# The Cost of Curbing Externalities with Market Power: Alcohol Regulations and Tax Alternatives

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Michigan Ross; NYU Stern and NBER

# Externalities of Sin Goods

Several tools available to address the externalities of sin goods:

| | |
|---|---|
| **corrective taxes** | Cigarettes \$5.35/pk in NY;<br>Taxes on 1.75L bottle of Smirnoff Vodka are \$7.50 in CT. |
| **price controls** | Scotland instituted a minimum price of £1.00 per alcohol serving in 2018. |
| **market structure** | Many states (NC, NH, MI, PA) have state-run liquor monopolies<br>Maine has a private monopoly. |
| **other regulations** | Where and when alcohol/cigarettes can be sold<br>("blue" laws) |

# Using Market Power to Curb Alcohol Consumption

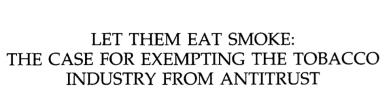
We examine a popular regulation call Post-and-Hold (PH).

- Used in roughly a dozen U.S. states (including Connecticut).
- Facilitates non-competitive pricing by wholesalers.
  - Descriptive evidence indicates prices are substantially higher in PH states, particularly for higher-end products.
  - Pricing patterns suggest conscious parallelism.
- Benefits wholesalers for sure, but some argue has PH the advantage of also curbing alcohol consumption.
  - We show that PH is an inefficient way to restrain consumption.
  - Tax alternatives could reduce ethanol consumption by roughly 8% without reducing CS, or
  - Boost CS by 6% by switching from PH to taxes.

# Current Debates

Is allowing firms to expand or exploit market power a good way to correct externalities?


**The World's First Green Antitrust Provision Shows that Climate Action is the Newest Antitrust Frontier**


LET THEM EAT SMOKE:
THE CASE FOR EXEMPTING THE TOBACCO INDUSTRY FROM ANTITRUST

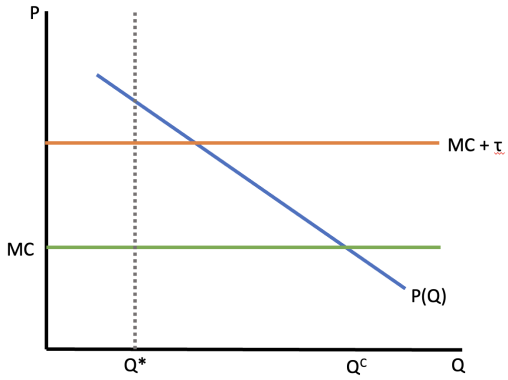

**Ohio's marijuana proposal was lambasted for creating a cartel. But pot cartels could work.**

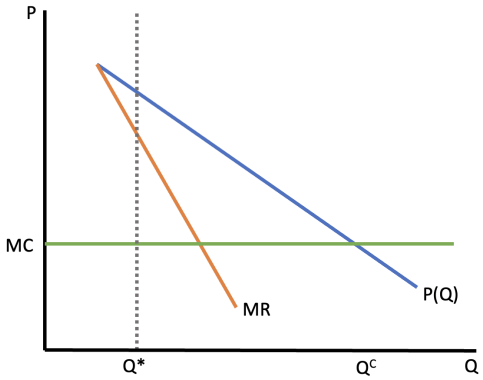
By German Lopez | @germanrlopez | german.lopez@vox.com | Nov 4, 2015, 11:50am EST

- Austria passed a law providing an antitrust exemption for firms pursuing sustainability benefits.
- U.S. state marijuana markets feature substantial limits to competition.
- Switzerland said negative externalities from smoking can offset harms of a tobacco merger.
- "Chicken of Tomorrow" in Netherlands: can firms coordinate on sustainability practices (and higher prices).

