Making a Smooth Exit? Menthol Bans and Cigarette Sales in Massachusetts

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FDA Proposes Rules Prohibiting Menthol Cigarettes and Flavored Cigars to Prevent Youth Initiation, Significantly Reduce Tobacco-Related Disease and Death

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Why are menthol cigarettes special?

- Menthol is a flavor additive to cigarettes that provides a minty taste and cooling sensation when smoking

- The 2009 Tobacco Control Act banned flavored cigarettes, but it provided an exemption for menthols. Menthols are the only flavored cigarettes currently sold in the USA

- Menthols represent about 37% of the US cigarette market (roughly $27 billion dollars in revenue; roughly 18.5 million users)

- Menthols are popular among African Americans and young people

  - FDA estimates: 85% of African American smokers use menthol cigarettes vs. 29% of White smokers

  - Tobacco companies have heavily advertised menthols towards African American consumers

Why does the federal government want to ban menthol cigarettes?

1. Reduce the level of nicotine addiction and dependence
   > "The combined effects of menthol and nicotine in the brain are associated with behaviors indicative of greater addiction to nicotine compared to nicotine alone"

2. Reduce overall cigarette consumption
   > "Published modeling studies have estimated a 15.1 percent reduction in smoking prevalence within 40 years if menthol cigarettes were no longer available in the United States"

3. Reduce the number of people who smoke (gateway effect)
   > "Menthol's flavor and sensory effects reduce the harshness of cigarette smoking among new users and facilitate experimentation and progression to regular smoking of menthol cigarettes, particularly among youth and young adults"

4. Improve health outcomes, particularly among minority communities
   > "Due to this increased prevalence of menthol cigarette smoking, members of underserved communities bear a disproportionate burden of tobacco-related morbidity and mortality"

This research examines the reduction in menthol consumption and overall cigarette consumption

STATED REASONS FROM THE 2022 FDA PROPOSAL

1. Reduce the level of nicotine addiction and dependence
   "The combined effects of menthol and nicotine in the brain are associated with behaviors indicative of greater addiction to nicotine compared to nicotine alone"

2. Reduce overall cigarette consumption
   "Published modeling studies have estimated a 15.1 percent reduction in smoking prevalence within 40 years if menthol cigarettes were no longer available in the United States"

3. Reduce the number of people who smoke (gateway effect)
   "Menthol's flavor and sensory effects reduce the harshness of cigarette smoking among new users and facilitate experimentation and progression to regular smoking of menthol cigarettes, particularly among youth and young adults"

4. Improve health outcomes, particularly among minority communities
   "Due to this increased prevalence of menthol cigarette smoking, members of underserved communities bear a disproportionate burden of tobacco-related morbidity and mortality"

Our goal is to describe how menthol bans affect the market for cigarettes

RESEARCH GOAL

- There has been very limited research that analyzes retail data to measure the effect of menthol bans, and these papers have executional flaws

- Our approach: address this question by using data on retail cigarette sales corresponding to the June 2020 Massachusetts menthol ban

- Measure the changes in menthol and non-menthol sales inside and outside MA after the menthol ban took place

  - How much demand for menthol cigarettes gets diverted into cross-border sales?

  - How much does overall cigarette consumption decrease?

- How would alternative menthol policies do instead?

We have two distinct but related research questions

How did the 2020 MA menthol ban affect sales and consumption of cigarettes?	What would have happened if the government had passed an alternative policy instead?

We have two distinct but related research questions

	How did the 2020 MA menthol ban affect sales and consumption of cigarettes?	What would have happened if the government had passed an alternative policy instead?
Research goal	Quantify the realized reduction in cigarette sales and consumption among MA residents, both for menthols and all cigarettes	Predict the hypothetical (counterfactual) reduction in cigarette sales and consumption among MA residents, both for menthols and all cigarettes
Modeling approach	Estimate a reduced form demand model that accounts for cross-border shopping, preference heterogeneity, price differences across stores, seasonality and time trends; etc.	Estimate a structural demand model where consumer utility depends on distance to the store, preferences for menthol vs. non-menthols, prices, seasonality; etc.
Current literature	There are recent papers looking at this question, but they have shortcomings in their analysis	There are no recent papers that can comment on alternative policies like a menthol tax or a nationwide menthol ban

Most prior research on menthol bans has relied on survey data

EXAMPLES USING SURVEY DATA

- Canada (2017 menthol ban):
  20% of Canadian menthol smokers continued to smoke menthol cigarettes after the ban (Chung-Hall et al. 2022)

- England (2020 menthol ban):
  44% of English teenage menthol smokers continued to smoke menthol cigarettes after the ban (East et al. 2022)

- San Francisco (2018 menthol ban):
  70% of San Francisco menthol smokers continued to smoke menthol cigarettes after the ban (Yang et al. 2020)

Survey data suggests that local menthol bans have had less success than national bans, so accounting for cross-border shopping is crucial

EXAMPLES USING SURVEY DATA

Nationwide

- Canada (2017 menthol ban):
  20% of Canadian menthol smokers continued to smoke menthol cigarettes after the ban (Chung-Hall et al. 2022)

- England (2020 menthol ban):
  44% of English teenage menthol smokers continued to smoke menthol cigarettes after the ban (East et al. 2022)

- San Francisco (2018 menthol ban):
  70% of San Francisco menthol smokers continued to smoke menthol cigarettes after the ban (Yang et al. 2020)

Local

[illustrative – not comprehensive] This research is part of a broader marketing literature on how to reduce smoking activity

SUGGESTED INTERVENTIONS (MOTIVATED BY ANALYSIS OF SALES DATA)

- Plain packaging laws (Bonfrer et al. 2020)

- Regulations on e-cigarettes (Tuchman 2019; Chen and Rao 2020)

- Increasing cigarette excise taxes (Gordon and Sun 2015; Wang, Lewis and Singh 2016)

- Antismoking ads and public usage restrictions (Wang, Lewis, and Singh 2021)

- Limiting TV product placement for cigarettes (Goli et al. 2022)

- This research: imposing a ban or a tax on menthol cigarettes

There are three recent papers in the public health literature that use retail sales data to evaluate the 2020 MA menthol ban

Kingsley et al. (*AJPH* 2022) find limited evidence of cross-border sales by looking at aggregate time trends in retail sales

- No econometric model
- No control group in the analysis
- Does not account for time trends or seasonality
- Measures cross-border shopping by looking at sales outcomes for entire states rather than for specific regions bordering MA

Asare et al. (*JAMA Internal Med.* 2022) find that total cigarette sales in MA declined substantially after the ban was enforced

- Does not account for cross-border shopping

Rich (2022) finds a substantial *increase* in MA menthol consumption after the ban was enforced (i.e., the ban backfired)

- Uses wholesale shipment data from distributors to retailers, rather than retail sales data
- Uses neighboring states as a control group in some analysis, even though these areas are indirectly "treated" by the MA ban

These research questions are tricky to analyze empirically

POTENTIAL ISSUES

- Need to account for cross-border shopping → stores near the border will see a different pattern than stores far from the border

- Preferences for cigarettes and menthols are heterogeneous → different stores will see different consumer reactions to the ban

- MA prices are much higher than NH → even before the ban, quite a bit of cross-border shopping was occurring, and we need to estimate this quantity

- Cigarettes are easily storable in retail warehouses → wholesale purchases may not be a good proxy for actual retail sales

- Cigarette sales have seasonality and overall time trends → need to create an appropriate control group to properly measure the effect of the MA ban

- Nielsen samples a different proportion of stores in different states → need to reweight the store-level observations when calculating the sales changes in different areas

AGENDA

1. Introduction

2. Data

3. Empirical analysis

4. Mechanism exploration and counterfactuals

Our approach is to analyze retail sales data before and after the ban

RETAIL SALES

- Nielsen RMS: cigarette sales in grocery, drug, mass merchandise, and convenience stores

- Each observation is a UPC-store-week

- Key variables

  - Sales quantity

  - Prices
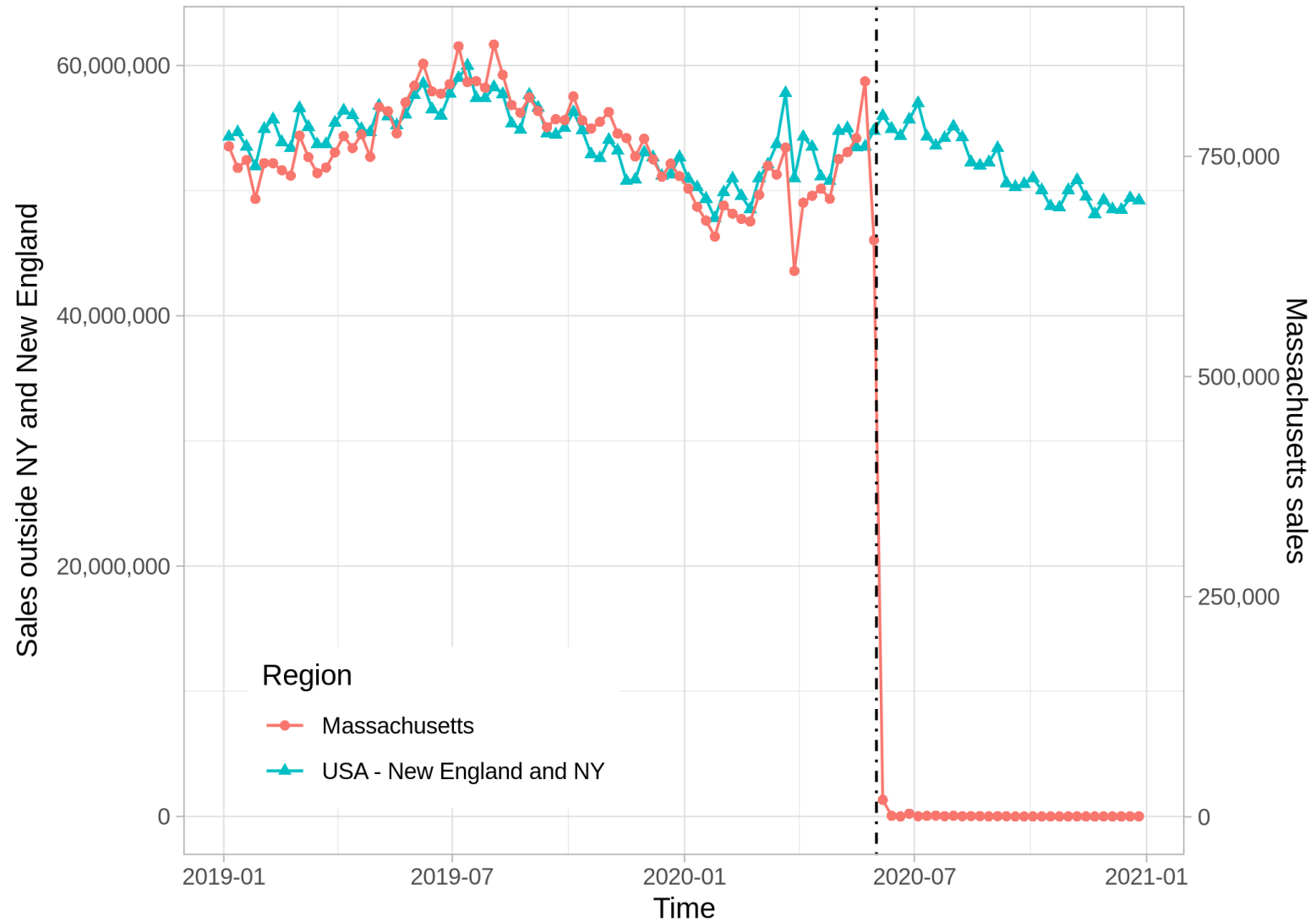
  - Menthol or non-menthol

  - Store location

Summary of the retail data (Jan 2019 – Dec 2020)

