Push-Me Pull-You: Comparative Advertising in the OTC Analgesics Industry

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Question

- How do firms strategically use self-promoting and comparative advertising to push up own brand perception along with pulling down the brand images of targeted rivals?
- Non-comparative advertising:
  - Only positive promotion.
- Comparative advertisement:
  - By comparing one's own product in favorable light relative to a rival, has both a positive promotion component and an indirect effect through denigrating a rival.

Objective and Main Findings

- Propose a simple model of targeting advertising to determine who should do more of what kind of advertising against whom.
- Construct novel and unique dataset on the content of advertising, using data from the Over-The-Counter (OTC) analgesics industry in the US.
- Ask whether those relationships are actually there and how large they are.
- Finding for self-promotion advertising FOC:
  - Higher market shares are associated with higher non-comparative advertising
  - Outgoing attacks are half as powerful as direct non-comparative ads;
  - Every dollar spent by its competitors on incoming attacks requires 40 cents to mitigate.
- Findings for comparative advertising FOC:
  - Firms have a greater incentive to attack larger firms, and this incentive is increasing in the share of the attacker.
  - Firms carry attacks on their competitors jointly, each dollar that firm j's competitors spend attacking firm k, firm j spends 45 cents attacking firm k.

Quality, Formally

- Firm $j = 1, ...n$ charges price p_j and has perceived quality $Q_j(.)$, $j = 1, ...n$.
- Arguments of $Q_j(A_{jj}, \{A_{jk}\}_{k \neq j}, \{A_{kj}\}_{k \neq j})$, $j = 1, ..., n$:
  - Self-promoting advertising, A_{jj};
  - “Outgoing” advertising by Firm j targeted against Firm k, A_{jk}, which has a direct positive effect;
  - "Incoming” comparative advertising by Firm k targeting Firm j, A_{kj}, $k \neq j$, which has a negative (detraction) effect on Firm j's perceived quality.

Demand

$$U_j = \delta_j + \mu\varepsilon_j, \qquad j = 0, 1, ..., n, \text{ with } \delta_j = Q_j(.) - p_j.$$

- "Outside option" (of not buying a painkiller) be associated to an objective utility $\delta_0 = V_0$.
- μ expresses the degree of horizontal consumer/product heterogeneity.
- There are M consumers in the market, so that the total demand for product j will be Ms_j, $j = 0, ..., n$
- The structure of the random term determines the form of the corresponding demand function. At first, we do not impose further structure, but we later specialize (for the comparative advertising analysis) to the logit model to get a sharper set of benchmark properties..

Profits

- Product j is produced by Firm j at constant marginal cost, c_j.
- Firm $j's$ profit-maximizing problem is:

$$\underset{\{p_j, A_j\}}{Max}\ \pi_j = M(p_j - c_j)s_j - A_{jj} - \gamma \sum_{k \neq j} A_{jk} \qquad j = 1, ...n.$$

  - $\gamma > 1 =>$ comparative advertising intrinsically more costly because of the risk involved that a competitor might challenge the ad
  - Advertising quantities (the A's) are dollar expenditures.
  - Pricing and advertising levels are determined simultaneously in a Nash equilibrium.

Firms' Optimal Choices: Non-Comp Ads

- Non-comparative advertising expenditures are determined by:

$$\frac{d\pi_j}{dA_{jj}} = \frac{d\pi_j}{d\delta_j}.\frac{\partial Q_j}{\partial A_{jj}} - 1 = M(p_j - c_j)\frac{ds_j}{d\delta_j}\frac{\partial Q_j}{\partial A_{jj}} - 1 \leq 0, \quad \text{with equality if } A_{jj} > 0$$

- Pricing first-order condition can be substituted into the advertising one to get:

$$Ms_j \frac{\partial Q_j}{\partial A_{jj}} \leq 1, \quad \text{with equality if } A_{jj} > 0, \qquad j = 1, ..., n.$$

- Intuition: Raising A_{jj} by \$1 and raising price by $\$\frac{\partial Q_j}{\partial A_{jj}}$ leaves δ_j unchanged. This change therefore increases the revenue by $\$\frac{\partial Q_j}{\partial A_{jj}}$ on the existing consumer base (i.e., Ms_j consumers). This extra revenue is equated to the \$1 marginal cost of the change, the RHS.

