14.271: Industrial Organization I

Introduction to Empirical Models of Demand II

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*Lecture Notes are based on notes from Paolo Somaini, Nikhil Agarwal, Phil Haile, and the most recent IO handbook chapters.

BLP — supply side

Firm's profit function:

$$\pi_f = \sum_{j \in \mathcal{J}_f} \Big[(p_j - mc_j)\, q_j(\mathbf{p}) - FC_j \Big]$$

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Define **ownership**-matrix:

$$H_{jk} = \begin{cases} 1, & \text{if } \exists f : \{j, k\} \subset \mathcal{J}_f; \\ 0, & \text{otherwise} \end{cases} \qquad j, k = 1, \ldots, J$$

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Let Ω be a matrix with elements $\Omega_{jk} = -\partial q_k / \partial p_j \cdot H_{jk}$ and assume Nash-Bertrand pricing, we get **FOC**s:

$$\mathbf{q}(\mathbf{p}) - \Omega(\mathbf{p} - \mathbf{mc}) = 0 \Leftrightarrow \mathbf{mc} = \mathbf{p} - \Omega^{-1}\mathbf{q}(\mathbf{p})$$

$\rightarrow$ Given demand estimates, a conduct model (nature of competition), and prices, we can back out the marginal costs that make the first-order condition for prices hold exactly.

Using supply side restrictions for estimation

Assume that **marginal cost** are given by:

$$mc_{jt} = \mathrm{w}_{jt}\gamma + \omega_{jt}$$

This leads to:

$$\mathbf{p}_t - \Omega^{-1}\mathbf{q}\left(\mathbf{p}_t\right) = \mathrm{w}_t\gamma + \boldsymbol{\omega}_t$$

We can now construct **additional moments**, which are informative about both supply and demand side parameters.

$$\mathbb{E}\left[\omega_{jt}(\gamma, \alpha_0, \beta_0, \Gamma, \Sigma) \cdot \tilde{z}_{jt}\right] = 0$$

Comments on the use of supply side restrictions

Comments:

- Often introduces many new moment conditions relative to the new number of parameters
- Typically, this substantially improves the precision of the demand estimates, especially the random coefficients
- It is econometrically efficient to estimate the demand and supply side jointly
- We may not feel comfortable to assume a model of conduct
- Overidentifying restrictions allow us to test conduct models (the last study we look at today is an example)

BLP — empirical results

BLP — empirical results

Data:

- All car makes from 1971-1990, market defined as the whole US
- List prices
- 2217 year-model observations

Characteristics from Automotive News Market Data Book:

- # of cylinders
- # of doors
- horsepower
- length, width, weight, wheelbase
- EPA rating for miles per gallon
- dummies for air conditioning, automatic

BLP — empirical results

TABLE 1

DESCRIPTIVE STATISTICS

Year	No. of Models	Quantity	Price	Domestic	Japan	European	HP/Wt	Size	Air	MPG	MP$
1971	92	86.892	7.868	0.866	0.057	0.077	0.490	1.496	0.000	1.662	1.850
1972	89	91.763	7.979	0.892	0.042	0.066	0.391	1.510	0.014	1.619	1.875
1973	86	92.785	7.535	0.932	0.040	0.028	0.364	1.529	0.022	1.589	1.819
1974	72	105.119	7.506	0.887	0.050	0.064	0.347	1.510	0.026	1.568	1.453
1975	93	84.775	7.821	0.853	0.083	0.064	0.337	1.479	0.054	1.584	1.503
1976	99	93.382	7.787	0.876	0.081	0.043	0.338	1.508	0.059	1.759	1.696
1977	95	97.727	7.651	0.837	0.112	0.051	0.340	1.467	0.032	1.947	1.835
1978	95	99.444	7.645	0.855	0.107	0.039	0.346	1.405	0.034	1.982	1.929
1979	102	82.742	7.599	0.803	0.158	0.038	0.348	1.343	0.047	2.061	1.657
1980	103	71.567	7.718	0.773	0.191	0.036	0.350	1.296	0.078	2.215	1.466
1981	116	62.030	8.349	0.741	0.213	0.046	0.349	1.286	0.094	2.363	1.559
1982	110	61.893	8.831	0.714	0.235	0.051	0.347	1.277	0.134	2.440	1.817
1983	115	67.878	8.821	0.734	0.215	0.051	0.351	1.276	0.126	2.601	2.087
1984	113	85.933	8.870	0.783	0.179	0.038	0.361	1.293	0.129	2.469	2.117
1985	136	78.143	8.938	0.761	0.191	0.048	0.372	1.265	0.140	2.261	2.024
1986	130	83.756	9.382	0.733	0.216	0.050	0.379	1.249	0.176	2.416	2.856
1987	143	67.667	9.965	0.702	0.245	0.052	0.395	1.246	0.229	2.327	2.789
1988	150	67.078	10.069	0.717	0.237	0.045	0.396	1.251	0.237	2.334	2.919
1989	147	62.914	10.321	0.690	0.261	0.049	0.406	1.259	0.289	2.310	2.806
1990	131	66.377	10.337	0.682	0.276	0.043	0.419	1.270	0.308	2.270	2.852
All	2217	78.804	8.604	0.790	0.161	0.049	0.372	1.357	0.116	2.099	2.086