	Massachusetts data
Num. brands	83
Num. weeks	104
Start date	January 1, 2019
Menthol ban date	June 1, 2020
End date	December 31, 2020
Num. flavors	2 (menthol & non-menthol)
Num. stores	558
Num. store-flavor-weeks	116,064

The menthol ban eliminated menthol sales in Massachusetts

Sales of non-menthols increased in Massachusetts after the ban
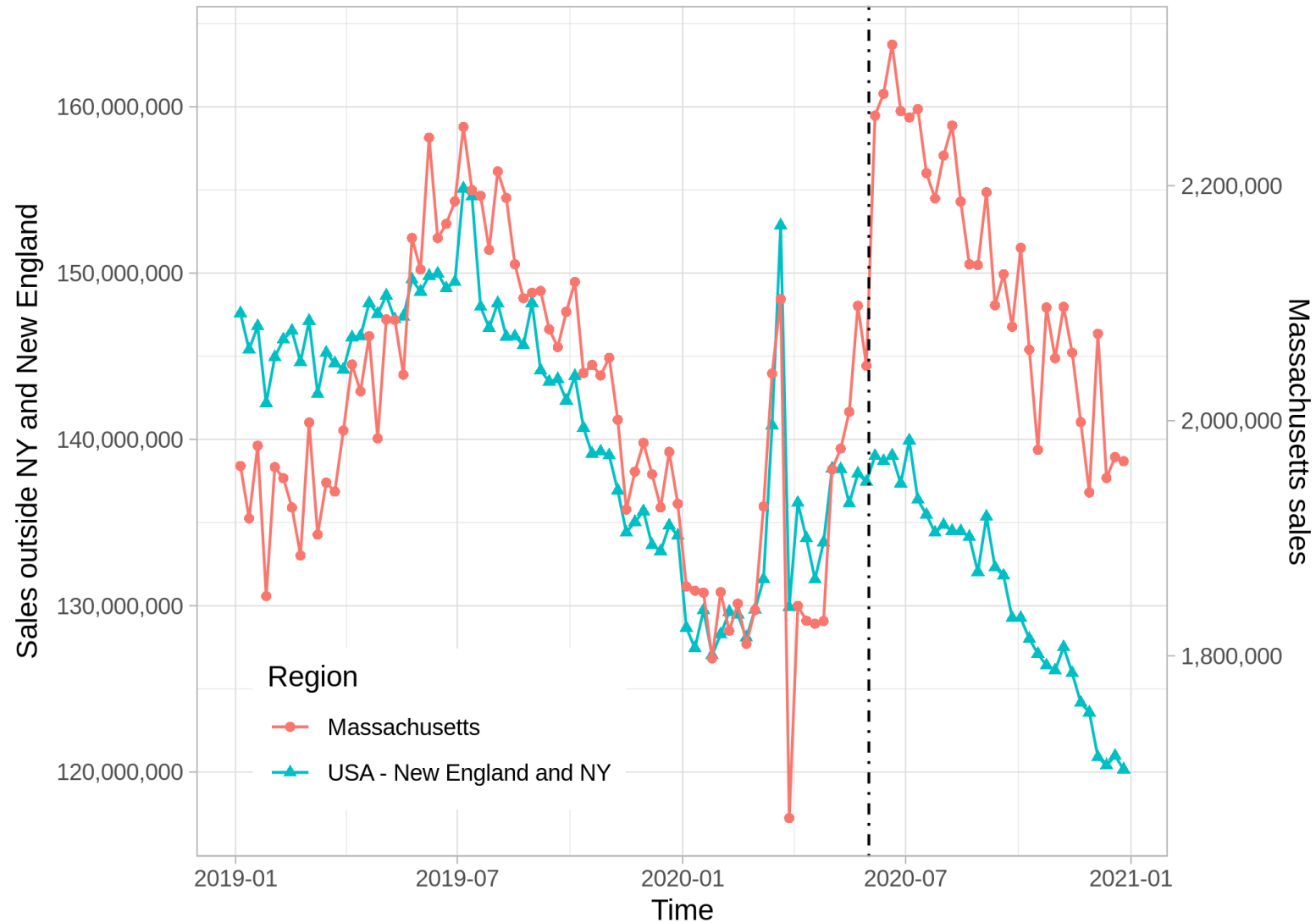
Total sales of cigarettes decreased in Massachusetts after the ban
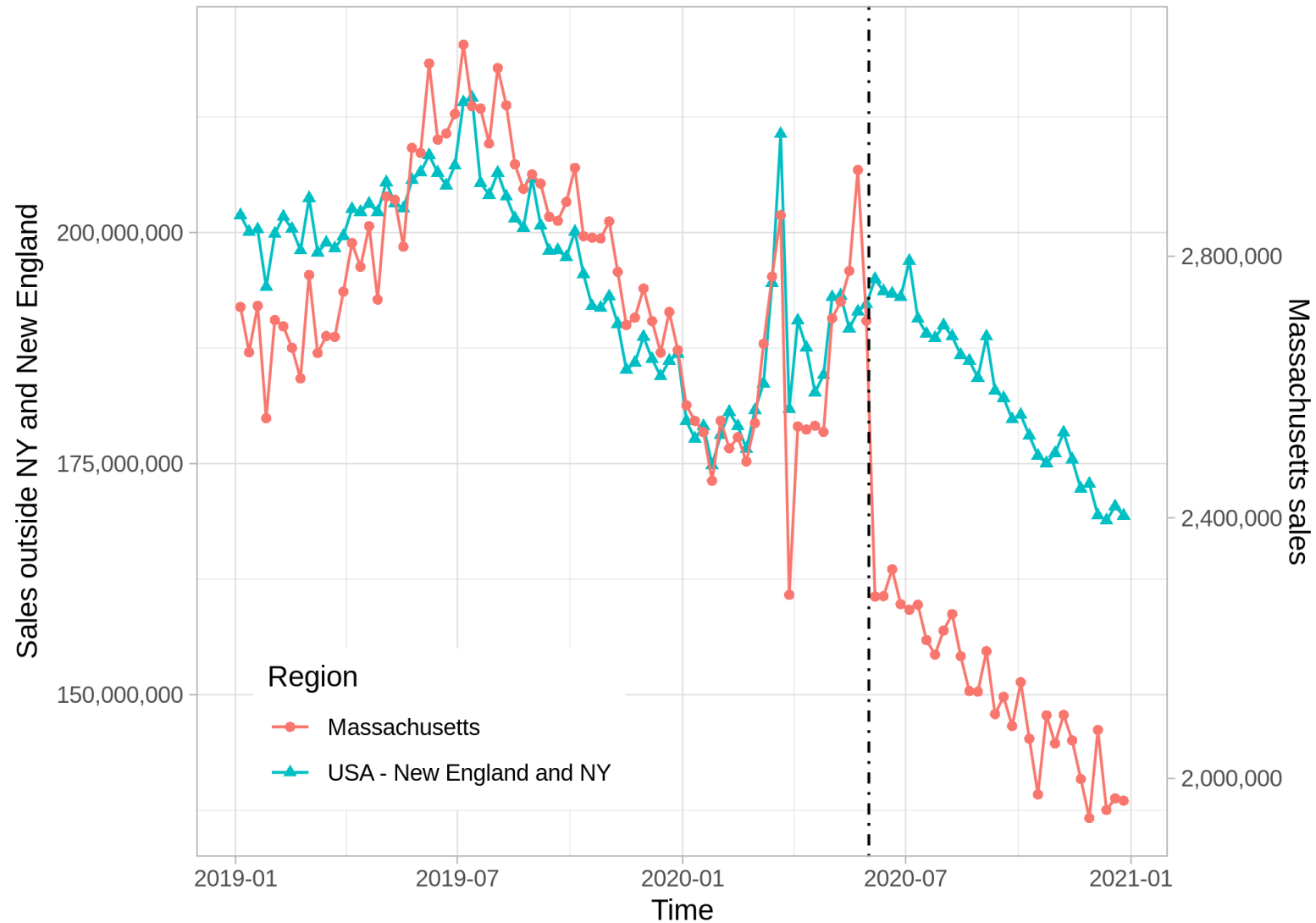
This preliminary analysis shows that the menthol ban had strong effects on Massachusetts consumers

SUMMARY OF OUTCOMES AFTER THE BAN

- MA Menthol sales go to zero

- Sizable increase in MA non-menthol sales → some menthol smokers switch to non-menthols after the ban

- Total MA cigarette sales go down → many menthol smokers stop smoking after the ban

Examining Massachusetts sales in isolation can lead to misleading conclusions

SUMMARY OF OUTCOMES AFTER THE BAN

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- Total MA cigarette sales go down → many menthol smokers stop smoking after the ban

PROBLEMS WITH THIS ANALYSIS

- Some MA smokers might have been buying cigarettes outside the state before the menthol ban was implemented (low prices)

- After the ban, MA smokers were even more incentivized to buy cigarettes outside the state (low prices + menthol availability)

- To properly characterize the ban's effect on MA smokers, we need to measure their cross-border shopping behavior

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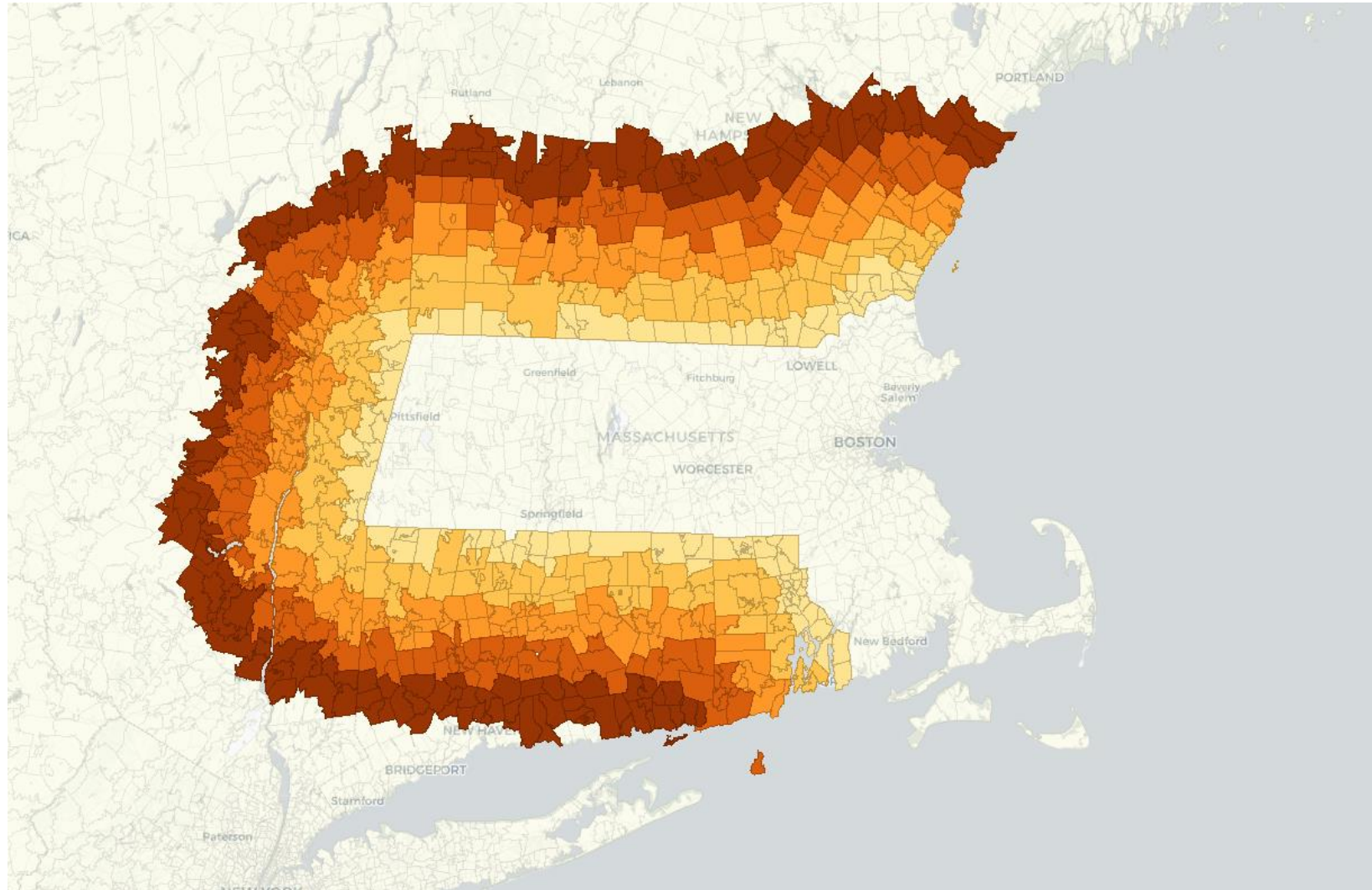3. Empirical analysis

