The Rise of Niche Consumption

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Households Concentrating Spending (Within Category)

Household Herfindahl

# Varieties per HH
Economy Spreading Out Spending (Within Category)

Aggregate Herfindahl

# Varieties per Store
How To Reconcile?

- Households increasingly like their “top” products, but differ on what those top products are: growing “niche” consumption!

- Another dimension of growing fragmentation in economy:
  - Digital content (e.g. Aguado et al. 2015)
  - Political ideology (e.g. Gentzkow et al. 2017)
  - Job polarization (e.g. Autor et al. 2006)
Examples of Fragmenting Product Space

Varieties ↑ and concentration ↓ in each. But household taste not spread evenly over products, so HH concentration ↑.
How to Understand These Facts?

- Build a model with following elements:
  - Households choose number of varieties to consume
  - Households spend a lot on some varieties, a little on others
  - Different households consume different varieties
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• Commonly used models won’t do
  • Standard love-of-variety: $H^{HH} = \frac{1}{N}$
  • Standard discrete choice: $H^{HH} = 1$
  • Representative HHs: $H^{HH} = H^{Agg}$
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• Implications through lens of model:
  • Innovation cost ↓ or idiosyncratic tastes ↑ (isomorphic)
  • Welfare gains from better product selection
Agenda

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Baseline Data Sample

- Nielsen Homescan 2004-2015
  - All households using sampling weights
  - Non-magnet, non-fresh produce, non-generic items
  - Balanced set of narrow product categories (modules)

- Products are UPCs (baseline) or brand (robustness)

- 107 categories (e.g. carbonated beverages or laundry supplies)

- Average over category concentration measures with constant weights across time to eliminate composition
Measuring Concentration

• **Household Concentration:**
  - Within categories, **for each household**, calculate product spending shares and Herfindahls
  - Average over households and categories to get average Household Herfindahl by year: $H_{t}^{HH}$

• **Aggregate Concentration:**
  - Within categories, **add up all households’ product spending**, calculate shares and Herfindahls
  - Average over categories to get average Aggregate Herfindahl by year: $H_{t}^{agg}$
Fact 1: Household Product Concentration is Increasing

Are these the Autor et al. (2017) “super-stars”?
Fact 1: Household Product Concentration is Increasing

• Are these the Autor et al (2017) "super-stars"?
Fact 2: Aggregate Product Concentration is Decreasing
Results are Highly Robust

- Holds whether defining “products” as UPCs or brands
- Pervasive across product categories and locations
- Even within most individual retailers
- Seen within all demographic groups, so not about:
  - rich vs. poor
  - black vs. white
  - college vs. non-college
  - old vs. young
  - urban vs. rural
  - etc.

Detailed results
Largely Driven by Extensive Margin (Churning Varieties)

- Trends substantially dampened if restrict to balanced products
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- Trends substantially dampened if restrict to balanced products
- Trends strongest in retailers with most variety growth:

![Graphs showing trends and correlations between HH Herfindahl, Variety Growth, and Agg Herfindahl Growth.](image-url)
How to Think about These Patterns?

- We find household consumption segmentation interesting *per se*, consistent with trends in other walks of life.

- But, we develop a model to think about the driving forces and implications for welfare and market power.

- Many models (discrete-choice, basic CES) ill-suited, often specify number of varieties or have identical households.
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Setup for Household $i$

- HHs $i \in [0, 1]$ spend $E$ on goods $k \in [0, N]$ to maximize:

$$U_i = \left( \int_{k \in \Omega_i} \left( \gamma_{i,k} C_{i,k} \right)^{\sigma-1} dk \right)^{\frac{\sigma}{\sigma-1}} - F \times (|\Omega_i|)^\epsilon$$

- Let $\tilde{\gamma}_{i,k} = \gamma_{i,k}/p_k$ be price-adjusted taste, distributed Pareto:

$$Pr(\tilde{\gamma}_{i,k} < y) = G(y) = 1 - \left(\frac{y}{b}\right)^{-\theta},$$

where larger $\theta$ means a flatter distribution of tastes.

- Price Index:

$$P = P_i = \left( \int_{k \in \Omega_i} \left( \tilde{\gamma}_{i,k} \right)^{\sigma-1} dk \right)^{\frac{1}{1-\sigma}}$$

$$= \left( 1 + \frac{1 - \sigma}{\theta} \right)^{\frac{1}{\sigma-1}} b^{-1} \times \left( \frac{|\Omega_i|}{N} \right)^{\frac{1}{1-\sigma}} \times \left( \frac{|\Omega_i|}{N} \right)^{\frac{1}{\theta}}$$

= Ave Price \quad Variety Gains \quad Selection
Choice of Varieties and Concentration

