Discussion of:

Information Distortion in Label Design in the Over-the-Counter Drug Market

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What are we talking about?: Excedrin Headaches!

Active ingredient(s)	Brand	Migraine	Revenue	Mean price	Unit share
Acetaminophen					
Acetaminophen	No	No	80,667,365.55	5.08	0.1197
Acetaminophen	Yes	No	84,462,384.85	7.33	0.0868
Acetaminophen combinations					
Acetaminophen/Aspirin	No	Yes	56,319.78	10.26	0.0000
Acetaminophen/Aspirin	No	No	16,911.00	5.78	0.0000
Acetaminophen/Aspirin	Yes	No	32.40	1.47	0.0000
Acetaminophen/Aspirin/Caffeine	No	Yes	7,698,290.19	5.46	0.0106
Acetaminophen/Aspirin/Caffeine	No	No	13,550,366.32	4.86	0.0210
Acetaminophen/Aspirin/Caffeine	Yes	Yes	22,184,750.22	7.73	0.0216
Acetaminophen/Aspirin/Caffeine	Yes	No	44,967,056.57	7.46	0.0455

- This paper is really about Excedrin the migraine treatment that is (250mg Acetaminophen, 250mg Aspirin, 65mg Caffeine)
  - Sometimes this is labeled as "Migraine" (3% share) sometimes as "Extra Strength" or something else "Tension Headache", etc. (6.6% share)
  - Split is 2/3 branded, 1/3 private label (CVS, Walgreens, etc.)
- Tylenol sells Acetaminophen on its own (often in 500mg tablets) – around 20% of the market.
- Remainder is Ibuprofen (Advil/Motrin 46%) and Naproxen (Aleve 16%)

Baseline: No Systematic Price Discrimination on Labels

Key descriptive fact (Figures 1–2): Excedrin Migraine and Excedrin Extra Strength have identical formulations but are sold as distinct products.

Current pricing behavior:

- Median store prices them identically ∼75% of weeks
- Remaining weeks: roughly 50/50 split — migraine higher vs. extra strength higher
- Price wedge $\Delta \equiv (p_m - p_{es})/p_{es}$ is centered at zero with symmetric tails
- Consistent with temporary sales

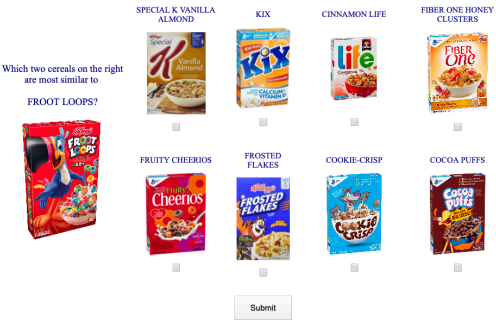
Why no discrimination at baseline?

Consumer confusion about efficacy means **noisy sorting** across labels — firms can't identify a high-WTP segment to target.

- 2DPD package size
- 3DPD loyalty cards (?)

Unobserved Embeddings/Characteristics: Magnolfi Maclure Sorensen (AEJM: 2023)

FIGURE 1: Sample survey page



What if we could first estimate unobserved characteristics?

- Is j more similar to k or l?
- Use embedding procedure to calculate what amounts to a likelihood

$$\max_{\mathbf{X}\in\mathbb{R}^{m\times J}} \ln\left(\frac{f(||x_l - x_j||, \alpha)}{f(||x_l - x_j||, \alpha) + f(||x_k - x_j||, \alpha)}\right)$$

- Get a $m \times J$ matrix with m factors (embeddings).
- Idea: m is small (like 3-4). [2 in this paper!]

Unobserved Embeddings/Characteristics: Add an Experiment

Figure 4: Example of the Triplet

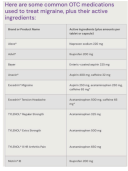
(a) Generic Actual Market

(b) "Same Active Components" Treatment

Figure 6: Comparison of Front Label Examples

Your task in each question is to identify the two drugs that are most similar to each other in terms of their effectiveness for (headache)/(migraine) relief. Effectiveness in this context refers to how well the drug reduces your headache and provides relief.

(a) "Same Effectiveness"



(b) "Migraine Educational Material"

Figure 7: Second and Third Treatments

Nice Idea: These become policy levers in the counterfactual $\longrightarrow$ relative location in this latent 2D space changes!

Demand and Supply Model

Demand

- Product Characteristics, brand, migraine label, number of pills, and price
- Demographics: age, gender, income, HH size, Bernoulli latent status r: $\{Headache, Migraine\}$
- Beliefs $\beta_r \cdot I[r = \{m, h\}] \cdot [x_{jt}, \hat{x}_j^{embed}]$ (everyone agrees!).
- RC on price $\alpha_i \sim N(-0.42, 0.199)$ should be lognormal.
- Other RC not significant (size and constant) – but nothing for active ingredient!

Supply

- Standard Bertrand-Nash with constant marginal cost and a fixed cost of entry.
- But small products have inelastic demand $\varepsilon \approx -0.8$ so assume they are set as fraction of large packages(!)
- This is because logit is $\varepsilon = \alpha \cdot p_j \cdot (1 - s_j)$ and we don't have enough heterogeneity!
- We may need better cost-shifting IV (brand level elasticities seem low to me!)
- Unitizing prices by package size would flip the elasticities!

Counterfactual: Transparency Creates a New Discrimination Channel

Mechanism: Information treatments resolve efficacy confusion but reveal label preferences.

Step 1: Consumer response

- Consumers learn products are bioequivalent
- Price-sensitive consumers switch to cheaper label
- Remaining buyers of migraine label are those with high WTP for the label itself
- Demand for migraine label becomes **less elastic** among remaining buyers

Step 2: Firm response

- Firms observe less elastic residual demand for migraine label
- Raise migraine-label prices relative to extra strength
- Two opposing forces:
  - ↓ Cross-molecule competition ⇒ prices fall
  - ↑ Label loyalty exploitation ⇒ migraine premium rises
- Net effect: average prices fall, but price *gap* widens

Magnitude of the Price Discrimination Effect

Pr(Migraine label priced higher) in equilibrium:

Scenario	Mean
Baseline	0.43
Same Active Components	1.00
Same Effectiveness	0.97
Educational Material	0.40

Average price gap (migraine vs. extra strength):

- Same Active Components: **17**× baseline gap
- Same Effectiveness: **3**× baseline gap

Distributional concern

Who pays the migraine premium?

Group	Pr(migraine)
Young, low-income	0.53
Young, high-income	0.45
Old, low-income	0.36
Old, high-income	0.32

Young, low-income consumers have both the **highest migraine entry probability** and the **highest WTP** for migraine labels (Figure 10a). These are very large numbers (12-15%)!

Final Thoughts?

- Are embedding/characteristics a basis that explains beliefs about horizontal differentiation of products? or are they actual beliefs about effectiveness? (vertical component?)
- We probably want random coefficients for active ingredients
- We can unitize sales/prices or not, but the results might be quite different.
- Big Picture: Would FDA labeling (or FTC advertising) intervention raise prices for young, low-income, migraine sufferers? [Handel-like "information provision might be bad", here because it improves segmentation of market]