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Nearby states show an increase in menthol sales after the MA ban
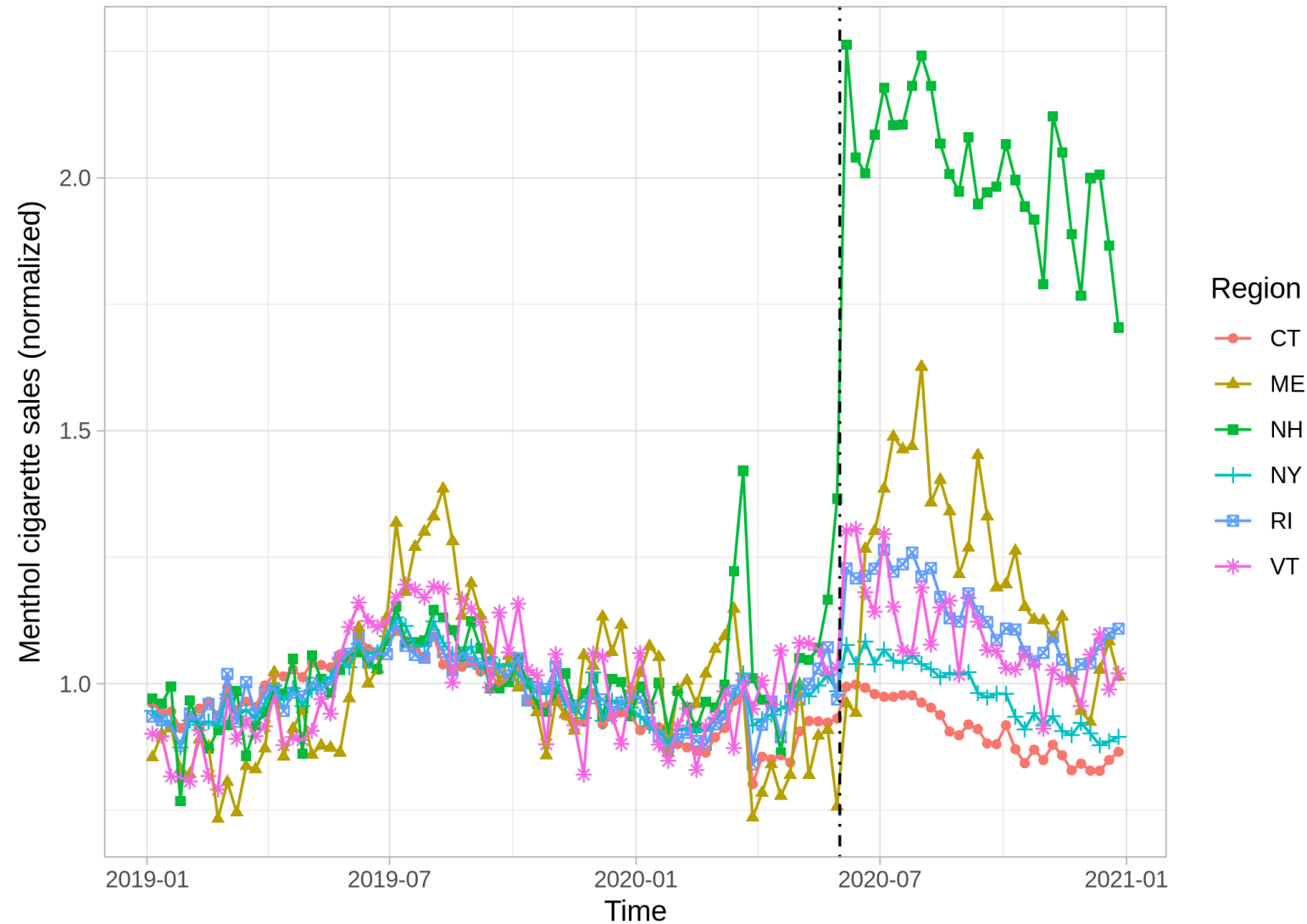
# To understand cross-state shopping behavior, we examine which nearby stores receive a bump in sales

# Analysis of nearby retail data shows that the MA menthol ban increases menthol sales up to 30 miles from the border

|	Model 1	Model 2	Model 3
<10 miles	0.172*** (0.028)	0.177*** (0.028)	0.207*** (0.023)
10 - 20 miles	0.040** (0.019)	0.044** (0.019)	0.066*** (0.015)
20 - 30 miles	0.011 (0.015)	0.014 (0.015)	0.029** (0.013)
30 - 40 miles	0.011 (0.034)	0.017 (0.034)	0.001 (0.015)
40 - 50 miles	−0.019 (0.026)	−0.016 (0.026)	−0.001 (0.025)
Fixed effects	store-flavor retailer-state-week	store-flavor retailer-state-week store-week of year	store-flavor store-week
# Observations	475,365	475,365	475,365

