

Market Structure & Product Variety: Evidence from a Natural Experiment in Liquor Licensure

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Why study Washington's liquor markets?

- ▶ **Privatization of liquor sales in 2012 creates a natural experiment in market configuration**
 - ▶ Compare outcomes in “treatment” and “control” markets that have different numbers of firms
 - ▶ The simplicity of the strategy lets us explore more outcomes than is typical for this literature
 - ▶ Not only prices and quantities, but also product offerings and consumption across relevant subpopulations
- ▶ *Main result: in concentrated markets, marginal firm increases consumption and product variety, but does not change prices*
- ▶ Liquor sales are heavily regulated across the US
 - ▶ Substantial variation across states
 - ▶ Public policy concern about negative externalities

Related Literature

- ▶ Empirically challenging question: market structure is endogenous, unobserved information structure
 - ▶ Bresnahan and Reiss (1991), Berry (1992), Barwick (2008), Ciliberto and Tamer (2009), Magnolfi and Roncoroni (2017)
- ▶ In multi-product settings with market power, even theoretical predictions are ambiguous
 - ▶ Mussa and Rosen (1978), Spulber (1989), Champsaur and Rochet (1989), Borenstein and Rose (1984), Rochet and Stole (2002), Stole (2007)
- ▶ Empirics of product variety:
 - ▶ Berry and Waldfogel (2001), McManus (2007), Sweeting (2010, 2013), Fan (2013), Eizenberg (2014), Wollman (2017)
- ▶ Empirical studies of liquor markets:
 - ▶ Seim and Waldfogel (2013), Conlon and Rao (2016), Seo (2016), Miravete, Seim and Thurk (2017)

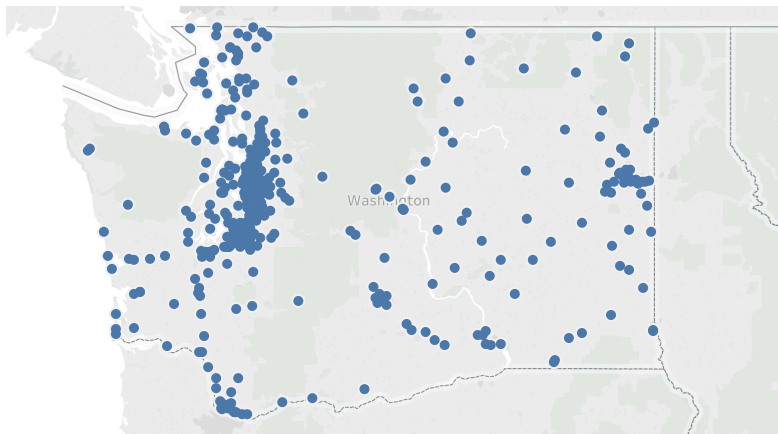
Setting: Privatization of Liquor Sales in WA

- ▶ 1933: Prohibition ends \Rightarrow 18 Alcohol Beverage Control (ABC) states
- ▶ 2012: Washington becomes the first ABC state to privatize, due to a ballot initiative
- ▶ Prior to liberalization:
 - ▶ State ran purchasing, distribution, and retail
 - ▶ Uniform markups (51.9%) across products and locations
 - ▶ Uniform and comprehensive product offerings
 - ▶ 20.5% alcohol sales tax and \$3.7708 per liter tax
 - ▶ 328 stores across the state

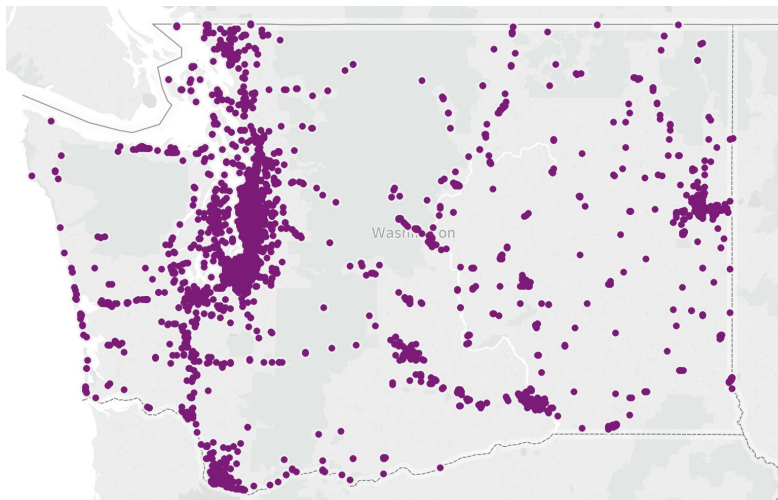
After Privatization

- ▶ Auction or close state stores
- ▶ New fees: 10% on distributors and 17% on retailers
 - ▶ On top of existing taxes
- ▶ Retail outlets larger than 10,000ft² are eligible for a license
 - ▶ Regulators want to restrict liquor availability
 - ▶ Costco's role: funded a \$20M+ campaign for the ballot initiative
- ▶ Exception: legacy state stores

