Flavorants and Addiction

An Empirical Analysis of Tobacco Product Bans and Taxation

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Disclosures

- No specific grant from any funding agency in the public, commercial, or not-for-profit sectors was received for this research.
- Further, an no times have the authors of this work received funding from sources including (but not limited to) tobacco companies, pharmaceutical companies, advocacy groups, consulting firms, etc.
- Analyses herein are based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researchers and do not reflect the views of NielsenIQ.

Introduction

Goal: Determine impact of menthol ban.

- Cigarette smoking related to about **one of every five deaths**.
  - 480,000 lives lost each year.
- Black Americans **overwhelmingly prefer** menthol products.
  - Impact of historical racial marketing practices.
- **FDA proposed ban** on Menthol Cigarettes.
  - Menthol makes up about one-third of all sales.
  - Advance health equity among the Black American community.
- FDA considering additional flavor bans on tobacco products.

Research Questions

- How does banning menthol cigarettes impact smoking rates?
  - What about in marginalized communities?
  - Do consumers switch to alternative products?
- Can taxation be as effective?
  - What tax rate results in the same reduction?
  - How does consumer surplus compare to the ban?
- What if the FDA expands the ban to E-cigarette flavorants?
  - E-cigarettes still available in both menthol and flavored varieties.

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Approach

Main Idea: Design a model of **consumer demand** and **firm supply**.

- **RCNL** model using Nielsen data from 2015 through July 2019.
  - Incorporate **Retail and Household data** (Grieco et al., 2021).
  - Addiction via **dynamic state dependency** (Tuchman, 2019).
  - Within **category substitution** via nested logit.
  - **Demographic interactions** with **demand** parameters.
- **Supply side model** incorporates dynamic state dependency.
- **Counterfactual simulation** on impact of bans and taxation.
  - Consider merged producers of cigarettes and e-cigarettes.

Model: Data

- **Nielsen retail data** from 2015 through July 2019.
  - Form markets at the **DMA/week level**.
    - 100 largest used in model estimation.
    - DMA race and income: 2019 ACS 5-year estimates.
- **Nielsen household data** from 2015 through July 2019.
  - 14,712 households making over 350,000 purchases.
  - Classify households by racial and income status.
- Aggregate to products at **category/flavor level**.
  - **3 categories ("nests")** for a total of **6 products**:
    - **Cessation**.
    - **Cigarettes:** regular tobacco and menthol.
    - **E-cigarettes:** regular tobacco, menthol, and flavored.

Model: Choice and Utility

Main Idea: Individuals choose whatever provides highest **utility**.

- Utility of **no-consumption** normalized to 0.
- Utility from **consuming** choice j, where j **is a member** of category g:

$$u_{ijmt} = x_j'\beta_i + \alpha_i p_{jmt} + \phi \mathbb{I}\Big(\sum_{g' \in \mathcal{G}} C_{ig',t-1} > 0\Big) + \rho_g C_{ig,t-1} + \xi_{jmt} + \bar{\epsilon}_{ijmt}$$

  - x_j: product characteristics.
  - p_{jmt}: retail price.
  - $C_{ig,t-1}$: indicator for consumption in group g the prior week.
  - ξ_{jmt}: common demand shocks.
  - $\bar{\epsilon}_{ijmt}$: unobserved individual preferences for products.
- Ind. parameters contain a mean, demographic, and random component.

Model: Evaluation

- Decompose indirect utility:

$$u_{ijmt} = \delta_{jmt} + \mu_{ijmt}(\Theta) + \bar{\epsilon}_{ijmt}(\Theta).$$

  - Common (mean) Utility: $\delta_{jmt} = x_j'\beta + \alpha p_{jmt} + h_{gmt}'\gamma + \xi_{jmt}$.
  - Individual Utility: $\mu_{ijmt}(\Theta)$, $\bar{\epsilon}_{ijmt}(\Theta)$ depend on model's heterogeneous parameters.

- **Household Likelihood:**
  - Provided Θ and δ, we can evaluate the household likelihood function.
    - Integrate over unobserved preferences.

- **Retail Market Simulation:**
  - Simulate market shares using 200 simulated consumer "types" per market.
    - Random draws from demographic and preference distributions.
  - Evaluate iteratively, over time.
    - Simulate joint distribution of "type" and consumption status.

Model: Estimation

- **Step 1)** Maximum Likelihood
  - For any Θ, there's a **unique** δ where simulated shares equal observed shares.
  - Household log likelihood a function of $\big(\Theta, \delta(\Theta)\big)$.
  - 14,712 households with 2,100,709 weekly observations.
  - Sandwich estimator of covariance for $\widehat{\Theta}$.
- **Step 2)** Two-Stage Least Squares with Hausman instruments.
  - Regress: $\delta(\widehat{\Theta}) = x_j'\beta + \alpha p_{jmt} + \xi_{jmt}$.
  - 135,600 weekly product-level observations .
  - Bootstrapped standard errors for $(\widehat{\beta}, \widehat{\alpha}, \widehat{\gamma})$.