• Optimal number of varieties given by:

$$|\Omega_i| = |\Omega| = \left( \frac{bE \left( \frac{1}{1-\sigma} - \frac{1}{\theta} \right) \left( 1 + \frac{1-\sigma}{\theta} \right) \frac{1}{1-\sigma} N^{1/\theta}}{F \epsilon} \right) \left( \epsilon - \frac{1}{1-\sigma} + \frac{1}{\theta} \right)^{-1}$$

• “Cutoff” variety whose taste satisfies: $$\frac{|\Omega|}{N} = 1 - G(\tilde{\gamma}^*)$$. 
Closed-form solution for Household Herfindahl:

\[ H_{HH} = N \int_{\gamma_i^*}^{\infty} (P_i \tilde{\gamma}_{i,k})^{2(\sigma-1)} dG(y) \]

\[ = \frac{(\eta + 1)^2}{4\eta} \frac{1}{|\Omega|}, \]

where \( \eta = 1 - 2(\sigma - 1)/\theta \in (0, 1) \).
How Does this Fit the Data?

Model Fit by HH–Product Groups–Year

Slope by Product Group

Estimated η by Product Group

R² of Predictions Within Product Group
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Rank Function

• All HHs same \# varieties \(|\Omega|\), price \(P\), and shares \((P\tilde{\gamma}_{i,k})^{\sigma-1}\), but Chobani may have large \(\tilde{\gamma}\) for some HHs and not others

• Assume each HH “ranks” products from favorite to least:

\[
    r_{i,j} = (1 - \alpha) j + \alpha x_{i,j},
\]

\(j \in [0, N]\) is common, \(x_{i,j} \sim U[0, N]\) is idiosyncratic taste

• If \(\alpha = 0\), we have representative HHs

• If \(\alpha > 0\), HHs like different products
Key Cutoffs

- Goods $j \in (0, j^*]$ have positive spending, where:
  \[ j^* = \left( 2\alpha |\Omega| N / (1 - \alpha) \right)^{\frac{1}{2}} \]

- Goods $j \in (j^*, N)$ are not purchased (i.e. failed products)

- Worst idiosyncratic draw $x^*_j$ yielding positive consumption of $j$:
  \[ x^*_j = (1 - \alpha) (j^* - j) / \alpha \]
Aggregate Market Shares

- Index HHs by their $x_{i,j}$’s and integrate spending shares:

$$s_j = \frac{1}{N} \int_{x=0}^{x^*_j} E \times s_{i,j} \, dx = \frac{\eta + 1}{\eta j^*} \left( 1 - \left( \frac{j}{j^*} \right)^{\eta} \right)$$

- This gives us the Aggregate Herfindahl:

$$\mathcal{H}^{\text{Agg}} = \frac{2(\eta + 1)}{(2\eta + 1)} \left( \frac{1}{2\tilde{\alpha} |\Omega|} \right)^{\frac{1}{2}},$$

where we define $\tilde{\alpha} = \alpha N / (1 - \alpha)$. 
How Does this Fit the Data?

- Given observed $|\Omega|$, pick $\eta$ and $\tilde{\alpha}$ to match $H_{\text{Agg}}$ and $H_{\text{HH}}$
- Do for overall economy and for each product group:
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What Does Model Say about Herfindahls Trends?

- Using data on $|\Omega^t|$ and on:

$$\mathcal{H}_{HH,t} = \frac{(\eta^t + 1)^2}{4\eta^t} \frac{1}{|\Omega^t|} \quad \text{and} \quad \mathcal{H}_{Agg,t} = \frac{2(\eta^t + 1)}{(2\eta^t + 1)} \left( \frac{1}{2\tilde{\alpha}^t |\Omega^t|} \right)^{\frac{1}{2}}.$$

- $\eta$ decreased by 1%. $\tilde{\alpha}$ increased by 68%.
What Drove the Rise of Niche Consumption?

**Conclusion 1:**

- Matching empirical $\Delta H^\text{Agg} < 0 < \Delta H^\text{HH}$ requires $\alpha \uparrow$ or $N \uparrow$
- Pervasiveness within groups suggests $N \uparrow$ rather than $\alpha \uparrow$
What Drove the Rise of Niche Consumption?

• **Conclusion 1:**
  - Matching empirical $\Delta \mathcal{H}^{Agg} < 0 < \Delta \mathcal{H}^{HH}$ *requires* $\alpha \uparrow$ or $N \uparrow$
  - Pervasiveness within groups suggests $N \uparrow$ rather than $\alpha \uparrow$

• **Conclusion 2:**
  - Other shocks required since $N \uparrow$ implies $|\Omega| \uparrow$ (counterfactual)
  - Candidates include increases in $\epsilon$ or $F$
What are the Implications of $\mathcal{N} \uparrow$?

