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
\[ \Delta \tau = 6.68 \text{¢} \]

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

**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
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

1. Related Literature
2. Data
3. Methodology and Results
4. Conclusions
On the Agenda

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Related Literature

- **Taxes and the business location decision**
  - 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**
  - U.S. refineries: Muehlegger and Sweeney (2017)
  - Environmental regulations: Fullerton and Muehlegger (2018)
On the Agenda

1. Related Literature
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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
### Number of Retailers by Petroleum Administration for Defense Districts

<table>
<thead>
<tr>
<th>PADD Region</th>
<th>Year 2016(^A)</th>
<th>Year 2018(^B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Coast</td>
<td>55,544</td>
<td>49,798</td>
</tr>
<tr>
<td>Midwest</td>
<td>38,481</td>
<td>41,006</td>
</tr>
<tr>
<td>Gulf Coast</td>
<td>24,605</td>
<td>25,495</td>
</tr>
<tr>
<td>Rocky Mountain</td>
<td>4,260</td>
<td>5,049</td>
</tr>
<tr>
<td>West Coast</td>
<td>17,487</td>
<td>16,266</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140,377</strong></td>
<td><strong>137,614</strong></td>
</tr>
</tbody>
</table>

\(^\star\) 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
Data

Proximity Regions to State Borders

Source: Author's calculation

C. Hurtado (UIUC - Economics)
Spatial Tax Notches: $\Delta \tau$

Source: Author’s calculation

C. Hurtado (UIUC - Economics)
Bunching at the Border:

All Retailers

Data

Source: Author’s calculation

C. Hurtado (UIUC - Economics)

Behavioral Responses to Spatial Tax Notches

36%
Methodology and Results

On the Agenda

1. Related Literature
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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:

$$\Pi_{fs} = \Omega(\xi_f, \zeta_s) + \varepsilon_{fs}$$

$$= \omega'_f \eta + \nu_f + \lambda g_s(\Delta \tau_s) + x'_s \theta + \varphi_s + \kappa_{j(s)} + \varepsilon_{fs},$$

where

- $\omega_f$: Vector of retailer characteristics
- $\nu_f$: Retailer-fixed effect
- $g_s(\Delta \tau_g)$: function of the tax differential $\Delta \tau_s$
- $\varphi_s$: Location-specific effect
- $x_s$: Vector of location characteristics
- $\kappa_{j(s)}$: Jurisdiction fixed effect
- $\varepsilon_{fs}$: 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

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

where the summation is across all possible locations $s'$

- The percentage change in the expected number of firms

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

- 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 $\varepsilon_{fs}$ follow i.i.d. type I extreme value distribution:

$$
Pr (s = s_1 | s \in \{s_1, s_2\}) = \frac{1}{1 + \exp \left( -\lambda (g_{s_1} (\Delta \tau_{s_1}) - g_{s_2} (\Delta \tau_{s_2})) - (\kappa_{j s_1} - \kappa_{j s_2}) \right)}
$$
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
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.
### Location decision: Spatial differencing

<table>
<thead>
<tr>
<th></th>
<th>Logit Model</th>
<th>Probit Model</th>
<th>Linear Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
</tr>
<tr>
<td>Low-Tax</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi × ΔTax/10¢</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulation controls?</td>
<td>no</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Other controls?</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Adj. R²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo R²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num. obs.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable: Indicator of a Retailer on a Square of the Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Logit Model</td>
</tr>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td>Low-Tax</td>
<td>.0059** (0.0019)</td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi</td>
<td>−.0048*** (0.0012)</td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi × ΔTax/10¢</td>
<td>−.0039* (0.0015)</td>
</tr>
<tr>
<td>Regulation controls?</td>
<td>no</td>
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<tr>
<td>Other controls?</td>
<td>no</td>
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<tr>
<td>Adj. R²</td>
<td>.1710</td>
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<tr>
<td>Pseudo R²</td>
<td></td>
</tr>
<tr>
<td>Num. obs.</td>
<td>331,076</td>
</tr>
</tbody>
</table>

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.
### Location decision: Conditional logit

