Behavioral Responses to Spatial Tax Notches in the Retail Gasoline Market

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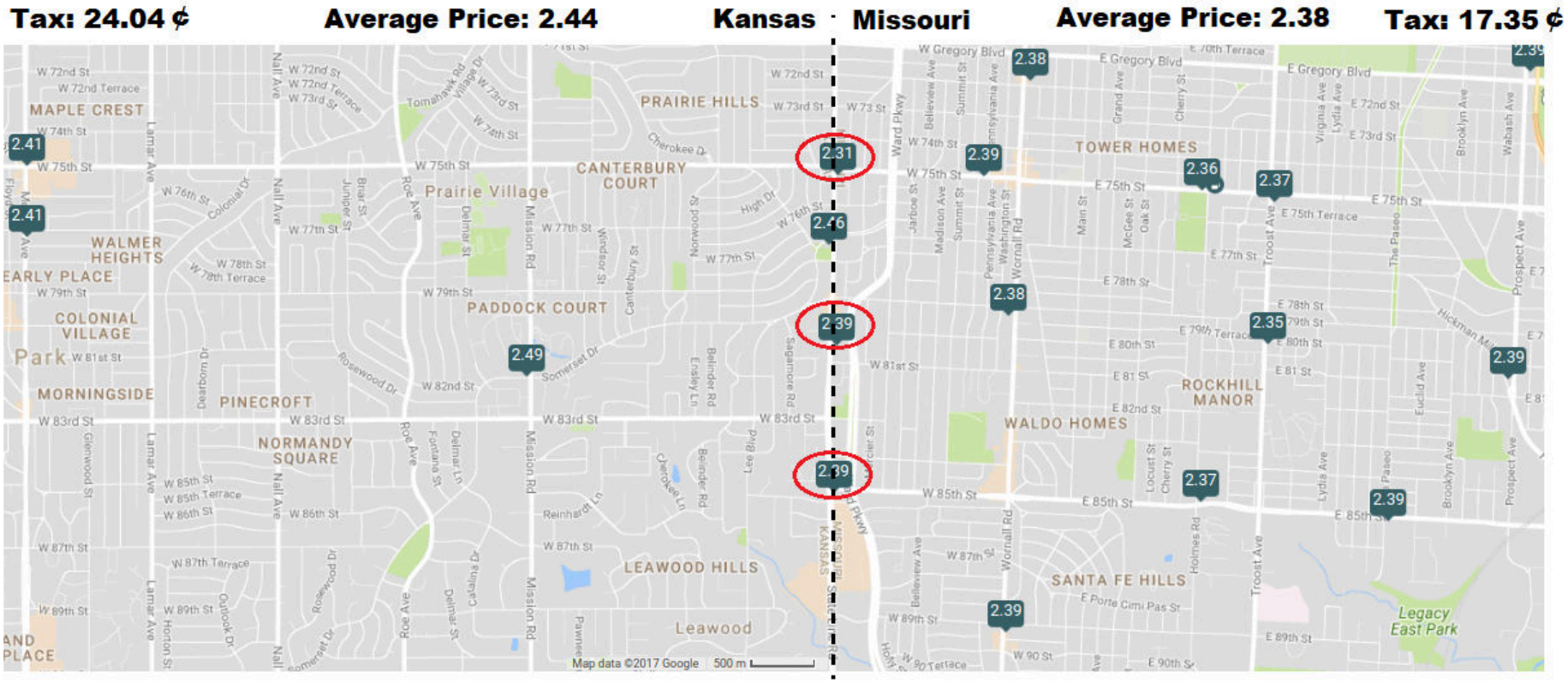
Motivation

- Do taxes affect business location decisions and local competition?
  - Taxation could deter business entry or encourage firm reallocation
  - On the contrary, tax revenues could improve business activity
- In 2017, the mean state-level excise gasoline tax was 33¢ per gallon:
  - Equivalent to 13.2% of the $2.4 average price per gallon
  - Large spatial tax notches:
    e.g., 36¢ between AZ and CA or 31¢ between OH and PA
- Strong incentives for gasoline buyers and sellers:
  - Location choices of retailers on the low-tax side of a border
  - Consumers cross borders to search for better prices
- Misallocations and distortions to the local competition



$\Delta\tau = 6.68¢$

Source: GasBuddy Webpage (retrieved on Nov-7-2017)

Question and Relevance

Question:

- How do spatial tax notches affect the location decisions of retailers?
- What are the effects of these notches on the distribution of the tax burdens between gasoline buyers and sellers?

Relevance:

- Evidence of consumers with heterogeneous sensitivities to fuel prices
- Measure of distortions to local competition near jurisdictional borders

Question and Relevance

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- What are the effects of these notches on the distribution of the tax burdens between gasoline buyers and sellers?

Relevance:

- Evidence of consumers with heterogeneous sensitivities to fuel prices
- Measure of distortions to local competition near jurisdictional borders

Methodology

- Unique data on prices and locations of near 140,000 gasoline retailers
- Location choice of fueling stations
  - Choice model on a fine rectilinear grid over United States
- Tax pass-through given retailer location and consumer search
  - Two-way decomposition: idiosyncratic prices
  - Use of idiosyncratic prices on a cross-section to determine tax incidence

Preview of Findings and Contribution

- Location choice of fueling stations
  - 30% more gasoline retailers on the low-tax side of the border
  - This effect dissipates as you move away from the border
- Tax pass-through given retailer location and consumer search
  - Tax pass-through of 75% at high-tax side within 15 miles of border
  - Tax pass-through of 100% at low-tax side within 15 miles of a border

On the Agenda

On the Agenda

Related Literature

- Taxes and the business location decision
  - Conditional logit: Bartik (1985), Coughlin et al. (1991)
  - Spatial differencing: Holmes (1998), Duranton et al. (2011)
- Behavioral responses of consumers (but not for firms)
  - Cigarettes tax: Merriman (2010), Chiou and Muehlegger (2014)
  - Alcohol tax: Stehr (2007)
- Smaller tax incidence close to state borders
  - Doyle Jr and Samphantharak (2008), Harding et al. (2012)
- The burden of environmental regulation under imperfect competition
  - Gasoline in Spain: Stolper (2017)
  - U.S. refineries: Muehlegger and Sweeney (2017)
  - Environmental regulations: Fullerton and Muehlegger (2018)

On the Agenda

Data

- Unique dataset that includes:
  - Excise gasoline tax: American Petroleum Institute
  - Location of gasoline retailers: Web-scraping GasBuddy.com
  - Spatial tax notches: $\Delta\tau$, using location
  - Retail Gasoline Price: Daily reported price of retailers (3/17 to 4/18)
  - Regulation: Gasoline requirements and regional supply
  - Population: Census block groups estimates from the ACS
  - Minimum Wage: Local minimum wage ordinances
  - Roads: Primary and secondary roads from Census Bureau

Data

Number of Retailers by Petroleum Administration for Defense Districts

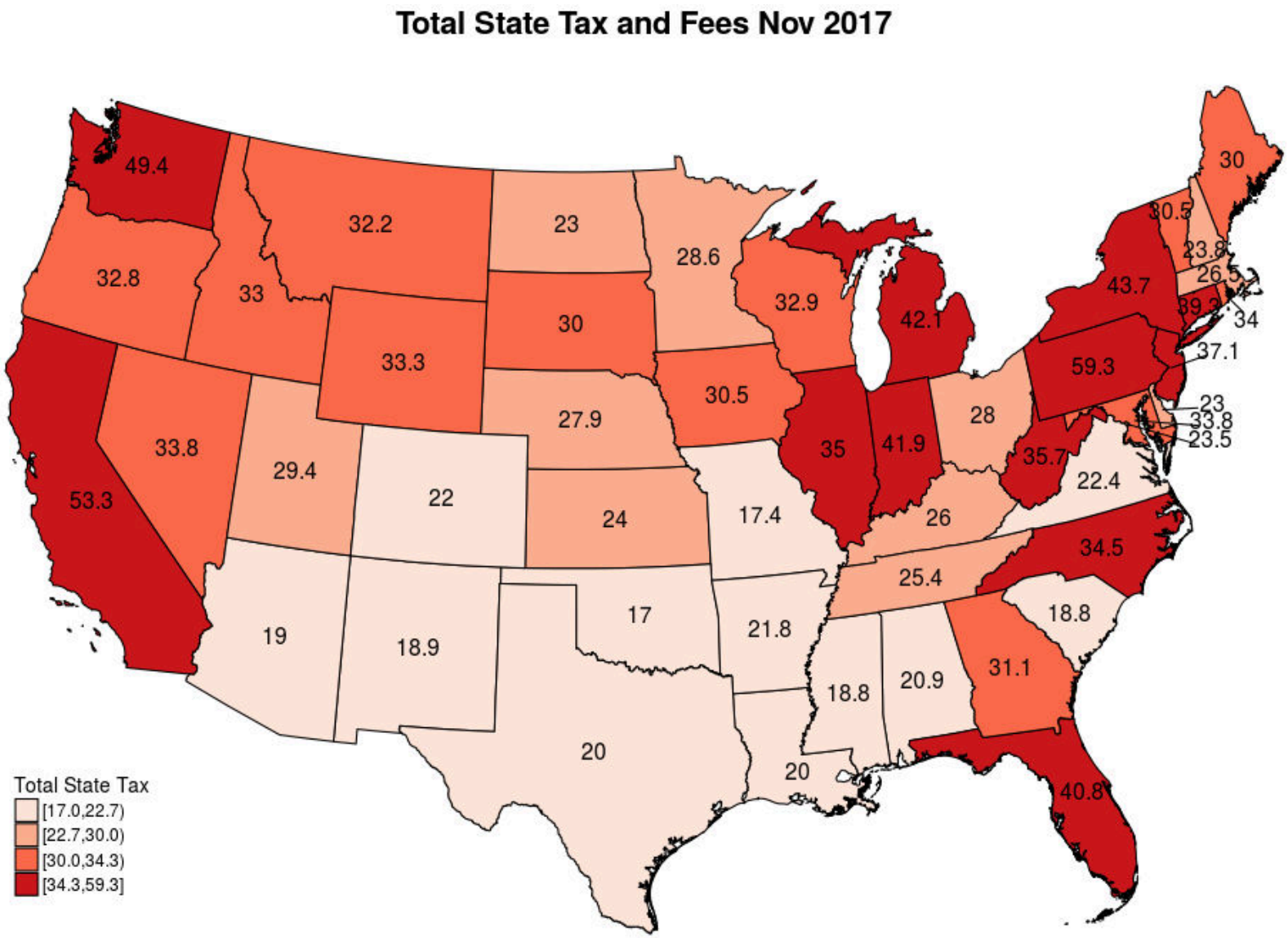
PADD Region♣	Year 2016[A]	Year 2018[B]
East Coast	55,544	49,798
Midwest	38,481	41,006
Gult Coast	24,605	25,495
Rocky Mountain	4,260	5,049
West Coast	17,487	16,266
Total	140,377	137,614