Firms' Optimal Choices: Comp Ads

- For Comp Ads, the problem is more opaque - use logit. Then,

$$\frac{d\pi_j}{dA_{jk}} = \frac{d\pi_j}{d\delta_j}.\frac{\partial Q_j}{\partial A_{jk}} + \frac{d\pi_j}{d\delta_k}.\frac{\partial Q_k}{\partial A_{jk}} = \underbrace{M(p_j - c_j)\frac{s_j(1-s_j)}{\mu}\frac{\partial Q_j}{\partial A_{jk}}}_{\text{own Q enhancement}}$$

$$+ \underbrace{M(p_j - c_j)(-\frac{s_j s_k}{\mu})\frac{\partial Q_k}{\partial A_{jk}}}_{\text{competitor's Q denigration}} - \gamma \leq 0, \text{with equality if } A_{jk} > 0.$$

- After some algebra, we can rewrite:

$$(0 <) - M\frac{s_j s_k}{1 - s_j}\frac{\partial Q_k}{\partial A_{jk}} \leq \gamma - \lambda.$$

- Intuition: Raising A_{jk} by \$1 equal to brand k raising price by $\$\frac{-\partial Q_k}{\partial A_{jk}}$ (since the same δ_k is attained). Such a rival price change causes j's market share to rise by $\frac{s_j s_k}{\mu}$. This increment is valued at $M(p_j - c_j)$. By the price first-order condition, $p_j - c_j = \frac{1}{\mu(1-s_j)}$, and the foc above follows.

Predictions

- (**Non-Comparative Advertising levels**): In equilibrium, firms with larger market shares will use more non-comparative advertising.
- (**Larger target more):** In equilibrium, for all firms using a strictly positive level of non-comparative advertising, larger firms will use more comparative advertising against each target.
- (**Larger targeted more**) In equilibrium, larger firms suffer more attacks from each rival.
  - Follows from the logit property that fall-out is greater from peeling off consumers from a larger rival. Analogously, the largest brands will also be those attacked most (Tylenol in our industry context.)

Description of the Industry

- OTC analgesics market:
  - Worth approximately $2 billion in retail sales per year (including generics)
  - Covers pain-relief medications with four major active chemical ingredients: Aspirin, Acetaminophen, Ibuprofen, and Naproxen Sodium.
- Nationally advertised brands: Tylenol, Advil and Motrin, Aleve, Bayer, and Excedrin.
- Three different data-sets:
- (1) Sales - AC Nielsen
- (2) Advertising - TNS-Media Intelligence
- (3) Medical news data - From publicly available news archives.

Sales Data

- Raw dataset:
  - Average prices, dollar sales, and dollar market shares (excluding Wal-Mart sales) of all OTC oral analgesics products sold in the U.S., 2001-2005
  - Products vary in package size (the number of pills) and the strength of the active ingredient in milligrams.
- Measure of a *serving* of pain medication, or an *episode of pain*
  - Step 1: Strength of active ingredient in milligrams.
  - Step 2: From milligrams of the active ingredient to max number of pills per day.
  - Step 3: Multiply by average number of pain days (3)
- *Market size* for OTC analgesic products = US population 18 years or older.
- Generic product price information - exogenous variation in our instrumental variable approach = average price of the unit of episode of pain relief for the generic brands.

Table 1: Brands, market share and advertising levels of OTC analgesics market

Brand	Active Ing.	Price per serving	Sales Share	Brand Vol. Share	Weighted Share	Max Pills	TA/ Sales	CA/ Sales	CA/ TA	Ownership
Tylenol	ACT	$2.15	29.16%	38.90%	30.51%	7.22	17.34%	4.98%	28.71%	McNeil
Advil	IB	$1.61	17.15%	22.87%	24.21%	5.90	20.00%	14.60%	72.99%	Wyeth
Aleve	NS	$.84	8.25%	11.00%	22.40%	3	26.56%	23.82%	89.71%	Bayer
Excedrin	ACT	$2.41	8.80%	11.74%	8.28%	9.22	26.42%	4.02%	15.22%	Novartis
Bayer	ASP	$1.85	5.73%	7.65%	6.98%	10.07	28.82%	8.80%	30.53%	Bayer
Motrin	IB	$1.73	5.83%	7.78%	7.68%	5.86	20.39%	8.07%	39.58%	McNeil
Generic	ACT	$1.17	8.00%							
Generic	IB	$.66	9.25%							
Generic	ASP	$.82	6.08%							
Generic	NS	$.57	1.66%							

