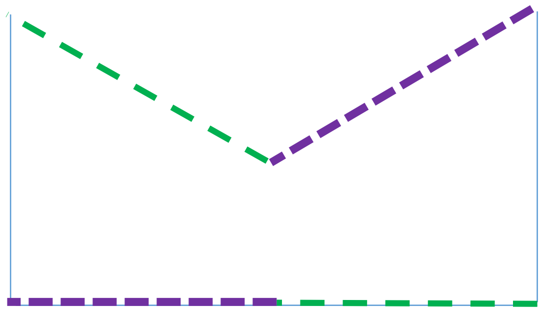
- *Example*. Consider a variant of the Hotelling model where consumers only get utility from the better-matched product. Suppose $\theta \sim U[0,2]$ and gross values are:

$$v_1(\theta) = \begin{cases} 2-\theta & \text{if } \theta < 1 \\ 0 & \text{if } \theta \geq 1 \end{cases} \qquad v_2(\theta) = \begin{cases} 0 & \text{if } \theta < 1 \\ \theta & \text{if } \theta \geq 1 \end{cases}$$

- Again, suppose that each θ is a different market. Firms can observe θ and charge θ-dependent prices without arbitrage.

With no discrimination this is like monopoly pricing with $D_j(p) = 2 - p$. The outcome is $p_j^* = 1$.

With discrimination asymmetric Bertrand at each θ is essentially θ by θ monopoly pricing. Consumers buy from the closer firm at $p_j^*(\theta) = v_j(\theta)$.



Oligopoly Price Discrimination

2rd Degree

Developing tractable models of competitive 2nd degree discrimination is difficult. One wants both vertical and horizontal differentiation. Demand reflects both cross-firm and within-firm substitution.

The theoretical literature has focused on a few different special cases:

- Assuming independent horizonal and vertical preferences produces a tractable model.
- Discrete vertical types can also be tractable by making IC constraints nonbinding.
- Low dimensional models without vertical differentiation.

Oligopoly Price Discrimination

2[rd] Degree – Independent Vertical and Horizontal Types

Stole's *Handbook of IO* chapter surveys a large literature.

- Firms *j* can produce range of qualities *s* at constant marginal cost *c(s)*.
- Consumer *i's* utility from buying a quality *s* good from firm *j* is

$$u_{ij} = \theta_i s - p_{js} + \varepsilon_{ij}$$

- Assume θ_i and the ε_{ij} are all independent with $\theta_i \sim F_\theta$ and $\varepsilon_{ij} \sim F_\varepsilon$.

Write $s^*(\theta) \equiv \max_s \theta s - c(s)$ for the efficient quality for a type v buyer.

Example. Consider a Hotelling-like version with two firms: suppose $\varepsilon_{i1} \sim U[0, t]$ and $\varepsilon_{i2} = -\varepsilon_{i1}$. Then, a NE is $p_{js}^* = c(s) + t$ for all *j, s,* with all consumers buying quality $s^*(\theta_i)$ from the firm with the largest ε_{ij}.

The intuition for the result is straightforward. When all goods are offered at the same markup all consumers compare the prices at which firms sell $s^*(\theta_i)$. This gives the same FOC as in the Hotelling model.

Notes:

1. Stole surveys a literature that contains similar results for general distributions.
2. Independence is a very strong assumption. For many applications, the step from uncorrelated to independent will not be appropriate.

Oligopoly Price Discrimination

2rd Degree – Discrete Vertical Types

- Firms *j* = 1, 2 can produce qualities s_L and s_H at marginal cost *c*. Define $\Delta s \equiv s_H - s_L$.
- Consumers have vertical type $\theta_i \in \{t_L, t_H\}$ and horizontal types $\epsilon_{i1} \sim U[0,1]$ and $\epsilon_{i2} = -\epsilon_{i1}$. Assume i's utility from buying quality *s* from j is

$$u_{ij} = \theta_i(s - \varepsilon_{ij}) - p_{js}$$

- Assume θ_i and the ε_{i1} are independent with $\text{Prob}\{\theta_i = t_H\} = \frac{1}{2}$.

