

Estimating the Effects of Deregulation in the Ontario Wine Retail Market

Victor Aguirregabiria, Daniel Ershov, Junichi Suzuki

University of Toronto

April 20, 2016

Syracuse University

Motivation

- Good number of countries and states where government owns and operates retail liquor stores.
 - 9 Canadian prov.; 18 US states; Nordic countries except Denmark
- Different considerations have motivated this strong form of regulation:
 - Direct control to limit alcohol consumption;
 - Contribution to the government revenue;
 - Protection of domestic producers
- Standard arguments for monopoly inefficiency still apply:
 - A public monopoly may increase prices and limit product variety beyond what is required to account for the negative externalities.
 - It may be less efficient than taxing a more competitive market.

Motivation [2]

- To illuminate this complex policy debate, it is important to have **empirical studies that evaluate the effects** that different regulatory environments have on: consumption, consumer welfare, firms' profits, and government revenue.
- The main goal of this paper is to provide this type of empirical evaluation for the **wine retail market of Ontario, Canada**.

Our Approach

- Most previous empirical studies: reduced form methodology comparing jurisdictions with a public monopoly and jurisdictions with free entry market.
 - Limitations due to heterogeneity across jurisdictions and endogeneity of regulatory regimes.
- We use a **structural approach** for the estimation of **consumer demand and firm costs**, and use this estimated structure to construct equilibrium **outcomes under counterfactual regulatory scenarios** for competition and pricing policies.
- Ontario: existence of some competition between state-owned firm and 2 private firms help us to construct counterfactual scenarios.

Our Approach [2]

- Our structural approach is in the spirit of recent work by Seim and Waldfogel (AER, 2013) and Miravete, Seim, and Thurk (2014) for the Pennsylvania liquor monopoly.
- Main differences between these previous studies and our paper:
 - They study number and location of stores, while we concentrate in pricing and product assortment decisions;
 - They evaluate the effect of going from pure monopoly to free entry, while we considerate more intermediate forms of deregulation.

Outline

1. **Ontario wine retail market and regulation**
2. **Data and Descriptive Evidence**
3. **Model**
4. **Estimation and Preliminary Empirical Results**
5. **Counterfactual Experiments**

Ontario wine retail market and regulation

- Ontario wine retail market can be characterized as a triopoly.
- State-owned LCBO: 640 stores; 60% share of Ontario wines; monopoly of foreign wines.
- Privately owned Wine Rack (164 stores) and Wine Shop (101 stores)
- These private companies can sell only their own brands of wine (sold also at LCBO stores)

Ontario wine retail market: Pricing

- LCBO chooses the retail price of every liquor product.
- Uniform pricing at every store (LCBO or not)
- Constant markup across widely defined product categories.
 - Markup for all Ontario wines: 65.5%
 - Markup for all Foreign wines: 71.5%

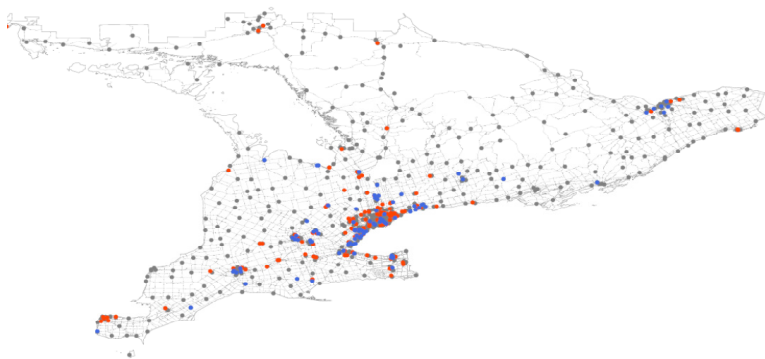
Data

- Data from LCBO (through a Free of Information request) on sales, inventories, retail and wholesale prices, detailed product characteristics, at the store-SKU-day level.

634 stores; 16,249 SKUs; 24 months; approx 250 million obs

- For this paper we aggregate data at the store-SKU-month level.
- Exact geographic location of every store of LCBO, WR, and WS.
- Consumer demographics at the census tract level.