BLP — empirical results

TABLE II

THE RANGE OF CONTINUOUS DEMAND CHARACTERISTICS (AND ASSOCIATED MODELS)

Variable	Percentile 0	25	50	75	100
Price	90 Yugo 3.393	79 Mercury Capri 6.711	87 Buick Skylark 8.728	71 Ford T-Bird 13.074	89 Porsche 911 Cabriolet 68.597
Sales	73 Toyota 1600CR .049	72 Porsche Rdstr 15.479	77 Plym. Arrow 47.345	82 Buick LeSabre 109.002	71 Chevy Impala 577.313
HP/Wt.	85 Plym. Gran Fury 0.170	85 Suburu DH 0.337	86 Plym. Caravelle 0.375	89 Toyota Camry 0.428	89 Porsche 911 Turbo 0.948
Size	73 Honda Civic 0.756	77 Renault GTL 1.131	89 Hyundai Sonata 1.270	81 Pontiac F-Bird 1.453	73 Imperial 1.888
MP$	74 Cad. Eldorado 8.46	78 Buick Skyhawk 15.57	82 Mazda 626 20.10	84 Pontiac 2000 24.86	89 Geo Metro 64.37
MPG	74 Cad. Eldorado 9	79 BMW 528i 17	81 Dodge Challenger 20	75 Suburu DL 25	89 Geo Metro 53

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TABLE III

RESULTS WITH LOGIT DEMAND AND MARGINAL COST PRICING
(2217 OBSERVATIONS)

Variable	OLS Logit Demand	IV Logit Demand	OLS ln(*price*) on *w*
Constant	−10.068	−9.273	1.882
	(0.253)	(0.493)	(0.119)
*HP/Weight**	−0.121	1.965	0.520
	(0.277)	(0.909)	(0.035)
Air	−0.035	1.289	0.680
	(0.073)	(0.248)	(0.019)
MP$	0.263	0.052	—
	(0.043)	(0.086)	
*MPG**	—	—	−0.471
			(0.049)
*Size**	2.341	2.355	0.125
	(0.125)	(0.247)	(0.063)
Trend	—	—	0.013
			(0.002)
Price	−0.089	−0.216	—
	(0.004)	(0.123)	
No. Inelastic Demands	1494	22	*n.a.*
(+/− 2 *s.e.'s*)	(1429–1617)	(7–101)	
R^2	0.387	*n.a.*	.656

BLP — empirical results

TABLE IV

ESTIMATED PARAMETERS OF THE DEMAND AND PRICING EQUATIONS: BLP SPECIFICATION, 2217 OBSERVATIONS

Demand Side Parameters	Variable	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Means ($\bar{\beta}$'s)	*Constant*	−7.061	0.941	−7.304	0.746
	HP/Weight	2.883	2.019	2.185	0.896
	Air	1.521	0.891	0.579	0.632
	MP$	−0.122	0.320	−0.049	0.164
	Size	3.460	0.610	2.604	0.285
Std. Deviations (σ_β's)	*Constant*	3.612	1.485	2.009	1.017
	HP/Weight	4.628	1.885	1.586	1.186
	Air	1.818	1.695	1.215	1.149
	MP$	1.050	0.272	0.670	0.168
	Size	2.056	0.585	1.510	0.297
Term on Price (α)	$\ln(y-p)$	43.501	6.427	23.710	4.079
Cost Side Parameters					
	Constant	0.952	0.194	0.726	0.285
	ln(*HP/Weight*)	0.477	0.056	0.313	0.071
	Air	0.619	0.038	0.290	0.052
	ln(*MPG*)	−0.415	0.055	0.293	0.091
	ln(*Size*)	−0.046	0.081	1.499	0.139
	Trend	0.019	0.002	0.026	0.004
	$\ln(q)$			−0.387	0.029