Pre-liberalization Outlet Locations



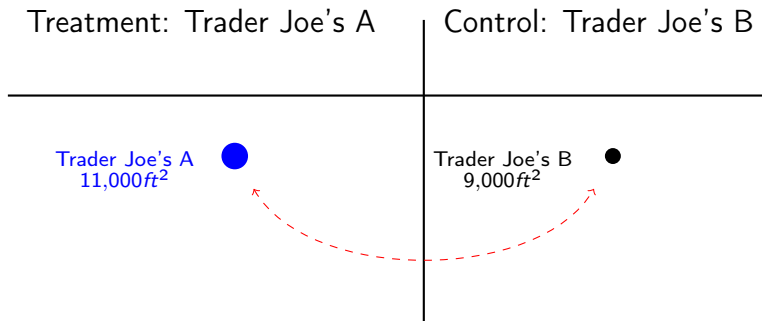
Post-liberalization Outlet Locations



Roadmap

1. Data sources
2. Does the regulation bind?
 - ▶ Effect of licensure threshold on entry decision

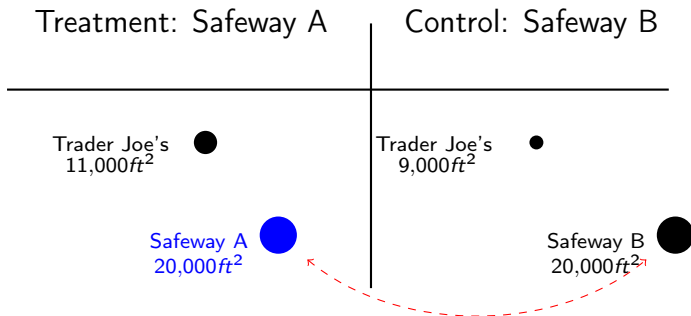
Does the Regulation Bind?



Roadmap

1. Data sources
2. Does the regulation bind?
 - ▶ Effect of licensure threshold on entry decision
3. Are there strategic effects?
 - ▶ Effect of rivals' license eligibility on own entry decision

Are there strategic effects?

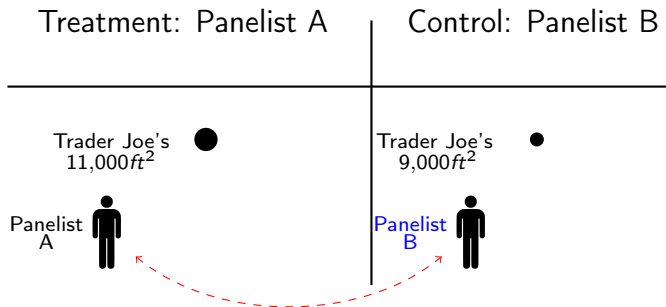


- ▶ Do marginally eligible firms crowd out bigger rivals?
- ▶ How localized is competition?

Roadmap

1. Data sources
2. Does the regulation bind?
 - ▶ Effect of licensure threshold on entry decision
3. Are there strategic effects?
 - ▶ Effect of rivals' license eligibility on own entry decision
4. How are individual purchases affected?
 - ▶ Effect of an additional retailer on prices, quantities, product variety
 - ▶ Across subgroups: non-drinkers, moderate drinkers, heavy drinkers

How are individual purchases affected?



Data Sources - Washington State Liquor Control Board

Before privatization:

- ▶ Monthly price lists (uniform markup lets us back out acquisition cost)
- ▶ Beer/wine licensure

After privatization:

- ▶ Beer, wine and liquor licensure: names, addresses, entry/exit dates (off-premise sales)

Potential Entry Pool: 2011 Beer/Wine Licensees

Summary Statistics for Beer, Wine and Liquor Licensure	
<u>Prior to 2012: Beer and wine licensed retailers</u>	4,978
Chain licensees	2,098
<u>At Liberalization: Existing Beer/Wine Licensees</u>	4,977
Liquor-licensed	1,075
Chain liquor licensees	924
<u>At Liberalization: Entrants</u>	570
Liquor-licensed	57
Beer and wine licensed	558
Chain stores	130

Data Sources - Nielsen Panelist Dataset

- ▶ 2,700 households report all their shopping trips
- ▶ Product-level prices/quantities
 - ▶ From spirits purchases before and after privatization
- ▶ Panelist Zip 5
- ▶ Focus on panelists who live in treatment/control zip codes
 - ▶ with at least one 2011 beer/wine licensees sized between 5,000-15,000ft².

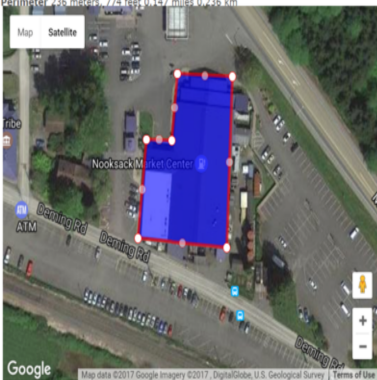
Data Sources - Google Maps

- ▶ Store geolocation & distances across stores
- ▶ Use Google Maps Developers' Square Footage Calculator

Address: 5047 MOUNT BAKER HWY DEMING
Area 0 meters², 0 feet² 0.00 acres 0.000 miles² 0.000 km²
Perimeter 0 meters, 0 feet 0.000 miles 0.000 km



Address: 5047 MOUNT BAKER HWY DEMING
Area 2943 meters², **31680 feet²**, 0.73 acres 0.001 miles² 0.003 km²
Perimeter 236 meters, 774 feet 0.147 miles 0.236 km



Data Sources - Google Maps (cont.)