# Restricting Consumption of a Negative Externality Good

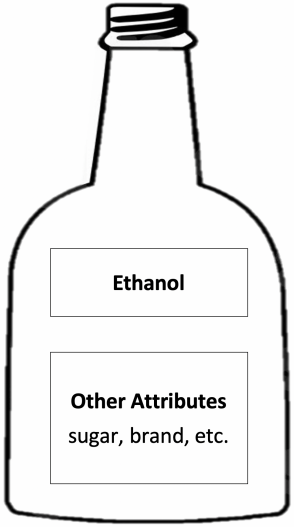
With a single product ("ethanol") there may not be an efficiency difference between market power and some tax.



# Sin Goods As Differentiated Products

- Intuition from homogenous goods suggests maybe market power is a second-best method to address the externality.
- Our work suggests this intuition is highly misleading.
  - Extremely sensitive to the assumption of homogenous products.
  - Market power can distort not only how much you consume but also which products you consume.



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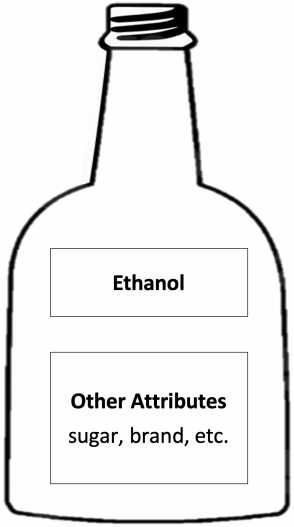
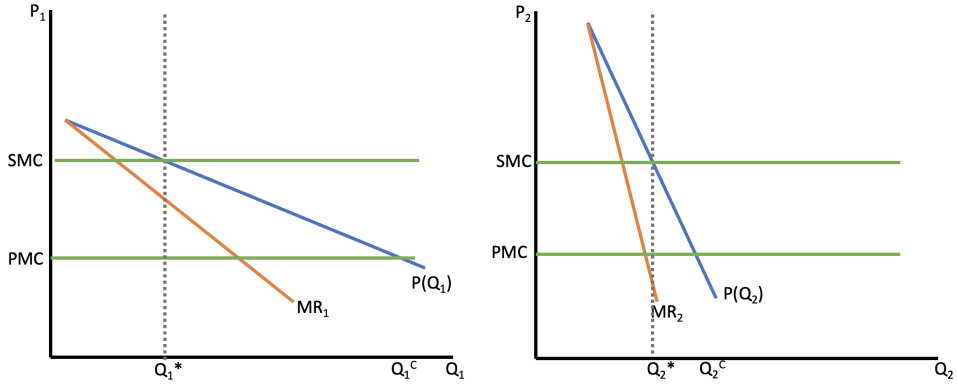


# With Differentiated Products ...

Products with the same marginal damage can bear very different markups.



# Legal Status of Post-and-Hold (PH)

PH has been subject to significant legal challenge.

- In 2019 the second circuit ruled that PH did not violate the Sherman Act despite leading to higher prices
  - We were not engaged by either side, but this paper was cited heavily, particularly in the dissenting opinion.
- Prior ruling by the ninth circuit disallowed key PH provisions.
- Circuit split opens the door for the Supreme Court to weigh in.

# Post and Hold

# How Does Post and Hold Work?

## Step 1: Price Schedule

- Wholesalers post a uniform (no discounts) price schedule. They must sell all products they stock at these prices to any licensed retailers.
- These prices are submitted to the regulator and printed in a book.

## Step 2: Price Posting

- The price book is circulated among wholesalers and retailers.
- **Lookback:** Adjustment period of 48 hours, during which wholesalers can adjust prices downwards (only), but can't beat the lowest price from a competing wholesaler in the first step.
- Prices are fixed for 30 days and distributed to retailers.

## Step 3: Sales Happen (30 Days Later)

# The Incentives of PH: A Simple Example

**2nd Step**

Assume retail firms always pick the cheapest wholesaler.

Assume 3 wholesalers with identical costs ($c$) and the following Step 1 prices:

$$P_1 = 19 \quad \rightarrow \quad [18, 19]$$

$$P_2 = 18 \quad \rightarrow \quad [18] \quad \rightarrow 18$$

$$P_3 = 20 \quad \rightarrow \quad [18, 20]$$

**1st Step**

If you know you get to match your lowest competitor, what price should you play in the 1st stage?