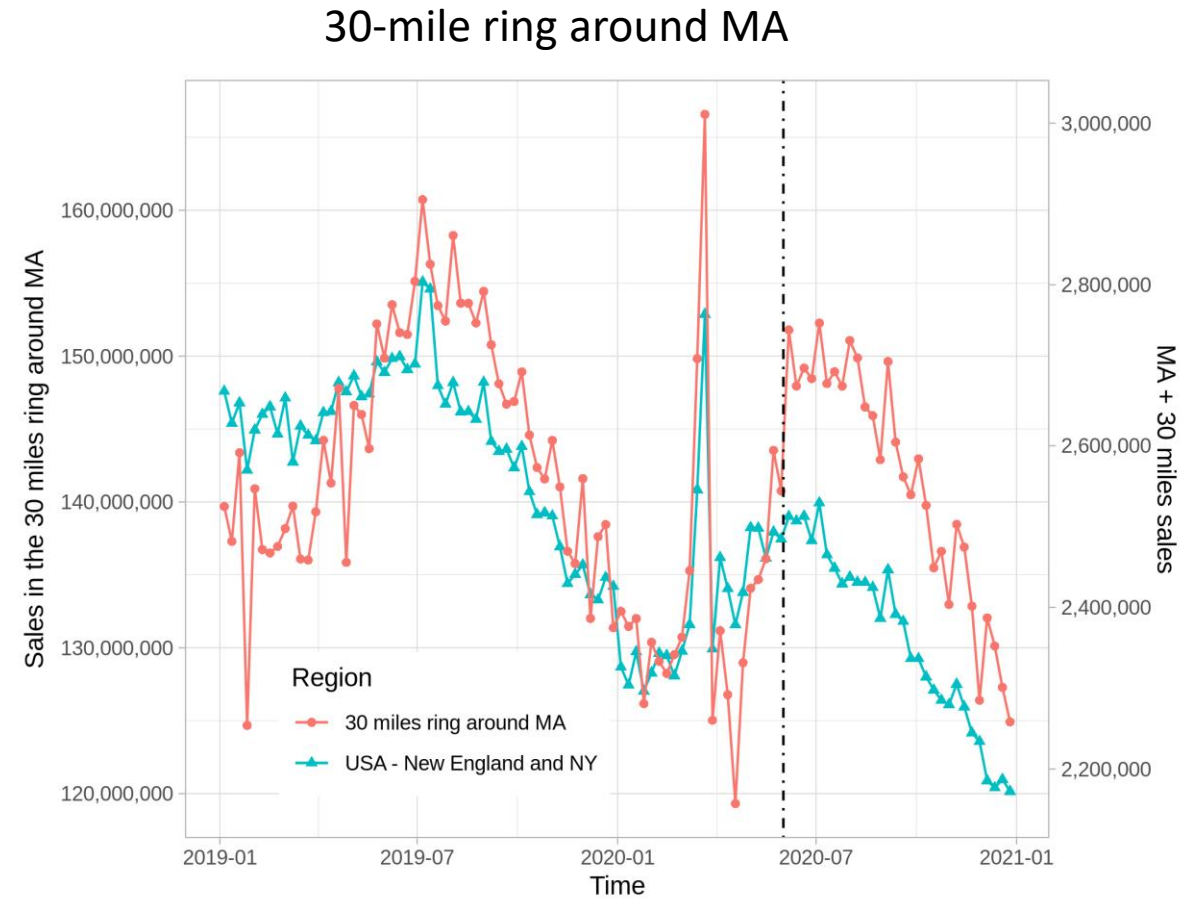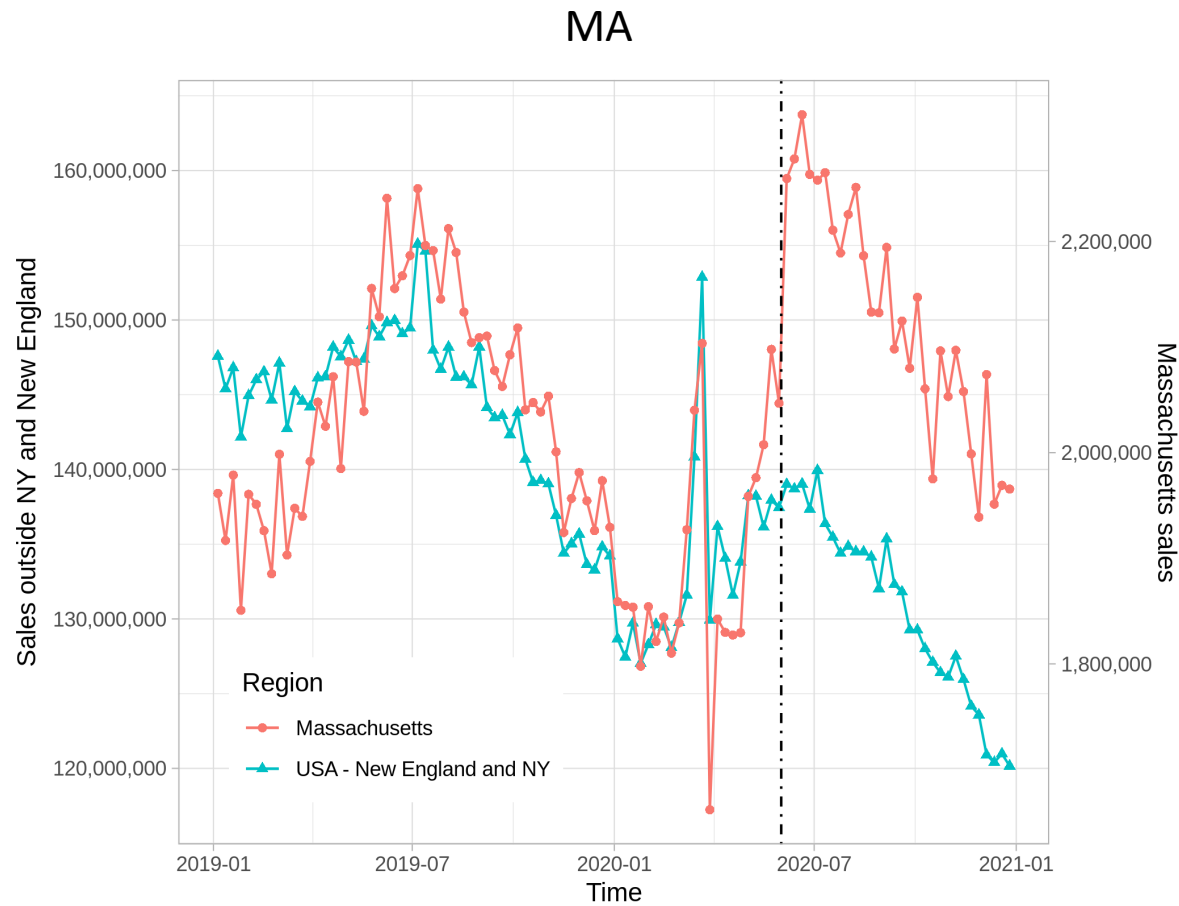# We examine stores in neighboring states, within 30 miles of the MA border
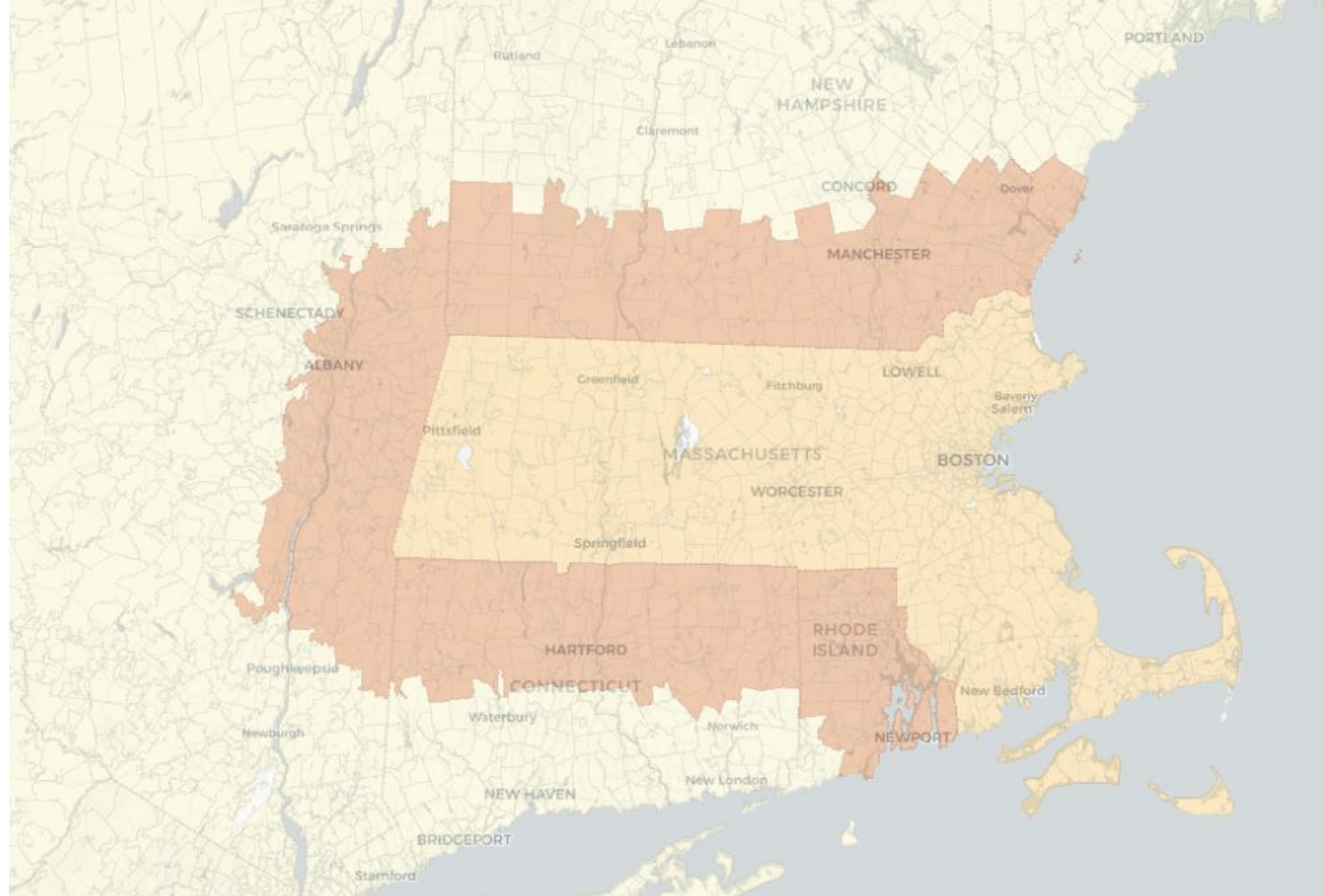
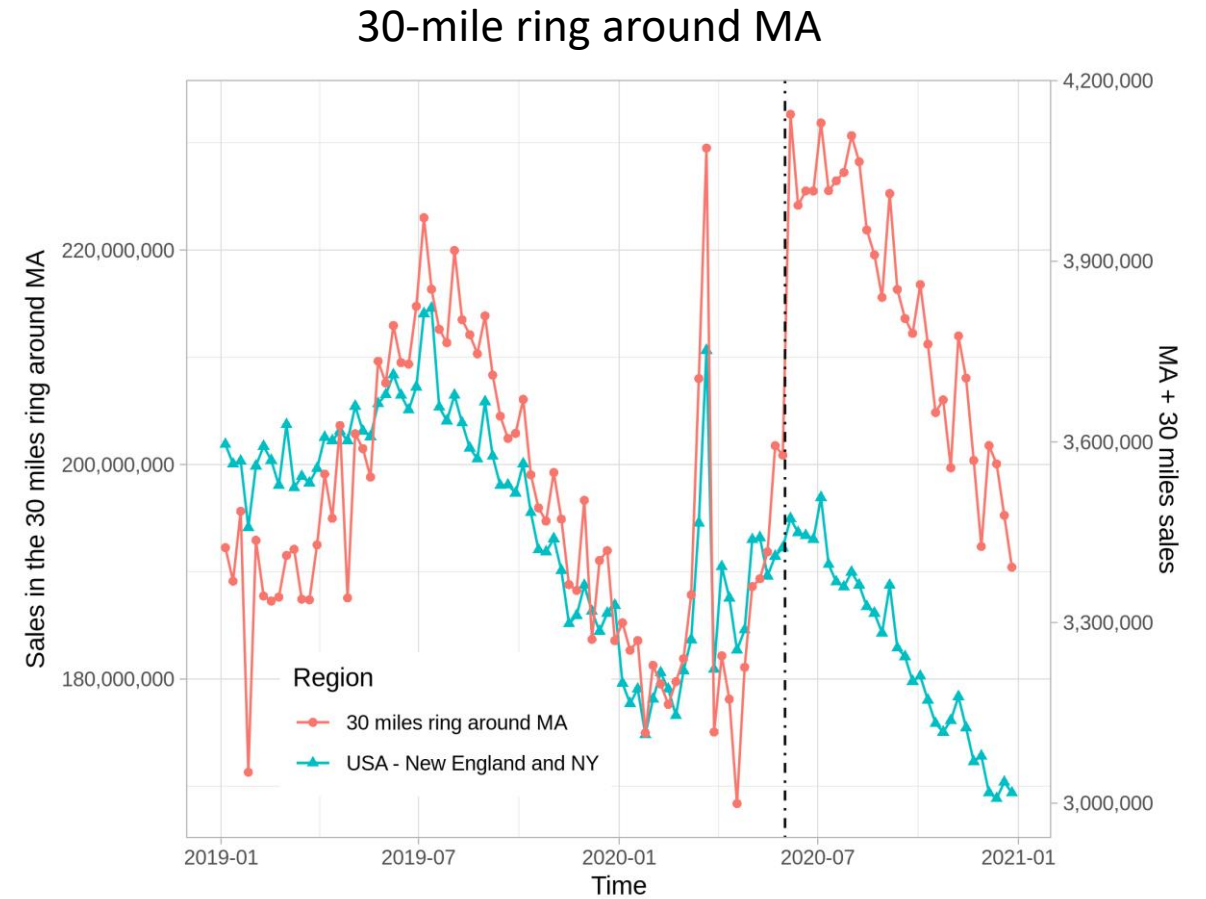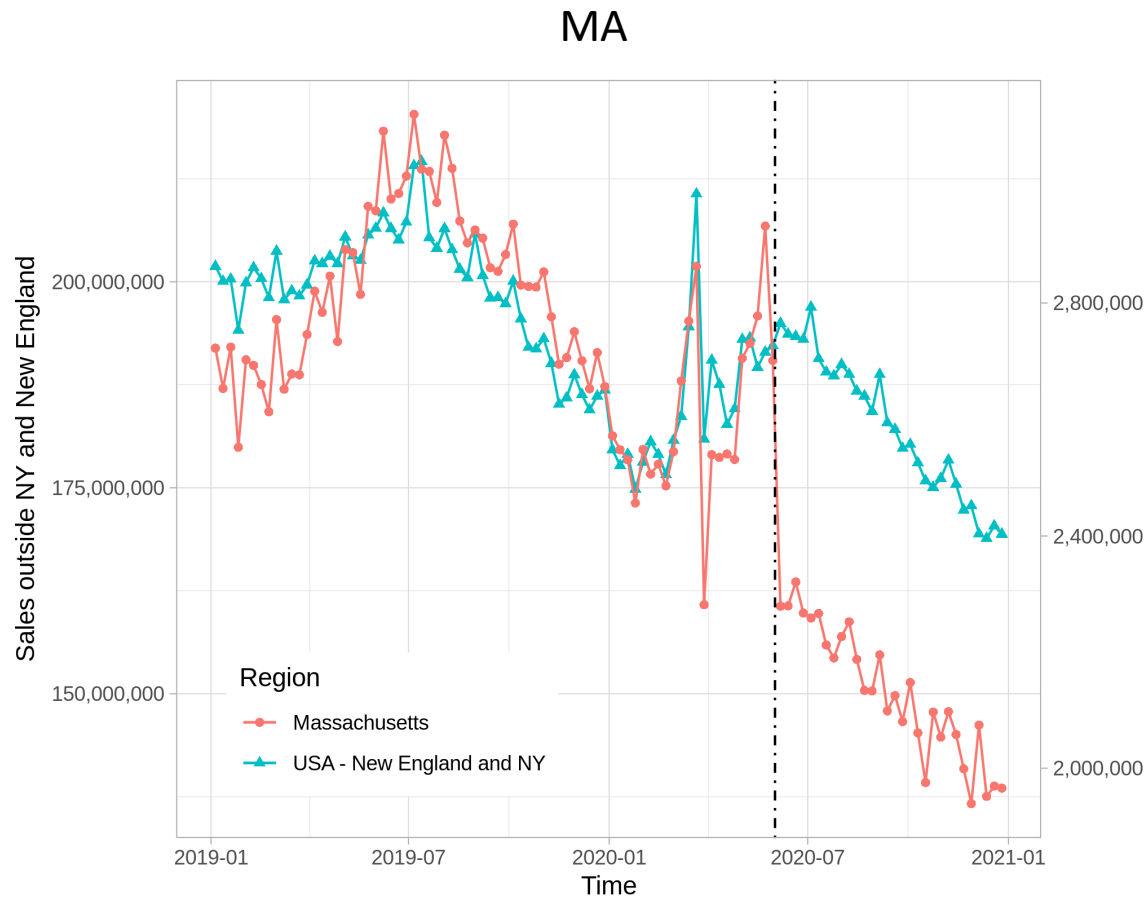# Menthol sales in Massachusetts versus the 30-mile ring around MA
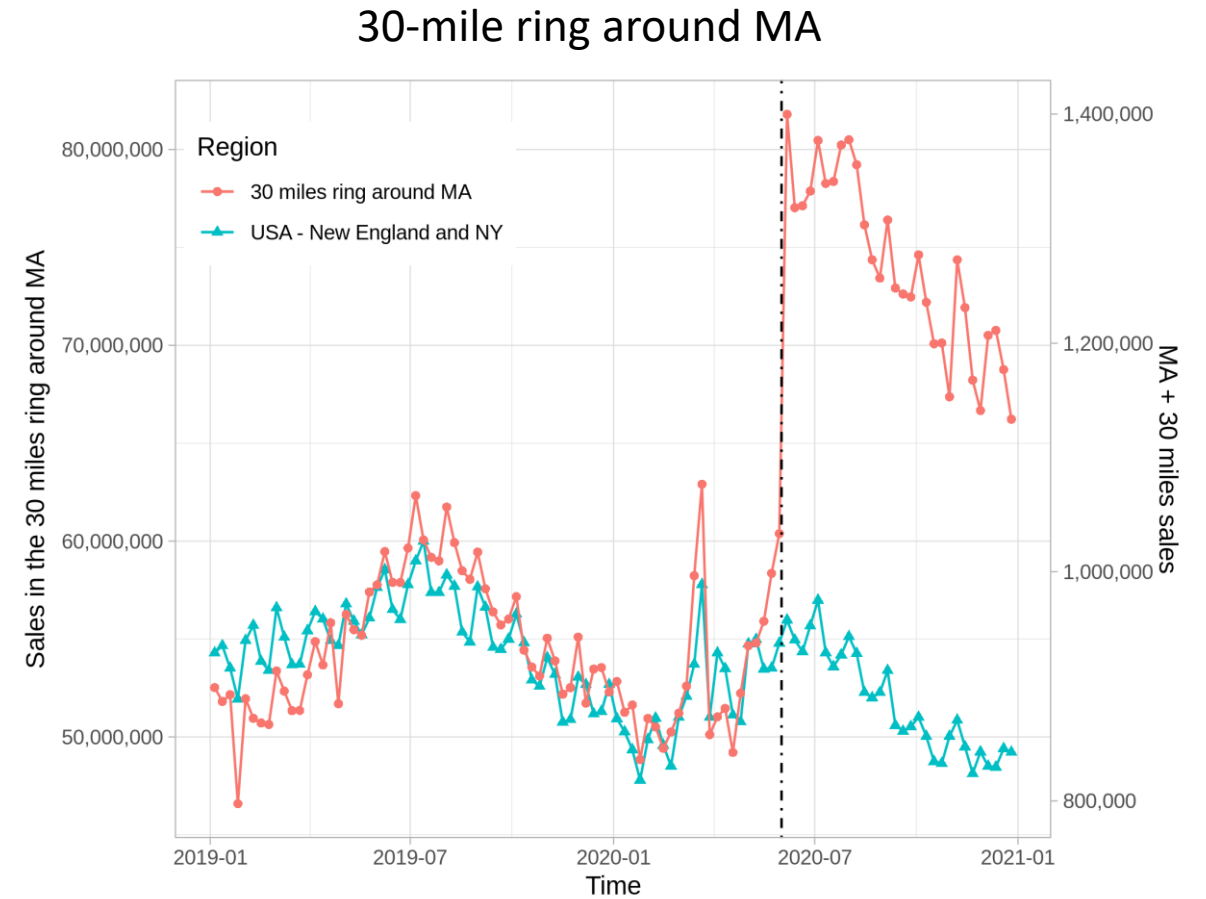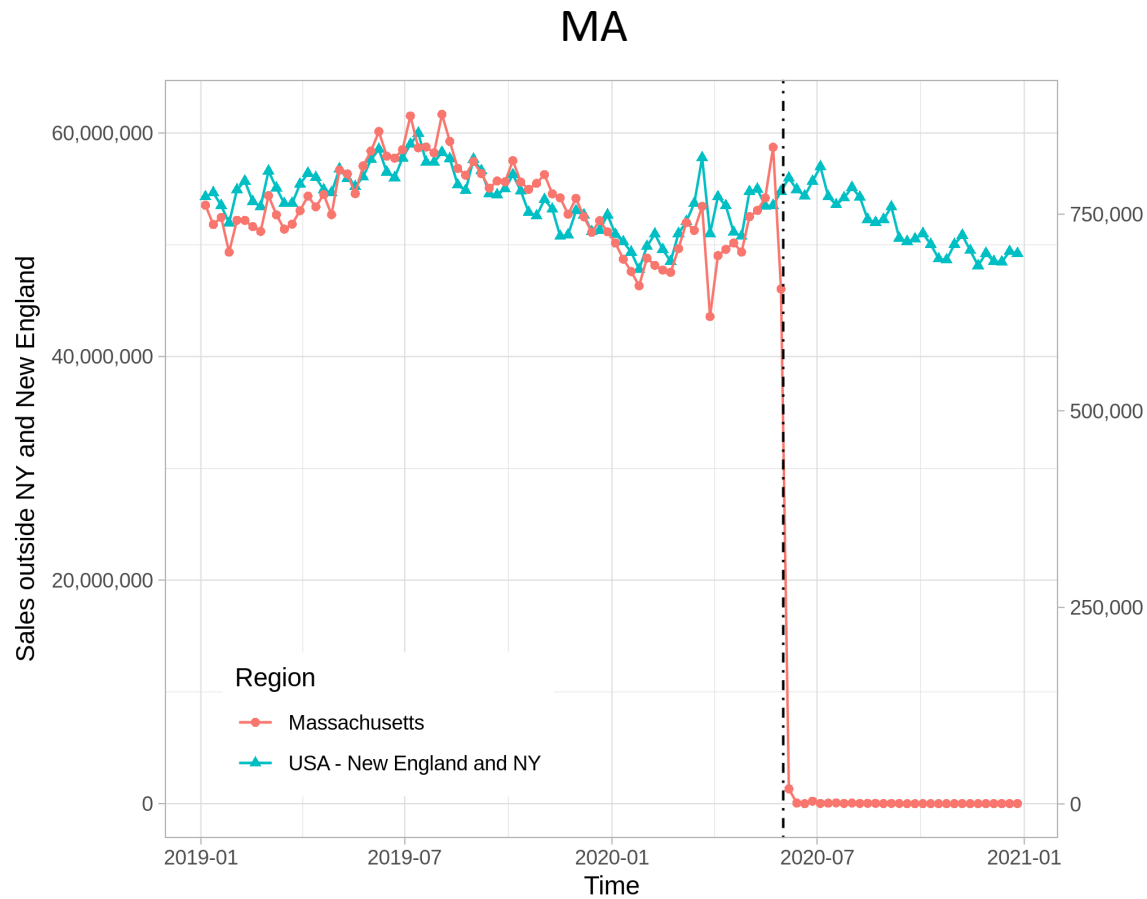
Non-Menthol sales in Massachusetts versus the 30-mile ring around MA