♣ Excluding Alaska and Hawaii

[A] Gasoline Stations and Convenience Stores from CBP

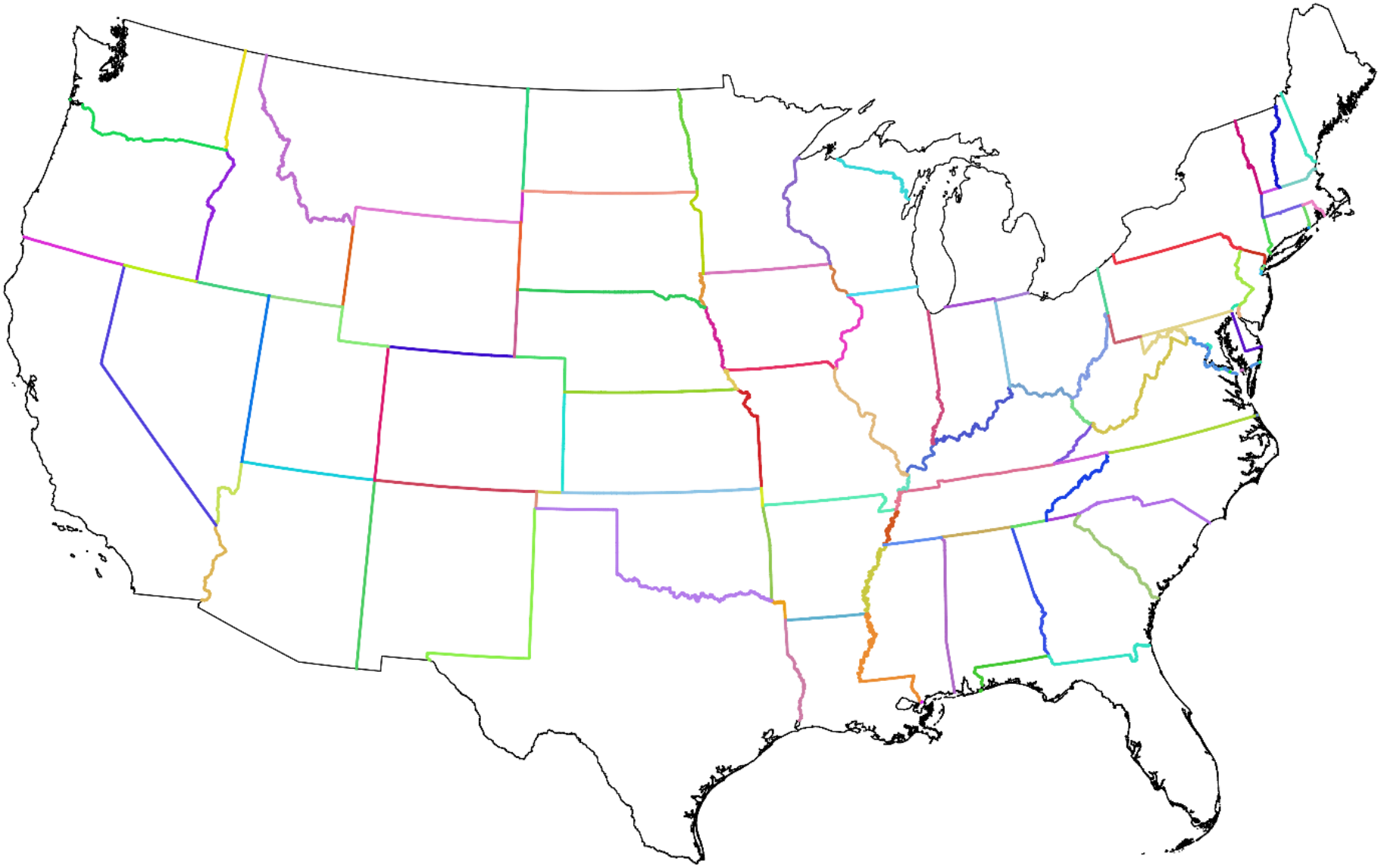
[B] Information from GasBuddy.com

Source: County Business Patterns (CBP) and Author's calculation



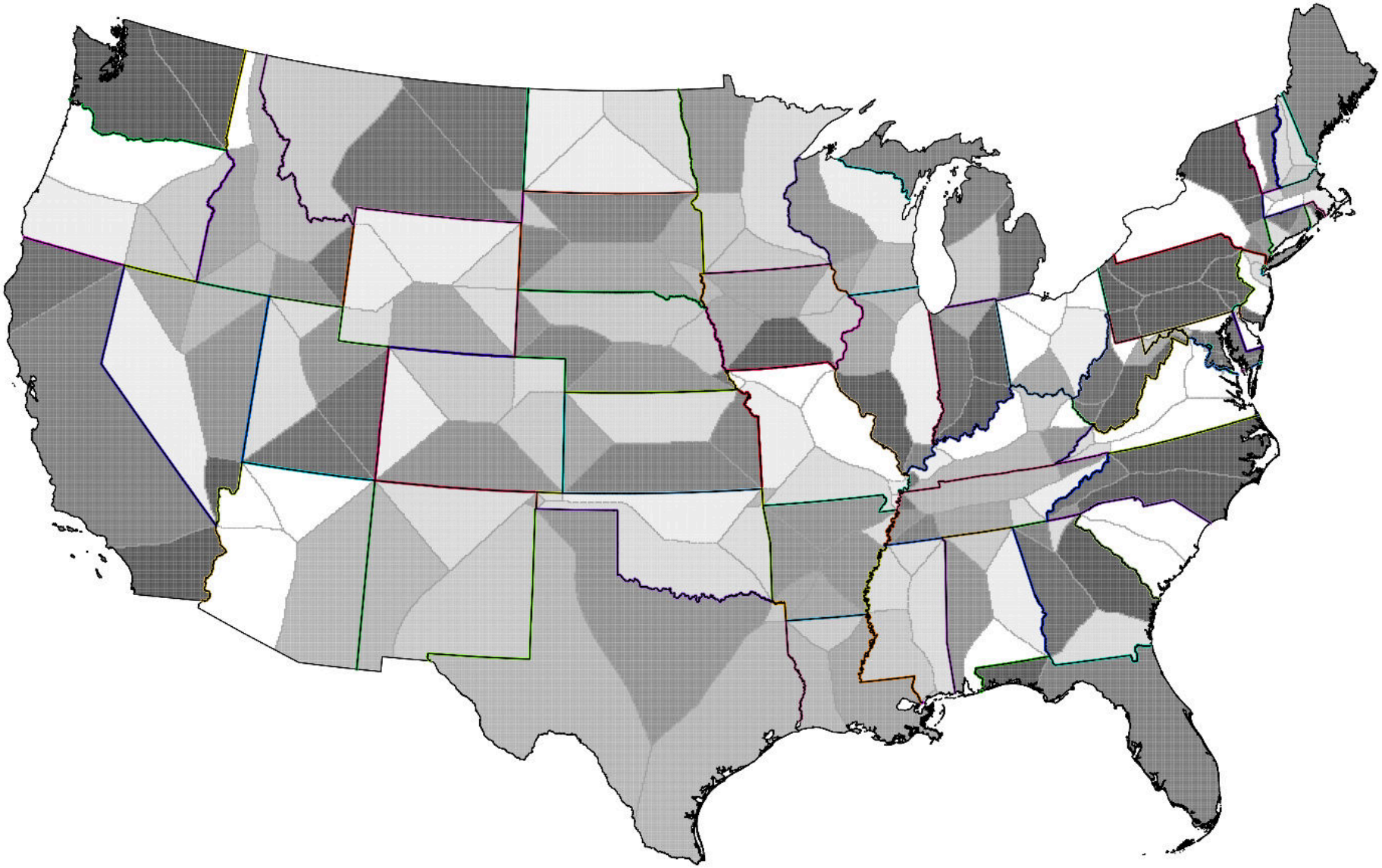
Source: American Petroleum Institute

Proximity Regions to State Borders



Source: Author's calculation

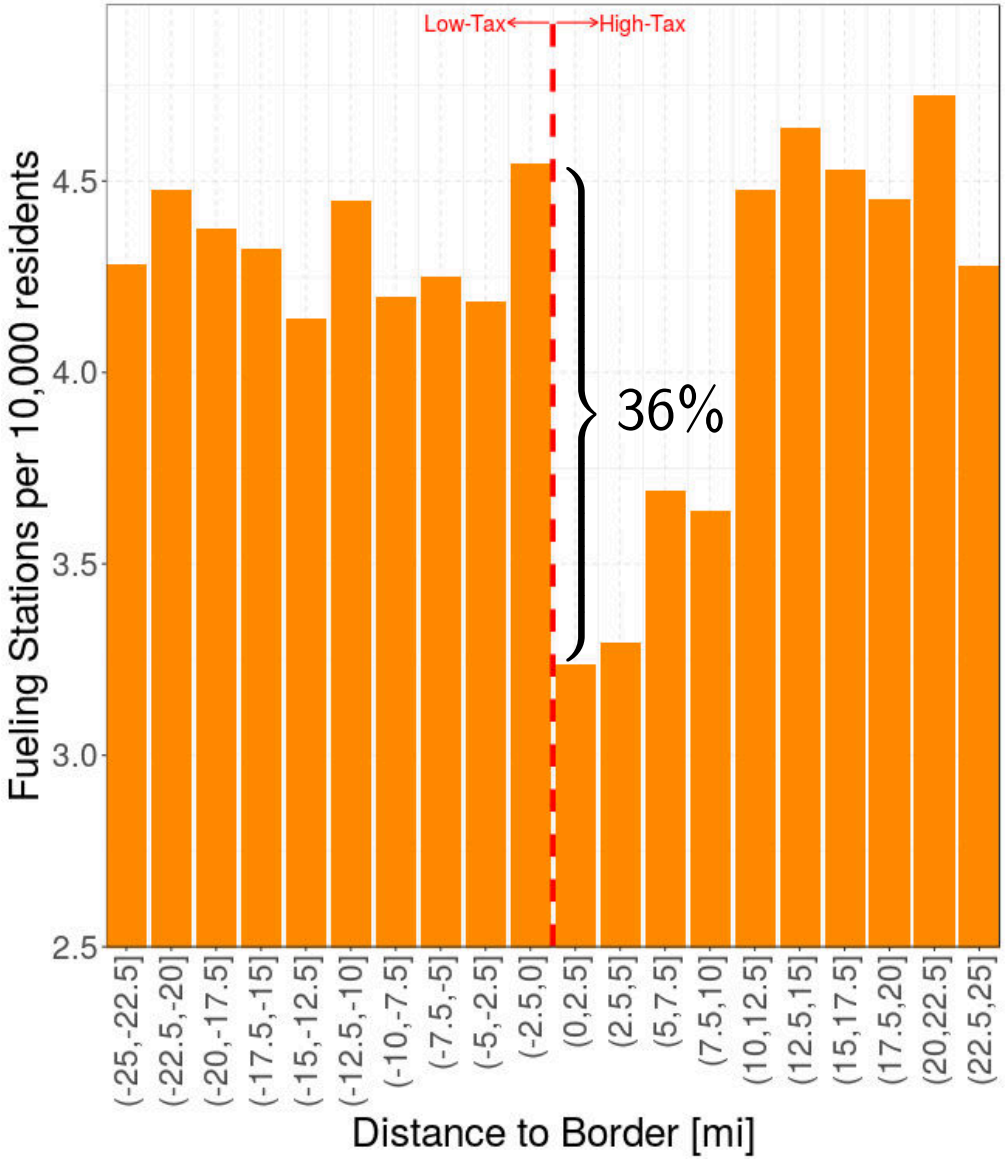
Spatial Tax Notches: $\Delta\tau$



Source: Author's calculation

Bunching at the Border:

All Retailers

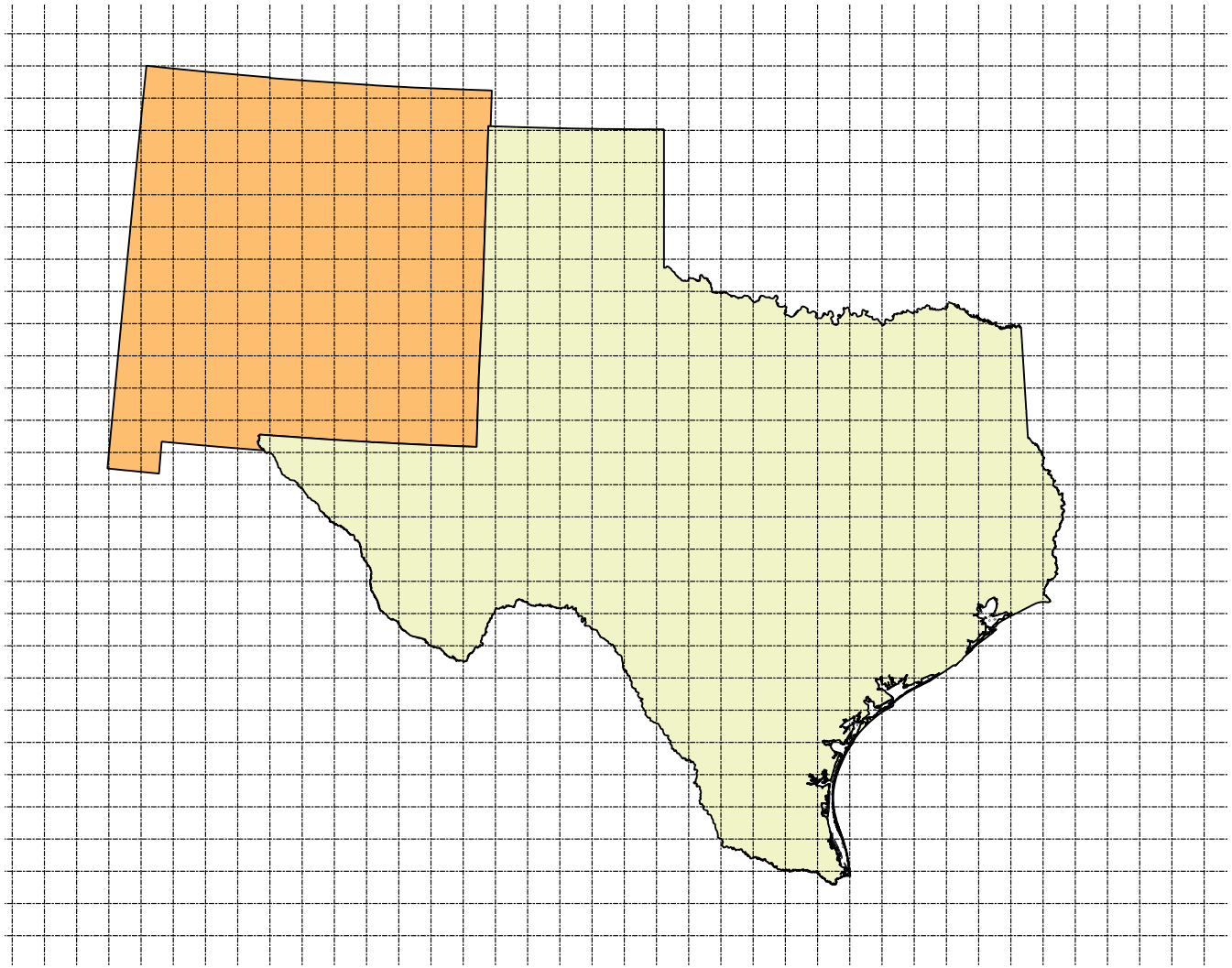


On the Agenda

Location decision: Choice set

- Gasoline retailers choose small geographic locations
  - The intersection avenues or a site close to the exit of a highway
- How to represent the choice set of the gasoline retailers?
- Grid of 3-by-3 mi squares overlaid across the continental US
- Squares divided using administrative borders and coastlines
  - Around 330 thousand grid elements
- Current population estimates from the ACS on each square
- Primary and secondary roads passing over each element of the grid
- Linear distance, driving distance, driving time to the border

Location decision: Choice set



Location decision: Entry of Gasoline Retailers

- The profit a retailer, f, located on a square, s, is:

$$\begin{aligned}\Pi_{fs} &= \Omega\left(\xi_f, \zeta_s\right) + \varepsilon_{fs} \\ &= \omega_f^{'}\eta + \upsilon_f + \lambda g_s(\Delta\tau_s) + x_s^{'}\theta + \varphi_s + \kappa_{j(s)} + \varepsilon_{fs}, \qquad (1)\end{aligned}$$

where

- ω_f: Vector of retailer characteristics
- υ_f: Retailer-fixed effect
- $g_s(\Delta\tau_g)$: function of the tax differential $\Delta\tau_s$
- φ_s: Location-specific effect
- x_s: Vector of location characteristics
- $\kappa_{j(s)}$ jurisdiction fixed effect
- ε_{fs}: Retailer location-specific shock

Location decision: Entry of Gasoline Retailers

- The standard approach to estimate a location choice model:
  - McFadden (1973) conditional logit
- The probability of retailer f choosing location s is

$$P_{fs} = \frac{\exp\left(\Omega\left(\xi_f, \zeta_s\right)\right)}{\sum_{s'} \exp\left(\Omega\left(\xi_f, \zeta_{s'}\right)\right)}, \tag{2}$$

  where the summation is across all possible locations $s^{'}$
- The percentage change in the expected number of firms

$$\frac{\partial logE(n_s)}{\partial x_{sk}} = (1 - P_{fs})\theta_{sk}$$

- The estimation of the conditional logit model is difficult
  - when controlling for station-specific characteristics and
  - the set of possible locations is large

Location decision: Spatial differencing

- Spatial differencing:
  - Controls for both observed and unobserved site-specific factors
  - Controls for retailer-specific unobserved characteristics
- Consider two neighboring locations s_1 and s_2 across the border
- Corresponding jurisdictions are $j_{(s_1)}$ and $j_{(s_2)}$.
- The identification assumption is that $\varphi_{s_1} \approx \varphi_{s_1}$ and $x_{s_1} \approx x_{s_2}$
- The assumption holds if location-specific effects and characteristics vary smoothly across space
- If the shocks ε_{fs} follow i.i.d. type *I* extreme value distribution:

$$Pr\left(s = s_1 | s \in \{s_1, s_2\}\right) = \frac{1}{1 + \exp\left(-\lambda\left(g_{s_1}(\Delta\tau_{s_1}) - g_{s_2}(\Delta\tau_{s_2})\right) - \left(\kappa_{j_{s_1}} - \kappa_{j_{s_2}}\right)\right)}$$

Location decision: Spatial differencing

- Same retailer choosing between sites across borders
- Only involves border fixed effects and demand for gasoline
- Assumption: $g_{s_1}(\Delta\tau_{s_1}) - g_{s_2}(\Delta\tau_{s_2})$, depends linearly on:
  - side of the border where the square s_1 is located
  - distance to the border
  - magnitude of the tax differential
- Critical identification assumption:
  - Holds only if location-specific characteristics vary smoothly across space

Location decision: Identification assumption

Balance on Location-Specific Characteristics

Characteristics	Estimate	Std. Error	t-value	p-value
Unbalanced				
Gasoline Tax	6.76	0.75	8.95	0.00
Oxig. Fuels	-0.10	0.04	-2.24	0.03
Price-Gouging Law	0.17	0.09	1.90	0.06
Balanced				
Population	281.27	396.80	0.71	0.48
Number of Roads	0.03	0.12	0.25	0.80
Distance to Road	0.14	0.28	0.49	0.62
RFG	0.01	0.09	0.17	0.87
Point of Taxation	-0.11	0.10	-1.11	0.27
Minimum Wage	0.33	0.26	1.26	0.21

The table reports the coefficient estimates, the standard errors, the t-statistics, and the p-values for a regression of the listed characteristics on an indicator variable for being on the high-tax side of the border. RFG stands for Reformulated Gasoline Regulation. The regressions include border pair fixed effects and the standard errors of the OLS estimates are clustered at the border pair level.

Results: Spatial differencing

Location decision: Spatial differencing

	Dependent Variable: Indicator of a Retailer on a Square of the Grid					
	Logit Model		Probit Model		Linear Model	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Low-Tax						
Low-Tax × Dist. to Border/50mi						
Low-Tax × Dist. to Border/50mi × ΔTax/10¢						
Regulation controls?	no	yes	no	yes	no	yes
Other controls?	no	no	no	no	no	no
Adj. R^2						
Pseudo R^2						
Num. obs.						

The Logit and Probit models show mfx. Distance to border in 50 mi units. ΔTax in 10¢ units. The symbols *, **, *** denote significance at the 90%, 95%, and 99% level. Standard errors in parentheses. Full set of interactions included but not presented.

Results: Spatial differencing

Location decision: Spatial differencing

	Dependent Variable: Indicator of a Retailer on a Square of the Grid					
	Logit Model		Probit Model		Linear Model	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Low-Tax	.0059**	.0069***	.0073***	.0091***	.0093***	.0110***
	(.0019)	(.0019)	(.0021)	(.0022)	(.0023)	(.0024)
Low-Tax × Dist. to Border/50mi	−.0048***	−.0045***	−.0061***	−.0057***	−.0067***	−.0062***
	(.0012)	(.0012)	(.0013)	(.0013)	(.0014)	(.0014)
Low-Tax × Dist. to Border/50mi × ΔTax/10¢	−.0039*	−.0040**	−.0039*	−.0039*	−.0042*	−.0044*
	(.0015)	(.0015)	(.0017)	(.0017)	(.0020)	(.0020)
Regulation controls?	no	yes	no	yes	no	yes
Other controls?	no	no	no	no	no	no
Adj. R^2					.0977	.0978
Pseudo R^2	.1710	.1712	.1712	.1714		
Num. obs.	331,076	331,076	331,076	331,076	331,076	331,076

The Logit and Probit models show mfx. Distance to border in 50 mi units. ΔTax in 10¢ units. The symbols *, **, *** denote significance at the 90%, 95%, and 99% level. Standard errors in parentheses. Full set of interactions included but not presented.

Results: Conditional logit

Location decision: Conditional logit

	Dependent Variable: Indicator of a Retailer on a Square of the Grid	
	Conditional Logit	
	Model 7	Model 8
Low-Tax	.2178***	.2889***
	(.0124)	(.0128)
Low-Tax × Dist. to Border/50mi	−.1027***	−.0990***
	(.0073)	(.0073)
Low-Tax × Dist. to Border/50mi × ΔTax/10¢	−.1912***	−.1479***
	(.0093)	(.0094)
Regulation controls?	no	yes
Other controls?	yes	yes
Pseudo R^2	.6474	.6492
Num. obs.	331,076	331,076

Model 8 includes regulation variables: RFG, oxi.fuel, point of taxation, minimum wage, price gouging law. Distance to border in 50 mi units. ΔTax in 10¢ units. The symbols *, **, *** denote significance at the 90%, 95%, and 99% level, respectively. Standard errors in parentheses. Full set of interactions included but not presented. The estimates use the equivalence between the likelihood function of the conditional logit and the Poisson regression developed in Guimarães et al. (2003).

Methodology: Idiosyncratic Prices

- Ideal setup:

$$p_{f,t} = \beta\tau_{f,t} + W_{f,t}\delta + \rho_f + \gamma_t + \epsilon_{f,t} \tag{3}$$

  for retailer f on date t

  - ρ_f: Retailer fixed effects to model individual heterogeneity
  - γ_t: Date fixed effects to model price cycles and trends Example.

- But, there is not enough variation of taxes on a daily frequency.
  - $\tau_{f,t}$ is in fact τ_f.
  - No identification of tax pass-through under retailer fixed effects.

- How can we remove the time effects from the price of each retailer?
  - For example, for each retailer, compute average price over time
  - Two-way fixed-effect model to recover the retailer's idiosyncratic prices

Methodology: Idiosyncratic Prices

- First step, remove time effects from price:

$$p_{f,t} = \rho_f + \gamma_t + \epsilon_{f,t} \tag{4}$$

for retailer f on date t.

  - ρ_f: Retailer fixed effects (average prices for station f over time)
  - γ_t: Date fixed effects

- Second step, model the price using the fixed effects estimates:

$$\hat{\rho}_f = \beta_0 \tau_f + \mathbb{1}(\text{Regulation}_f)\gamma + \mathbb{1}(\text{PADD}_f)\eta + X_f\theta + \varepsilon_f \tag{5}$$

where

  - τ_f: State tax of retailer f
  - $\mathbb{1}(\text{Regulation}_f)$: RFG, RVP, OF, POT, Minimum Wage
  - $\mathbb{1}(\text{PADD}_f)$: Regional petroleum markets
  - X_f: Local demand characteristics for retailer f

- Estimate $\hat{\beta}_0$ using weighted OLS

Results: Average Pass-Through

Tax Incidence Around Administrative Boundaries

	Dependent Variable: Retailers' Idiosyncratic Prices in cents					
	States	All Stations		Inner Land	Border	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax in cents: β_0						
Distance to Border in mi.						
Population per 10,000 res.						
Retailers per mi.^{2}						
Roads per mi.^{2}						
Regulation Controls	no	no	yes	yes	no	yes
PADD	yes	yes	yes	yes	yes	yes
Adj. R^2						
Num. obs.						
RMSE						

The dependent variable is the idiosyncratic price in cents per gallon. The unit of analysis is the gasoline retailer, except for column Model 1, where the analysis is at the state level. All estimations use the OLS method. Standard errors clustered at the state level are in parentheses. The symbols *, **, *** denote significance at the 90%, 95%, and 99% level, respectively.