- ▶ Hire workers on Amazon Mechanical Turk to collect square footage
- ▶ 5,578 stores, 10 cents per store, ≥ 2 workers per store
- ▶ Qualification tests & accuracy bonuses

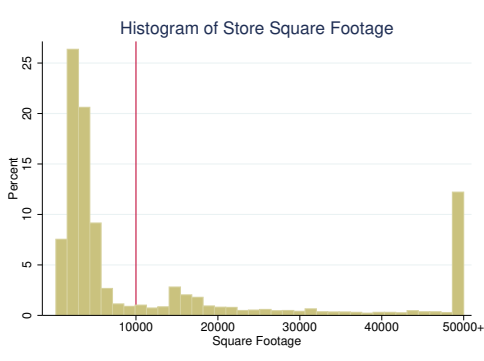
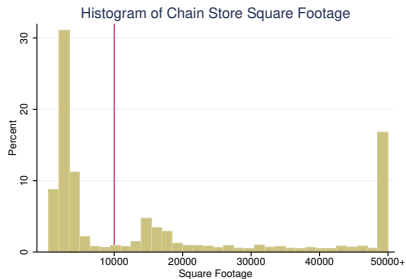
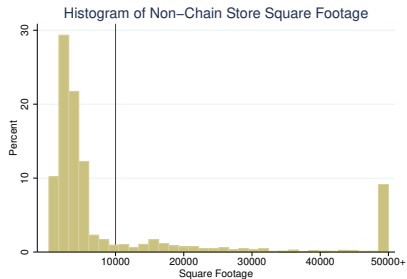


Figure: All Stores

Chains vs. Independent Stores



(a) Chain Stores



(b) Independent Stores

Go to chain sizes

License Eligibility and Entry

Is there a differential entry probability at the cutoff?

- ▶ Licensure may not bind, barely eligible firms do not find it profitable to enter

Estimating equation:

$$1 [\text{Has Liquor License}_s] = \alpha_0 + \alpha_1 \cdot 1 [SqFt_s \geq 10,000]_s + \alpha_2 \cdot SqFt_s + \alpha_3 \cdot 1 [SqFt_s \geq 10,000]_s \cdot SqFt_s + \epsilon_s$$

- ▶ Relevant sample: beer/wine selling outlets, prior to 2012
- ▶ Concerns:
 - ▶ Covariate Balance
 - ▶ Expansion to the cutoff
 - ▶ Differential renovation probabilities

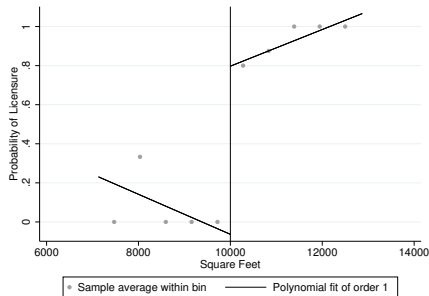
▶ Map of locations

License Eligibility and Entry - Results

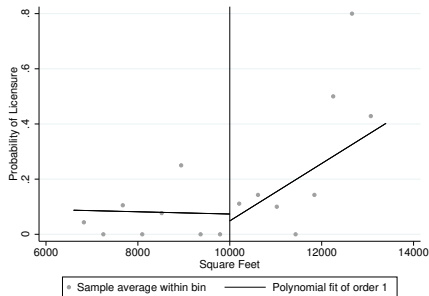
RD Estimates of the Effect of Licensure on Entry				
	(1)	(2)	(3)	(4)
	All Stores	Independent Stores	Chain Stores	Large Chains (10+ Stores)
Licensure Discontinuity	0.38*** (0.119)	0.12 (0.141)	0.80*** (0.187)	0.79*** (0.189)
Observations	4605	2599	2006	1870
Effective Observations – Below	94	53	51	14
Effective Observations – Above	84	54	42	24
Bandwidth	2721.9	2405.2	2293.2	1960.6
McCrary Test P-Value	0.379	0.620	0.545	0.981

► MSE Optimal

RD Plots



(a) Chains

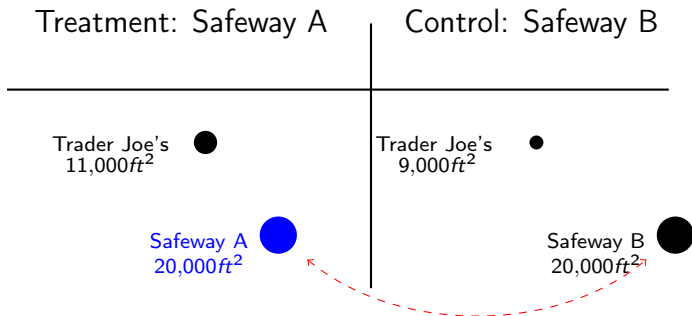


(b) Independents

License Eligibility and Sales - Results

RD Estimates of the Effect of Licensure and License-Eligibility on Liquor Sales				
	(1)	(2)	(3)	(4)
Panel A: Licensure and Sales				
	All Stores	Independent Stores	Chain Stores	Large Chains (10+ Stores)
Licensure	99,929** (41,700)	-	86,411** (35,776)	87,307** (35,294)
Observations	4605	-	2006	1973
Effective Observations – Below	101	-	27	24
Effective Observations – Above	88	-	47	49
Bandwidth	2914.9	-	3174.2	3297.4
Panel B: License-Eligibility and Sales				
	All Stores	Independent Stores	Chain Stores	Large Chains (10+ Stores)
License-Eligibility	39,437** (19,588)	6,000 (17,051)	86,440** (34,966)	85,721** (35,063)
Observations	4605	2599	2006	1973
Effective Observations – Below	91	92	16	14
Effective Observations – Above	84	53	27	25
Bandwidth	2634.2	3188.0	2232.3	2186.8

Neighbors' License Eligibility and Entry



- ▶ Do marginally eligible firms crowd out bigger rivals?
- ▶ How localized is competition?