Total cigarette sales in Massachusetts versus the 30-mile ring around MA

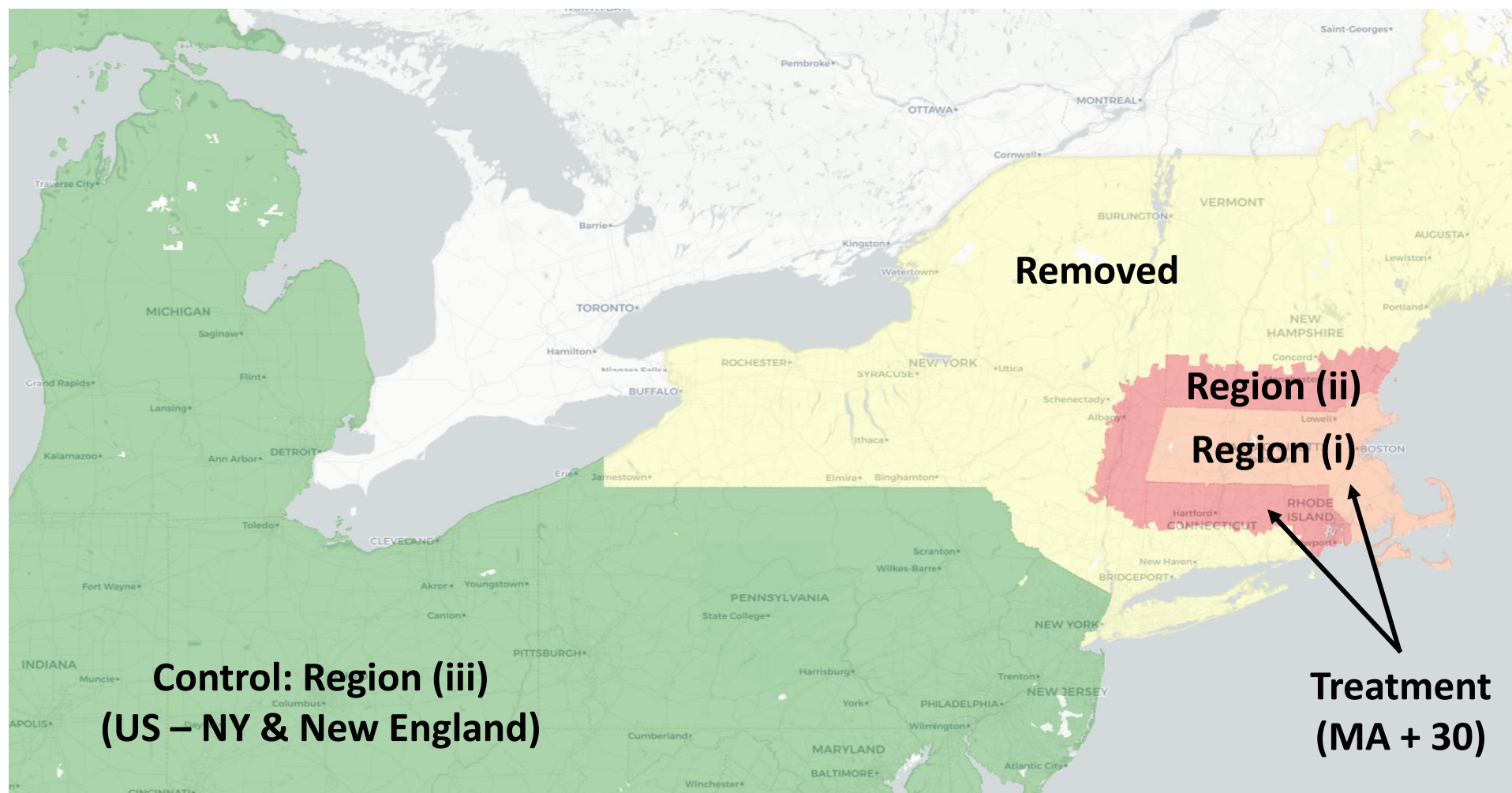# These descriptive patterns motivate our modeling approach