Table 2: Comparative advertising and target pairs

Adv-ertiser ⇓	TARGET:						
	Advil	Aleve	Bayer	Excedrin	Motrin	Tylenol	Total
Advil	-	17.80 [26]	-	4.26 [20]	-	160.20 [56]	182.26 [102]
Aleve	2.64 [9]	-	2.64 [9]	3.12 [16]	2.64 [9]	134.31 [58]	145.36 [101]
Bayer	13.17 [25]	2.05 [8]	-	-	2.05 [8]	15.69 [37]	32.95 [78]
Excedrin	-	1.96 [6]	2.15 [7]	-	-	19.96 [14]	24.08 [28]
Motrin	18.84 [25]	18.79 [25]	-	-	-	-	37.63 [50]
Tylenol	23.07 [43]	45.11 [51]	28.10 [40]	4.27 [21]	15.64 [39]	-	116.18 [194]
Total	57.72 [102]	85.71 [116]	32.89 [56]	11.66 [57]	20.33 [56]	330.15 [165]	538.47 [552]

Advertising Data

- Raw dataset: Monthly advertising expenditures on each ad, and video files of all TV advertisements for the 2001-2005 time period for each brand advertised in the OTC analgesics category.
- Advertising Content: Watched all (>4K!) the ads and coded according to their content.
  - Whether the commercial had any comparative claims
  - Which brand (or class of drugs) it was compared to
  - Unit of observation is a year-month-brand-attacked brand combination.
- Attack Matrix: See Table 2.

News Shocks

- Between 2001 and 2005, OTC analgesics market endured several medical news related shocks.
- Follow Chintagunta, Jiang and Jin (2007) = us Lexis-Nexis to search over news.
- News Shock:
  - From a data-set of articles we then constructed a data-set of news shocks.
  - Check whether a news shock was associated with any new medical findings that were published in major scientific journals.
  - Table 3.
- Effect of a Shock:
  - Each shock assigned a dummy variable, equal to 1 in all the periods after and including t: $t; t + 1; \ldots; T$
  - Interact each of the major shocks listed in **Table 3** with brand dummies.

Table 3: Medical News Shocks

No.	News Shock Description	Date	Source
	Major		
1	Risk of Cardiovascular Events Associated With Selective COX-2 Inhibitors	8/21/2001	Journal of the American Medical Association (JAMA)
2	Ibuprofen Interferes with Aspirin	12/20/2001	New England Journal of Medicine
3	FDA Panel Calls for Stronger Warnings on Aspirin and Related Painkillers	9/21/2002	FDA Public Health Advisory
4	Aspirin Could Reduce Breast Cancer Risk/ NSAIDs Protect Against Alzheimer's	4/8/2003/ 4/2/2003	JAMA American Academy Of Neurology
5	Anti-Inflammatory Pain Relievers Inhibit Cardioprotective Benefits of Aspirin	9/9/2003	Circulation
6	Vioxx Withdrawn From the Market	9/30/2004	
7	Long Term Use of Naproxen Associated with Increased Cardiovascular Risk	12/23/2004	FDA Public Health Advisory
8	Bextra Withdrawn	4/7/2005	
	Minor		
9	Ibuprofen May Prevent Alzheimer's	11/8/2001	Nature
10	Aspirin May Prevent Prostate Cancer	3/12/2002	Mayo Clinic Proceedings
11	Aspirin May Prevent Pancreatic Cancer	8/6/2002	J. of the National Cancer Institute
12	Aspirin Prevents Colorectal Adenomas	3/6/2003	New England Journal of Medicine
13	Misusing acetaminophen, can be deadly	1/23/2004	FDA Public Health Advisory
14	Myocardial infarction associated with Vioxx	4/19/2004	Circulation
15	Celebrex and Vioxx increases risk of acute myocardial infarction or cardiac death	8/25/2004	Annual meeting of the International Society for Pharmacoepidemiology
16	Acetaminophen, NSAIDs Increase Women's Hypertension Risk	8/15/2005	Hypertension

Quality Function

- After *extensive* experimentation, we chose the following functional form for the base quality:

$$Q_j = \begin{array}{c} -\left(\bar{A}_j - \alpha_1\left(A_{jj} + \lambda \sum_{k \neq j} A_{jk}\right)\right)^2 \\ -\phi\left(\bar{C}_j - \left(A_{jj} + \lambda \sum_{k \neq j} A_{jk}\right)\right)\sum_{k \neq j} A_{kj} \\ +\sum_{k \neq j}\left(\bar{A}_{kj} - \alpha_2 A_{kj}\right)^2 - \beta \sum_{k \neq j} \sum_{k' \neq j, k' \neq k} A_{kj} A_{k'j} \end{array}$$