Neighbors' License Eligibility and Entry

Estimating equation:

$$\begin{aligned} 1 [\text{Has Liquor License}]_s = & \alpha_0 + \alpha_1 \cdot 1 [\text{Is Chain}]_s + \alpha_2 \cdot N_s^{d,10-15} \\ & + \alpha_3 \cdot 1 [\text{Is Chain}]_s \cdot N_s^{d,10-15} + \sum_k \lambda_k^d \cdot 1 [N_s^{d,5-15} = k] + \epsilon_s \end{aligned}$$

- ▶ $N_s^{d,5-15}$: stores within distance d from store s sized 5,000-15,000ft²

Concerns: **Covariate Balance**

Distance-Based Neighbor Entry Effects

Effect of the License Eligibility of Nearby Stores on Own Entry Decisions										
Bandwidth = 5000 square feet										
Distance to Store (miles):		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Independents	# of Marginally License Eligible Neighbors	-0.079 (0.143)	-0.197** (0.077)	-0.166** (0.067)	-0.158*** (0.046)	-0.102** (0.048)	-0.093*** (0.036)	-0.048 (0.041)	-0.059* (0.035)	-0.020 (0.034)
	Baseline Entry Probability	0.315*** (0.025)	0.329*** (0.025)	0.335*** (0.026)	0.344*** (0.027)	0.339*** (0.027)	0.345*** (0.027)	0.335*** (0.028)	0.341*** (0.029)	0.331*** (0.030)
Chains	# of Marginally License Eligible Neighbors	0.099* (0.057)	0.020 (0.036)	0.003 (0.036)	-0.005 (0.032)	-0.003 (0.027)	0.000 (0.022)	0.002 (0.022)	0.014 (0.020)	0.013 (0.018)
	Baseline Entry Probability	0.947*** (0.008)	0.950*** (0.008)	0.951*** (0.009)	0.953*** (0.009)	0.952*** (0.009)	0.951*** (0.010)	0.950*** (0.010)	0.946*** (0.011)	0.944*** (0.012)
# of Neighbors in the Bandwidth FE		x	x	x	x	x	x	x	x	x
N		1163	1163	1163	1163	1163	1163	1163	1163	1163

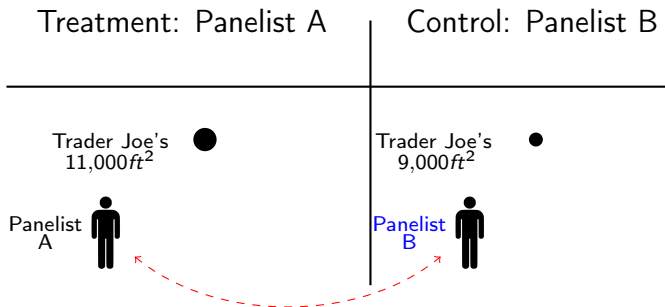
► n-Nearest Neighbor Spec

Distance-Based Neighbor Sales Effects

Effect of the License Eligibility of Nearby Stores on Own Sales of Liquor											
Bandwidth = 5000 square feet											
Distance to Store (miles):		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Independents	# of Marginally License Eligible Neighbors	72,625** (33,324)	19,244 (20,035)	-5,373 (19,005)	11,002 (18,745)	11,606 (21,872)	8,966 (14,797)	21,304 (18,753)	14,271 (13,749)	27,708** (12,496)	11,153 (11,090)
	Baseline Sales	30,136*** (4,572)	30,750*** (4,993)	32,650*** (5,460)	31,455*** (4,899)	30,176*** (5,218)	30,857*** (4,949)	26,445*** (5,880)	28,020*** (5,547)	22,850*** (5,790)	27,452*** (6,151)
Chains	# of Marginally License Eligible Neighbors	109,852*** (34,819)	50,221* (25,931)	45,401* (24,169)	41,184* (24,001)	62,326*** (22,725)	44,217** (19,235)	43,648** (17,780)	35,466** (15,155)	40,155*** (14,307)	34,268** (13,664)
	Baseline Sales	247,366*** (9,504)	248,089*** (9,817)	247,044*** (10,176)	245,338*** (10,363)	239,653*** (10,004)	240,702*** (10,250)	238,001*** (10,433)	238,467*** (10,799)	232,591*** (9,802)	234,445*** (10,100)
# of Neighbors in the Bandwidth FE		x	x	x	x	x	x	x	x	x	x
N		1163	1163	1163	1163	1163	1163	1163	1163	1163	1163

How does entry affect consumers?

Examine liquor purchases, including price & quantity measures.