KEY ASPECTS

- Cigarette sales are seasonal (higher in summer)

- The MA menthol ban affects sales in neighboring areas, up to 30 miles away from the MA border

- To understand the treatment effect of the MA ban, we need to examine the greater MA+30 area

- Our "control" group should consist of areas that we know were unaffected by the ban, not the states that are neighboring MA

Our empirical approach is to compare the treated region (MA + 30) with non-neighboring parts of the USA

Removed

Region (ii)

Region (i)

Control: Region (iii)
(US – NY & New England)

Treatment
(MA + 30)

We use a log-log demand model and a difference-in-differences setup

For region/state *s* and week *t*:

Quantity sold

Interaction:
MA + 30 miles × Post-ban

MA + 30 miles

$$\log(1 + Q_{st}) = \alpha \cdot \mathbb{1}_{\{s=\text{MA}+30\}} \cdot \mathbb{1}_{\{t \geq \text{June 1, 2020}\}} + \gamma \cdot \mathbb{1}_{\{s=\text{MA}+30\}} +$$

$$\delta \cdot \mathbb{1}_{\{t \geq \text{June 1, 2020}\}} + \beta \log(P_{st}) + \eta_s + \eta_t + \epsilon_{st}$$

Post-ban

Price

Fixed effects:
state/region, week

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Post-ban

Price

Fixed effects:
state/region, week

Metric	Menthols	Non-menthols	All cigarettes
% Change in MA demand (not sales) post-ban vs. pre-ban	-54.47 ***	+17.05 ***	-4.05 ***

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Current literature	There are recent papers looking at this question, but they have shortcomings in their analysis	There are no recent papers that can comment on alternative policies like a menthol tax or a nationwide menthol ban

What affects people's willingness to travel to buy menthol cigarettes?
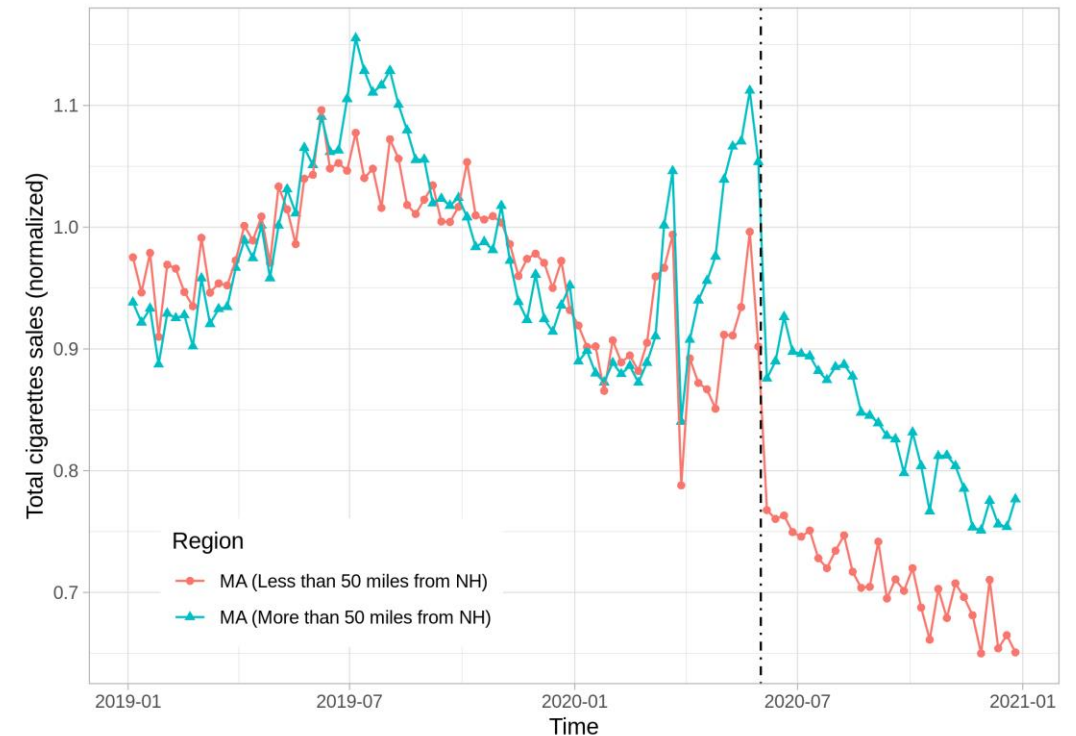
KEY FACTORS

- Variation in distance from the state borders (travel cost)

- Variation in prices of items across state borders

- Variation in how much they prefer menthols vs. non-menthols

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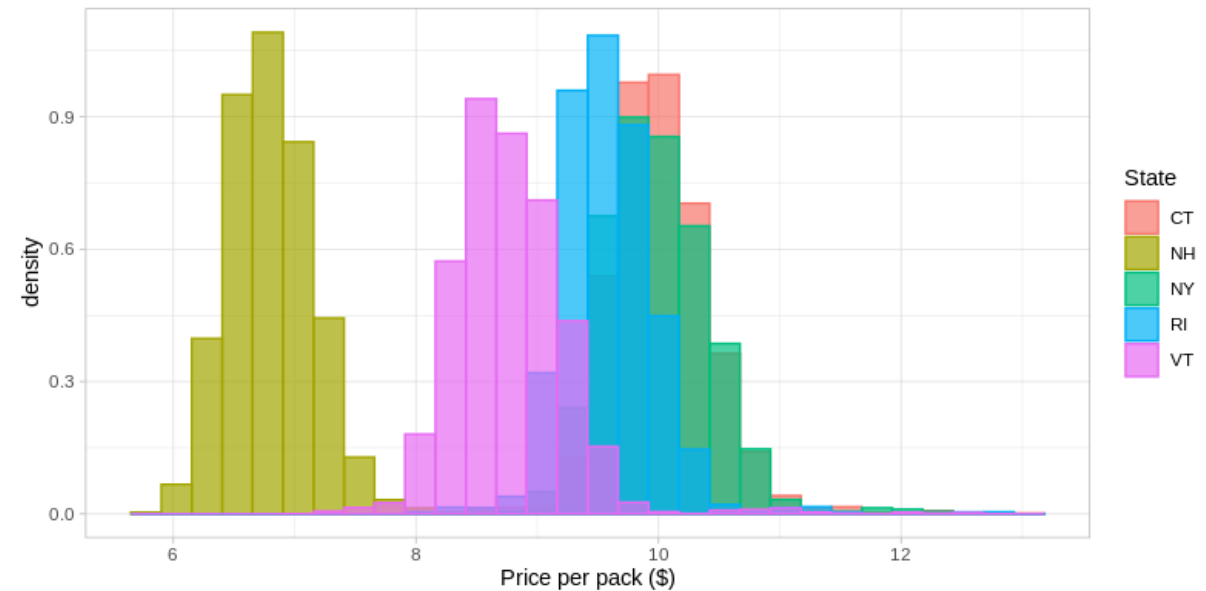
VARIATION IN DISTANCE FROM THE BORDER

What affects people's willingness to travel to buy menthol cigarettes?

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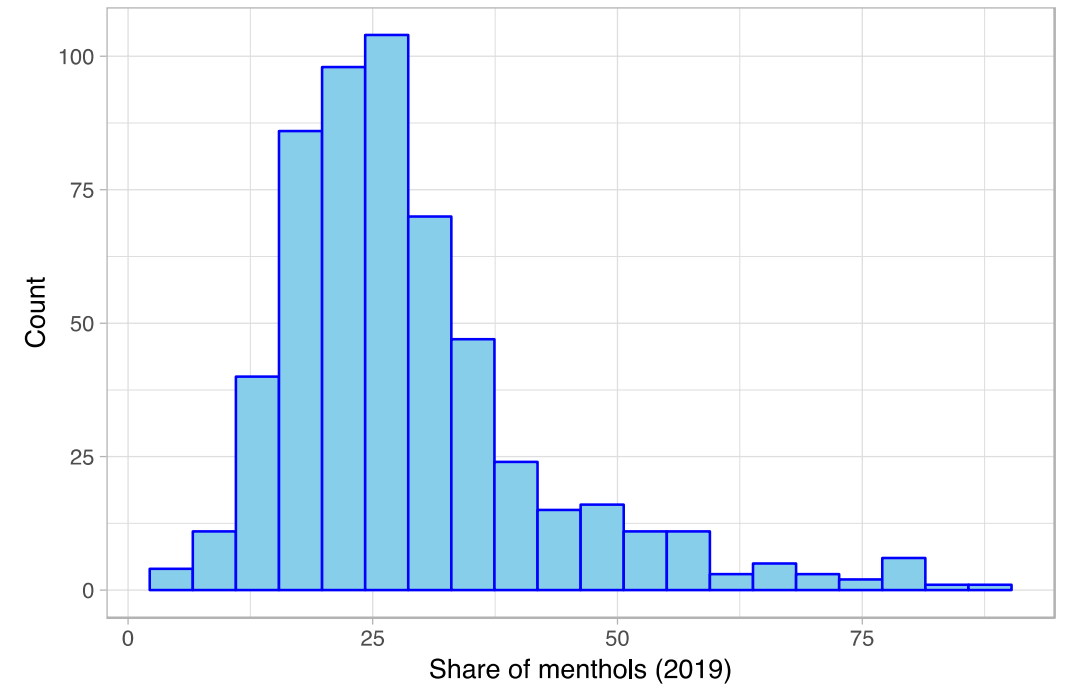
VARIATION IN CIGARETTE PRICES

What affects people's willingness to travel to buy menthol cigarettes?