Stores Geographic Location: Ontario



Stores Geographic Location: Great Toronto Area



Stores Geographic Location: Great Toronto Area



Descriptive Stats: # Products and Monthly Revenue

| | | |
|---------------------------------|-------------|------------------|
| Foreign | 14,016 SKUs | (CAD 77 million) |
| All Ontario | 2,233 SKUs | (CAD 80 million) |
| Wine Rack products sold at LCBO | 167 SKUs | (CAD 13 million) |
| Wine Shop products sold at LCBO | 116 SKUs | (CAD 10 million) |

Note: Total number of SKUs = 16,249; Number of stores = 634.

Number of stores selling a SKU

| | Mean | Median | Pctile 10 | Pctile 90 |
|---------------------------------|------|--------|-----------|-----------|
| Foreign | 47 | 8 | 1 | 153 |
| All Ontario | 173 | 145 | 2 | 417 |
| Wine Rack products sold at LCBO | 259 | 259 | 16 | 512 |
| Wine Shop products sold at LCBO | 287 | 299 | 43 | 466 |

Note: Total number of SKUs = 16,249; Number of stores = 634.

Prices (CAD per 750 ml bottle)

| | Mean | Median | Pctile 10 | Pctile 90 |
|---------------------------------|-------|--------|-----------|-----------|
| Foreign | 44.30 | 22.95 | 12.75 | 94.00 |
| All Ontario | 18.60 | 13.05 | 7.50 | 30.00 |
| Wine Rack products sold at LCBO | 16.50 | 9.95 | 6.55 | 32.40 |
| Wine Shop products sold at LCBO | 12.51 | 8.98 | 6.48 | 18.95 |

Note: Total number of SKUs = 16,249; Number of stores = 634.

Monthly sales per SKU (in 750 ml bottles)

| | Mean | Median | Pctile 10 | Pctile 90 |
|---------------------------------|--------|--------|-----------|-----------|
| Foreign | 932 | 29 | 1 | 1,978 |
| All Ontario | 5,400 | 1,228 | 5 | 14,066 |
| Wine Rack products sold at LCBO | 10,669 | 3,946 | 42 | 32,698 |
| Wine Shop products sold at LCBO | 11,900 | 5,455 | 164 | 29,002 |

Note: Total number of SKUs = 16,249; Number of stores = 634.

Model and Counterfactuals

- Effects on Consumption, Consumer Surplus, profits, and government revenue of **eliminating the private retailers WR and WS**.
- Counterfactual can be interpreted as effect of going from a pure state-owned monopoly to the limited competition in Ontario regime.
- For this evaluation, it is key to estimate the **degree of spatial differentiation** and the **degree of product differentiation between Ontario and Foreign wines**.
- For this purpose, we propose and estimate a demand system with spatial and product differentiation.

Demand Model: Basics

- Consumers live in L home addresses (i.e., centroids of census tracts) indexed by ℓ .
- Each consumer has a unit demand per month (1 bottle).
- A consumer consideration set consists of all the stores within a 3km radius (10km for rural locations) around the home address.
- Within this set, the consumer chooses the (store, SKU) pair that maximizes his (indirect) utility net of price and transportation costs.

Demand Model: Utility

- Utility of consumer i buying SKU j at store s :

$$u_{ijs} = X_j \beta_x - \alpha p_j + \zeta_j - \gamma d_{is} + Z_s \beta_z + \omega_s + \varepsilon_{ijs}$$

X_j = Product characteristics; p_j = Price; ζ_j = Unobserved products char;

d_{is} = Distance from consumer to store; Z_s = Store characteristics;

ω_s = Unobservable store characteristics.

- The unobservable ε_{ijs} has a Nested Logit structure with three nests: store, group, and SKU:

$$\varepsilon_{ijs} = \sigma_1 \varepsilon_{ijs}^{(1)} + \sigma_2 \varepsilon_{ig(j)s}^{(2)} + \sigma_3 \varepsilon_{is}^{(3)}$$

Demand Model: Shares

- We observed quantities q_{jst} for every LCBO store-SKU-month.
- Model implies that:

$$q_{js} = \sum_{\ell=1}^L H_{\ell} \mathbf{1}\{s \in R(\ell)\} \mathbb{P}_{\ell js}$$

where $\mathbb{P}_{\ell js}$ is the probability that a consumer living in address ℓ decides to buy product j at store s .