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable: Indicator of a Retailer on a Square of the Grid</th>
<th>Conditional Logit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 7</td>
<td>Model 8</td>
</tr>
<tr>
<td>Low-Tax</td>
<td>.2178***</td>
<td>.2889***</td>
</tr>
<tr>
<td></td>
<td>(.0124)</td>
<td>(.0128)</td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi</td>
<td>−.1027***</td>
<td>−.0990***</td>
</tr>
<tr>
<td></td>
<td>(.0073)</td>
<td>(.0073)</td>
</tr>
<tr>
<td>Low-Tax × Dist. to Border/50mi × ΔTax/10¢</td>
<td>−.1912***</td>
<td>−.1479***</td>
</tr>
<tr>
<td></td>
<td>(.0093)</td>
<td>(.0094)</td>
</tr>
<tr>
<td>Regulation controls?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Other controls?</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>.6474</td>
<td>.6492</td>
</tr>
<tr>
<td>Num. obs.</td>
<td>331,076</td>
<td>331,076</td>
</tr>
</tbody>
</table>

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:
  \[ p_{f,t} = \beta \tau_{f,t} + \mathcal{W}_{f,t} \delta + \rho_f + \gamma_t + \epsilon_{f,t} \]  
  for retailer \( f \) on date \( t \)
  
  - \( \rho_f \): Retailer fixed effects to model individual heterogeneity
  - \( \gamma_t \): Date fixed effects to model price cycles and trends

- But, there is not enough variation of taxes on a daily frequency.
  
  - \( \tau_{f,t} \) is in fact \( \tau_f \).
  - 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 and Results

Methodology: Idiosyncratic Prices

First step, remove time effects from price:

\[ p_{f,t} = \rho_f + \gamma_t + \epsilon_{f,t} \]  

for retailer \( f \) on date \( t \).

- \( \rho_f \): Retailer fixed effects (average prices for station \( f \) over time)
- \( \gamma_t \): Date fixed effects

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

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

where

- \( \tau_f \): 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
### Tax Incidence Around Administrative Boundaries

<table>
<thead>
<tr>
<th></th>
<th>States</th>
<th>All Stations</th>
<th>Inner Land</th>
<th>Border</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax in cents: $\beta_0$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to Border in mi.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population per 10,000 res.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retailers per mi.$^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads per mi.$^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Regulation Controls        | no      | no           | yes        | yes     |
| PADD                       | 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.
## Tax Incidence Around Administrative Boundaries

<table>
<thead>
<tr>
<th></th>
<th>States</th>
<th>All Stations</th>
<th>Inner Land</th>
<th>Border</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
</tr>
<tr>
<td>Tax in cents: ( \beta_0 )</td>
<td>1.00*** (0.09)</td>
<td>1.00*** (0.04)</td>
<td>0.99*** (0.04)</td>
<td>1.05*** (0.05)</td>
</tr>
<tr>
<td>Distance to Border in mi.</td>
<td>0.00 (0.01)</td>
<td>0.00 (0.01)</td>
<td>0.01 (0.01)</td>
<td>−0.07 (0.08)</td>
</tr>
<tr>
<td>Population per 10,000 res.</td>
<td>0.54** (0.18)</td>
<td>0.88** (0.34)</td>
<td>0.30 (0.17)</td>
<td></td>
</tr>
<tr>
<td>Retailers per mi.(^2)</td>
<td>−1.93*** (0.53)</td>
<td>−2.82*** (0.50)</td>
<td>−0.77 (0.64)</td>
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<tr>
<td>Roads per mi.(^2)</td>
<td>0.72* (0.31)</td>
<td>1.11** (0.39)</td>
<td>0.10 (0.20)</td>
<td></td>
</tr>
<tr>
<td>Regulation Controls</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>PADD</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Adj. R(^2)</td>
<td>.89</td>
<td>.74</td>
<td>.75</td>
<td>.78</td>
</tr>
<tr>
<td>Num. obs.</td>
<td>49</td>
<td>126,981</td>
<td>126,934</td>
<td>96,727</td>
</tr>
</tbody>
</table>

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.
### Tax Incidence Around Administrative Boundaries

<table>
<thead>
<tr>
<th></th>
<th>Model 3</th>
<th>Model 3i</th>
<th>Model 6</th>
<th>Model 6i</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable:</strong> Retailers’ Idiosyncratic Prices in cents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All Stations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax in cents: $\beta_0$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax $\times$ Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax $\times$ High</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Border</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>All Other Controls</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Share of Low [%]</td>
<td>-</td>
<td>44</td>
<td>-</td>
<td>53</td>
</tr>
<tr>
<td>Share of High [%]</td>
<td>-</td>
<td>56</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>Sample</td>
<td>All</td>
<td>All</td>
<td>Border</td>
<td>Border</td>
</tr>
<tr>
<td>Adj. R²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num. obs.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>RMSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
### Tax Incidence Around Administrative Boundaries