Panelist Specification

Model how purchasing outcome y for household h , in month t , changes with the number of firms in h 's home zip code, denoted $z(h, t)$:

$$y_{ht} = \alpha_0 + \alpha_1 \cdot NL_{z(h,t)} + \alpha_2 \cdot NL_{z(h,t)}^2 + X'_{z(h,t)}\delta + \epsilon_{ht}$$

- ▶ No assumption that households shop within their own zip code.
- ▶ Cluster standard errors at the household level
- ▶ RD-inspired instruments for $NL_{z(h,t)}$ and $NL_{z(h,t)}^2$

Panelist Specification: First Stage

Estimate via Two-Stage Least Squares

- ▶ Instrument for $NL_{z(h,t)}$ and $NL_{z(h,t)}^2$ using the number of firms 10,000 – 15,000ft² and its interaction with the number of large stores (15,000ft² +).
- ▶ Control for the number of firms 5k – 15kft² using a set of indicator variables.

$$NL_{z(h,t)} = \pi_0 + \pi_1 \cdot N_{z(h,t)}^{10-15} + \sum_i \tilde{\pi}_i \cdot N_{z(h,t)}^{10-15} \times 1[N_{z(h,t)}^{15+} = i] \cdot NL_{z(h,t)}^2 \\ + \sum_k \lambda_k \cdot 1[N_{z(h,t)}^{5-15} = k] + \sum_j \gamma_j \cdot 1[N_{z(h,t)}^{15+} = j] + \epsilon_{z(h,t)}$$

Do zip codes with stores just above/below appear similar?

Covariate Balance of Zip Code Characteristics by Store Eligibility							
	# Households	# Stores	# WSLCB Stores	Log Population	% White	Log Median Income	# Accidents per Month
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of Marginally License-Eligible Firms	2.194 (4.309)	0.760 (1.610)	-0.039 (0.060)	0.074 (0.157)	1.169 (2.003)	0.011 (0.055)	1.587** (0.790)
Number of Stores in the Bandwidth FE	X	X	X	X	X	X	X
Mean	32.113	18.163	0.156	9.802	82.526	10.933	37.349
Observations	141	141	141	141	141	141	141

Notes: Sample includes zip codes with at least one chain store sized 5,000-15,000 ft². # households is the number of Nielsen Panel households in the zip code 2010-2012. # stores is the number of beer/wine licensees as of 12/2011. Demographic data come from the 2010 US Census. Coefficients are statistically significant at the *10%, **5%, and ***1% level.

- Data from the 2010 census on zip code demographics

Do panelists residing in these zip codes appear similar?

Covariate Balance of Panelist Characteristics by Local Store Eligibility

Panel A: Full Sample Covariates (N=1,426)

	(1)	(2)	(3)	(4)	(5)
				Income	
	Married	White	<25k	50k-100k	100k+
Number of Marginally License-Eligible Firms in Zip Code	-0.138*** (0.023)	-0.018 (0.018)	0.018 (0.017)	-0.010 (0.017)	-0.012 (0.018)
Number of Stores in the Bandwidth FE	X	X	X	X	X
Mean	0.610	0.832	0.162	0.187	0.162

Panel B: Pre-Liberalization Covariates (N=1,092)

	(6)	(7)	(8)
	# Shopping Trips	Purchase Probability	Liquor Expenditures
Number of Marginally License-Eligible Firms in Zip Code	0.450 (0.525)	0.035 (0.025)	0.425 (0.945)
Number of Stores in the Bandwidth FE	X	X	X
Mean	12.813	0.269	3.465

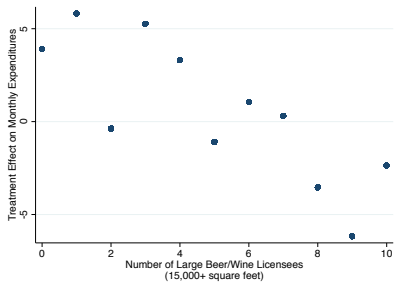
Notes: Panel A includes households in Washington State in the Nielsen sample from 2010-2015. Panel B includes households in Washington State in the sample from 2010-2012. Both samples exclude households that switch zip codes during this six year period (5.71% of households). The sample includes only those residing in a zip code with at least one chain store 5,000-15,000 ft².

Entry \Rightarrow Increased Purchases

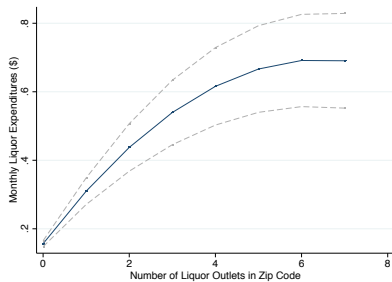
Effect of Market Structure on Consumption			
	(1)	(2)	(3)
<i>Panel A: IV</i>	Expenditures (\$)	Volume (L)	Ethanol (L)
# of Liquor Retailers	4.605*** (1.659)	0.208** (0.091)	0.086** (0.036)
# of Liquor Retailers ²	-0.322*** (0.124)	-0.014** (0.007)	-0.006** (0.003)
# of Stores in the Bandwidth FE		X	X
# of Stores Above the Bandwidth FE	X	X	X
Mean	5.305	0.275	0.109
Observations	31875	31875	31875
<i>Panel B: Reduced Form</i>	Expenditures (\$)	Volume (L)	Ethanol (L)
# of Marginally License-Eligible Stores	4.002** (1.631)	0.223** (0.101)	0.094** (0.040)
# of Marginally License-Eligible Stores \times # Stores Above the Bandwidth	-0.457*** (0.153)	-0.026*** (0.009)	-0.011*** (0.004)
# of Stores in the Bandwidth FE	X	X	X
# of Stores Above the Bandwidth FE	X	X	X
Observations	31875	31875	31875

Notes: Observations are at the panelist-month level for 06/2012-12/2015. Standard errors are clustered at the zip code level, and coefficients are statistically significant at the *10%, **5%, and ***1% level. Instruments in panel A are interactions between the # of marginally eligible firms and the # of stores above 15,000 ft². Partial F-statistics in Panel A are 15.57 for # liquor retailers and 16.82 for # liquor retailers².