Note that types with a higher WTP for quality have stronger horizontal preferences.

Example. In the model above suppose $\frac{t_H}{t_L} \in [3.2, 10]$, $t_L \Delta s < t_H - t_L < t_H \Delta s$, and $\Delta s \leq \overline{\Delta s} \equiv \frac{2(t_H + t_L)}{\sqrt{t_H t_L}} - 4$. Then, there is a NE with $p_{js}^* = c + t_s$ for all *j, s. All consumers buy from the closest firm, with type t_H consumers buying quality s_H and type t_L consumers buying s_L.*

The calculation is straightforward. Assume t_H types buy s_H and t_L types buy s_L we just have two Hotelling games with transportation costs t_H and t_L. The restrictions on Δs imply that only the t_H types are willing to pay the price difference that results. Other constraints rule out non-local deviations.

Notes:

1. The model allows high WTP consumers to have stronger horizontal preferences (in dollars).
2. Again, IC constraints are nonbinding in equilibrium and competition determines markups.
3. For some of the same parameters the model also has a NE with higher welfare where all buy s

Loss Leaders

Lal and Matutes (*J Business* 1994)

- Continuum of consumer have unit demands for products m = 1, 2.
- Firms $j = 1, 2$ sell both products. Costs c_m and qualities v_m common across firms.
- Consumers have horizontal types $\theta \sim U[0,1]$. Utilities are

  $v_1 + v_2 - p_{11} - p_{12} - t\theta$ if buy both products from firm 1

  $v_1 + v_2 - p_{21} - p_{22} - t(1-\theta)$ if buy both products from firm 2

  $v_1 + v_2 - p_{11} - p_{22} - t\theta - t(1-\theta)$ if buy good 1 from firm 1 and good 2 from firm 2
- Consider multistage game where (1) firms choose and advertise p_{j1}, (2) firms choose unadvertised price p_{j2}, (3) consumers visit one firm incurring cost $t\theta$ or $t(1-\theta)$ and learn its unadvertised price, and (4) consumers purchase or visit the other firm incurring another transportation cost

Proposition. In the model above:

(a) Equilibrium prices satisfy $p_{j1}^* + p_{j2}^* = c_1 + c_2 + t$

(b) Individual prices are $p_{j2}^* = v_2$ and $p_{j1}^* = c_1 + c_2 + t - v_2$.

The argument for p_{j2}^* is that consumers will always pay ε more than they had anticipated when they get to the store unless $p_{j2}^* = v_2$. Competition in p_{j1}^* is then as in Hotelling, but with consumers paying v_2 more than announced price.

Notes:

1. Product 1 is the "loss leader". Its price can be below cost, but need not be.
2. Loss leaders are profit neutral. Profits are unchanged if both prices are advertised or if good 2 does not exist.
3. With per-product advertising costs firms would choose to advertise just one product.

Add On Pricing

In some examples of 2nd degree discrimination the high quality product involves add-ons with less visible prices: hotel restaurant meals and minibar items, rental car insurance and car seats, bank account overdraft fees, printer cables and toner.

Consider a model that combines a loss-leader information structure with discrete 2nd degree discrimination.

- Firms $j = 1, 2$ advertise prices p_{jL} for goods of quality s_L. Quality s_L and s_H both have cost c.
- Consumers who incur a small cost to visit *j* learn the price p_{jU} for an upgrade to $s_H = s_L + \Delta s$.
- Consumers have vertical type $\theta_i \in \{t_L, t_H\}$ and horizontal types $\epsilon_{i1} \sim U[0, 1]$ and $\epsilon_{i2} = -\epsilon_{i1}$. θ_i and the ε_{i1} are independent with $\text{Prob}\{\theta_i = t_H\} = \frac{1}{2}$. *i*'s utility from buying quality *s* from *j* is

$$u_{ij} = v_i(s - \varepsilon_{ij}) - p_{js}$$

Proposition. In the model above with the same parameter restrictions as two slides ago:

(a) There is a sequential equilibrium with $p^*_{jU} = t_H \Delta s$ and $p^*_{jL} = c + \bar{t}\left(1 - \frac{\Delta s}{2}\right)$ where $\bar{t} = \frac{2t_1 t_2}{t_1 + t_2}$.