Equations to Be Estimated

- Non-comparative ad equations:

$$A_{jj} = \max\left\{-\bar{A}^*_{jj} - \frac{\alpha^*}{Ms_j} - \lambda \sum_{k\neq j} A_{jk} + \phi^* \sum_{k\neq j} A_{kj}, 0\right\}..$$

- Comparative Ads:

$$A_{jk} = \max\left\{-\gamma^* \frac{1-s_j}{Ms_j s_k} - \beta^* A_{kk} - \omega^* \sum_{l\neq k} A_{kl} + \varphi^* \sum_{l,j\neq k} A_{lk} + \bar{A}^*_k, 0\right\}.$$

- Deep cross equation restrictions: if $\phi^* > 0$, then $\beta^* > 0$, $\omega^* > 0$.
- Think of the above as "quasi-structural" parameters.

Identification I (Brand FE)

- Two main concerns:
  - Left-censoring of non-comparative and comparative advertising (Tobits);
  - Endogeneity of market shares and advertising expenditures.
- Brand Fixed Effects: Exploit the panel structure of our data to account for time-constant differences across brands.
  - Model the unobservable ξ_{jt} as:

$$\xi_{jt} = \bar{\xi}_j + \Delta\xi_{jt},$$

  $\bar{\xi}_j$ brand fixed effect, while $\Delta\xi_{jt}$ time specific idiosyncratic shocks. Two fixed effects, one for the top brands (Advil, Aleve, Tylenol), and one for the other brands (Excedrin, Motrin, Bayer) fits our data best (Figure 2).

Identification II (News Shocks and Exclusion Restrictions)

- Using Timing to Identify the Parameters: Use news shocks ...
  - Exogenous since they require new medical discoveries, which 'surprise' both the consumers and the firms.
- Exclusion Restrictions : Need variables that affect advertising only through shares, but not directly - marginal cost = generic prices...
  - MC must be constant - otherwise, the price of the generic would depend on the quantity produced by the branded products.
  - Bertrand competition and free entry among generic producers of the drugs with the same active ingredient leads to pricing at marginal cost.
  - Cost of producing generic products highly correlated with cost of producing branded products, then generic prices have an additional indirect impact on branded products' market shares through branded prices.

Non-Comparative Ads FOC:

- The unit of observation now is a *brand-year-month*.
- Start by running the following simple Tobit regression:

$$\begin{cases} A^*_{jjt} = -\frac{\alpha^*}{Ms_{jt}} - \lambda \sum_{k\neq j} A_{jkt} + \phi^* \sum_{k\neq j} A_{kjt} - \xi_{jt}, \quad \xi_{jt} \sim N\left(0, \sigma^2\right), \\ A_{jjt} = \max\left(A^*_{jjt}, 0\right). \end{cases}$$

- For the economic interpretation of α^*:

$$e_{A_{jj},s_j} = \frac{dA_{jj}}{ds_j}\frac{s_j}{A_{jj}}.$$

Table 4: Self Promotion

	Baseline	Brand Dummy	Major News Shocks	All News Shocks	Full IV	Partial IV	Partial IV Linear
$\frac{1}{Ms_{jt}}$	-0.0300	-0.212***	-0.146*	-0.120	-0.0810	-0.113	
	(0.0198)	(0.0596)	(0.0826)	(0.0731)	(0.0772)	(0.0730)	
Ms_{jt}							9.971***
							(2.655)
$\sum_{k \neq j} A_{jk}$	-0.700***	-0.657***	-0.575***	-0.452***	-0.466***	-0.468***	-0.455***
Outgoing Comp Ads	(0.0760)	(0.0758)	(0.0635)	(0.0607)	(0.0615)	(0.0616)	(0.0601)
$\sum_{k \neq j} A_{kj}$	0.590***	0.596***	0.395***	0.367***	0.401***	0.399***	0.332***
Incoming Comp Ads	(0.0620)	(0.0610)	(0.0650)	(0.0655)	(0.0671)	(0.0672)	(0.0686)
$\bar{\xi}_T$		-0.305***	-0.0973	-0.0556	-0.00492	-0.0479	-0.266**
Top Brand FE		(0.0943)	(0.121)	(0.110)	(0.115)	(0.109)	(0.109)
Constant	0.234***	0.637***	0.517***	0.455***	0.376**	0.440***	0.0399
	(0.0417)	(0.131)	(0.171)	(0.152)	(0.160)	(0.152)	(0.0573)
Ctr Fct $[\frac{1}{Ms_{jt}}]$					5.261		
					(4.270)		
Ctr Fct $[\sum_{k \neq j} A_{jk}]$					0.0192	0.0185	0.0166
					(0.0218)	(0.0218)	(0.0213)
Ctr Fct $[\sum_{k \neq j} A_{kj}]$					-0.0965**	-0.0952**	-0.0801*
					(0.0479)	(0.0480)	(0.0472)
Elasticity (Ms_{jt})	0.312	2.208	1.520	1.244	.8421	1.1712	1.5412
Observations	348	348	348	348	348	348	348
Log Likelihood	8.699	13.82	131.6	152.6	155.4	154.6	160.3
Major News Shocks	No	No	Yes	Yes	Yes	Yes	Yes
Minor News Shocks	No	No	No	Yes	Yes	Yes	Yes
F Test (1st Stage, $\frac{1}{Ms_{jt}}$)					←--	F(3,344)=52.12	--→
						Prob>F=0.000	
First Stage Full R^2, $\frac{1}{Ms_{jt}}$						R^2=0.9857	
First Stage Residual R^2, $\frac{1}{Ms_{jt}}$						R^2=0.3181	
F Test (1st Stage), $\sum_{k \neq j} A_{jk}$					←--	F(3,344)=52.12	--→
						Prob>F=0.000	
First Stage Full R^2, $\sum_{k \neq j} A_{jk}$						R^2=0.5436	
First Stage Residual R^2, $\sum_{k \neq j} A_{jk}$						R^2=0.4483	
F Test (1st Stage), $\sum_{k \neq j} A_{kj}$					←--	F(3,344)=52.12	--→
						Prob>F=0.000	
First Stage Full R^2, $\sum_{k \neq j} A_{kj}$						R^2=0.7622	
First Stage Residual R^2, $\sum_{k \neq j} A_{kj}$						R^2=0.3239	

Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
1) The three first stage regressions are the same for the last three columns.
2) F Test (1st Stage) is a test of whether the coefficients of the ivs are all equal to zero in the first stage.
3) First Stage Full R^2 is the R^2 of the first stage regression, without including the ivs.
4) First Stage Residual R^2 is the R^2 of the regressions of the residuals of the first stage regression without ivs on the ivs. It says how much of the residual variation in the first stage is explained by the ivs.

Comparative Ads FOC

- The unit of observation now is a *pair of brand-year-month*
- Start by running the following simple Tobit regression:

$$\left\{ \begin{array}{c} A^*_{jkt} = -\gamma^* \frac{1-s_{jt}}{M s_{jt} s_{kt}} - \beta^* A_{kkt} - \omega^* \sum_{l \neq k} A_{klt} + \varphi^* \sum_{l,j \neq k} A_{lkt} + \xi_{jkt}, \\ \xi_{jkt} \sim N\left(0, \sigma^2\right) \\ A_{jkt} = \max\left(A^*_{jkt}, 0\right) \end{array} \right\}$$