Entry \Rightarrow Increased Purchases



(a) Reduced Form Estimates



(b) TSLS Estimates

Adverse Effects?

Effect of Market Structure on Adverse Outcomes									
	Household Level (Monthly)						Zip Code Level		
	Buy Alcohol			Drink ≥		Beer & Wine Consumption (L)	Accidents 06/2012-12/2015		Bars Operating January 2013
	All	Heavy Drinkers	Non- Drinkers	2.35 L Alcohol	0.96 L Ethanol		All	Severe	
<i>Panel A: IV</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
# of Liquor Outlets	0.074*** (0.020)	0.208*** (0.053)	0.012 (0.010)	0.037*** (0.011)	0.038*** (0.011)	-0.792 (1.135)	0.021 (0.168)	0.012 (0.031)	9.597 (9.583)
# of Liquor Outlets ²	-0.005*** (0.002)	-0.017*** (0.004)	-0.001 (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	0.111 (0.084)	-0.007 (0.014)	-0.000 (0.002)	-0.825 (0.940)
# of Stores in the Bandwidth FE	X	X	X	X	X	X	X	X	X
# of Stores Above the Bandwidth FE	X	X	X	X	X	X	X	X	X
<i>Panel B: Reduced Form</i>									
# of Marginally License-Eligible Stores	0.058*** (0.016)	0.133*** (0.043)	0.014 (0.009)	0.020** (0.008)	0.021*** (0.008)	0.728 (0.751)	-0.011 (0.115)	0.009 (0.020)	5.426 (6.129)
# of Marginally License-Eligible Stores x # Stores Above the Bandwidth	-0.007*** (0.002)	-0.016*** (0.004)	-0.002*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.000 (0.068)	-0.007 (0.014)	-0.000 (0.002)	-0.795 (0.931)
# of Stores in the Bandwidth FE	X	X	X	X	X	X	X	X	X
# of Stores Above the Bandwidth FE	X	X	X	X	X	X	X	X	X
Observations	31875	7981	17810	31875	31875	31875	141	141	141
Mean	0.095	0.198	0.031	0.021	0.021	2.690	1.820	0.074	34.589

Notes: Observations in column 1-5 are at the panelist-month level for May 2012 - January 2015, and standard errors are clustered at the zip code level. Observations in columns 6-8 are at the zip code level, and standard errors are heteroskedasticity-robust. In all specifications, coefficients are statistically significant at the * 10%, ** 5%, and ***1% level. Severe accidents include: "Dead at Scene," "Dead on Arrival," "Died in Hospital" or "Suspected Serious Injury." 2.35L of alcohol and 0.96L of ethanol are the 75th percentile of monthly per person consumption among households, January 2010-May 2012. Heavy drinkers are households above the 75th percentile in average per-person consumption January 2010-May 2012. Instruments in panel A are interactions between the number of marginally eligible firms and indicator variables for the number of stores above 15,000 ft².

Prices don't change...

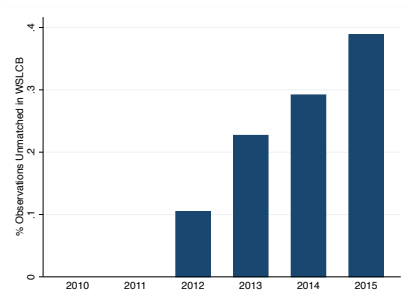
Effect of Market Structure on Log Price				
<i>Panel A: IV</i>	(1)	(2)	(3)	(4)
# of Liquor Outlets	0.027 (0.057)	0.006 (0.011)	0.097 (0.093)	-0.026 (0.017)
# of Liquor Outlets ²			-0.007 (0.007)	0.002* (0.001)
# of Stores in the Bandwidth FE	X	X	X	X
# of Stores above the Bandwidth FE	X	X	X	X
UPC FE		X		X
<i>Panel B: Reduced Form</i>				
# of Marginally License-Eligible Stores	0.023 (0.048)	0.006 (0.011)	0.042 (0.063)	-0.006 (0.016)
# of Marginally License-Eligible Stores × # Stores above the Bandwidth			-0.004 (0.008)	0.002 (0.002)
# of Stores in the Bandwidth FE	X	X	X	X
# of Stores above the Bandwidth FE	X	X	X	X
UPC FE		X		X
Observations	6037	6037	6037	6037

Notes: Standard errors clustered at the zip code level, and coefficients are statistically significant at the