(b) Profits in this game are higher than the profits in the game in which both p_L and p_H are visible.

(c) All consumers are worse off than in the game with no low-quality good.

Add On Pricing

Proposition. In the model above with the same parameter restrictions as three slides ago:

(a) There is a sequential equilibrium with $p_{jU}^* = t_H \Delta s$ and $p_{jL}^* = c + \bar{t}(1 - \frac{\Delta s}{2})$.

(b) Profits in this game are higher than the profits in the game in which both p_L and p_H are visible.

(c) All consumers are worse off than in the game with no low-quality good.

<u>Sketch of Proof</u>:

The fact that $p_{jU}^* = t_H \Delta s$ is just like the argument that $p_{j2}^* = v_2$ in Lal-Matutes. The firm has an incentive to make p_{jU} slightly higher unless it is at the monopoly price. The parameter restrictions make it is better to sell upgrades just to the high types.

p_{jL} is then chosen to maximize $(p - c)X(p, p_L^*) + p_{jU}^* X_H(p, p_L^*)$. The FOC for this is

$$(p_L^* - c)X'(p_L^*, p_L^*) + X(p_L^*, p_L^*) + p_{jU}^* X_H'(p_L^*, p_L^*) = 0$$

$$\Longrightarrow \quad (p_L^* - c)(-\frac{1}{2\bar{t}}) + \frac{1}{2} + t_H \Delta s(-\frac{1}{2t_H}) = 0$$

Other parameter restrictions ensure that the FOC solutions are global optima.

Add On Pricing

Proposition. In the model above with the same parameter restrictions as three slides ago:

(a) There is a sequential equilibrium with $p_{jU}^* = t_H \Delta s$ and $p_{jL}^* = c + \bar{t}(1 - \frac{\Delta s}{2})$.

(b) Profits in this game are higher than the profits in the game in which both p_L and p_H are visible.

(c) All consumers are worse off than in the game with no low-quality good.

Intuition:

Think about reducing all prices to $p^* - dp$ in the add-on model and the model with no low-quality good.

In both models the firms lose $\frac{1}{2} dp$ from charging lower prices to their existing customers.

In both models the gain is (# of customers gained) × (per-customer profit on the marginal customers gained).

The FOC implies that per-customer profits on marginal consumers are the same in both models.

Equilibrium profits depend on per-customer profits on the **average** consumer. These are higher than profits on the marginal consumers attracted by a price cut, because marginal consumers are disproportionately (in a ratio of t_H/t_L) cheapskates who only buy the low-quality good.

The ratio of average to marginal profits is larger in the add-on pricing model because the add-on is more expensive. This makes the per-consumer profit ratio between high and low types larger.

Briefly: Selling add-ons creates an adverse selection problem that makes firms hesitant to cut in prices.

"Understanding the Price Effects of the MillerCoors Joint Venture," Miller and Weinberg, *Econometrica*, 2017

Miller and Weinberg's paper is following a similar path to Bresnahan's.

- Its applied question is whether the rise in US beer prices following the 2008 joint venture of Miller and Coors can be explained as a consequence of static differentiated product competition, or if some degree of cooperation/collusion is needed.
- It estimates a model that assumes static differentiated competition pre-merger, and that post-merger MillerCoors (MC) and Anheuser Busch Inbev (ABI) are partially cooperative, as if maximizing their own profit plus κ times their rival's profit.
- We can test whether $\kappa=0$ to assess whether price changes were as expected, and use counterfactuals to comment on how different factors (cost savings, price changes due to MillerCoors internalizing cross-price effects, post-merger cooperation) contributed to observed price changes.

You'll learn more about demand systems like the one it uses next week, so I won't go into the details.