The highest price!

# The Incentives of PH: A Simple Example

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Your monopoly price

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# Nash Equilibrium and PH

In the paper we do some more sophisticated game theory:

- Any price between $[mc, p^m]$ is a Nash Equilibrium.
- Set your $p^m$ in first stage, and match lowest competitor price if $\underline{p} \geq mc$ in the second stage is the unique equilibrium that survives many refinements (iterated weak dominance, Pareto dominance, trembling hand, proper eq.).
- Iterated Weak Dominance works for the case with heterogeneous multi-product firms.
  - We also need to know the share each wholesaler sells of each product.
    - Can vary with products: 1/3 of Smirnoff Vodka, 1/5 of Captain Morgan.
    - Assumption: If you have 1/3 of Smirnoff, you retain 1/3 of Smirnoff at any price.

# Data

# Data

We assemble several data sources:

Price data (2007-)

- Wholesale and Manufacturer price data from price postings in CT Department of Consumer Protection.
  - Matching and digitizing these was a multi-year project
- Retail price data from Nielsen

Quantity data (2007-2013)

- Proprietary data from industry group (DISCUS) tracking every shipment from a member (around 70% of volume).
- Nielsen quantity data to capture sales of non-DISCUS products.
  - For example, Heaven Hill Distillery and Ketel One Vodka

Measure $Q$ in liters and $P$ in price per liter (avoid crazy policy implications!)

# Summary Statistics (by product, 24 quarters of data)

| | | | | | Manufacturer | | Wholesaler | | Retailer | |
|---|---|---|---|---|---|---|---|---|---|---|
| | # Obs | Share | Proof | % Flavored | Price | Margin | Price | Margin | Price | Margin |
| Gin | 59 | 7.40 | 87.07 | 0.02 | 11.15 | 3.01 | 16.21 | 3.79 | 18.72 | 2.34 |
| Rum | 147 | 17.50 | 73.63 | 0.21 | 10.17 | 2.60 | 15.08 | 3.65 | 17.60 | 2.52 |
| Tequila | 92 | 4.90 | 80.04 | 0.00 | 15.17 | 4.07 | 22.05 | 5.60 | 28.51 | 4.70 |
| Vodka | 208 | 44.80 | 79.19 | 0.15 | 10.73 | 2.79 | 15.42 | 3.42 | 18.05 | 2.54 |
| NA Whiskey | 127 | 15.20 | 81.80 | 0.00 | 11.59 | 3.18 | 17.41 | 4.54 | 20.08 | 2.76 |
| UK Whiskey | 102 | 10.20 | 80.79 | 0.00 | 18.36 | 4.51 | 25.04 | 5.41 | 28.15 | 3.12 |
| 750mL | 310 | 20.10 | 79.05 | 0.18 | 16.44 | 4.32 | 23.57 | 5.85 | 28.32 | 4.74 |
| 1L | 174 | 23.20 | 79.32 | 0.12 | 13.80 | 3.73 | 19.92 | 4.85 | 24.85 | 4.35 |
| 1.75L | 251 | 56.70 | 79.55 | 0.08 | 9.32 | 2.36 | 13.53 | 2.94 | 14.91 | 1.36 |
| All | 735 | 100.00 | 79.40 | 0.11 | 11.79 | 3.07 | 17.03 | 3.97 | 19.82 | 2.71 |