... but product assortment does

Effect of Market Structure on Product Mix									
	# Unique UPCs		# Brand Codes	1.75L Bottle	High Proof	Purchase Indicator		Cheap (R)	Cheap
	Panelist	ZIP Code				Expensive (R)	Expensive		
<i>Panel A: IV</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
# of Liquor Outlets	0.158*** (0.041)	13.440** (5.341)	0.147*** (0.040)	0.057*** (0.015)	0.028*** (0.010)	0.018** (0.009)	0.035*** (0.012)	0.038*** (0.012)	-0.001 (0.001)
# of Liquor Outlets ²	-0.012*** (0.003)	-0.824 (0.515)	-0.011*** (0.003)	-0.004*** (0.001)	-0.002** (0.001)	-0.001* (0.001)	-0.004*** (0.001)	-0.003*** (0.001)	0.000 (0.000)
# of Stores in the Bandwidth FE	X	X	X	X	X	X	X	X	X
# of Stores Above the Bandwidth FE	X	X	X	X	X	X	X	X	X
<i>Panel B: Reduced Form</i>									
# of Marginally License-Eligible Stores	0.109*** (0.033)	5.968 (3.780)	0.104*** (0.031)	0.047*** (0.011)	0.024*** (0.007)	0.013** (0.005)	0.044*** (0.015)	0.031*** (0.008)	-0.000 (0.001)
# of Marginally License-Eligible Stores	-0.013*** (0.004)	-0.602 (0.599)	-0.012*** (0.003)	-0.005*** (0.001)	-0.002*** (0.001)	-0.001 (0.001)	-0.003*** (0.001)	-0.004*** (0.001)	0.000 (0.000)
X # Stores Above the Bandwidth	X	X	X	X	X	X	X	X	X
# of Stores in the Bandwidth FE	X	X	X	X	X	X	X	X	X
# of Stores Above the Bandwidth FE	X	X	X	X	X	X	X	X	X
Observations	31875	125	31875	31875	31875	31875	31875	31875	31875
Mean	0.153	18.662	0.145	0.050	0.016	0.016	0.046	0.027	0.003
Notes: Observations in columns 1 & 3-9 are at the panelist-month level for May 2012 - January 2015. For these columns, standard errors are clustered at the zip code level. Observations in column 2 are at the zip code level for May 2012-January 2015 and standard errors are heteroskedasticity-robust. Coefficients are statistically significant at the * 10%, ** 5%, and ***1% level. Instruments in panel A are interactions between the number of marginally eligible firms and the number of stores above 15,000 ft ² .									

Increase in the purchase of new products over time



"Shoppers are really going to like it...They're going to see a better selection in nicer stores."

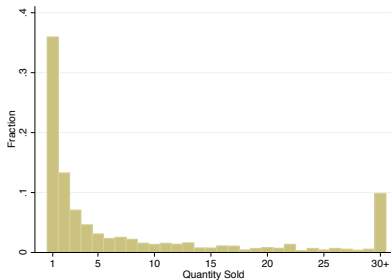
Joe Gilliam, president of the Northwest Grocery Association

Product assortment & selection

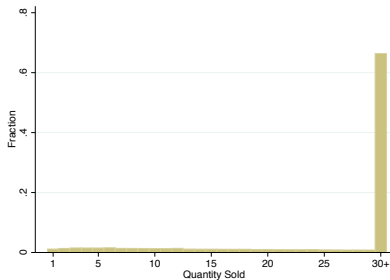
Panelists purchase a wider variety of products in treated zip codes

- ▶ Stores may offer a larger product assortment
- ▶ OR selection problem from transactions nature of data
 - ▶ Prices of products panelists do not purchase could be higher in control zip codes.
- ▶ Solution: auxiliary evidence from scanner data from 9 chains, where selection less dramatic
 - ▶ Weekly product-level prices/quantities for anonymous supermarkets
 - ▶ Chain ids and store zip 3

Annual Quantity Sold by UPC - Scanner Stores



(a) Consumer Panel - by Zip Code



(b) Scanner - by Store

Price & Product Variety for Scanner Stores

Price and Product Variation within and across Chains						
Variable		# Observations	Mean	SD	Min	Max
# Outlets per Chain		30	85.37	51.14	1	169
Annual Quantity Sold (mil)		30	1.84	1.77	0.00	6.17
Annual # Products - Chain		30	678	403	49	1,676
Annual # Products - Store		2,561	327	158	19	1,274
	Price	6,442	0.09	0.09	0	1.24
Coefficient of Variation	Price - within Chain	29	0.03	0.03	0	0.11
	# Products	4	0.47	0.03	0.44	0.51
	# Products - within Chain	29	0.18	0.14	0.02	0.43
Overlap - within Chain		8	0.81	0.12	0.63	0.94

Notes: Based on the sales of 9 retail chains in the Nilesen Scanner data operating in Washington State May 2012 - December 2015. Coefficient of variation for price is the average across UPCs of the following quotient: standard deviation of price divided by its mean. To calculate the within chain coefficient of variation, we recalculate the CoV separately by chain and then report the average across chains. "Overlap - within Chain" is a measure of similarity between inventories of two stores within the same chain. For any two stores within the same chain, we calculate the share of the smaller store's inventory also carried in the larger store, and then average that measure across branches within the chain.