BLP — empirical results

TABLE VI

A SAMPLE FROM 1990 OF ESTIMATED OWN- AND CROSS-PRICE SEMI-ELASTICITIES: BASED ON TABLE IV (CRTS) ESTIMATES

	Mazda 323	Nissan Sentra	Ford Escort	Chevy Cavalier	Honda Accord	Ford Taurus	Buick Century	Nissan Maxima	Acura Legend	Lincoln Town Car	Cadillac Seville	Lexus LS400	BMW 735i
323	−125.933	1.518	8.954	9.680	2.185	0.852	0.485	0.056	0.009	0.012	0.002	0.002	0.000
Sentra	0.705	−115.319	8.024	8.435	2.473	0.909	0.516	0.093	0.015	0.019	0.003	0.003	0.000
Escort	0.713	1.375	−106.497	7.570	2.298	0.708	0.445	0.082	0.015	0.015	0.003	0.003	0.000
Cavalier	0.754	1.414	7.406	−110.972	2.291	1.083	0.646	0.087	0.015	0.023	0.004	0.003	0.000
Accord	0.120	0.293	1.590	1.621	−51.637	1.532	0.463	0.310	0.095	0.169	0.034	0.030	0.005
Taurus	0.063	0.144	0.653	1.020	2.041	−43.634	0.335	0.245	0.091	0.291	0.045	0.024	0.006
Century	0.099	0.228	1.146	1.700	1.722	0.937	−66.635	0.773	0.152	0.278	0.039	0.029	0.005
Maxima	0.013	0.046	0.236	0.256	1.293	0.768	0.866	−35.378	0.271	0.579	0.116	0.115	0.020
Legend	0.004	0.014	0.083	0.084	0.736	0.532	0.318	0.506	−21.820	0.775	0.183	0.210	0.043
TownCar	0.002	0.006	0.029	0.046	0.475	0.614	0.210	0.389	0.280	−20.175	0.226	0.168	0.048
Seville	0.001	0.005	0.026	0.035	0.425	0.420	0.131	0.351	0.296	1.011	−16.313	0.263	0.068
LS400	0.001	0.003	0.018	0.019	0.302	0.185	0.079	0.280	0.274	0.606	0.212	−11.199	0.086
735*i*	0.000	0.002	0.009	0.012	0.203	0.176	0.050	0.190	0.223	0.685	0.215	0.336	−9.376

BLP — empirical results

TABLE VII

SUBSTITUTION TO THE OUTSIDE GOOD

Model	Given a price increase, the percentage who substitute to the outside good (as a percentage of all who substitute away.)	
	Logit	BLP
Mazda 323	90.870	27.123
Nissan Sentra	90.843	26.133
Ford Escort	90.592	27.996
Chevy Cavalier	90.585	26.389
Honda Accord	90.458	21.839
Ford Taurus	90.566	25.214
Buick Century	90.777	25.402
Nissan Maxima	90.790	21.738
Acura Legend	90.838	20.786
Lincoln Town Car	90.739	20.309
Cadillac Seville	90.860	16.734
Lexus LS400	90.851	10.090
BMW 735*i*	90.883	10.101

BLP — empirical results

TABLE VIII

A SAMPLE FROM 1990 OF ESTIMATED PRICE-MARGINAL COST MARKUPS AND VARIABLE PROFITS: BASED ON TABLE 6 (CRTS) ESTIMATES

	Price	Markup Over MC $(p - MC)$	Variable Profits (in $'000's) $q*(p - MC)$
Mazda 323	$5,049	$ 801	$18,407
Nissan Sentra	$5,661	$ 880	$43,554
Ford Escort	$5,663	$1,077	$311,068
Chevy Cavalier	$5,797	$1,302	$384,263
Honda Accord	$9,292	$1,992	$830,842
Ford Taurus	$9,671	$2,577	$807,212
Buick Century	$10,138	$2,420	$271,446
Nissan Maxima	$13,695	$2,881	$288,291
Acura Legend	$18,944	$4,671	$250,695
Lincoln Town Car	$21,412	$5,596	$832,082
Cadillac Seville	$24,353	$7,500	$249,195
Lexus LS400	$27,544	$9,030	$371,123
BMW 735*i*	$37,490	$10,975	$114,802

Comments on BLP (I)

- Very influential paper that has led to countless empirical studies and a large methodological literature
- The empirical results make a convincing case for the random coefficient model
- Identification and estimation challenges of BLP are now much better understood than they were at the time
- There are now many good sources to dive deeper into these types of models:
  1. For a general overview: 2021 IO Handbook Chapter 1 (Berry and Haile) and Chaper 2 (Gandhi and Nevo)
  2. For identification: Berry and Haile, Annual Review of Economics (2016), and Econometrica (2014)
  3. For practical estimation questions: Conlon and Gortmaker, RAND (2020)

Comments on BLP (I)

- Ignores that cars are a durable good. Durable good aspects are studied in:
  - Gowrisankaran and Rysman (JPE, 2012)
  - Gavazza et al. (AER, 2014)
  - Gillingham (JPE, 2021)
- Abstracts from dealerships. State franchise laws prohibit direct sales to consumers in most states.
- Model ignores that car prices are often negotiated.
- Ignores the financial transaction that is involved in a car purchase (accounts for $>$ 50% of dealer profits)

Two more conduct testing papers

Glenn has already introduced you to Bresnahan (1987) and Miller and Weinberg (2017).