# Stylized Facts

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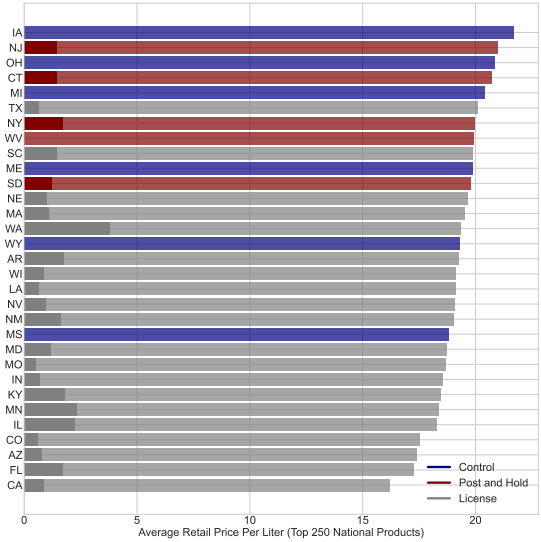
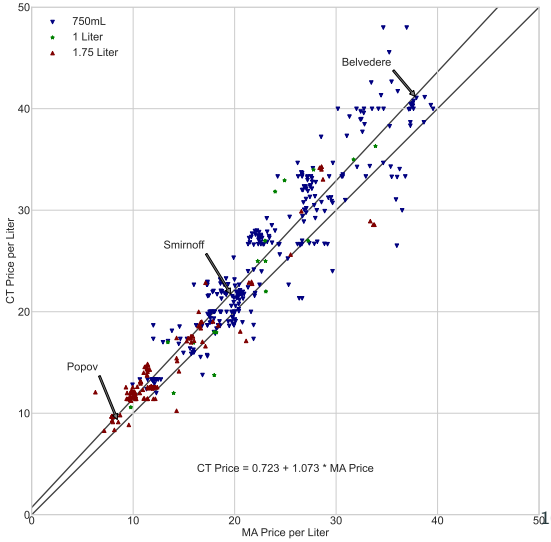
1. States with PH laws have higher prices (but not higher taxes).
2. Compared to Massachusetts, Connecticut has:
   - Higher Prices (especially at high end)
   - Lower Quality Bundle (as measured by national average prices)
3. Connecticut has pretty high wholesale markups (over manufacturer prices), especially on premium products.
4. Wholesale prices track each other and not explained by changes in manufacturer prices.

None of this should be a surprise, firms with market power price to elasticity.