"Understanding MillerCoors," Miller and Weinberg
Background

Some background for the paper:

- Despite the dramatic rise in craft breweries, cheap beer still dominates the US market. The top sellers are Bud Light, Coors Light, Miller Lite, Budweiser, …
- There has been substantial global consolidation of beer ownership in the past 20 years. Three firms now control the top 10 US brands. US concentration would be higher were it not for divestitures required in some merger agreements.
- Prior to the 2008 MillerCoors JV, ABI had a market share of about 35%, Miller 18%, and Coors 11%. Shares are much higher in some segments.
- MillerCoors argued that their JV would not be anticompetitive because cost savings (brewing Coors in Miller plants instead of shipping long distances, etc.) would allow them to be more competitive with AB Inbev.
- The DOJ approved the agreement in June 2008.

“Understanding MillerCoors,” Miller and Weinberg
Data

The paper is mostly using standard data sources.

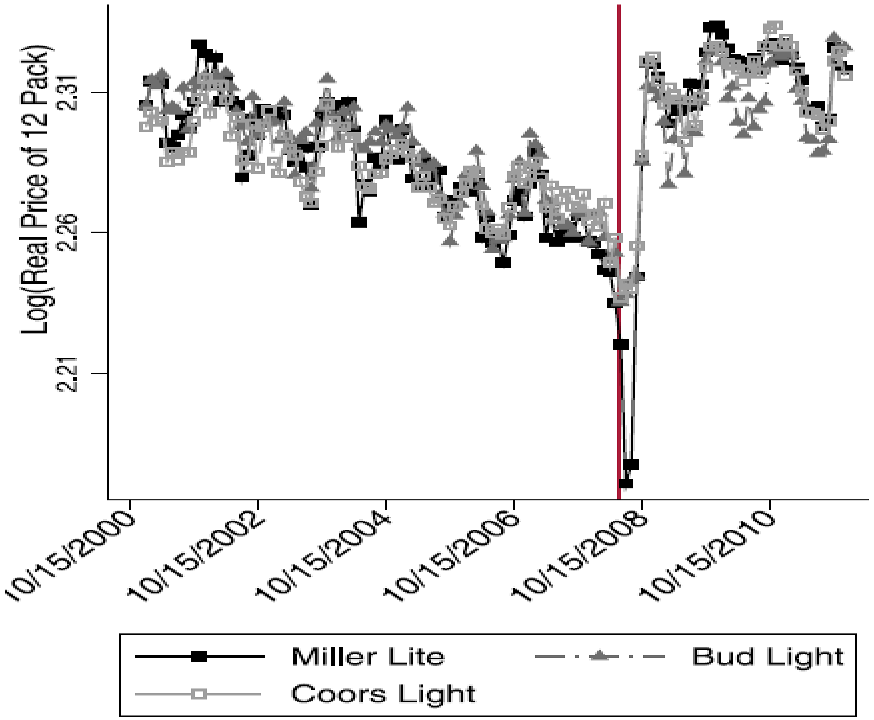
- Prices and quantities come from the IRI Academic Database store-week data.
- Regional demographics from census data.
- Manually collect driving distances from breweries.