We will now look at two conduct testing papers in the ready-to-eat (RTE) cereal market.

- Nevo (2001): Is the cereal industry collusive?
- Backus, Conlon, and Sinkinson (2021): is competition in this market consistent with the common ownership hypothesis?

Nevo (2001) — market power in the cereal industry

Why does the RTE cereal industry sustain such **high gross margins?**

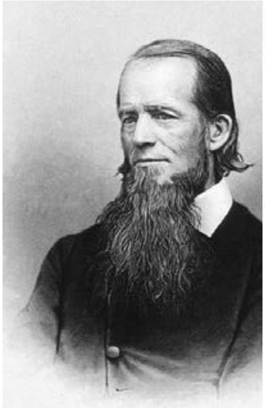
Competing explanations:

- Product differentiation (accounting for firms' multi-product incentives)
- Collusion

Approach

- Only use demand estimates to recover markups under alternatives
- Compare model-implied markups to accounting markups
- Panel data on demand for cereals across geographical markets

The historical origins of … breakfast cereals



James Caleb Jackson (1811-1895)
Granula → Exit

Image in the public domain via Wikimedia Commons.

John Harvey Kellogg (1852-1943)
Granola → Incumbent

Image in the public domain via Project Gutenberg.

Will Keith Kellogg (1860-1951)
Sugar → Incumbent

Image in the public domain via Wikipedia.

Charles William Post (1854-1914)
Grape Nuts → Competitor

Image in the public domain via Wikipedia

→ Many brands, high churn and advertising expenditures. Brand proliferation as barriers to entry? (Schmalensee, 1987 Bell Journal of Economics)

Nevo (2001) — motivating facts

TABLE I

VOLUME MARKET SHARES

	88Q1	88Q4	89Q4	90Q4	91Q4	92Q4
Kellogg	41.39	39.91	38.49	37.86	37.48	33.70
General Mills	22.04	22.30	23.60	23.82	25.33	26.83
Post	11.80	10.30	9.45	10.96	11.37	11.31
Quaker Oats	9.93	9.00	8.29	7.66	7.00	7.40
Ralston	4.86	6.37	7.65	6.60	5.45	5.18
Nabisco	5.32	6.01	4.46	3.75	2.95	3.11
C3	75.23	72.51	71.54	72.64	74.18	71.84
C6	95.34	93.89	91.94	90.65	89.58	87.53
Private Label	3.33	3.75	4.63	6.29	7.13	7.60

$\rightarrow$ Highly concentrated industry

Nevo (2001) — motivating facts

TABLE III

DETAILED ESTIMATES OF PRODUCTION COSTS

Item	$/lb	% of Mfr Price	% of Retail Price
Manufacturer Price	2.40	100.0	80.0
Manufacturing Cost:	1.02	42.5	34.0
Grain	0.16	6.7	5.3
Other Ingredients	0.20	8.3	6.7
Packaging	0.28	11.7	9.3
Labor	0.15	6.3	5.0
Manufacturing Costs (net of capital costs)[a]	0.23	9.6	7.6
Gross Margin		57.5	46.0
Marketing Expenses:	0.90	37.5	30.0
Advertising	0.31	13.0	10.3
Consumer Promo (mfr coupons)	0.35	14.5	11.7
Trade Promo (retail in-store)	0.24	10.0	8.0
Operating Profits	0.48	20.0	16.0

[a] Capital costs were computed from ASM data.

Source: Cotterill (1996) reporting from estimates in CS First Boston Reports "Kellogg Company," New York, October 25, 1994.

→ Large gross (accounting) markups

Nevo (2001) — demand and instruments

Demand model is similar to BLP (1995) but leverages panel data

$$u_{ijt} = x_j \beta_i^* - \alpha_i^* p_{jt} + \xi_j + \Delta\xi_{jt} + \varepsilon_{ijt}$$

where

$$\begin{pmatrix} \alpha_i^* \\ \beta_i^* \end{pmatrix} = \begin{pmatrix} \alpha_0 \\ \beta_0 \end{pmatrix} + \Pi D_i + \sum \nu_i$$

with $\nu_i \sim N(0, I_{k+1})$ and demographics D_i. t is city-quarter (6 quarters)

- Product characteristics: sugar, fat, calories, mushy, fiber, all-family, kids, adults

Problems with BLP instruments

- BLP instruments are constant within-brand, wish to identify within city-quarter-brand variation in prices