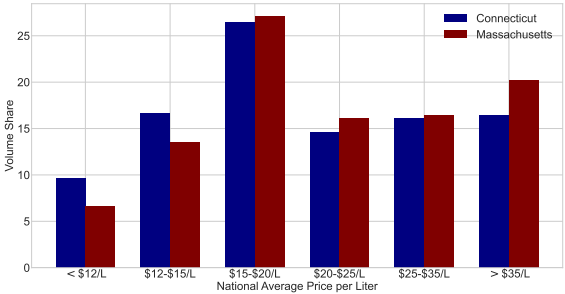
# Retail Prices are Higher in PH States



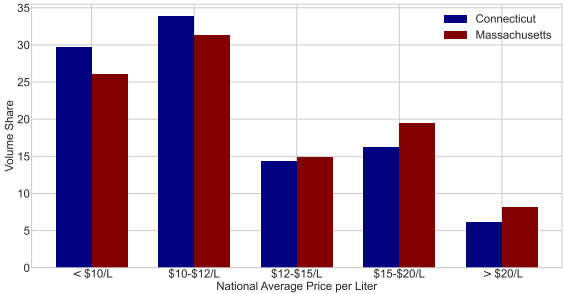



# CT Consumption Skews to Low-End Products

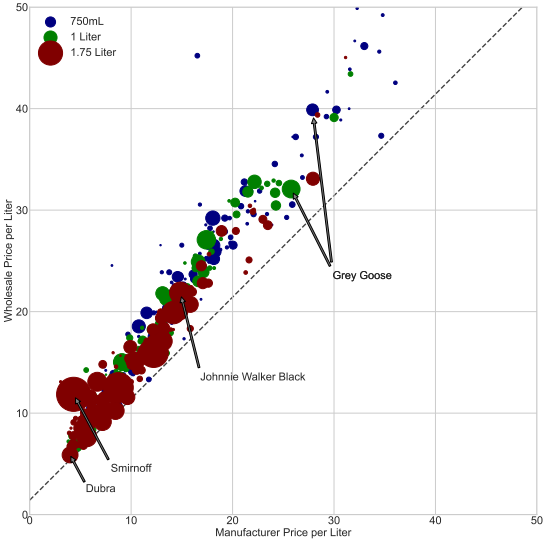
750mL Products




1750mL Products

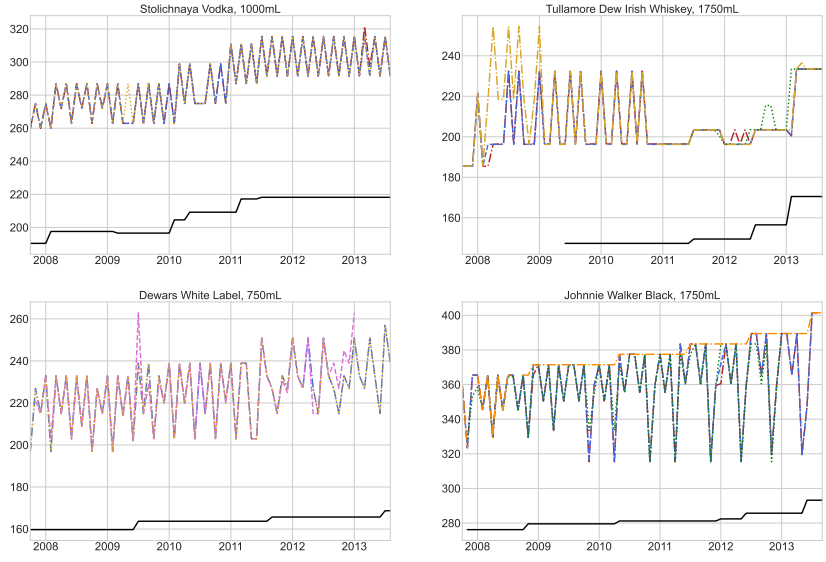


# Wholesale Margins Under Post and Hold




- Price Cost Margins (and Lerner Markups) are higher on premium products
- Markups on least expensive products (plastic bottle vodka) are very low.
- A planner seeking to minimize ethanol consumption would flatten these markups!
- Smirnoff (1.75L) is best seller (high markup / outlier).

# Wholesale Prices Closely Track Each Other



# Estimation and Results

# Demand Estimates

| $\Pi$ | Const | Price | 1750mL |
|---|---|---|---|
| Below $25k | 2.433 | -0.736 | -0.442 |
| | (0.287) | (0.056) | (0.083) |
| $25k-$45k | 0.243 | -0.720 | -0.258 |
| | (0.328) | (0.095) | (0.097) |
| $45k-$70k | 0.000 | -0.768 | 0.000 |
| | (0.000) | (0.094) | (0.000) |
| $70k-$100k | -0.960 | -1.032 | -0.275 |
| | (0.324) | (0.094) | (0.096) |
| Above $100k | -3.762 | -2.291 | -0.794 |
| | (0.262) | (0.074) | (0.077) |
| $\Sigma^2$ | | | |
| Const | 3.868 | 1.271 | |
| | (0.740) | (0.150) | |
| Price | 1.271 | 0.418 | |
| | (0.150) | (0.031) | |
| Nesting Parameter $\rho$ | | 0.27 | |
| | | (0.021) | |
| Fixed Effects | | Brand+Quarter | |