Table 5: Comparative Advertising

	Baseline	Pair Brand Dummies	Major News Shocks	All News Shocks	Full IV	Partial IV	Partial IV Linear
$\frac{1-s_j}{Ms_j s_k}$	-2.457***	-0.867**	-1.571**	-1.678**	-1.617**	-1.564**	
	(0.206)	(0.407)	(0.665)	(0.694)	(0.752)	(0.749)	
$Ms_j s_k$							7.112***
							(0.770)
A_{kk}	-0.0432**	-0.0306	0.00210	-0.00833	-0.0703		
Targeted Self-Promotion	(0.0215)	(0.0194)	(0.0270)	(0.0291)	(0.0717)		
$\sum_{k \neq l} A_{kl}$	-0.0330	0.00926	0.00811	0.00708	0.0239		
Targeted Outgoing Comp Ads	(0.0262)	(0.0260)	(0.0319)	(0.0349)	(0.0427)		
$\sum_{l \neq k,j} A_{lk}$	0.307***	0.342***	0.343***	0.354***	0.443***	0.410***	0.355***
Targeted Incoming Comp Ads	(0.0220)	(0.0214)	(0.0319)	(0.0349)	(0.0698)	(0.0475)	(0.0460)
$\bar{\xi}_{TB,TB}$		0.109**	-0.0241	-0.0363	-0.0490	-0.0358	-0.436***
Top Brand-Top Brand FE		(0.0505)	(0.0763)	(0.0788)	(0.0844)	(0.0840)	(0.0723)
$\bar{\xi}_{TB,OB}$		0.0455	-0.0275	-0.0362	-0.0284	-0.0205	-0.0259
Top Brand-Other Brand FE		(0.0402)	(0.0600)	(0.0622)	(0.0668)	(0.0666)	(0.0306)
$\bar{\xi}_{OB,OB}$		-0.0417	-0.166***	-0.177***	-0.195***	-0.186***	-0.173***
Other Brand-Other Brand FE		(0.0400)	(0.0624)	(0.0649)	(0.0702)	(0.0701)	(0.0341)
Ctr Fcn [s_{jt}]					1.163	1.258	-6.685***
					(2.014)	(2.003)	(2.072)
Ctr Fcn [s_{kt}]					-0.621	-0.731	-8.414***
					(1.997)	(1.976)	(2.054)
Ctr Fcn [A_{kk}]					0.0608		
					(0.0782)		
Ctr Fcn [$\sum_{k \neq l} A_{kl}$]					-0.0344		
					(0.0345)		
Ctr Fcn [$\sum_{l \neq k,j} A_{lk}$]					-0.137*	-0.110*	-0.0555
					(0.0804)	(0.0648)	(0.0621)
Constant	-0.00608	-0.104*	0.0148	0.0286	0.0243	0.00595	-0.236***
	(0.0116)	(0.0550)	(0.0797)	(0.0828)	(0.0902)	(0.0885)	(0.0288)
Elasticity (Ms_{jt})	1.580	0.558	1.010	1.079	1.0398	1.0060	6.0073
Elasticity (Ms_{kt})	1.504	0.531	0.962	1.027	0.9898	0.9577	6.0073
Observations	1740	1740	1740	1740	1740	1740	1740
Log Likelihood	-114.0	-34.42	134.1	138.9	141.6	140.4	181.4
Major News Shocks	No	No	Yes	Yes	Yes	Yes	Yes
Minor News Shocks	No	No	No	Yes	Yes	Yes	Yes
F Test (1st Stage), A_{kk}					←--	$F(27,238)=4.25$	--→
						Prob>F=0.000	
First Stage Full R^2, A_{kk}						$R^2=0.652$	
First Stage Residual R^2, A_{kk}						$R^2=0.101$	
F Test (1st Stage), $\sum_{k \neq l} A_{kl}$					←--	$F(30,247)=2.80$	--→
						Prob>F=0.000	
First Stage Full R^2, $\sum_{k \neq l} A_{kl}$						$R^2=0.540$	
First Stage Residual R^2, $\sum_{k \neq l} A_{kl}$						$R^2=0.444$	
F Test (1st Stage), $\sum_{l \neq k,j} A_{lk}$					←--	$F(29,230)=10.08$	--→
						Prob>F=0.000	
First Stage Full R^2, $\sum_{l \neq k,j} A_{lk}$						$R^2=0.767$	
First Stage Residual R^2, $\sum_{l \neq k,j} A_{lk}$						$R^2=0.307$	

Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

1) The three first stage regressions are the same for the last three columns.

2) F Test (1st Stage) is a test of whether the coefficients of the ivs are all equal to zero in the first stage.

3) First Stage Full R^2 is the R^2 of the first stage regression, without including the ivs.

4) First Stage Residual R^2 is the R^2 of the regressions of the residuals of the first stage regression without ivs on the ivs. It says how much of the residual variation in the first stage is explained by the ivs.

5) The F test and R^2 for the first stage for Ms_{jt} are given in Table 4

Conclusions

- Think of this paper as developing a template for a Push-Pull analysis. Understanding the first order conditions for advertising as a first step.
- Only three papers which deploy models of price and advertising competition that are close to ours. Gasmi, Laffont, and Vuong [1992], Roberts and Samuelson [1988], Goeree [2008].
- Here a deeper look at the advertising decisions - we look at the **content of ads (comp ads)**.
- Proviso: we only look at persuasion role as in GLV and RS (vs. only informative in Goeree).
- In the (next) future:
  - Estimate full equilibrium model, and do counterfactual exercises to see if industry is at a suboptimal equilibrium (prisoner's dilemma?). This is particularly true with comparative ads that have not informative role ... here, in our Push-Pull model there is no info role for advertising.
  - Introduce more details in the nature of advertising ... that is model how firms can mention characteristics in their advertising decisions.