Two instruments

1. Panel version of Hausman instruments. **Issue:** common national shocks, coordinated advertising/stocking
2. "Cost-side" instruments: region dummies to pick up transportation costs; city density (cost of space). **Issue:** brand-specific regional shocks, or changes in demand due to income

TABLE V

RESULTS FROM LOGIT DEMAND[a]

Variable	OLS (i)	(ii)	(iii)	IV (iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Price	−4.96	−7.26	−7.97	−8.17	−17.57	−17.12	−22.56	−23.77	−23.37	−23.07
	(0.10)	(0.16)	(0.15)	(0.11)	(0.50)	(0.49)	(0.51)	(0.53)	(0.47)	(1.17)
Advertising	0.158	0.026	0.026	0.157	0.020	0.020	0.018	0.017	0.018	0.013
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log of Median Income	—	—	0.89	—	—	—	1.06	1.13	1.12	—
			(0.02)				(0.02)	(0.02)	(0.02)	
Log of Median Age	—	—	−0.423	—	—	—	−0.063	0.003	−0.007	—
			(0.052)				(0.059)	(0.062)	(0.061)	
Median HH Size	—	—	−0.126	—	—	—	−0.053	−0.036	−0.038	—
			(0.027)				(0.029)	(0.031)	(0.031)	
Fit/Test of Over Identification[b]	0.54	0.72	0.74	436.9	168.5	181.2	83.96	82.95	85.87	15.06
				(26.30)	(30.14)	(16.92)	(30.14)	(16.92)	(42.56)	(42.56)
1st Stage R^2	—	—	—	0.889	0.908	0.908	0.910	0.909	0.913	0.952
1st Stage F-test	—	—	—	5119	124	288	129	291	144	180
Instruments[c]	—	—	—	brand dummies	prices	cost	prices	cost	prices, cost	prices, cost

TABLE VI

RESULTS FROM THE FULL MODEL[a]

Variable	Means (β's)	Standard Deviations (σ's)	Interactions with Demographic Variables: Income	Income Sq	Age	Child
Price	−27.198	2.453	315.894	−18.200	—	7.634
	(5.248)	(2.978)	(110.385)	(5.914)		(2.238)
Advertising	0.020	—	—	—	—	—
	(0.005)					
Constant	−3.592[b]	0.330	5.482	—	0.204	—
	(0.138)	(0.609)	(1.504)		(0.341)	
Cal from Fat	1.146[b]	1.624	—	—	—	—
	(0.128)	(2.809)				
Sugar	5.742[b]	1.661	−24.931	—	5.105	—
	(0.581)	(5.866)	(9.167)		(3.418)	
Mushy	−0.565[b]	0.244	1.265	—	0.809	—
	(0.052)	(0.623)	(0.737)		(0.385)	
Fiber	1.627[b]	0.195	—	—	—	−0.110
	(0.263)	(3.541)				(0.0513)
All-family	0.781[b]	0.1330	—	—	—	
	(0.075)	(1.365)				
Kids	1.021[b]	2.031	—	—	—	
	(0.168)	(0.448)				
Adults	1.972[b]	0.247	—	—	—	
	(0.186)	(1.636)				
GMM Objective (degrees of freedom)			5.05 (8)			
MD χ^2			3472.3			
% of Price Coefficients > 0			0.7			

TABLE VIII

MEDIAN MARGINS[a]

	Logit (Table V column ix)	Full Model (Table VI)
Single Product Firms	33.6% (31.8%–35.6%)	35.8% (24.4%–46.4%)
Current Ownership of 25 Brands	35.8% (33.9%–38.0%)	42.2% (29.1%–55.8%)
Joint Ownership of 25 Brands	41.9% (39.7%–44.4%)	72.6% (62.2%–97.2%)
Current Ownership of All Brands	37.2% (35.2%–39.4%)	—
Monopoly/Perfect Price Collusion	54.0% (51.1%–57.3%)	—

$\rightarrow$ Current ownership structure matches markup estimates

Comments

- Paper is well written and explained
- Natural industry to account for multi-product considerations (few producers but many brands)
- Use demand model to speak to a substantive issue of collusion
- Advertising not a strategic variable
- Would firms be able to implement the monopoly solution?
- Testing approach is predicated on observing the right accounting cost

The common ownership hypothesis

The common ownership hypothesis

→ large diversified owners may place non-zero weights on profits of different firms that compete with each other.

The Top Owners of the Largest U.S. Airlines

Just a few investors own chunks of all four top carriers.