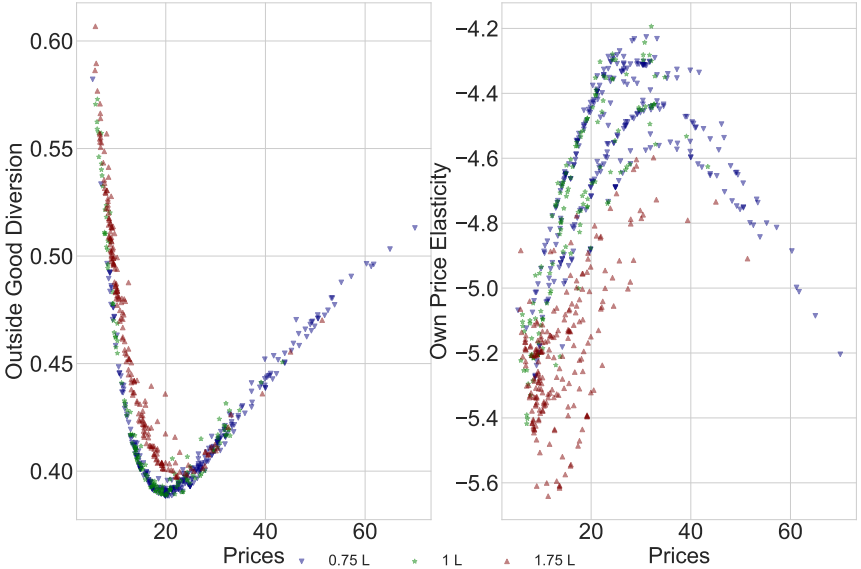
| Model Predictions | 25% | 50% | 75% |
|---|---|---|---|
| Own Elasticity | -5.072 | -4.772 | -4.484 |
| Aggregate Elasticity | -0.545 | -0.530 | -0.506 |
| Own Pass-Through | 1.293 | 1.329 | 1.368 |
| Observed Wholesale Markup (PH) | 0.188 | 0.233 | 0.276 |
| Predicted Wholesale Markup (PH) | 0.222 | 0.238 | 0.255 |

- Random Coefficients Nested Logit (RCNL): Substitution within category (Vodka/Tequila/Rum/Gin/Whiskey)
- Demographic Interactions w/ 5 income bins (matched to micro-moments)
- Correlated Normal Tastes: (Constant, Size, Price)
- Supply moments exploit observed upstream prices and tax change (ie: match observed markups).

$$\mathbb{E}[\omega_{jt}] = 0, \text{ with } \omega_{jt} = \left(p_{jt}^{w} - p_{jt}^{m} - \tau_{jt}\right) - \eta_{jt}\left(\theta_2\right).$$

- Pass-through consistent with estimates from our AEJ:Policy paper.

# Elasticity and Substitution to Outside Option



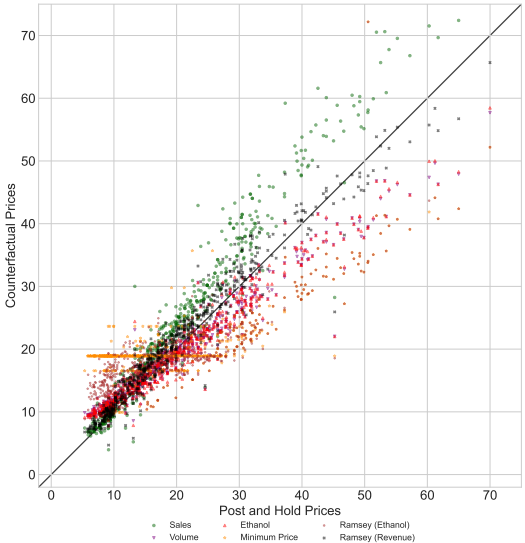
# Diversion Ratios for Selected Products