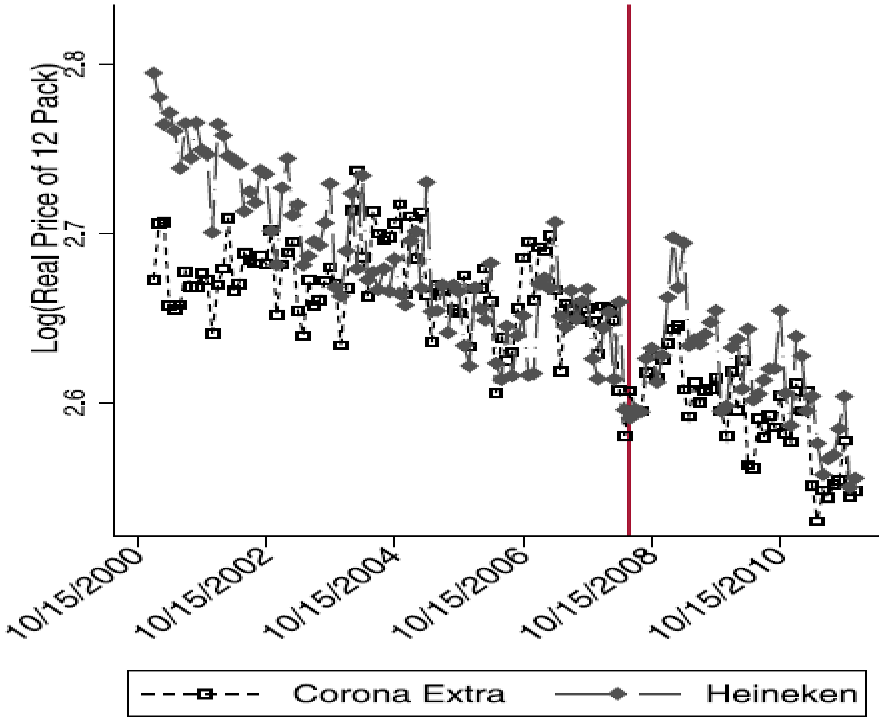
“Understanding MillerCoors,” Miller and Weinberg
Descriptive Evidence on Pricing

Simple graphs of average retail prices make clear that prices for ABI and MC’s flagship brands jumped after the merger.

Price changes for the largest competitors are not obvious.

Difference-in-difference regressions suggest that the jumps were about 10% for 12 packs of the flagship brands and about 5% for all brands/package sizes.





“Understanding MillerCoors,” Miller and Weinberg

Demand Estimation

The paper uses a standard random-coefficients logit demand model:

- Utility of consumer i in region r buying j is $u_{ijrt} = x_j \beta_i^* + \alpha_i^* p_{jrt} + \sigma_j^D + \tau_t^D + \xi_{jrt} + \overline{\varepsilon}_{ijrt};$
- The coefficients β_i^* and α_i^* are assumed to vary across consumers based on heterogeneous income D_i, e.g. $\beta_i^* = \beta + \Pi D_i$ and give the model some flexibility in estimating substitution patterns. There aren’t many x’s.
- Instruments for price include distance to the brewery and an indicator for being an ABI or MC brand in the post-merger period.
- Everything other than the 13 largest premium brands is grouped with the “outside good”.
- The demand parameters are estimated in a first-stage that does not assume prices are set in a profit-maximizing (or any other) manner.

“Understanding MillerCoors,” Miller and Weinberg
Demand Estimation

Here’s a table with estimated elasticities. The substitution patterns are pretty symmetric, but perhaps that’s not so bad given that the beers are pretty similar.

Product-Specific Own and Cross-Elasticities

Bud Light	−4.389	0.160	0.019	0.182	0.235	0.101	0.146	0.047	0.040	0.130	0.046	0.072	0.196
Budweiser	0.323	−4.272	0.019	0.166	0.258	0.103	0.166	0.047	0.039	0.121	0.043	0.068	0.183
Coors	0.316	0.154	−4.371	0.163	0.259	0.102	0.167	0.046	0.038	0.119	0.042	0.066	0.180
Coors Light	0.351	0.160	0.019	−4.628	0.230	0.100	0.142	0.047	0.041	0.132	0.047	0.073	0.199
Corona Extra	0.279	0.147	0.018	0.137	−5.178	0.108	0.203	0.047	0.035	0.104	0.035	0.061	0.158
Corona Light	0.302	0.151	0.018	0.153	0.279	−5.795	0.183	0.048	0.037	0.113	0.039	0.065	0.171
Heineken	0.269	0.145	0.018	0.131	0.311	0.108	−5.147	0.047	0.035	0.101	0.034	0.059	0.153
Heineken Light	0.240	0.112	0.014	0.124	0.210	0.086	0.138	−5.900	0.026	0.089	0.028	0.051	0.135
Michelob	0.301	0.140	0.015	0.146	0.208	0.089	0.135	0.042	−4.970	0.116	0.036	0.061	0.175
Michelob Light	0.345	0.159	0.019	0.181	0.235	0.101	0.146	0.047	0.041	−5.071	0.046	0.072	0.196
Miller Gen. Draft	0.346	0.159	0.019	0.182	0.235	0.101	0.146	0.047	0.040	0.130	−4.696	0.072	0.196
Miller High Life	0.338	0.159	0.019	0.177	0.242	0.102	0.153	0.047	0.040	0.127	0.045	−3.495	0.191
Miller Lite	0.344	0.159	0.019	0.180	0.237	0.101	0.148	0.047	0.040	0.129	0.046	0.071	−4.517
Outside Good	0.016	0.007	0.001	0.009	0.011	0.005	0.006	0.002	0.002	0.006	0.002	0.003	0.009