Results: Average Pass-Through

Tax Incidence Around Administrative Boundaries

	Dependent Variable: Retailers' Idiosyncratic Prices in cents					
	States	All Stations		Inner Land	Border	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax in cents: β_0	1.00***	1.00***	.99***	1.05***	.91***	.89***
	(.09)	(.04)	(.04)	(.05)	(.04)	(.04)
Distance to Border in mi.		.00	.00	.01	−.07	−.07
		(.01)	(.01)	(.01)	(.08)	(.08)
Population per 10,000 res.			.54**	.88**		.30
			(.18)	(.34)		(.17)
Retailers per mi.^{2}			−1.93***	−2.82***		−.77
			(.53)	(.50)		(.64)
Roads per mi.^{2}			.72*	1.11**		.10
			(.31)	(.39)		(.20)
Regulation Controls	no	no	yes	yes	no	yes
PADD	yes	yes	yes	yes	yes	yes
Adj. R^2	.89	.74	.75	.78	.54	.55
Num. obs.	49	126,981	126,934	96,727	30,218	30,207
RMSE	29.56	14.17	14.06	14.14	13.12	13.03

The dependent variable is the idiosyncratic price in cents per gallon. The unit of analysis is the gasoline retailer, except for column Model 1, where the analysis is at the state level. All estimations use the OLS method. Standard errors clustered at the state level are in parentheses. The symbols *, **, *** denote significance at the 90%, 95%, and 99% level, respectively.

Results: Pass-Through Around Administrative Boundaries

Tax Incidence Around Administrative Boundaries

	Dependent Variable: Retailers' Idiosyncratic Prices in cents			
	All Stations		Border	
	Model 3	Model 3i	Model 6	Model 6i
Tax in cents: β_0				
Tax × Low				
Tax × High				
All Other Controls	yes	yes	yes	yes
Share of Low [%]	-	44	-	53
Share of High [%]	-	56	-	47
Sample	All	All	Border	Border
Adj. R^2				
Num. obs.				
RMSE				

The dependent variable is the idiosyncratic prices in cents per gallon. The unit of analysis is the gasoline retailer. All estimations use the OLS method. In parenthesis the 95% confidence interval. The symbol * denotes that one is outside the confidence interval. All other controls indicates that the regression includes explanatory variables for gasoline regulation, PADD and other characteristics.

Results: Pass-Through Around Administrative Boundaries

Tax Incidence Around Administrative Boundaries

	Dependent Variable: Retailers' Idiosyncratic Prices in cents			
	All Stations		Border	
	Model 3	Model 3i	Model 6	Model 6i
Tax in cents: β_0	.99		.89*	
	[.90; 1.07]		[.80; .98]	
Tax × Low		1.01		.82
		[.79; 1.23]		[.59; 1.06]
Tax × High		.95		.98
		[.82; 1.08]		[.84; 1.11]
All Other Controls	yes	yes	yes	yes
Share of Low [%]	-	44	-	53
Share of High [%]	-	56	-	47
Sample	All	All	Border	Border
Adj. R^2	.75	.76	.55	.58
Num. obs.	126,934	126,934	30,207	30,207
RMSE	14.06	13.84	13.03	12.60

The dependent variable is the idiosyncratic prices in cents per gallon. The unit of analysis is the gasoline retailer. All estimations use the OLS method. In parenthesis the 95% confidence interval. The symbol * denotes that one is outside the confidence interval. All other controls indicates that the regression includes explanatory variables for gasoline regulation, PADD and other characteristics.

Results: Pass-Through Around Administrative Boundaries

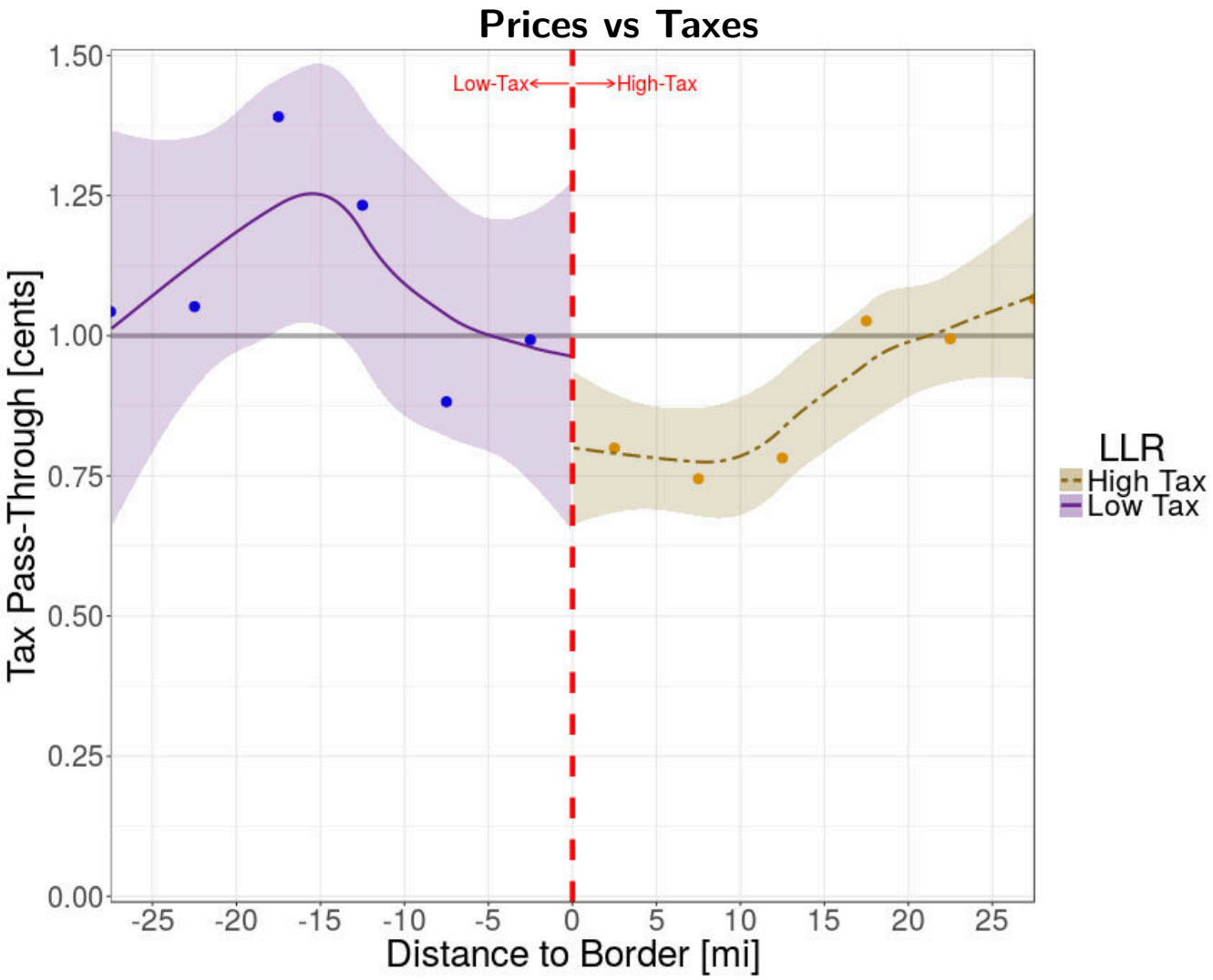
- Price may also depend on $\Delta\tau$ and the distance to the border, d_i:

$$\begin{aligned} p_i &= \beta_0 \tau_i + \beta_1 d_i \Delta\tau_i + \cdots \\ &= \beta_0 \tau_i + \beta_1 d_i \left(\tau_i - \tau_{-i}\right) + \cdots \\ &= \beta_0 \tau_i + \beta_1 d_i \tau_i - \beta_1 d_i \tau_{-i} + \cdots \end{aligned}$$

- where
  - τ_i: State tax for retailer i.
  - τ_{-i}: Out of state tax across the border for retailer i
- Hence:

$$\frac{\partial p_i}{\partial \tau_i} = \beta_0 + \beta_1 d_i$$

Results: Pass-Through Around Administrative Boundaries



LLR: Local Linear Regression.

On the Agenda

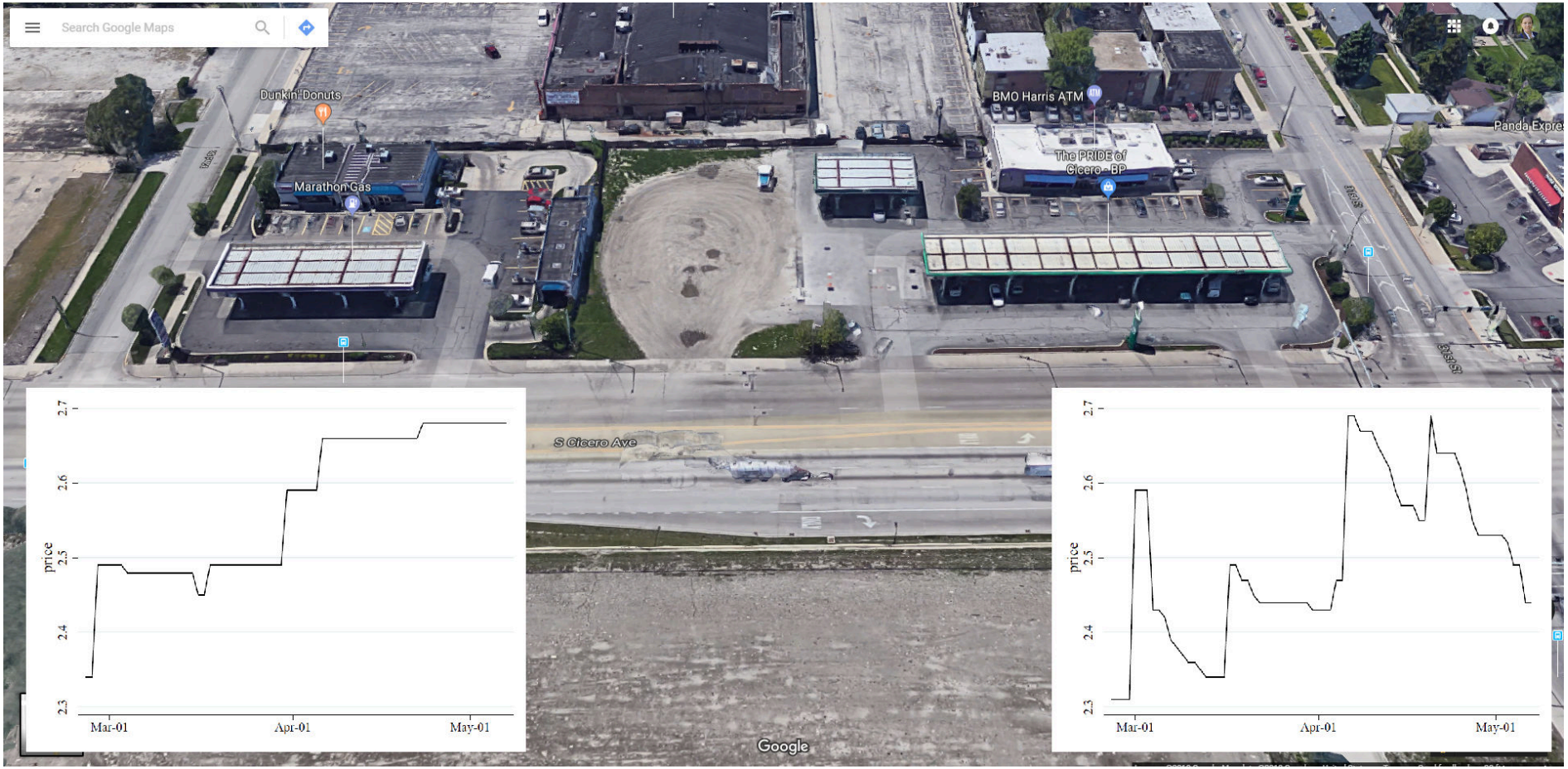
Conclusions

- Location decision of the fueling stations
  - Spatial differencing:
    - Finding a gasoline station on the low-tax side is 0.7% more likely
    - The higher odds reduce by 0.45% when moving away from the border
    - The reduction with distance increases by 0.40% for every 10¢ $\Delta\tau$
  - Change in number of retailers:
    - Significant 28.9% increase on the low-tax side
    - Reduction of 9.9% when moving away from the border
    - The reduction with distance increases by 14.8% for every 10¢ $\Delta\tau$
- Tax pass-through under firm location and consumer search
  - Tax incidence of 75% at high-tax side within 15 miles of border
  - Tax incidence of 100% at low-tax side within 15 miles of a border