| | Median Price | % Substitution | | Median Price | % Substitution |
|---|---|---|---|---|---|
| Capt Morgan Spiced 1.75 L ($15.85) | | | Cuervo Gold 1.75 L ($18.33) | | |
| Bacardi Superior Lt Dry Rum 1.75 L | 12.52 | 7.59 | Cuervo Gold 1.0 L | 21.32 | 3.26 |
| Bacardi Superior Lt Dry Rum 1.0 L | 15.03 | 2.06 | Sauza Giro Tequila Gold 1.0 L | 8.83 | 2.15 |
| Smirnoff 1.75 L | 11.85 | 1.87 | Don Julio Silver 1.75 L | 22.81 | 2.12 |
| Bacardi Dark Rum 1.75 L | 12.52 | 1.57 | Smirnoff 1.75 L | 11.85 | 1.80 |
| Lady Bligh Spiced V Island Rum 1.75 L | 9.43 | 1.46 | Cuervo Gold 0.75 L | 23.44 | 1.44 |
| Woodford 0.75 L ($34.55) | | | Beefeater Gin 1.75 L ($17.09) | | |
| Jack Daniel Black Label 1.0 L | 27.08 | 4.25 | Tanqueray 1.75 L | 17.09 | 7.11 |
| Jack Daniel Black Label 1.75 L | 21.85 | 4.19 | Gordons 1.75 L | 11.19 | 2.55 |
| Jack Daniel Black Label 0.75 L | 29.21 | 2.66 | Seagrams Gin 1.75 L | 10.23 | 1.84 |
| Makers Mark 1.0 L | 32.79 | 2.46 | Smirnoff 1.75 L | 11.85 | 1.82 |
| Makers Mark 0.75 L | 31.88 | 1.53 | Gilbey Gin 1.75 L | 9.30 | 1.56 |
| Dubra Vdk Dom 80P 1.75 L ($5.88) | | | Belvedere Vodka 0.75 L ($30.55) | | |
| Popov Vodka 1.75 L | 7.66 | 3.88 | Absolut Vodka 1.75 L | 15.94 | 3.34 |
| Smirnoff 1.75 L | 11.85 | 2.79 | Grey Goose 1.0 L | 32.08 | 2.71 |
| Sobieski Poland 1.75 L | 9.09 | 1.93 | Smirnoff 1.75 L | 11.85 | 2.36 |
| Grays Peak Vdk Dom 1.75 L | 9.16 | 1.78 | Ktl1 Vdk Im 1.75 L | 20.71 | 1.49 |
| Bellows Vodka 1.0 L | 6.21 | 1.49 | Absolut Vodka 1.0 L | 24.91 | 1.47 |

# Design of Counterfactual Policies

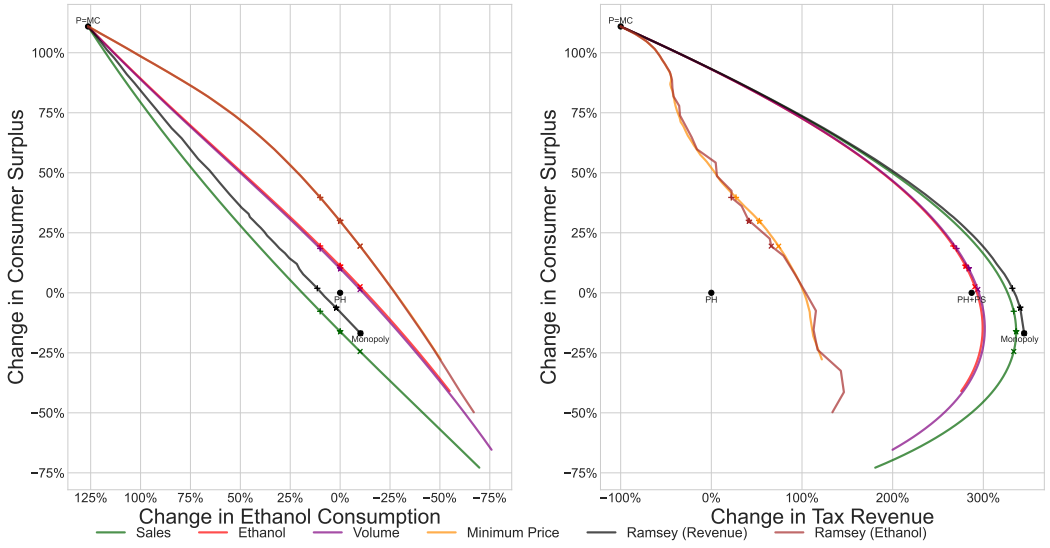
| Policy | Product Prices |
|---|---|
| Sales Tax | $p_{jt} = mc_{jt} \cdot (1 + \tau_r)$ |
| Volumetric Tax | $p_{jt} = mc_{jt} + \tau_v$ |
| Ethanol Tax | $p_{jt} = mc_{jt} + \tau_e \cdot ABV_{jt}$ |
| Minimum Unit Price | $p_{jt} = \max\{mc_{jt}, \tau_u \cdot ABV_{jt}\}$ |
| Ramsey-Revenue | $\mathbf{p}(\overline{R}) = \arg\max_{\mathbf{p} \geq \mathbf{mc}} CS(\mathbf{p})$ s.t. $(\mathbf{p} - \mathbf{mc}) \cdot \mathbf{q}(\mathbf{p}) > \overline{R}$ |
| Ramsey-Ethanol | $\mathbf{p}(\overline{E}) = \arg\max_{\mathbf{p} \geq \mathbf{mc}} CS(\mathbf{p})$ s.t. $ABV \cdot \mathbf{q}(\mathbf{p}) \leq \overline{E}$ |
| Monopoly | $\mathbf{p} = \arg\max_{\mathbf{p}} (\mathbf{p} - \mathbf{mc}) \cdot \mathbf{q}(\mathbf{p})$ |