RCNL Demand Estimates

Table: RCNL Demand Estimates.

	Means (β)	**Std. Dev.** (Σ)	**Demographic Interactions (Π)**	
			Low Income	**Black**
Price	-0.290***		-0.017	
	(0.012)		(0.026)	
Cigarette	-1.375***	2.036***	0.351**	-0.700***
	(0.078)	(0.028)	(0.164)	(0.090)
E-cigarette	-7.452***	2.281***	0.365*	-1.929***
	(0.188)	(0.075)	(0.220)	(0.329)
Cessation	-6.581***	2.805***		
	(0.157)	(0.086)		
Menthol	-0.794***	1.188***	0.118***	1.055***
	(0.054)	(0.054)	(0.029)	(0.062)
Menthol $\times$ Ecig.	-0.267***			
	(0.030)			
Flavored	0.072		-0.397*	1.040***
	(0.070)		(0.213)	(0.319)

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				Low Income	Black
Past Consumption	(ϕ)	0.247***			
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Cess State Dependence	(ρ_q)	0.958***			
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Cig State Dependence	(ρ_c)	0.405***			
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E-cig State Dependence	(ρ_e)	2.672***			
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Supply Side

- Firms max profits over time-periods in sample.
  - Differentiated Bertrand pricing model with **state dependence**.
  - Final weeks biased from simplifying assumption $\rightarrow$ burn last quarter.
- Consider **two versions** of my supply-side model:
  - Independent producers of cigarettes and e-cigarettes.
  - Merged producers of cigarettes and e-cigarettes.

Policy 1:
Menthol Cigarette Ban

Menthol Cigarette Ban

Table: Average Weekly Percent Change in Product Usage

		Independent	Merged
		% Change	% Change
Cigarettes	Black	-35.10%	-35.11%
	Non-Black	-9.28%	-9.30%
	High Income	-11.35%	-11.36%
	Low Income	-15.16%	-15.19%
	Average	**-12.57%**	**-12.59%**

- **Additional Findings:**
  - 68% of all menthol smokers switch to regular tobacco cigarettes.
    - About 53% of Black menthol smokers switch.
  - Average CS falls by 16%.
    - Black CS falls by about 43%.
  - Patterns similar to Levy et al. (2021) and Issabakhsh et al. (2022).

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	Average	**-12.57%**	**-12.59%**
E-Cigarettes	Black	+12.27%	+23.09%
	Non-Black	+4.40%	+10.08%
	High Income	+3.78%	+8.94%
	Low Income	+7.48%	+15.45%
	Average	**+4.93%**	**+10.94%**

- **Additional Findings:**
  - Less than 2% of cigarette quitters substitute to e-cigarettes.
  - Patterns similar to Chaiton et al. (2020).

Menthol Cigarette Ban

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	High Income	+3.78%	+8.94%
	Low Income	+7.48%	+15.45%
	Average	**+4.91%**	**+10.94%**
	Cessation	+1.74%	+1.74%

Policy 2:
Cigarette Sales Tax

Cigarette Sales Tax

- **$1.02 sales tax** $\rightarrow$ equivalent reduction in average smoking rates.
- Average CS falls by about 14%.
  - Black CS falls by about 13%.
  - Non-Black households **prefer ban** and Black households **prefer tax**.
- Expected tax revenue of **$114.6 million a week**.
  - $24.4 billion generated from April 2015 through April 2019.
- Smaller increase in e-cigarette usage compared to Menthol Ban.
- Little impact on cessation product usage.

Policy 3:
Total Flavorant Ban

Total Flavorant Ban

- Reduction in cigarette consumption **near identical** to menthol ban.
- **Average reduction** in e-cigarette usage of 46%.
- **Impact varies** by flavorant popularity (time).
  - Pre-2018 average reduction is about 40%.
  - Post-2018 average reduction is about 51%.
- Little impact on cessation product usage.

Summary

Summary

- **Combine household and retail data** to evaluate menthol ban.
  - RCNL framework and allow for dynamic state dependency.
- Demand parameters suggest **significant demographic preference**.
  - Black smokers strongly prefer menthol.
  - Low-Income households display greater cigarette preference.
- **Menthol ban** reduces cigarette smoking by 13%.
  - Black cigarette smoking rate falls by 35%.
- **$1.02 sales tax** reduces cigarette smoking equivalently.
  - Expected tax revenue of $114.6 million a week.
- **Expand ban** to menthol and flavored e-cigarettes.
  - 46% decrease in e-cigarette usage.

Questions?

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