“Understanding MillerCoors,” Miller and Weinberg

Supply Estimation

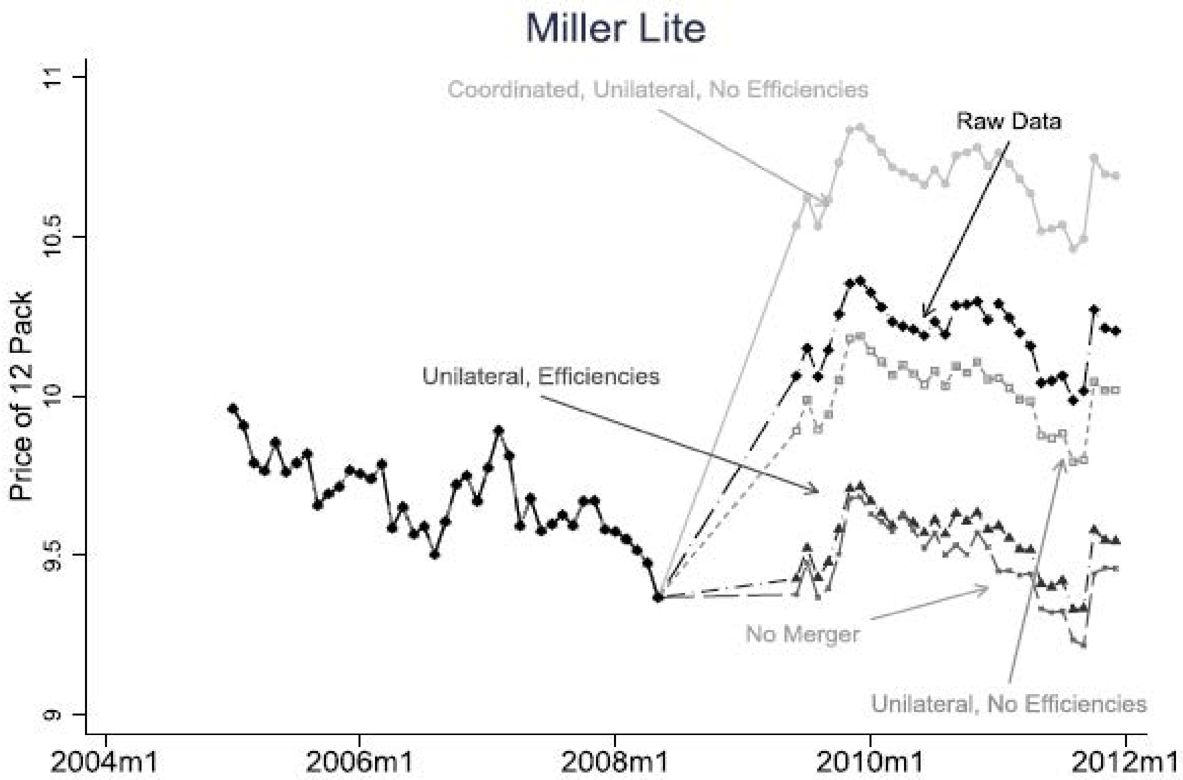
Supply is then estimated taking the demand estimates as given.