<table>
<thead>
<tr>
<th></th>
<th>All Stations</th>
<th>Border</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 3</td>
<td>Model 3i</td>
</tr>
<tr>
<td>Model 6</td>
<td>Model 6i</td>
<td></td>
</tr>
<tr>
<td><strong>Dependent Variable:</strong> Retailers' Idiosyncratic Prices in cents</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All Stations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax in cents: $\beta_0$</td>
<td>.99</td>
<td>.89*</td>
</tr>
<tr>
<td></td>
<td>[.90; 1.07]</td>
<td>[.80; .98]</td>
</tr>
<tr>
<td>Tax × Low</td>
<td>1.01</td>
<td>.82</td>
</tr>
<tr>
<td></td>
<td>[.79; 1.23]</td>
<td>[.59; 1.06]</td>
</tr>
<tr>
<td>Tax × High</td>
<td>.95</td>
<td>.98</td>
</tr>
<tr>
<td></td>
<td>[.82; 1.08]</td>
<td>[.84; 1.11]</td>
</tr>
<tr>
<td><strong>All Other Controls</strong></td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>Share of Low [%]</td>
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<tr>
<td></td>
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<td>Share of High [%]</td>
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<td>-</td>
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<td><strong>Adj. R²</strong></td>
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<td>.55</td>
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<td><strong>Num. obs.</strong></td>
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<td>30,207</td>
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<tr>
<td><strong>RMSE</strong></td>
<td>14.06</td>
<td>13.03</td>
</tr>
</tbody>
</table>

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, $d_i$:

\[ p_i = \beta_0 \tau_i + \beta_1 d_i \Delta \tau_i + \cdots = \beta_0 \tau_i + \beta_1 d_i (\tau_i - \tau_- i) + \cdots = \beta_0 \tau_i + \beta_1 d_i \tau_i - \beta_1 d_i \tau_- i + \cdots \]

- where
  - $\tau_i$: State tax for retailer $i$.
  - $\tau_- i$: 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

Prices vs Taxes

LLR: Local Linear Regression.

C. Hurtado (UIUC - Economics)

Behavioral Responses to Spatial Tax Notches
On the Agenda

1. Related Literature
2. Data
3. Methodology and Results
4. Conclusions
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

C. Hurtado (UIUC - Economics)  Behavioral Responses to Spatial Tax Notches
Behavioral Responses to Spatial Tax Notches
Price Cycles

Champaign, IL

Mar-01  Apr-01  May-01

price
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
Rental Units – Newly Built Apartments

C. Hurtado (UIUC - Economics)

Behavioral Responses to Spatial Tax Notches
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


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.


References


Location of Gasoline Retailers

Source: Author's calculation

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Colored Maps

U.S. Gasoline Requirements

- RFG
- AZ CBG
- 7 RVP
- 7.8 ETX RVP
- 7.8 RVP
- OF
- Conventional

Reformulated Gasoline (RFG) is a blend created to burn more cleanly. RFG is required in states with high smog levels. RFG is currently used in 17 states and the District of Columbia. About 10 percent of gasoline sold in the U.S. is reformulated.

The Reid Vapor Pressure (RVP) program is a seasonal state regulation on the volatility of gasoline. Small RVP reduces the evaporative emissions from gasoline. Oxygenated Fuels (OF) can enhance fuel combustion and thereby reduce exhaust emissions.

Source: Environmental Protection Agency Jan 2019
Petroleum Administration for Defense Districts

Source: EIA Regional movements of crude oil and petroleum products
Crude Oil

Onshore Well

Offshore Platform

Tanker Vessel

Refining

Transportation

Refinery

Transport Truck

Pipe Line

Ship - Barge

Rail

Bulk Facilities

Storage

aka Terminals

(Wholesalers)

Distributors

Transport Truck

Retailers

Final User

Source: Author's calculation
Minimum Wage in April 2018

Colored Maps

Minimum Wage

Source: Author's calculations

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

- **Price:**
  

- **Consumer search:**
  
  Lewis and Marvel (2011), Byrne et al. (2013)

- **Potential sample selection:**
  
  Atkinson (2008)
Price Cycles

Champaign, IL

Source: Author's calculation