- And

$$\mathbb{P}_{\ell js} = \mathbb{P}_{\ell s} \mathbb{P}_{g(j)|s} \mathbb{P}_{j|s,g(j)}$$

where $\mathbb{P}_{\ell s}$, $\mathbb{P}_{g(j)|s}$, and $\mathbb{P}_{j|s,g(j)}$ have a logit structure in terms of different "inclusive values"

Demand Model: Within-store shares

- Within-store, within-group

$$\mathbb{P}_{j|s,g(j)} = \frac{a_{js} \exp\left\{\frac{\delta_j}{\sigma_1}\right\}}{\sum_{k \in g(j)} a_{ks} \exp\left\{\frac{\delta_k}{\sigma_1}\right\}}$$

where $a_{js} \in \{0, 1\}$ is a binary variable that represents the event "product j is in the assortment of products in store s ".

- Within-store, Between-group shares:

$$\mathbb{P}_{g|s} = \frac{\exp\left\{\frac{\sigma_1}{\sigma_2} I_{gs}^{(1)}\right\}}{\sum_{g'=1}^G \exp\left\{\frac{\sigma_1}{\sigma_2} I_{g's}^{(1)}\right\}}$$

where $I_{gs}^{(1)}$ is the level-1 inclusive value:

$$I_{gs}^{(1)} = \ln \left(\sum_{i \in g} a_{is} \exp\left\{\frac{\delta_i}{\sigma_1}\right\} \right)$$

Demand Model: Between stores shares

- Share:

$$\mathbb{P}_{\ell s} = \frac{\exp \left\{ \frac{1}{\sigma_3} \left[\sigma_2 I_s^{(2)} + Z_s \beta_z + \gamma d_{\ell s} \right] \right\}}{1 + \sum_{s' \in R(\ell)} \exp \left\{ \frac{1}{\sigma_3} \left[\sigma_2 I_{s'}^{(2)} + Z_{s'} \beta_z + \gamma d_{\ell s'} \right] \right\}}$$

where $I_s^{(2)}$ is the level-2 inclusive value:

$$I_s^{(2)} = \ln \left(\sum_{g=1}^G \exp \left\{ \frac{\sigma_1}{\sigma_2} I_{gs}^{(1)} \right\} \right)$$

Estimating Demand: Step 1:

- For LCBO stores, we observe the conditional shares $\mathbb{P}_{j|s,g,t}$ and $\mathbb{P}_{g|s,t}$.

$$\mathbb{P}_{g|s,t} = \frac{\sum_{j \in g} q_{jst}}{\sum_{g'=1}^G \sum_{j \in g'} q_{jst}} \quad \text{and} \quad \mathbb{P}_{j|s,g,t} = \frac{q_{jst}}{\sum_{k \in g} q_{kst}}$$

- The model implies:

$$\begin{aligned} \ln \left(\mathbb{P}_{j|s,g(j),t} \right) - \ln \left(\mathbb{P}_{1|s,g(1),t} \right) &= [X_j - X_1] \tilde{\beta}_x + (-\tilde{\alpha}) [p_{jt} - p_{1t}] \\ &+ (-\tilde{\sigma}_2) \left[\ln \left(\mathbb{P}_{g(j)|s,t} \right) - \ln \left(\mathbb{P}_{g(1)|s,t} \right) \right] + \zeta_{jst}^* \end{aligned}$$

- To deal with the endogeneity of prices and group-shares, we have implemented two IV approaches:
 - BLP: using characteristics of other products as instruments;
 - Using prices and shares at $t - 2$ and before as instruments in the equation in first-differences.