- Production costs are allowed to vary with distance and to potentially decrease for MC after the merger: $mc_{jrt} = w_{jrt}\gamma + \sigma_j^S + \tau_t^S + \mu_r^S + \eta_{jrt};$
- After the merger ABI and MC are assumed to place weight κ on the profits earned on all brands of the other firm.
- The κ parameter is estimated at 0.25-0.37 in various specifications.
- Cost is estimated to decrease for MillerCoors after the merger.
- The cost of producing a Coors Light 12 pack is estimated to decrease by about $1, but markups increase by about $1.80 resulting in higher prices.

"Understanding MillerCoors," Miller and Weinberg
Counterfactuals

Counterfactuals illustrate how the change in prices reflect three effects:

- Cost "efficiencies"
- MC's "unilateral" incentive to raise prices given effects on acquired brands
- "Coordinated" behavior of MC and ABI after the merger.



On Wednesday Tobias will take over for a week and discuss demand estimation. The reading for his first lecture is:

- Gandhi and Nevo (NBER wp 29257)

See you then!

Oligopoly Price Discrimination

2rd Degree – Mixed Bundling in a Model without Vertical Types

Armstrong and Vickers (*REStud* 2010) ask why industries like phone-internet-cable offer discounts for bundled purchases even though many consumers presumably prefer a single provider.

- Continuum of consumer have unit demands for products *m* = 1, 2.
- Firms $j = A, B$ sell both products. Costs c_m and qualities $v_m$common. Mixed bundling prices T_1^j, T_2^j, T_{12}^j.
- Consumers have horizontal types $\theta_1, \theta_2 \sim U[0, 1] \times [0,1]$. Utilities are

  $v_1 + v_2 - T_{12}^A - t\theta_1 - t\theta_2$ if buy both products from firm A
  $v_1 + v_2 - T_{12}^B - t(1 - \theta_1) - t(1 - \theta_2)$ if buy both products from firm B
  $v_1 + v_2 - T_1^A - T_2^B - t\theta_1 - t(1 - \theta_2) - z$ if buy good 1 from A and good 2 from B.

Proposition. Let $\Phi(d)$ be the fraction splitting purchases when both firms charge T_1, T_2, $T_1 + T_2 - d$ and all consumers purchase. Then, the optimal bundling discount is positive and satisfies $d = -\frac{2\Phi(d)}{\Phi'(d)}$.

The formula again comes out of a simple FOC. Consider simultaneously raising the prices of the unbundled goods by dp and leaving the bundle price unchanged.

Oligopoly Price Discrimination

2rd Degree – Mixed Bundling in a Model without (and with) Vertical Types

- Continuum of consumer have unit demands for products m = 1, 2.
- Firms $j = A, B$ sell both products. Costs c_m and qualities $v_m$common. Mixed bundling prices T_1^j, T_2^j, T_{12}^j.
- Consumers have horizontal types $\theta_1, \theta_2 \sim U[0,1] \times [0,1]$. Utilities are

  $v_1 + v_2 - T_{12}^A - t\theta_1 - t\theta_2$ if buy both products from firm A

  $v_1 + v_2 - T_{12}^B - t(1-\theta_1) - t(1-\theta_2)$ if buy both products from firm B

  $v_1 + v_2 - T_1^A - T_2^B - t\theta_1 - t(1-\theta_2) - z$ if buy good 1 from A and good 2 from B.

Proposition. Let $\Phi(d)$ be the fraction splitting purchases when both firms charge $T_1, T_2, T_1 + T_2 - d$ and all consumers purchase. Then, the optimal bundling discount is positive and satisfies $d = -\frac{2\Phi(d)}{\Phi'(d)}$.

Notes:

1. This result adds to our earlier discussion of mixed bundling, characterizing what is optimal.
2. Intuition for why bundles are discounted comes from price discrimination. When a consumer is marginal for buying just good 1 from me instead of the bundle, it must be that they have a low value for good 2. This makes me want to offer a discount for buying good 2 as well.
3. The paper also discusses a more general model in which consumers also have a vertical type. It is set up like the "independent vertical and horizontal types" models and has a similar outcome – markups are quality-independent and each consumer buys the quality that is optimal for them.