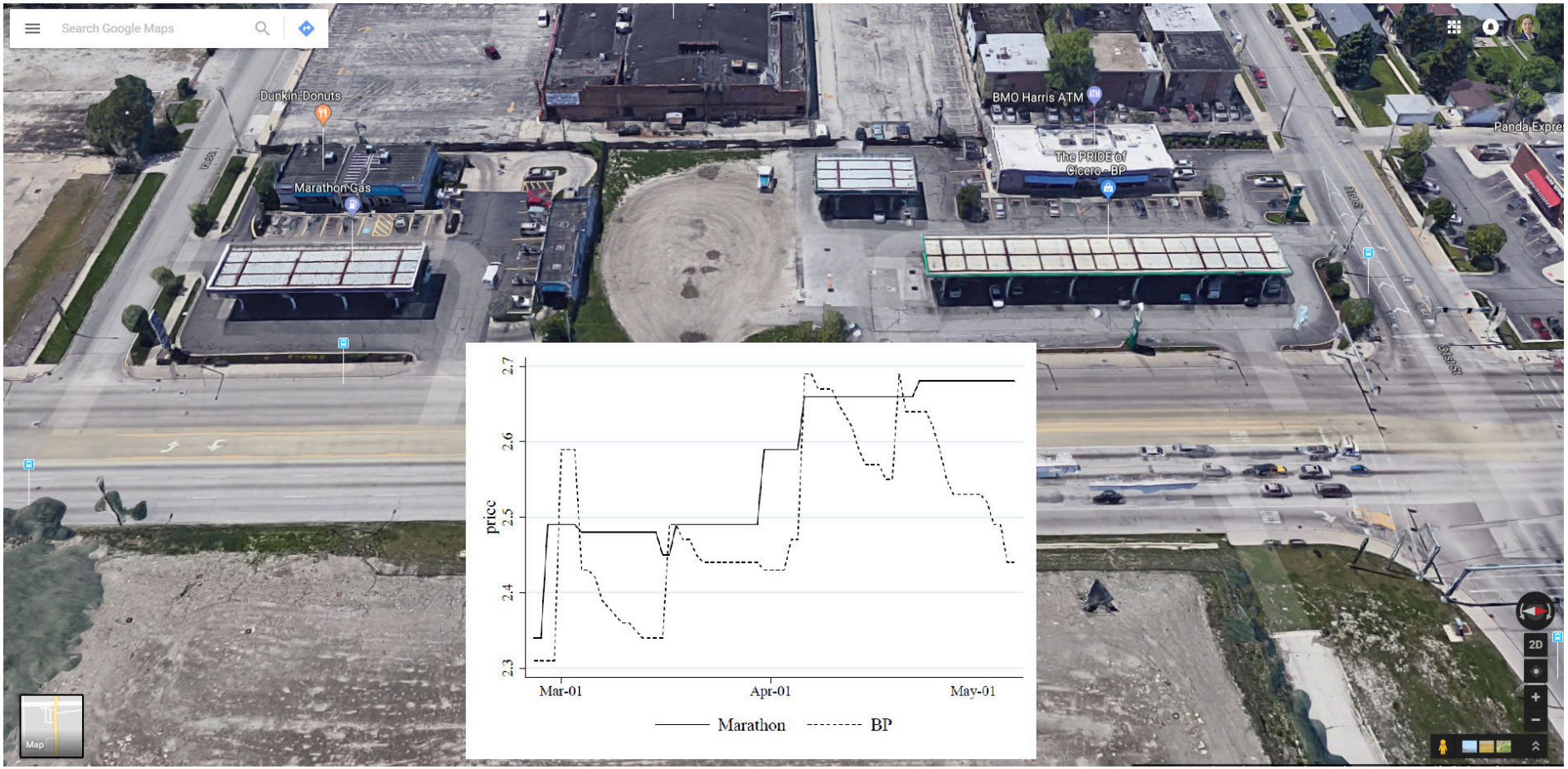
Thank you!

questions, comments, suggestion:
hrtdmrt2@illinois.edu

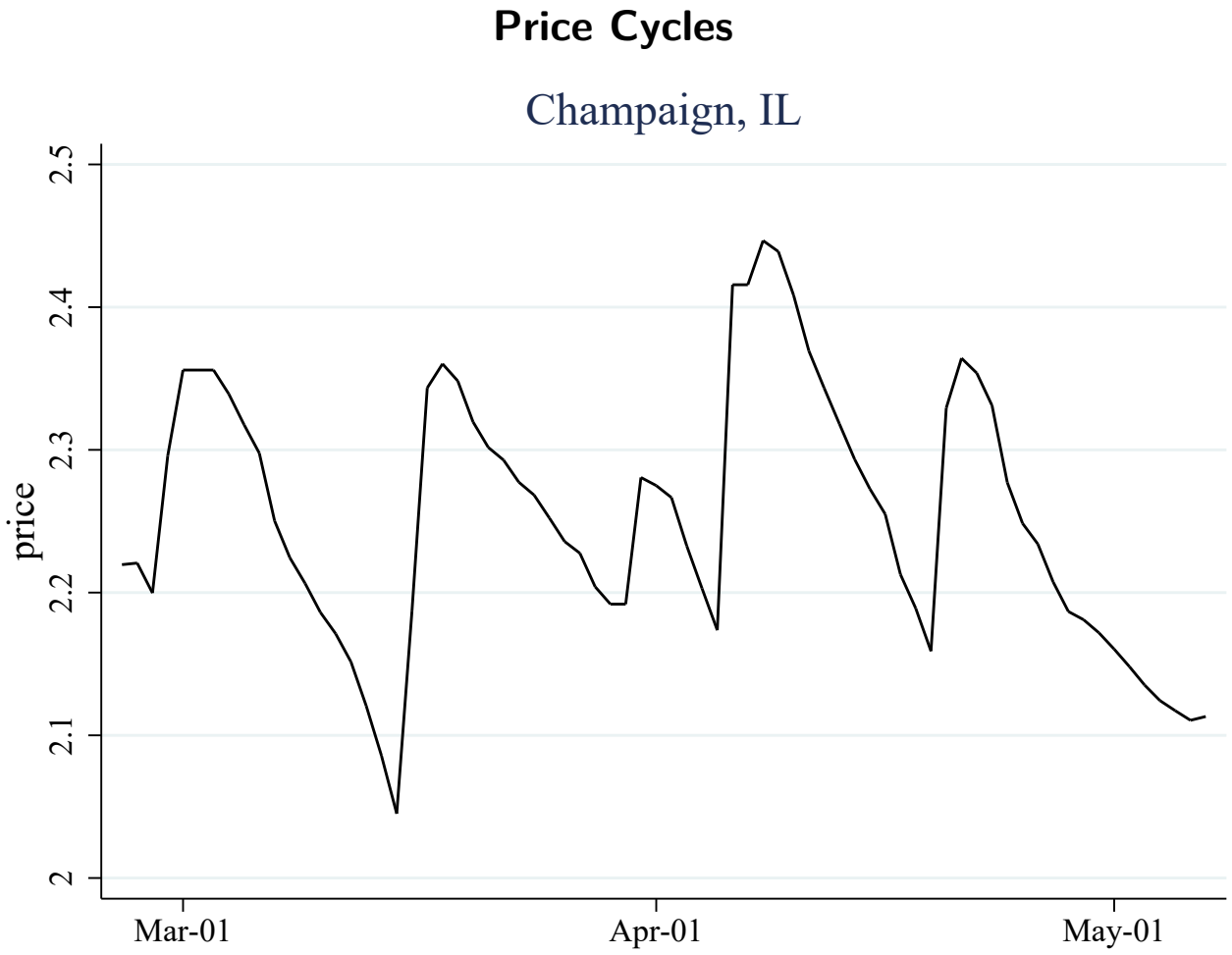
Other Research



Other Research



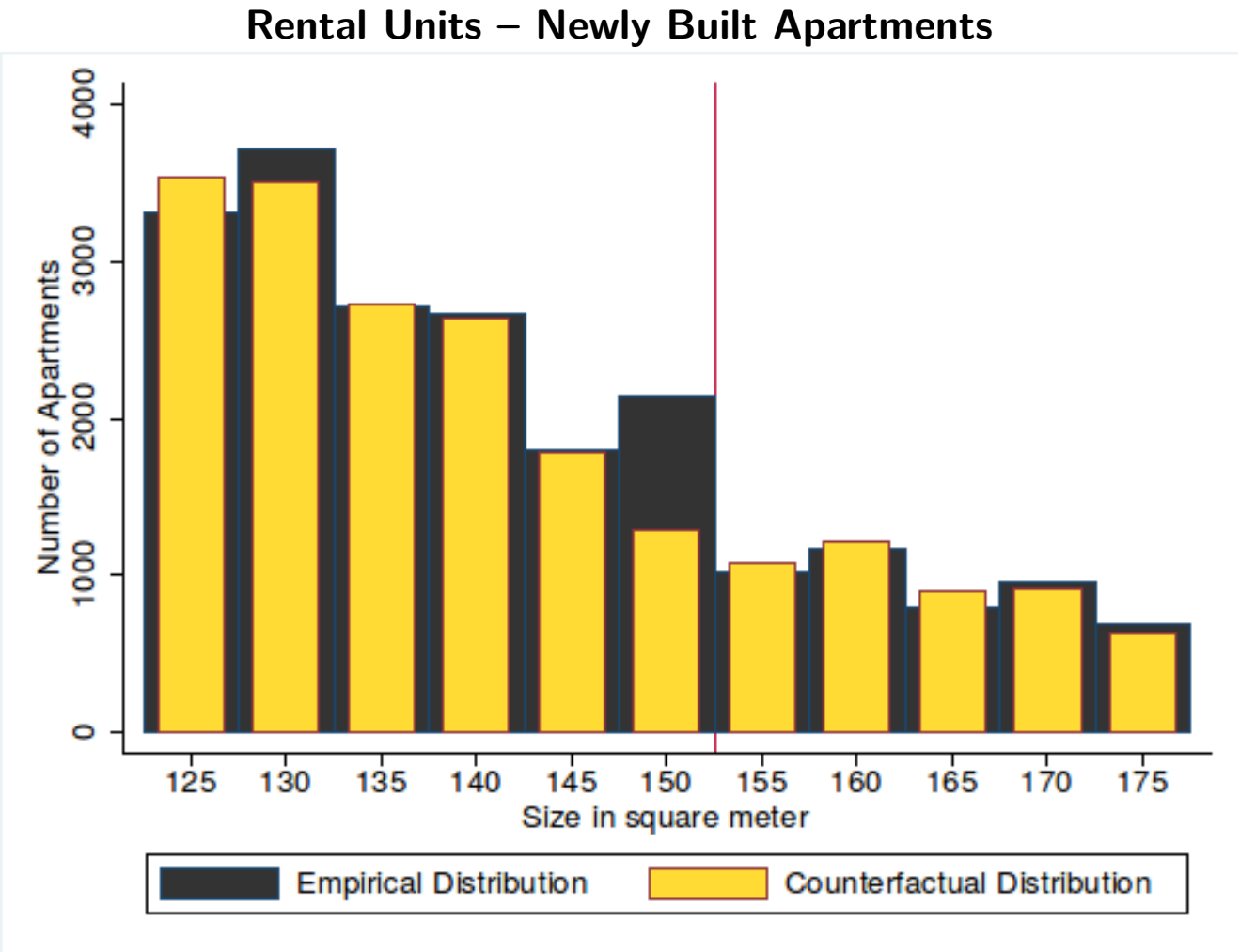
Other Research



Pricing Strategy Heterogeneity in Retail Gasoline Markets

- This paper has three main contributions:
  1. Methodology: Indicator of the cycling pricing at the station level
     - Robust to price trends and well suited at the retailer level
  2. Heterogeneous pricing strategies: New source of variation
     - Cycling and non-cycling stations in every retail gasoline market
     - Cycling stations charge 3.5 cents less than non-cycling stations
     - Price "jumps" are predictable (not Edgeworth cycles)
  3. Reasons behind the pricing strategy choices:
     - Cyclers are less likely to have non-price features: Service stations, restaurants
     - Non-cyclers are more likely to develop a relation with consumers: Loyalty cards or cash discounts
     - Cyclers are more likely to locate on the low-tax side of the border: suggesting that they try to attract price sensitive consumers

Other Research



Responses to Tax Kinks in the Rental Housing Market

- Distortionary effects of taxes on rental properties.
- Special feature of the tax code in Iran's rental market
  - tax-exemption threshold is based on the property's size
- Large bunching occurs below the tax cutoff.
- Structural framework with property taxes and costs of filing.
- Optimization frictions: dominated region

References I

Atkinson, B. 2008. On retail gasoline pricing websites: potential sample selection biases and their implications for empirical research. Review of Industrial Organization, 33, 161–175.