Step 1: Estimation Results

| Demand Estimation. Step 1. Product Choice | | | |
|--|------------------|------------------|----------------------|
| Parameter (Variable) | (1) OLS | (2) BLP-IV | (3) Arellano-Bond |
| $\tilde{\alpha}$ (- Price) | 0.115 (0.001)*** | 0.407 (0.001)*** | 0.378 (0.002)*** |
| $\tilde{\sigma}_2$ | 1.674 (0.003)*** | 1.500 (0.011)*** | 1.864 (0.050)*** |
| $\tilde{\beta}_{alcohol}$ | 0.169 (0.001)*** | 0.314 (0.001)*** | 0.299 (0.003)*** |
| Observations | 5,117,154 | 5,117,154 | 5,117,154 |
| Time FEs | YES | YES | YES |
| Store FEs | YES | YES | YES |

Step 1: Elasticities

- At the median values of prices and characteristics:

Within-group own-price elasticity = -5.17

Within-store elasticity for Ontario wines = -4.24

Within-store elasticity for Foreign wines = -2.21

Within-store cross-elasticity = 1.81

Estimating Demand: Step 2 (Store choice)

- At this estimation step, we should deal with three main issues:
 - Shares $\mathbb{P}_{\ell st}$ are unobserved. We observe $q_{st} = \sum_{\ell=1}^L H_{\ell}$
 - $1\{s \in R(\ell)\} \mathbb{P}_{\ell st}$
 - For WR and WS, we do not observe q_{st} .
 - Endogeneity of Inclusive values, and of WR and WS store locations.
- Our approach:
 - Random-coefficients-like approach
 - We know product assortment of WR and WS stores. We can construct their inclusive values.
 - Arellano-Bond method/instruments

Step 2: Estimation Results

| Demand Estimation. Step 2. Store Choice | | |
|--|------------------|------------------|
| Parameter (Variable) | (1) OLS | (2) GMM |
| σ_2/σ_3 (Store Inclusive Value) | 0.931 (0.087)*** | 0.767 (0.103)*** |
| γ (\$ per Km) | 0.800 (0.122)*** | 0.750 (0.290)*** |
| Observations | 4,841 | 4,841 |
| R-square | 0.66 | |
| Time Fixed Effects | YES | YES |
| Store Fixed Effects | YES | YES |

Step 1: Elasticities

- At the median values of prices and characteristics:

Aggregate price-elasticity demand of wine: -1.27

% change in LCBO store demand due to presence of WR or WS stores: -5.7%

% change in LCBO store demand Ontario wine due to presence of WR or WS stores: -9.8%

Counterfactuals: Sales and Market shares

Counterfactual Sales and Market Shares

| | ON Share | WR/WS Share | % Δ Sales Relative to Baseline |
|---------------------|----------|-------------|--|
| LCBO Monopoly | 43.3% | 0% | - 5.1% |
| Baseline Estimates | 52.2% | 15.9% | - |
| More WR/WS Products | 43.5% | 23.8% | + 0.2% |

Note: Actual WR/WS market share is 14.8%.

Counterfactuals

**Counterfactuals:
Profits, Gov. Revenue, Consumer Surplus**

| | LCBO Profits (\$m/month) | WR/WS Profits (\$m/month) | Gov't Revenues (\$m/month) | Consumer Surplus (% Δ) |
|---------------------|--------------------------------|---------------------------------|----------------------------------|--------------------------------------|
| LCBO Monopoly | 49.7 | 0 | 63.6 | - 5.4 |
| Baseline | 44.1 | 6.7 | 58.5 | - |
| More WR/WS Products | 40.0 | 10.3 | 54.4 | + 2.8 |

Note: Prices and store locations are constant throughout.

Summary and Conclusions

- We propose and implement an approach to measure welfare effects of deregulating alcohol retail markets with state-owned firms.
- Ontario regulatory structure provides a helpful framework.
- We find substantial consumer transportation costs: this generates important welfare gains from the entry of private firms.
- **Monopoly** \rightarrow **entry of WR-WS**: increase in CS and Profits and Total welfare (despite reduction in gov't revenue).
- **Expansion of WR-WS products** \rightarrow Additional gains in CS and total welfare (despite reduction in profits and gov't revenue).