- Consider $\mathcal{N} \uparrow$ by 68% as calculated above

- Welfare changes from:
  - Love-of-Variety Gains ($|\Omega|^{\frac{1}{1-\sigma}}$): 1.95%
  - Selection Gains ($\left(\frac{|\Omega|}{N}\right)^{\frac{1}{\theta}}$): 9.10%
  - Fixed Cost Losses ($F \times |\Omega|^\epsilon$): -1.08%
  - Total $d\ln U$: 10.1%

- Shows up partly in the *Ideal* price index, not measured one
What if We Additionally Match $\mathcal{H}^{HH} \uparrow$ and $|\Omega| \downarrow$?

- **Same $N \uparrow$ plus $\epsilon \uparrow$ 4%?:**
  - Love-of-Variety Losses $(|\Omega|)^{\frac{1}{1-\sigma}}$: -3.11%
  - Selection Gains $\left( \frac{|\Omega|}{N} \right)^{\frac{1}{\theta}}$: 11.71%
  - Fixed Cost Losses ($F \times |\Omega|^\epsilon$): -0.46%
  - Total $d\ln U$: 7.87%

- **Same $N \uparrow$ plus $F \uparrow$ 25%?:**
  - Love-of-Variety Losses $(|\Omega|)^{\frac{1}{1-\sigma}}$: -3.11%
  - Selection Gains $\left( \frac{|\Omega|}{N} \right)^{\frac{1}{\theta}}$: 11.71%
  - Fixed Cost Losses ($F \times |\Omega|^\epsilon$): -0.83%
  - Total $d\ln U$: 7.46%
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Does Rise in Niche Consumption Affect Market Power?

- Herfindahls classically used to comment on market power

- Unlike standard CES, elasticity of demand reflects intensive and extensive margins:

  \[ \epsilon_j = \left[ \left( 1 - \left( \frac{j}{j^*} \right)^\eta \right)^{-1} \cdot \left\{ \frac{\theta}{2} - (\sigma - 1) \right\} \right] > \sigma \]

  \( \text{Intensive Margin} + \text{Extensive Margin} \)

- Extensive margin becomes more important as \( j \to j^* \) so markups increase with market share
Approximate Elasticity of Demand for Good $j$
Will $N \uparrow$ Change Aggregate Profits?

- Define “aggregate” markup, $\mu^{\text{Agg}}$, as:

$$
\mu^{\text{Agg}} = \frac{\text{Total Revenues}}{\text{Total Costs}} = \frac{\int_{0}^{j^*} s_j \, dj}{\int_{0}^{j^*} s_j \frac{\epsilon_j - 1}{\epsilon_j} \, dj} = \left[ \frac{\theta + (\sigma - 1)^2}{\sigma^2} - \frac{1}{2} \frac{\eta \theta^2}{\sigma^2} \left( \frac{\eta + 1}{2 + \theta} \right) \right] \times 2F_1 \left( 1, \frac{1}{\eta}; 1 + \frac{1}{\eta}; \frac{2\sigma}{2 + \theta} \right)
$$

- Note that $\mu^{\text{Agg}}$ is only a function of $\sigma$ and $\theta$

- Changes in $\alpha$, $N$, $F$, and $\epsilon$ matter for $H^{\text{HH}}$ or $H^{\text{Agg}}$ and have distributional impact, but unrelated to “aggregate” markup
Math:

- \( N \) only enters \( s_j \) and \( \epsilon_j \) through \( j^* \)
- \( s_j \) and \( \epsilon_j \) only functions of \( \frac{j}{j^*} \)
- Since integrate from \( j \) to \( j^* \), change of variables shows \( \mu^{\text{Agg}} \) independent of \( j^* \)

Intuition:

- Two opposing forces exactly cancel
- Selection Effects ↑: For fixed \( j \) an increase in \( j^* \) → lower extensive margin, greater market power and \( \mu_j \) ↑
- Competition ↑: \( j^* \) ↑ → decline in sales and profits for initial high markup items
Summary and Next Steps

- Increasing importance of niche consumption – HHs are concentrating while the aggregate economy is not
- Model and data suggest key role for increased product entry
- Greater welfare from better product selection (unmeasured)
- Differing importance of extensive/intensive margins imply markup differences across products. Cancel in aggregate.
HH Result Holds Within Demographic Groups

**Trend by Income**

- 2004 to 2015
- Herfindahl index for different income brackets: <$20k, $20−35k, $35−60k, >$60k

**Trend by Education**

- 2004 to 2015
- Herfindahl index for College and Non-College groups

**Trend by Race**

- 2004 to 2015
- Herfindahl index for White and Black populations

**Trend by Age**

- 2004 to 2015
- Herfindahl index for different age groups: <35, 35−49, 50−64, >=65
Aggregate Result Holds Within Demographic Groups

Trend by Income

Trend by Education

Trend by Race

Trend by Age

Trend by Age
Largely Driven by Extensive Margin (Churning Varieties)
Online Spending?