Bartik, T. J. 1985. Business location decisions in the united states: Estimates of the effects of unionization, taxes, and other characteristics of states. Journal of Business & Economic Statistics, 3, 14–22.

Byrne, D. P. 2017. Gasoline pricing in the country and the city. Working paper.

Byrne, D. P., Leslie, G. W., Ware, R. 2013. How do consumers respond to gasoline price cycles?

Chiou, L., Muehlegger, E. 2014. Consumer response to cigarette excise tax changes.

Coughlin, C. C., Terza, J. V., Arromdee, V. 1991. State characteristics and the location of foreign direct investment within the united states. The Review of Economics and Statistics, 675–683.

Coyne, D. 2017. Crossing the Border: How Political Boundaries Affect Gas Price Competition and State Motor Fuel Tax.

References II

Doyle Jr, J., Samphantharak, K. 2008. $2.00 gas! studying the effects of a gas tax moratorium. Journal of public economics, 92, 869–884.

Duranton, G., Gobillon, L., Overman, H. G. 2011. Assessing the effects of local taxation using microgeographic data. The Economic Journal, 121, 1017–1046.

Eckert, A., West, D. S. 2004a. Retail gasoline price cycles across spatially dispersed gasoline stations. The Journal of Law and Economics, 47, 245–273.

Eckert, A., West, D. S. 2004b. A tale of two cities: Price uniformity and price volatility in gasoline retailing. The Annals of Regional Science, 38, 25–46.

Eckert, A., West, D. S. 2005. Price uniformity and competition in a retail gasoline market. Journal of Economic Behavior & Organization, 56, 219–237.

Fullerton, D., Muehlegger, E. 2018. Who bears the economic costs of environmental regulations?Technical report, National Bureau of Economic Research.

González, J., Hurtado, C. 2018. Pricing Strategy Heterogeneity in Retail Gasoline Markets.

Guimarães, P., Figueirdo, O., Woodward, D. 2003. A tractable approach to the firm location decision problem. Review of Economics and Statistics, 85, 201–204.

References III

Harding, M., Leibtag, E., Lovenheim, M. F. 2012. The heterogeneous geographic and socioeconomic incidence of cigarette taxes: Evidence from nielsen homescan data. American Economic Journal: Economic Policy, 4, 169–98.

Holmes, T. J. 1998. The effect of state policies on the location of manufacturing: Evidence from state borders. Journal of Political Economy, 106, 667–705.

Lewis, M. S., Marvel, H. P. 2011. When do consumers search? The Journal of Industrial Economics, 59, 457–483.

McFadden, D. L. 1973. Conditional logit analysis of qualitative choice behavior. In P. Zarambka ed. Frontiers in Econometrics, New York: Academic Press, Chap. chapter 4, 105–142.

Merriman, D. 2010. The micro-geography of tax avoidance: evidence from littered cigarette packs in chicago. American Economic Journal: Economic Policy, 2, 61–84.

Muehlegger, E., Sweeney, R. L. 2017. Pass-through of input cost shocks under imperfect competition: Evidence from the us fracking boom.Technical report, National Bureau of Economic Research.

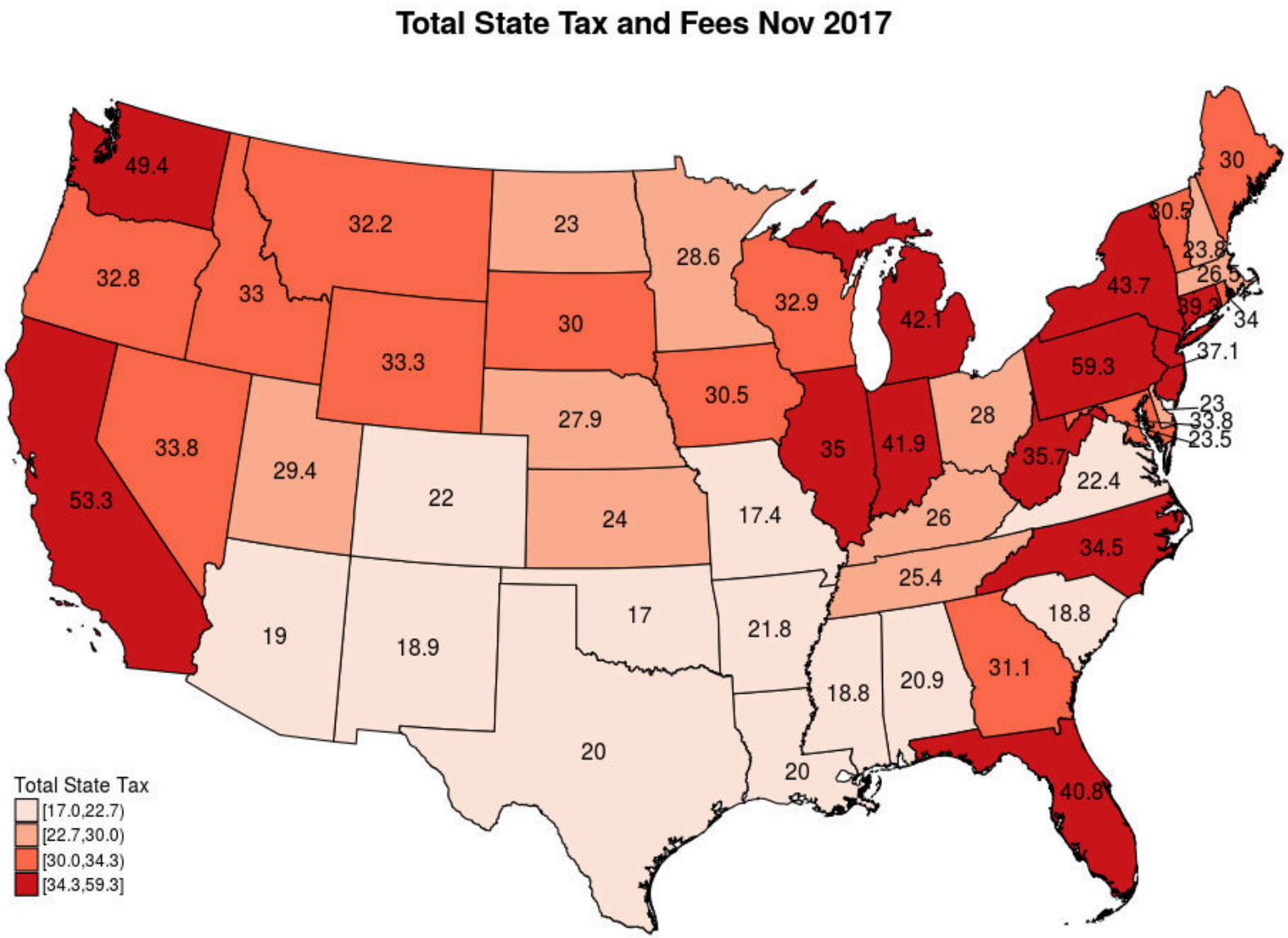
Noel, M. D. 2015. Do edgeworth price cycles lead to higher or lower prices? International Journal of Industrial Organization, 42, 81–93.

References IV

Stehr, M. 2007. The effect of sunday sales bans and excise taxes on drinking and cross-border shopping for alcoholic beverages. National Tax Journal, 85–105.

Stolper, S. 2017. Who Bears the Burden of Energy Taxes? The Role of Local Pass-Through.

Yilmazkuday, D., Yilmazkuday, H. 2016. Understanding gasoline price dispersion. The Annals of Regional Science, 57, 223–252.



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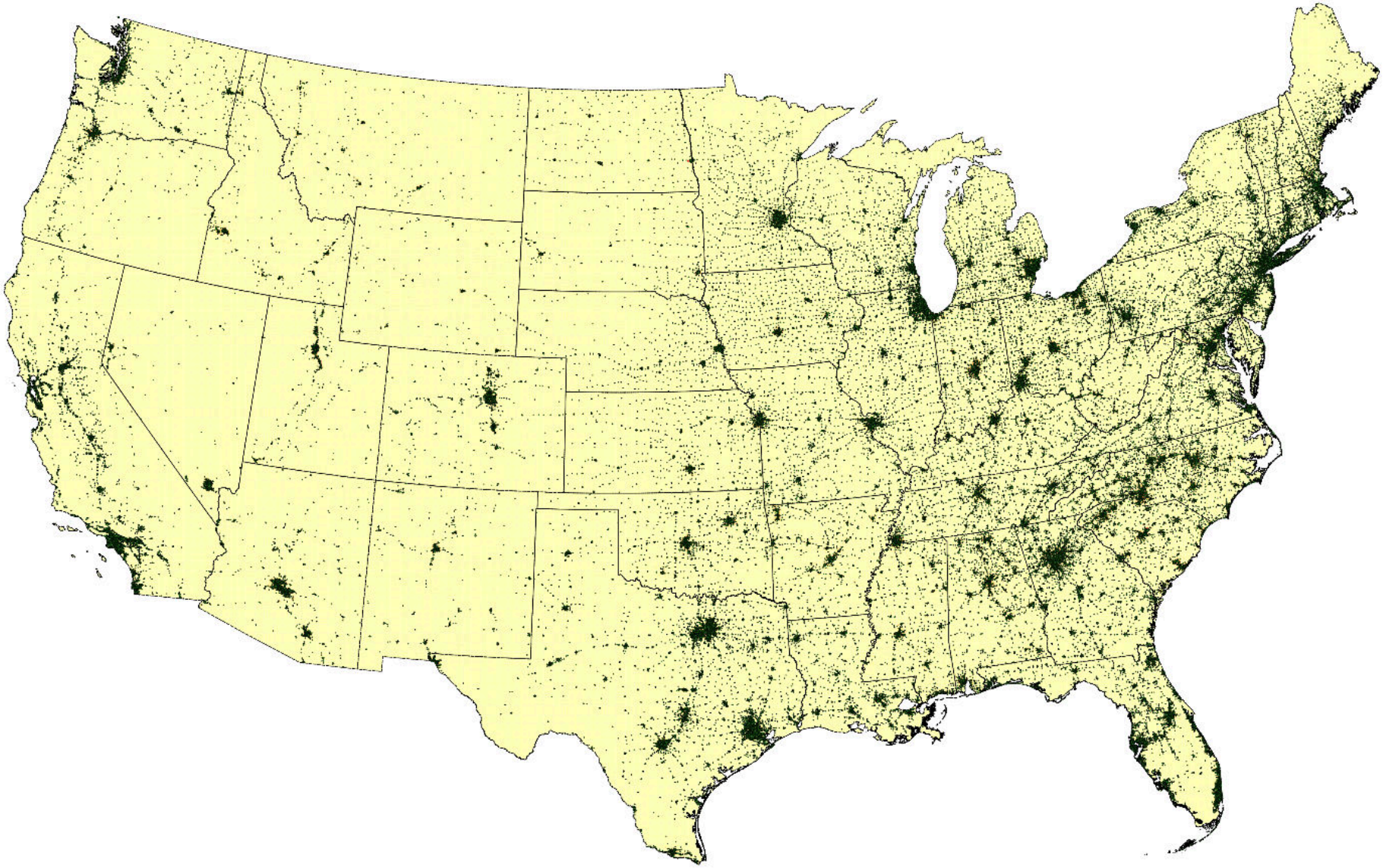
Source: American Petroleum Institute