KEY FACTORS

- Variation in distance from the state borders (travel cost)

- Variation in prices of items across state borders

- Variation in how much they prefer menthols vs. non-menthols

VARIATION IN MENTHOL SHARES

We estimate a demand model where people choose a flavor-store combination based on prices and distances

GOALS AND SETUP

- Estimate a model using pre-ban data to characterize demand for menthols and non-menthols

- Use this model to make counterfactual predictions about what would happen under different kinds of menthol policies

- Nested logit with random coefficients

  - Includes prices and travel costs

  - Preferences are modeled flexibly across individuals, stores, and markets
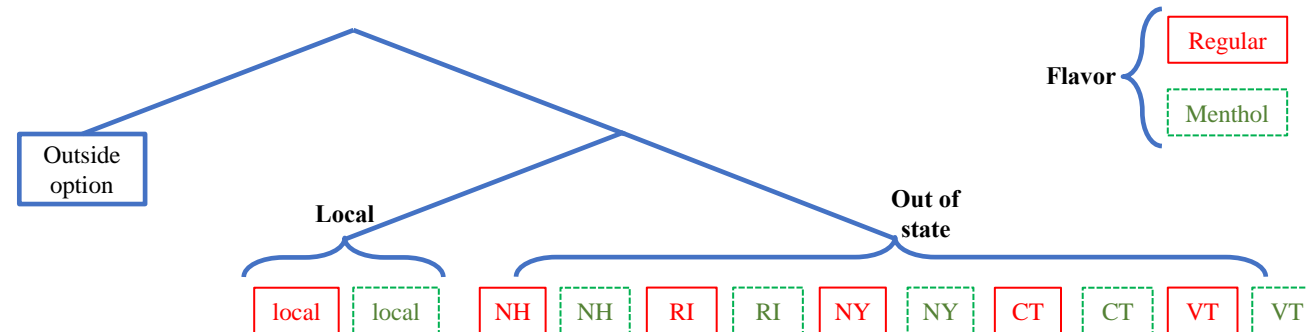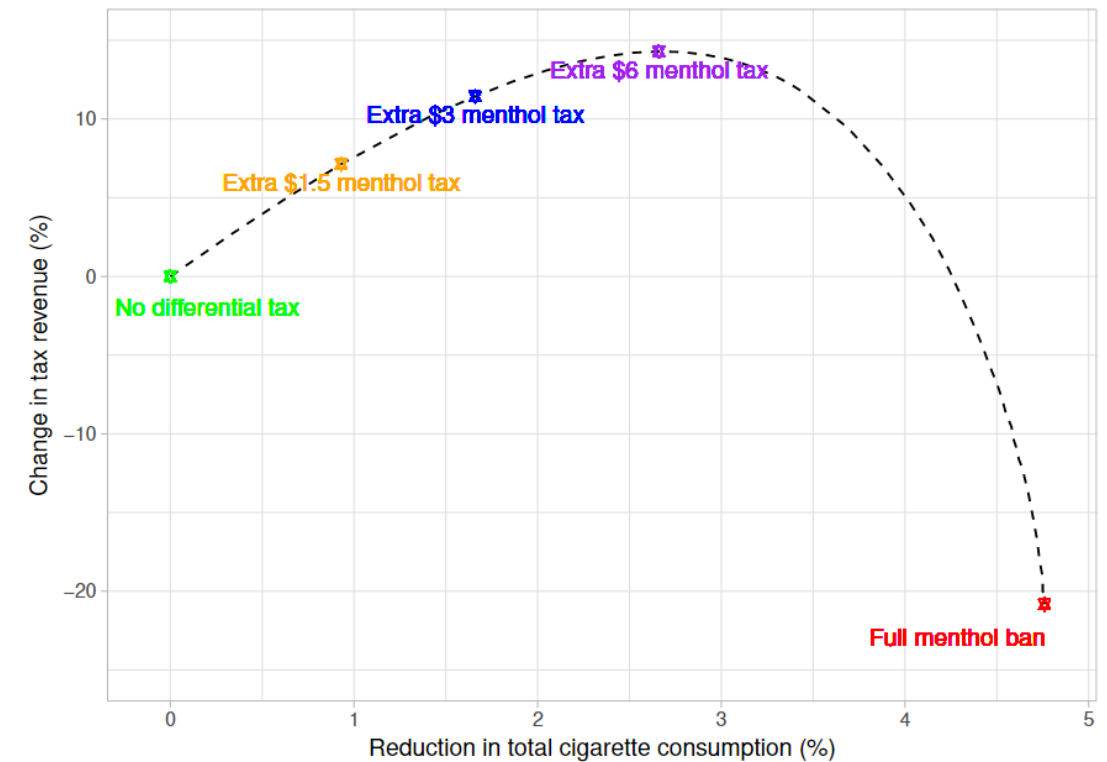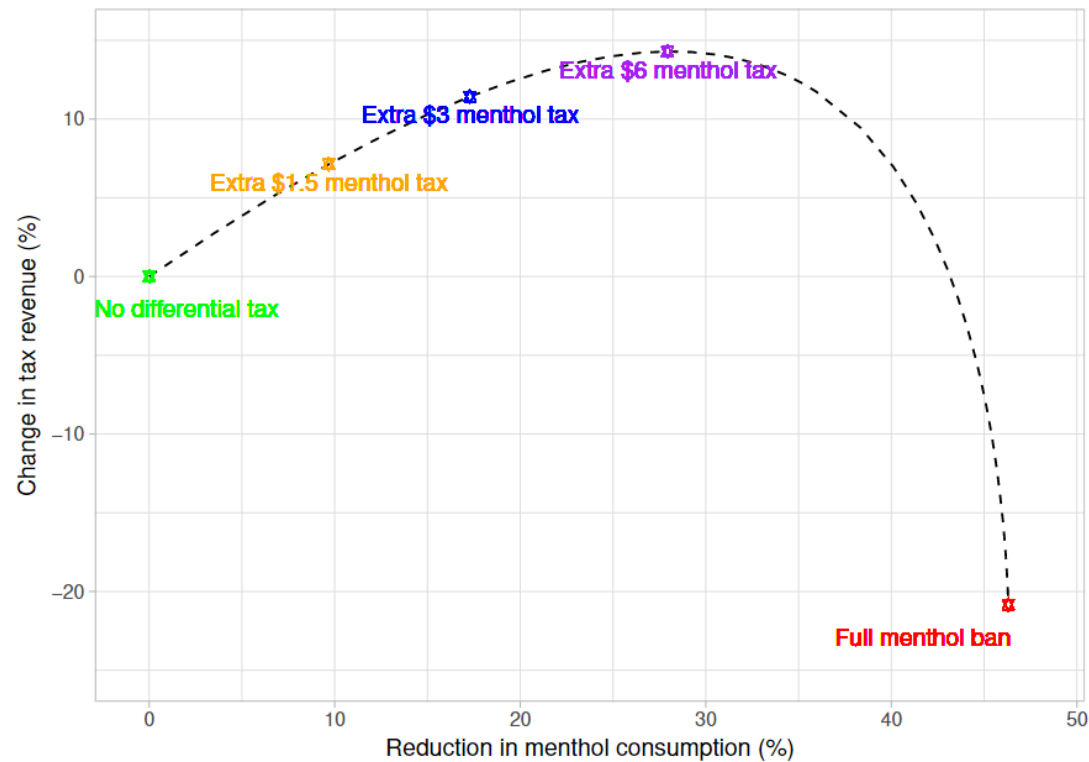
The structural demand model allows us to estimate what would happen under a statewide vs. nationwide menthol ban
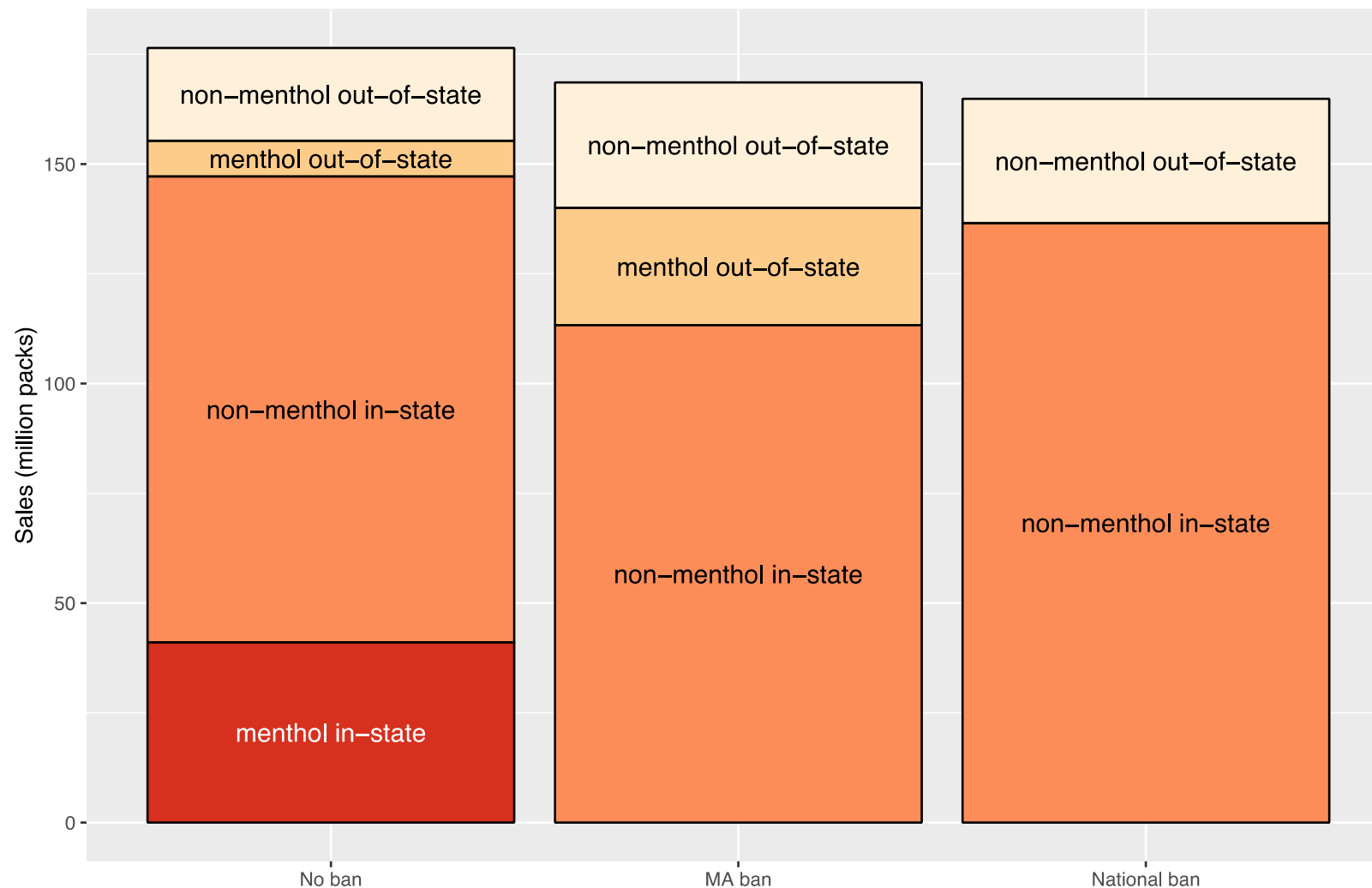
The structural demand model allows us to estimate what would happen if the state imposed a menthol tax

PARETO FRONTIER CURVES

Our results indicate that the Massachusetts menthol ban did not have its full intended effect

EFFECTS OF THE CURRENT POLICY

- About ½ of the pre-ban MA menthol consumption was diverted to neighboring areas (within 30 miles from the state border)

- Total MA cigarette consumption did not decrease by a sizable amount

- The main reasons for this ineffectiveness:

  - MA is a physically small state and many residents can easily drive to stores on the other side of the state border

  - NH has much lower cigarette prices and cigarette taxes than MA, thereby further incentivizing cross-border shopping

A statewide menthol ban seems to be a worse option than either a nationwide menthol ban or a statewide menthol tax

EFFECTS OF THE CURRENT POLICY

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EVALUATING ALTERNATIVE POLICIES

- A statewide menthol ban reduces cigarette consumption by 5%

- A nationwide menthol ban would reduce overall cigarette consumption by 7%

- A $6 menthol tax would reduce cigarette consumption by 3% while also yielding an incremental $180 million in MA tax revenues