AMERICAN AIRLINES	% OWNERSHIP:
T. Rowe Price	15.71
PRIMECAP	6.69
Vanguard	6.32
BlackRock	5.67
State Street	3.53
Putnam	2.72
Fidelity	1.88
Wellington Management	1.45
Adage Capital Management	1.19
Stelliam Investment Management	1.16

DELTA AIR LINES	
Vanguard	6.13
BlackRock	5.05
J.P. Morgan Asset Management	4.62
Lansdowne Partners	3.54
State Street	3.43
PRIMECAP	2.61
Fidelity	2.13
AllianceBernstein	1.62
PAR Capital Management	1.53
BNY Mellon Asset Management	1.49

SOUTHWEST AIRLINES	
PRIMECAP	11.83
Fidelity	7.78
Vanguard	6.25
BlackRock	6.23
State Street	3.61
Egerton Capital	2.46
BNY Mellon Asset Management	1.56
Dimensional Fund Advisors	1.22
T. Rowe Price	1.09
Northern Trust Global Investments	1.06

UNITED AIRLINES	
Vanguard	7.19
BlackRock	6.74
PRIMECAP	6.08
PAR Capital Management	5.05
J.P. Morgan Asset Management	3.95
Altimeter Capital Management	3.57
State Street	3.36
T. Rowe Price	3.31
Janus Capital	3.19
Fidelity	3.03

SOURCE S&P CAPITAL IQ DATA AND PROXY STATEMENTS FROM THE SECOND QUARTER OF 2016

The common ownership hypothesis

Recent empirical work suggests that the growth of large diversified common owners led to increases in prices in various industries

- Banking services, (Azar, Raina, and Schmalz 2016)
- Airfares (Azar, Schmalz, and Tecu 2018)

The common ownership hypothesis: Rotemberg (1984), O'Brien and Salop (2000)

Investor has β_{gs} fraction of cash flow rights of firm g's profit π_g

$$v_s = \sum_{\forall g} \beta_{gs} \cdot \pi_g$$

The common ownership hypothesis: Rotemberg (1984), O'Brien and Salop (2000)

Investor has β_{gs} fraction of cash flow rights of firm g's profit π_g

$$v_s = \sum_{\forall g} \beta_{gs} \cdot \pi_g$$

Firms place pareto-weights γ_{fs} on investors when maximizing objective function $Q_f(p_f, p_{-f})$:

$$Q_f(p_f, p_{-f}) = \sum_{\forall s} \gamma_{fs} \cdot v_s(p_f, p_{-f}) = \sum_{\forall s} \gamma_{fs} \cdot \left(\sum_{\forall g} \beta_{gs} \cdot \pi_g(p_f, p_{-f}) \right) =$$

$$\sum_{\forall s} \gamma_{fs} \beta_{fs} \pi_f + \sum_{\forall s} \gamma_{fs} \sum_{\forall f \neq g} \beta_{gs} \pi_g \propto \pi_f + \sum_{g \neq f} \underbrace{\left(\frac{\sum_{\forall s} \gamma_{fs} \beta_{gs}}{\sum_{\forall s} \gamma_{fs} \beta_{fs}} \right)}_{\equiv \kappa_{fg}(\gamma_f, \beta)} \pi_g$$

The common ownership hypothesis: Rotemberg (1984), O'Brien and Salop (2000)

Firm profits with common ownership effect:

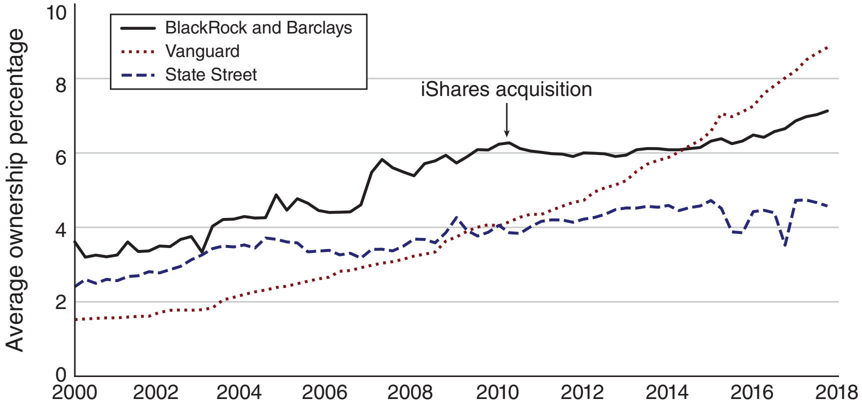
$$\max_{p_f} \pi_f\left(p_f, p_{-f}\right) + \sum_g \kappa_{fg} \pi_g\left(p_f, p_{-f}\right)$$

First order condition:

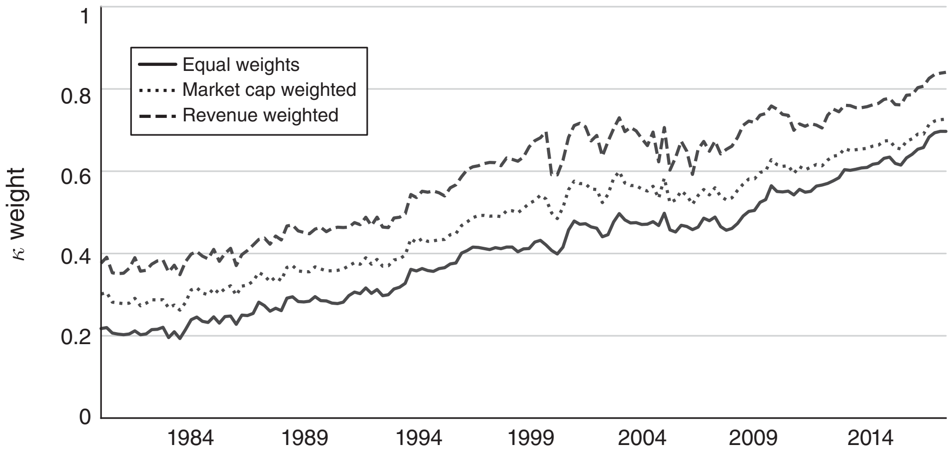
$$\underbrace{q_j(p) + (p_j - c_j) \cdot \frac{\partial q_j}{\partial p_j}(p)}_{\text{single product FOC}} + \underbrace{\sum_g \kappa_{fg} \cdot \left(\sum_{k' \in \mathcal{J}_g} (p_{k'} - c_{k'}) \cdot \frac{\partial q_{k'}}{\partial p_j}(p) \right)}_{\text{portfolio effects}} = 0$$

Backus, Conlon, Sinkinson (2021a) — the rise of institutional, diversified investment

Backus, Conlon, Sinkinson (2021a) — the rise of institutional, diversified investment



Backus, Conlon, Sinkinson (2021a) — profit weights



Backus, Conlon, Sinkinson (2021b) — common ownership, cereals

Backus, Conlon, Sinkinson (2021b) — common ownership, cereals

General Mills (GIS)

2004		2010		2016	
Capital Research and Management	7.28%	BlackRock, Inc	8.70%	BlackRock, Inc	7.36%
Barclays Global Investors	3.24%	State Street Global Advisors	5.92%	The Vanguard Group	6.92%
Wellington Management Group	3.06%	The Vanguard Group	3.56%	State Street Global Advisors	6.14%
State Street Global Advisors	2.48%	MFS	2.65%	MFS	3.37%
The Vanguard Group	1.95%	Capital Research and Management	2.43%	Capital Research and Management	2.12%

Kellogg's (K)

2004		2010		2016	
W.K. Kellogg Foundation	29.87%	W.K. Kellogg Foundation	22.94%	W.K. Kellogg Foundation	19.75%
Gund Family	7.26%	Gund Family	8.65%	Gund Family	7.68%
Capital Research and Management	2.83%	Capital Research and Management	3.54%	The Vanguard Group	4.97%
Barclays Global Investors	2.81%	BlackRock, Inc	2.97%	BlackRock, Inc	4.64%
W.P. Stewart & Co.	2.63%	The Vanguard Group	2.42%	MFS	3.51%

Quaker Oats, a Unit of PepsiCo (PEP)

2004		2010		2016	
Barclays Global Investors	4.40%	BlackRock, Inc	4.64%	The Vanguard Group	6.72%
State Street Global Advisors	2.81%	Capital Research and Management	4.37%	BlackRock, Inc	5.63%
FMR LLC	2.74%	The Vanguard Group	3.64%	State Street Global Advisors	3.98%
The Vanguard Group	2.08%	State Street Global Advisors	3.19%	Wellington Management Group	1.48%
Capital Research and Management	1.82%	Bank of America	1.63%	Northern Trust	1.37%

Post Brands, a Unit of Altria (2004, MO), Ralcorp (2010, RAH), and Post Holdings (2016, POST)

2004		2010		2016	
Capital Research and Management	7.37%	FMR LLC	10.18%	Wellington Management Group	9.63%
State Street Global Advisors	3.61%	BlackRock, Inc	8.35%	BlackRock, Inc	8.42%
Barclays Global Investors	3.51%	The Vanguard Group	3.57%	FMR LLC	7.24%
FMR LLC	2.60%	Baron Capital Group	3.39%	The Vanguard Group	6.93%
AllianceBernstein L.P.	2.25%	Steinberg Asset Management	2.68%	Tourbillon Capital Partners	6.89%

Backus, Conlon, Sinkinson (2021b) — common ownership pricing in breakfast cereals?