Location of Gasoline Retailers



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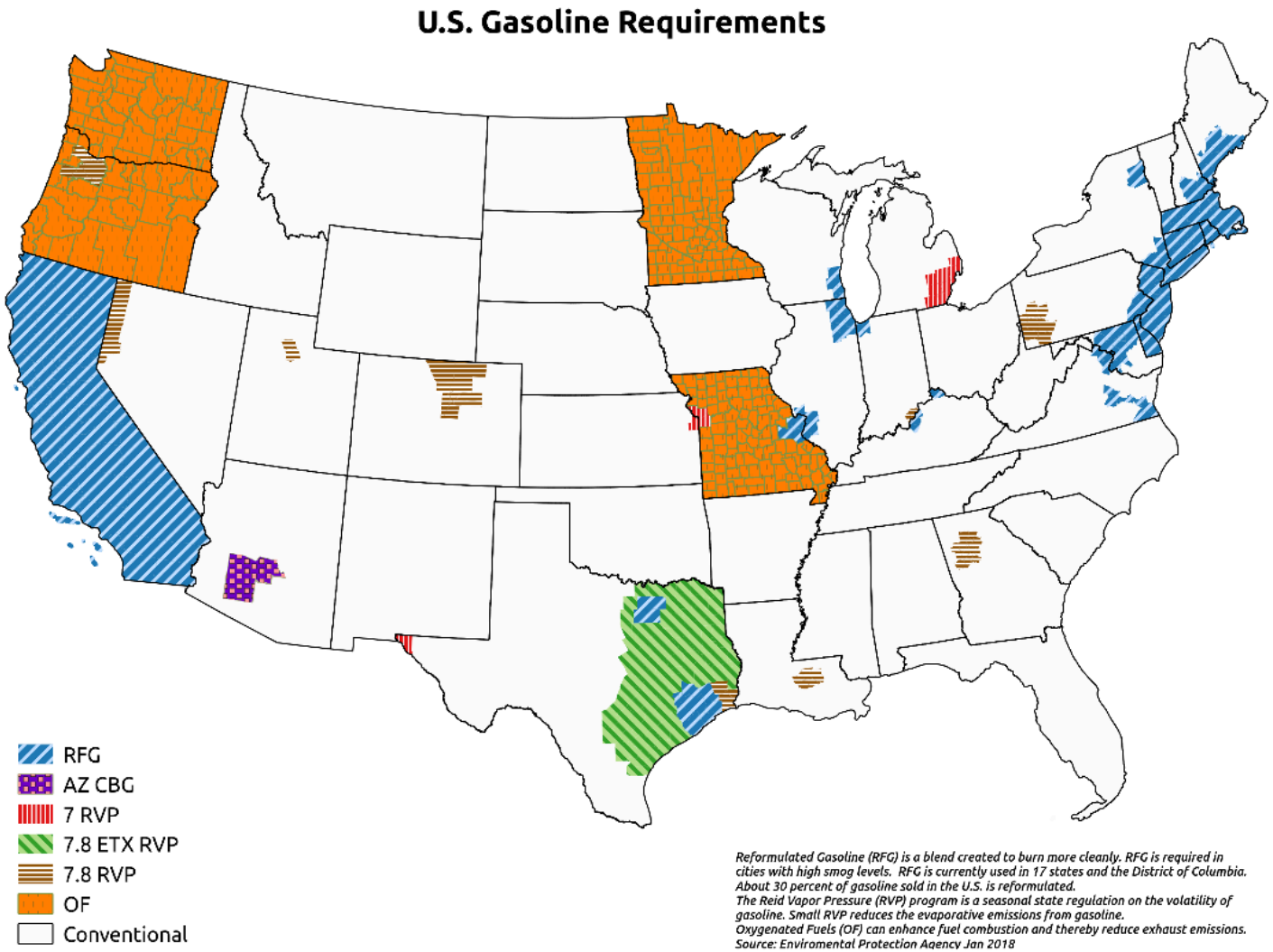
Source: Author's calculation



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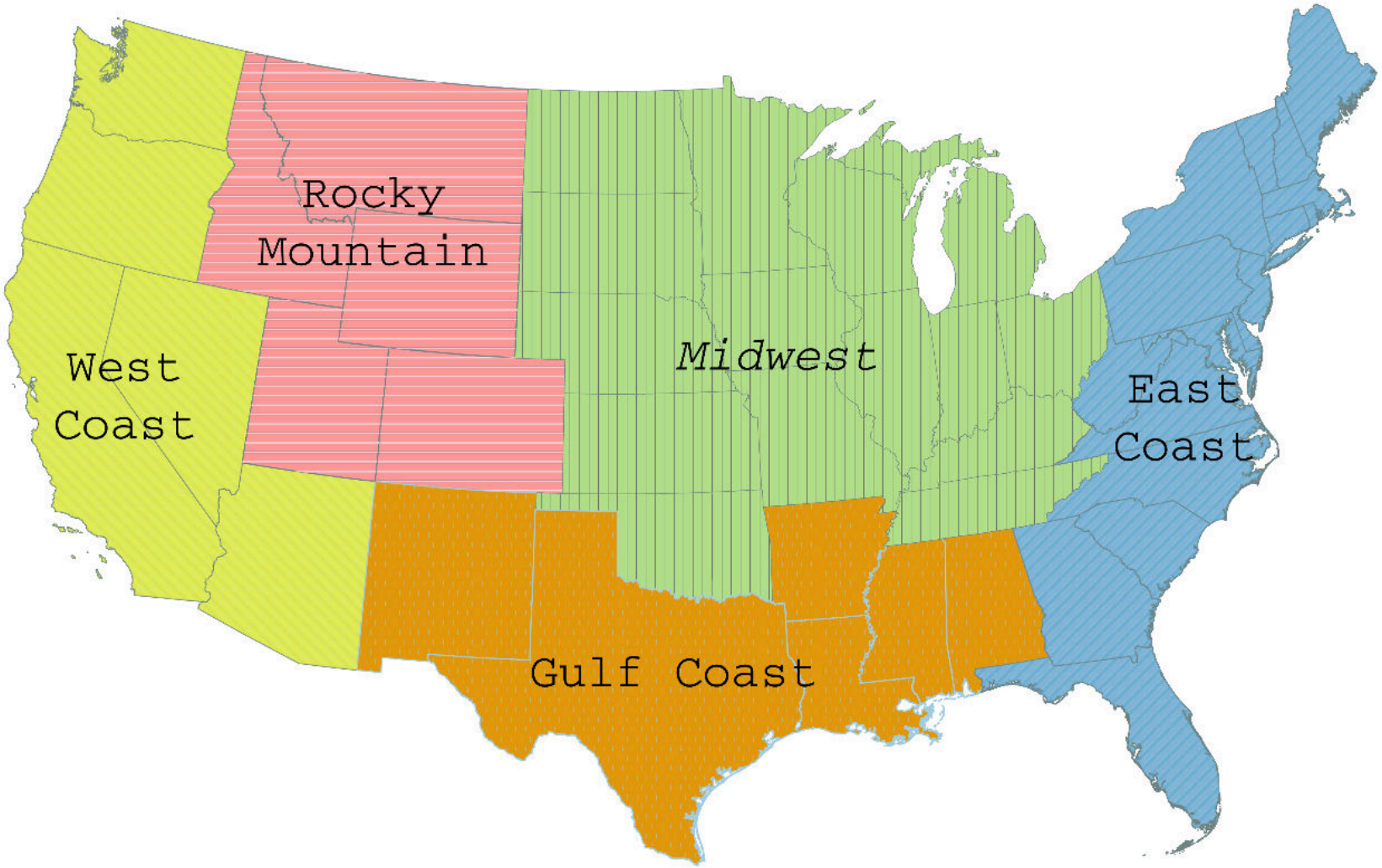
Source: EIA