# Prices Under Counterfactual Policies




- Sales Taxes: lower intercept, steeper slope
- Volume/Ethanol: higher intercept, flatter slope (very similar for most products)
- Minimum Price and Maximizing CS w/ Ethanol constraint raise prices at the bottom, and set $P \approx MC$ above some value

# Welfare of Counterfactual Policies



# How much can we reduce Ethanol consumption?

| | No Change to Ethanol | | | No Change to Overall CS | | |
|---|---|---|---|---|---|---|
| | Base | $wc = 1$ | $p^m$ | Base | $wc = 1$ | $p^m$ |
| % Δ Ethanol | 0.00 | -0.00 | -0.00 | -12.87 | -12.62 | -11.97 |
| % Δ Tax Revenue | 280.41 | 211.16 | 248.82 | 292.99 | 232.17 | 256.15 |
| % Δ Manufacturer Profit | 21.47 | 21.24 | 39.57 | 8.94 | 8.97 | 29.34 |
| % Δ Total CS | 11.18 | 10.94 | 10.09 | -0.00 | 0.00 | 0.00 |
| % Δ CS by Income | | | | | | |
| Below $25k | 1.23 | 0.79 | 1.31 | -11.82 | -12.00 | -10.73 |
| $25k-$45k | 0.90 | 0.25 | 0.56 | -18.57 | -18.76 | -17.44 |
| $45k-$70k | 0.36 | -0.16 | -0.64 | -17.91 | -18.02 | -17.41 |
| $70k-$100k | 5.37 | 4.83 | 4.45 | -12.59 | -12.71 | -11.97 |
| Above $100k | 16.73 | 16.64 | 15.21 | 8.25 | 8.34 | 7.72 |
| Tax per Liter | 5.48 | 4.48 | 5.02 | 6.50 | 5.47 | 5.83 |

# Discussion

Did we need this machinery to know PH is inefficient?

1. Estimating demand parameters (by matching observed markups) reveals which product prices to raise to most efficiently reduce alcohol consumption.
    - If we think problem drinkers disproportionately consumer low quality products, this is even more important.
2. Can't uncover the distributional impacts of policy alternatives without understanding the price sensitivity and allocation of consumers across products.

# Conclusion

- Post and Hold is a pretty bad way to restrict alcohol consumption
  - Obviously giving revenue to private firms is a major limitation
  - Free Lunch? Can restrict alcohol consumption by more than 8%, increase Consumer Surplus and nearly quadruple tax revenues (at the cost of wholesalers).
- Simple tax instruments do pretty well relative to product-specific (Ramsey) benchmarks
- Allowing for wholesale marginal costs and endogenous manufacturer responses reduces tax revenue but preserves effectiveness of simple tax instruments.

# Thanks