Derive moment for different **conduct models** m from:

$$mc_{jt} = \psi_j^m \left(\mathbf{s}_t, \mathbf{p}_t, \mathcal{D}\left(\mathbf{z}_t \right) \right)$$

Backus, Conlon, Sinkinson (2021b) — common ownership pricing in breakfast cereals?

Derive moment for different **conduct models** m from:

$$mc_{jt} = \psi_j^m\left(\mathbf{s}_t, \mathbf{p}_t, \mathcal{D}\left(\mathbf{z}_t\right)\right) = h_s\left(x_{jt}, \mathrm{w}_{jt}\right) + \omega_{jt}^m,$$

Backus, Conlon, Sinkinson (2021b) — common ownership pricing in breakfast cereals?

Derive moment for different **conduct models** m from:

$$mc_{jt} = \psi_j^m \left(\mathbf{s}_t, \mathbf{p}_t, \mathcal{D}\left(\mathbf{z}_t\right)\right) = h_s\left(x_{jt}, \mathrm{w}_{jt}\right) + \omega_{jt}^m,$$

where moments $\mathbb{E}\left[\omega_{jt} \mid \mathbf{z}_t\right] = 0$ are used to construct the GMM objective function $\tilde{Q}$.

Backus, Conlon, Sinkinson (2021b) — common ownership pricing in breakfast cereals?

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where moments $\mathbb{E}\left[\omega_{jt} \mid \mathbf{z}_t\right] = 0$ are used to construct the GMM objective function $\tilde{Q}$.

Test statistic (Rivers and Vuong (2002)):

$$T = \frac{\sqrt{n} \cdot \left(\tilde{Q}^{m_1} - \tilde{Q}^{m_2}\right)}{\widehat{\sigma}} \sim \mathcal{N}(0, 1)$$

Backus, Conlon, Sinkinson (2021b) — common ownership pricing in breakfast cereals?

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Comments:

1. Like Nevo (2021) they estimate a demand model for cereals
2. Like Nevo (2021) they test different conduct models but with a focus on common ownership
3. Unlike Nevo (2021) they do not discern model through a known markup estimate
4. Instead they test which conduct model best fits the estimated cost function

Backus, Conlon, Sinkinson (2021b) — common ownership, cereals

Table 8: Testing Results: Own-Profit Maximization vs Alternatives

	Others' Costs	Demographics	BLP Inst.	Dmd. Opt. Inst.
Own Profit Max vs.	Panel 1: $A(\mathbf{z}_t) = \mathbf{z}_t$, linear $h_s(\cdot)$			
Common Ownership	-2.4732	-0.0079	-1.2333	-4.9099
Common Ownership (MA)	-2.5918	0.0070	-1.2105	-4.9215
Common Ownership (Lag)	-2.5208	0.0075	-1.2125	-4.9351
Perfect Competition	0.8611	-2.3033	-3.1652	-10.9229
Monopolist	-2.4166	-0.8783	-3.5162	-6.0048
Own Profit Max vs.	Panel 2: $A(\mathbf{z}_t) = \mathbb{E}[\Delta\eta^{12}\|\mathbf{z}_t]$, linear $h_s(\cdot)$ and $g(\cdot)$			
Common Ownership	-1.2859	-0.2126	-0.8317	-5.2361
Common Ownership (MA)	-1.3993	-0.2071	-0.8340	-5.3019
Common Ownership (Lag)	-1.3506	-0.2093	-0.8367	-5.3271
Perfect Competition	1.1732	-0.8843	-1.4708	-10.7559
Monopolist	-1.4038	-0.3243	-1.0613	-5.3183
Own Profit Max vs.	Panel 3: $A(\mathbf{z}_t) = \mathbb{E}[\Delta\eta^{12}\|\mathbf{z}_t]$, random forest $h_s(\cdot)$ and $g(\cdot)$			
Common Ownership	-4.8893	-5.4460	-5.4412	-5.9585
Common Ownership (MA)	-5.4345	-6.1348	-5.8757	-6.4357
Common Ownership (Lag)	-5.1770	-5.9221	-5.7041	-6.2255
Perfect Competition	-7.7749	-8.7051	-8.9758	-10.0654
Monopolist	-5.2711	-6.7789	-5.9158	-6.5933

The common ownership hypothesis

Comments:

- Based on the models and measurement it seems a plausible conjecture that common-ownership incentives could reduce competition
- This case study rejects the common ownership hypothesis in favor of own-profit maximization
- More generally, many people are highly skeptical of the hypothesis due to a lack of (i) plausible mechanisms on how to act on those incentives, and (ii) a smoking gun that would suggest that institutional investors have acted on them
- Anton et al. (2022) suggest that managerial incentives are a potential mechanism