Petroleum Administration for Defense Districts



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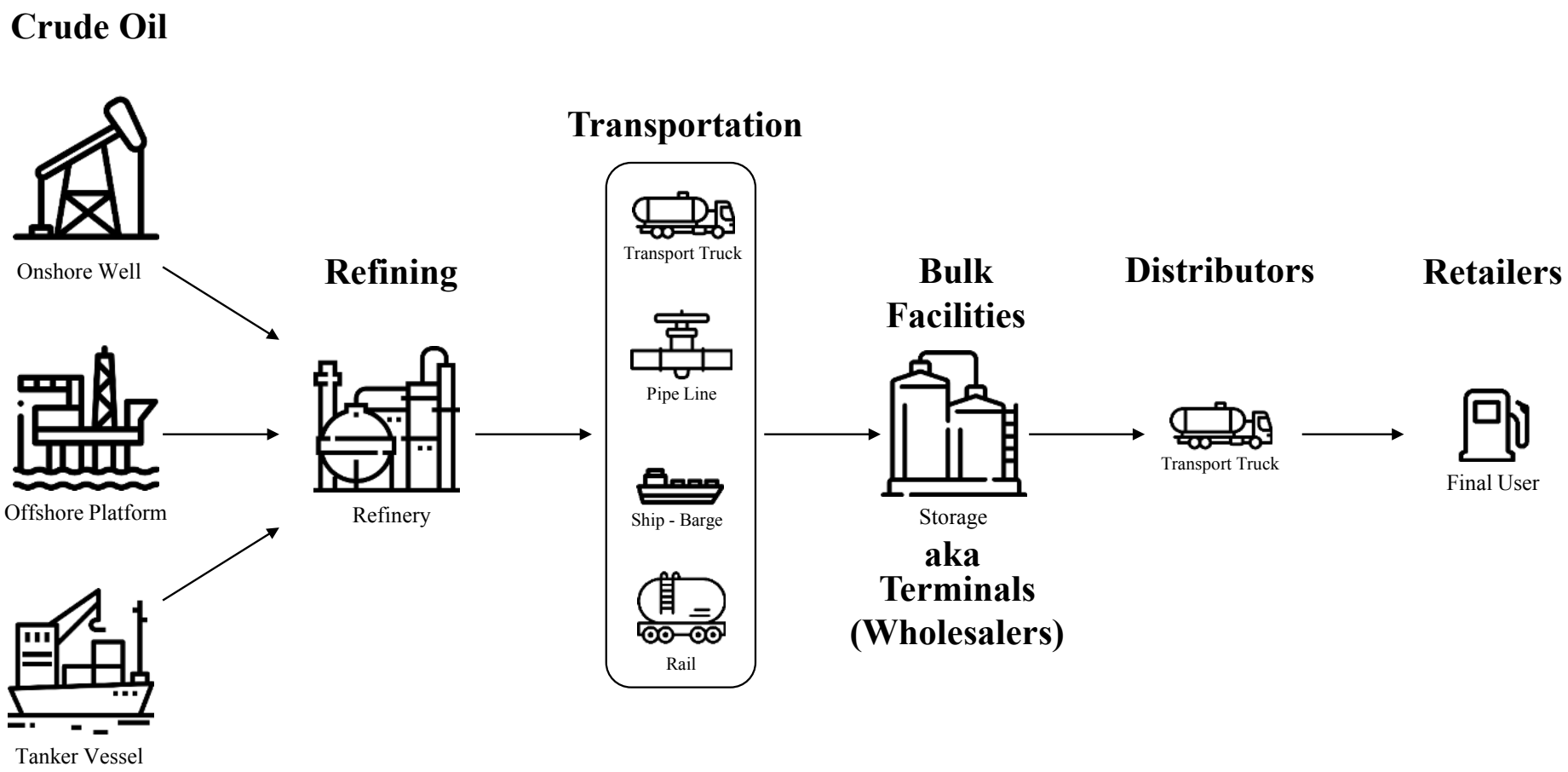
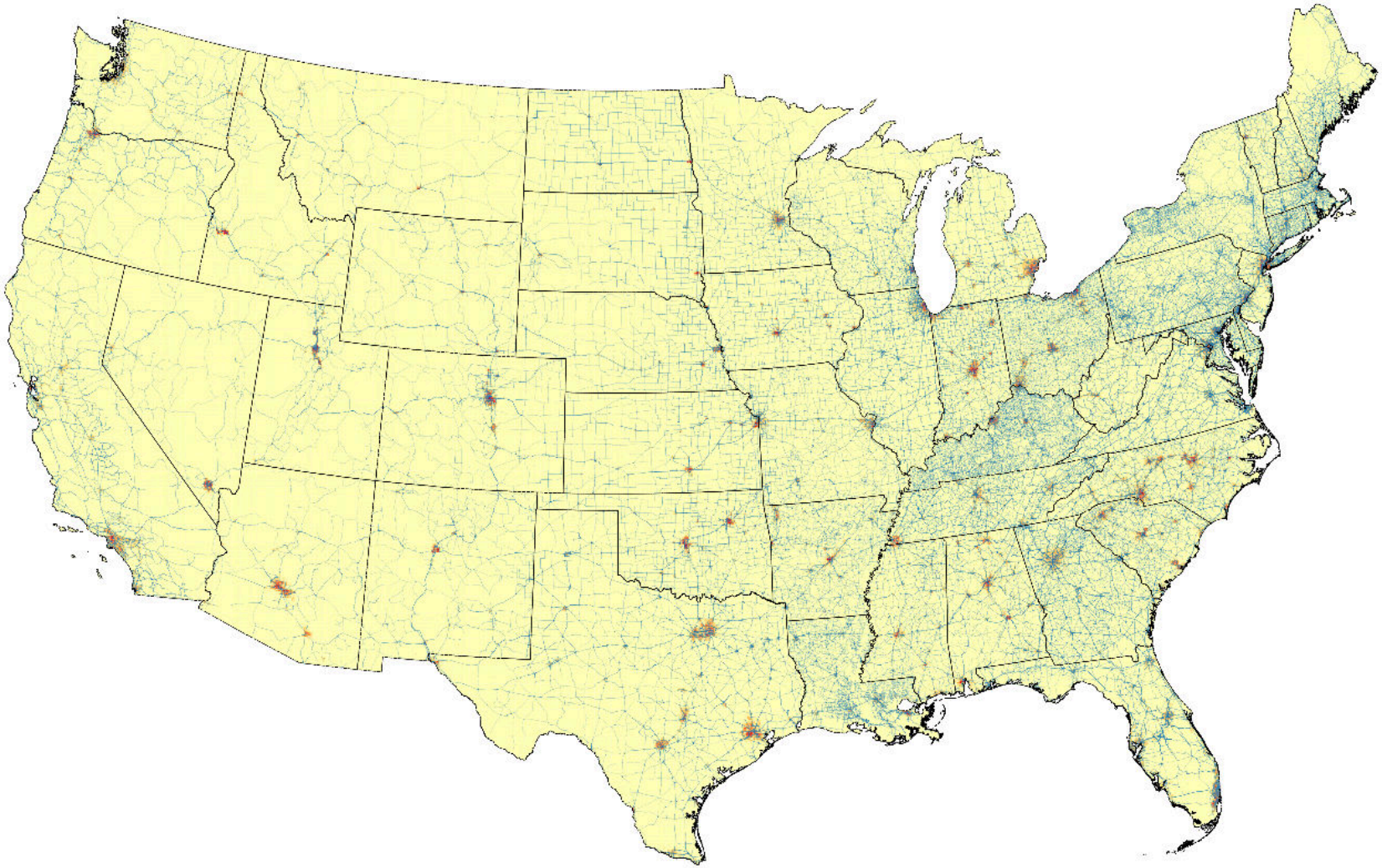
Source: EIA Regional movements of crude oil and petroleum products



Back Source: Author's calculation

Population and Roads



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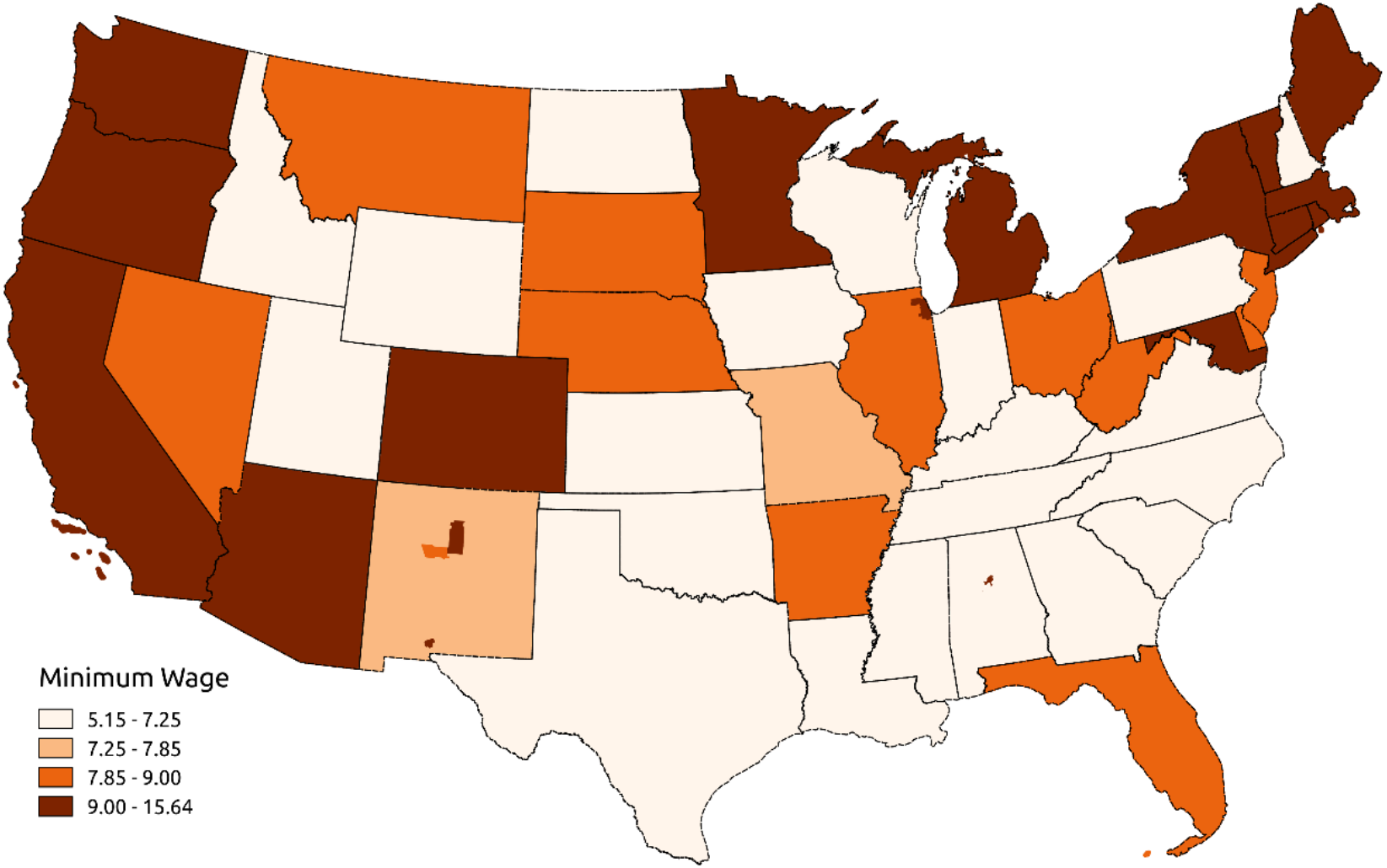
Source: Census Bureau

Minimum Wage in April 2018



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Source: Author's calculations

- Other research on retail gasoline markets also uses the same data.
  - Price:

    Eckert and West (2004b,a, 2005), Noel (2015), Yilmazkuday and Yilmazkuday (2016), Byrne (2017), Coyne (2017), González and Hurtado (2018)

  - Consumer search:

    Lewis and Marvel (2011), Byrne et al. (2013)

  - Potential sample selection:

    Atkinson (2008)

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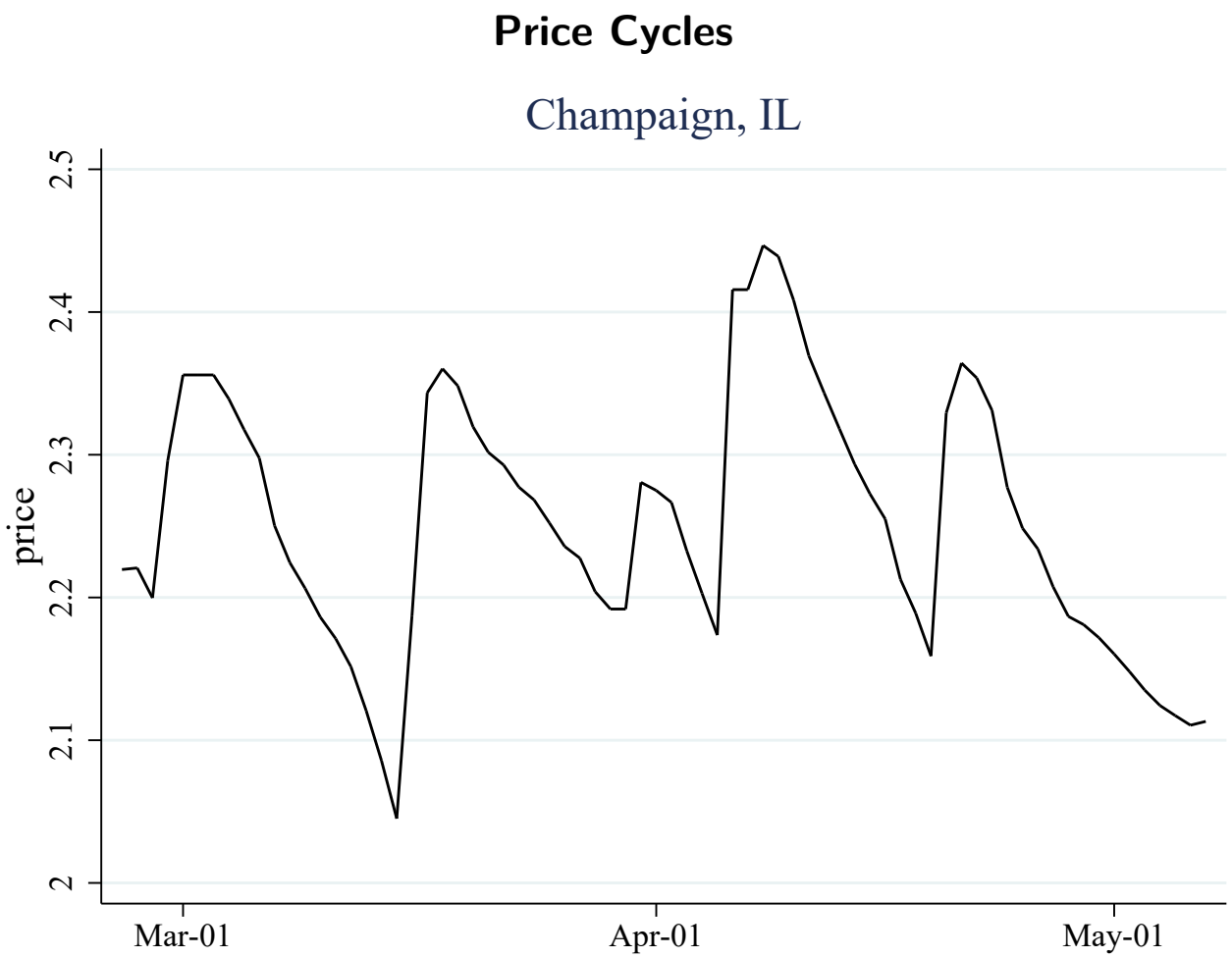

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