  - This revenue could be spent on other anti-tobacco initiatives

  - The Massachusetts Tobacco Cessation and Prevention Program received only $4.2 million in state funding in 2019
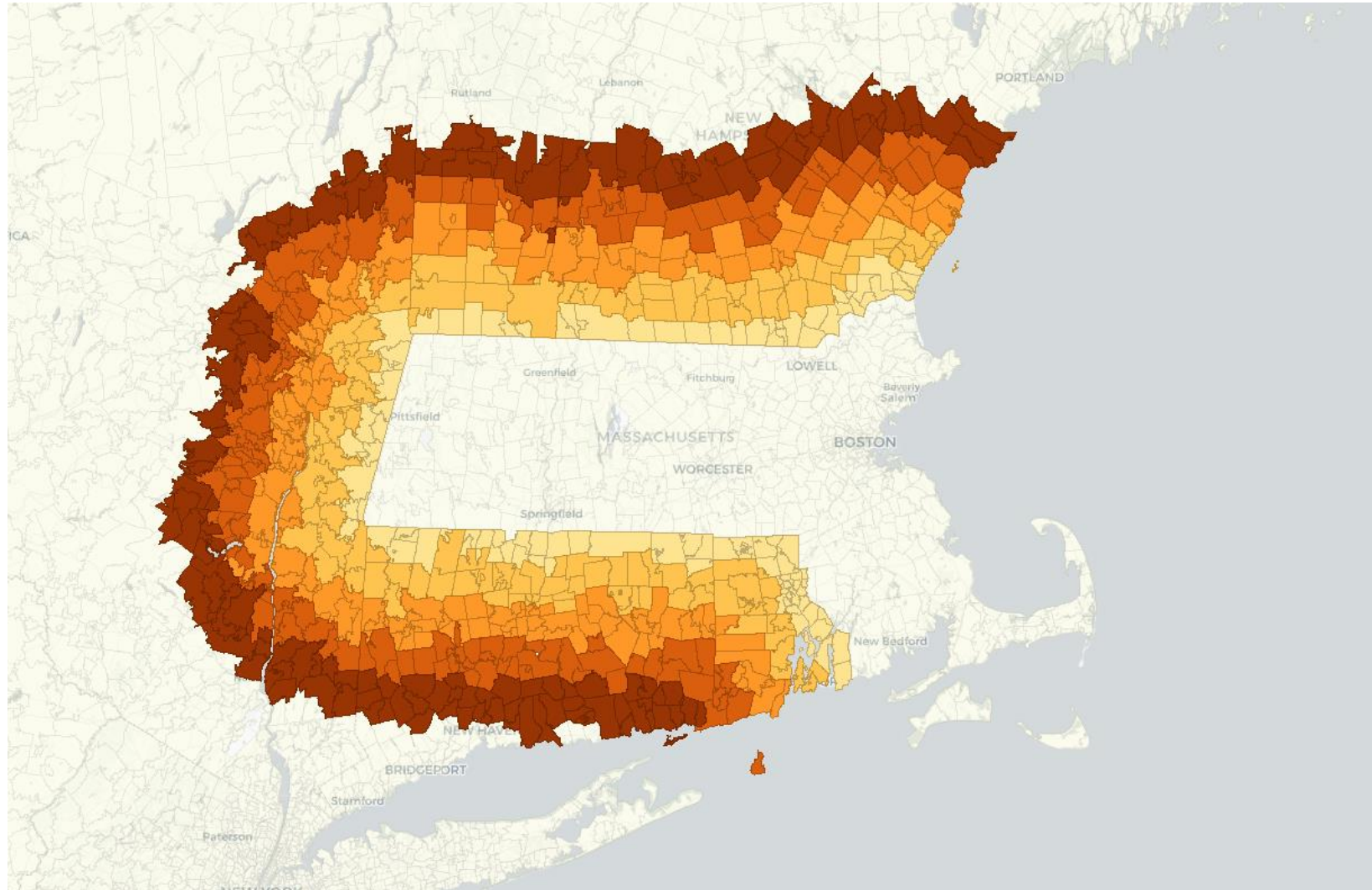
Thank you!

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5. Appendix

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Fixed effects	store-flavor retailer-state-week	store-flavor retailer-state-week store-week of year	store-flavor store-week
# Observations	475,365	475,365	475,365

A discrete choice model for flavor and location

We consider a nested logit random coefficient model

- Each market is defined as the local area around a store located in Massachusetts

- Each customer within a market choses the flavor (menthol/non-menthol) and where to shop

- Customers can either shop at the focal store (their own market) or travel to one of the neighboring states

- The purchase utility from each option depends on distance, and prices offered in that location/state.

- The benefit of a structural model is that we can simulate counterfactuals on:

  • National bans and bans imposed by individual states

  • Menthol taxes

A discrete choice model for flavor and location

Utility for individual i located at market j purchasing flavor k from location s during week t

Consumption utility

Travel cost

Random effects

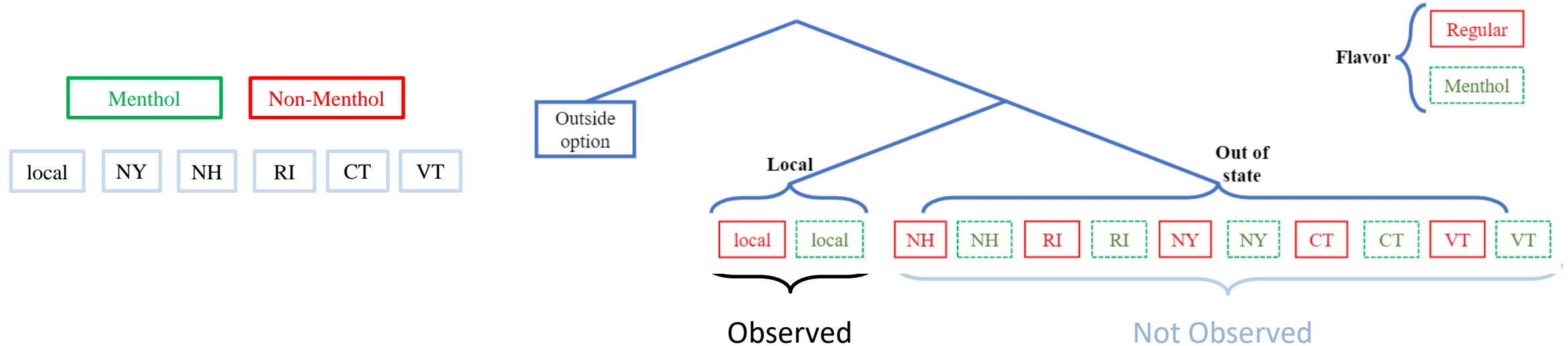$$u_{ijkst} = \eta_s + \gamma \log(d_{js} + 1) + \beta \log(P_{jkst}) + \eta_{jk} + \eta_{w_t} + \theta_{ik} + \epsilon_{ijkst},$$

State FE

Disutility from payment

Market-flavor and week FEs

A visualization of the micro demand model

Identification:

- The extent of substitution to non-menthols at stores in Massachusetts varies as a function of distance to each border
- There is variation in distance from different borders
- Any residual preference for an option is captured by state FEs

Out-of-state purchases in the pre-ban period

Massachusetts has one of the highest cigarette prices in the New England and New York region

- One would expect some smuggling to be already happening in the pre-ban period simply because of higher prices in Massachusetts

- The structural model needs to be calibrated to reflect the correct in-state share in the pre-ban period.

- We combine two data sets here:

    - CDC records cigarette consumption within each state

    - Total cigarette taxes collected at state level along with the tax per pack are report per year from tobacco tax data by each state

- Our analysis shows that 83.39% of cigarettes consumed in Massachusetts was purchased inside Massachusetts. We add this as a constraint to our optimization problem.

The demand estimation problem

Utilities

$$u_{ijkst} = \eta_s + \gamma \log(d_{js} + 1) + \beta \log(P_{jkst}) + \alpha \cdot \tau_{tc_j} + \eta_{jk} + \theta_{ik} + \epsilon_{ijkst},$$

Choice probabilities

$$p_{ijkst} = \frac{\exp(\frac{u_{ijkst}}{\lambda_l})}{\sum_{s\in\mathcal{N}_s,k}\exp(\frac{u_{ijkst}}{\lambda_l})} \cdot \frac{\left(\sum_{s\in\mathcal{N}_s,k}\exp(\frac{u_{ijkst}}{\lambda_l})\right)^{\frac{\lambda_l}{\lambda_h}}}{\sum_{\mathcal{N}_s\in\mathcal{N}}\left(\sum_{s\in\mathcal{N}_s,k}\exp(\frac{u_{ijkst}}{\lambda_l})\right)^{\frac{\lambda_l}{\lambda_h}}} \cdot \frac{\left(\sum_{\mathcal{N}_s\in\mathcal{N}}\left(\sum_{s\in\mathcal{N}_s,k}\exp(\frac{u_{ijkst}}{\lambda_l})\right)^{\frac{\lambda_l}{\lambda_h}}\right)^{\lambda_h}}{\left(\sum_{\mathcal{N}_s\in\mathcal{N}}\left(\sum_{s\in\mathcal{N}_s,k}\exp(\frac{u_{ijkst}}{\lambda_l})\right)^{\frac{\lambda_l}{\lambda_h}}\right)^{\lambda_h} + 1},$$

Fitted sales at local stores

$$\hat{S}_{jkst} = M_j \cdot \int_\theta p_{ijkst}(\theta).d_\theta$$

Constrained Minimum-Distance Estimator

$$\underset{\eta_s,\eta_j,\eta_{w_t},\theta_{ik},\gamma,\beta,\lambda}{\text{minimize}} \sum_{j,k,t,s=\text{MA}} \|S_{jkst} - \hat{S}_{jkst}\|^2$$

subject to:

$$\frac{\sum_{jkst}\left(\hat{S}_{jkst}\cdot\mathbb{1}_{\{t=2019\}}\cdot\mathbb{1}_{\{s\notin MA\}}\right)}{\sum_{jkst}\left(\hat{S}_{jkst}\cdot\mathbb{1}_{\{t=2019\}}\right)} = 0.8339, \quad k \in \{\text{Menthol}, \text{Regular}\},$$

$$\frac{\sum_{jkst}\left(\hat{S}_{jkst}\cdot\mathbb{1}_{\{t>t^*\}}\cdot\mathbb{1}_{\{s\notin MA\}}\right)}{\sum_{jk'st}\left(\hat{S}_{jk'st}\cdot\mathbb{1}_{\{t>t^*\}}\right)} = \psi_1, \quad k = \text{Menthol},$$

$$\frac{\sum_{jkst}\left(\hat{S}_{jkst}\cdot\mathbb{1}_{\{t>t^*\}}\cdot\mathbb{1}_{\{s\notin MA\}}\right)}{\sum_{jkst}\left(\hat{S}_{jkst}\cdot\mathbb{1}_{\{t>t^*\}}\cdot\mathbb{1}_{\{s\in MA\}}\right)} = \psi_2, \quad k = \text{Non-menthol},$$

Counterfactual analysis (national ban)

The effect of a local versus a national ban on menthols

Scenario	Product	In-state (%)	Out-of-state (%)	All (%)
Massachusetts ban	Menthol	-100	227.16	-46.23
	Non-menthol	6.77	35.2	11.54
	All	-23.51	88.72	-4.8
National ban	Menthol	-100	-100	-100
	Non-menthol	28.73	33.93	29.6
	All	-7.78	-3.41	-7.05

- Our analyses also shows that a menthol ban by any single neighbor of Massachusetts except for New Hampshire does not shift the overall tobacco consumption in MA in a meaningful way
- A national ban or a strong regional ban (by multiple) states is more successful in reducing tobacco consumption.