Overlap:

- ▶ Foreach pair of stores within the same chain, look for similarity in inventory - calculate the share of smaller outlets' inventory also carried by the larger outlet (between [0,1])
 - ▶ "large" means a larger total number of unique UPCs
- ▶ Find chain mean (average shares across pairs in chain)
- ▶ Report average across chains

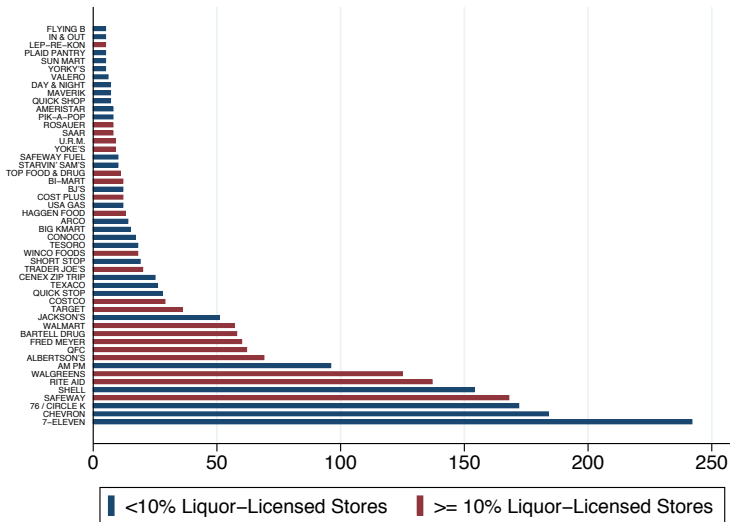
Putting it all together

- ▶ Rival entry increases revenue
 - ▶ But prices don't change
 - ▶ And product variety increases
- ▶ Competition induces firms to expand their product assortment
 - ▶ Move into products that are valued by consumers...or revenue wouldn't increase
- ▶ Why doesn't the monopolist carry these products?
 - ▶ No scope for adjusting $P \Rightarrow$ must be low-margin products

Conclusion

- ▶ Entry increases purchasing and product variety in duopoly liquor markets
 - ▶ 63%+ volume, 86%+ product variety
 - ▶ Diminishing returns
 - ▶ No detectable effect on prices
- ▶ For chains, entry is non-strategic
 - ▶ Almost all eligible stores sell liquor
 - ▶ Ease computational burden of free-entry counterfactuals
- ▶ Licensure threshold appears a blunt policy instrument
 - ▶ limits purchases, but only in some markets
 - ▶ consumers might substitute towards consuming elsewhere (e.g. bars)
 - ▶ hard to say what would have happened were very small stores eligible (e.g. minimarts)

Chain Sizes



► Go to Histograms

Chain Licensure



Demographics of Panelists vs State Population

Demographic	Consumer Panel	State
% White	85.1	82.5
<u>% Income</u>		
< 25k	17.5	20.3
> 100k	14.2	24.4
<u>% Education</u>		
< HS	4.1	10.6
HS	20.5	24.0
BA +	42.4	29.5

Notes: Data on Washington State population comes from the 2010 census. Education is for male heads of household from the Consumer Panel.

Covariate Balance

Covariate Balance of Store Characteristics Around the Licensure Threshold			
	(1)	(2)	(3)
	All Stores	Independent Stores	Chain Stores
Is Geolocated	-0.05 (0.088)	0.00 (0.102)	-0.01 (0.150)
Earliest Privilege Date (Days)	269.14 (550.8)	172.76 (631.7)	1,347.73 (1670.4)
Total Fines Paid in 2010 (\$)	-10.97 (34.1)	-28.72 (60.4)	36.11 (40.8)
Total Fines Paid in 2011 (\$)	-184.92 (150.7)	-49.43 (166.0)	-795.52** (337.2)
Total Fines Paid in 2012, Before June (\$)	2.06 (9.4)	13.39 (16.1)	-2.37 (5.4)
Zip Code Population	-968.15 (4667.6)	-5,339.74 (5747.6)	-3,986.55 (7919.5)
Zip Code Population Over 21	-809.60 (3438.3)	-4,004.47 (3995.3)	-1,907.31 (5576.2)
Zip Code African American Population	122.97 (459.3)	406.81 (459.6)	-2,531.51 (2313.9)
Zip Code Hispanic Population	-255.49 (1187.0)	280.56 (1682.2)	-4,539.33 (3849.1)
Zip Code Median Age	-3.62 (3.3)	-2.83 (4.5)	-3.02 (4.1)
Zip Code Unemployment Rate	1.55 (1.7)	2.22 (2.1)	1.19 (3.8)
Zip Code Median Household Income	-11,440.53 (8677.3)	-23,472.87** (9328.7)	-5,930.57 (18721.8)
Zip Code Percentage of Population with Less than High School Education	1.09 (3.5)	5.89 (4.6)	-10.19 (9.1)
Zip Code Percentage of Population with High School Education	-4.00 (2.9)	1.13 (3.5)	-14.16 (11.2)
Zip Code Percentage of Population with BA or Higher	5.90 (7.2)	-6.16 (8.1)	24.69 (21.2)
Zip Code Percentage of Population in Poverty	11.28** (4.54)	16.33*** (5.43)	5.14 (7.30)
Number of Neighbors within 0.5 Miles with Square Footage between 5,000 and 15,000	-0.13 (0.229)	-0.20 (0.290)	0.37 (0.235)
Number of Neighbors within 0.5 Miles with Square Footage between 10,000 and 15,000	0.16 (0.121)	0.05 (0.172)	0.39** (0.159)
Number of Neighbors within 0.5 Miles with Square Footage below 5,000	1.12 (1.469)	-0.62 (1.138)	6.53* (3.760)
Number of Neighbors within 0.5 Miles with Square Footage above 15,000	-0.22 (0.229)	0.03 (0.290)	-2.14 (0.235)

Corelogic Covariate Balance

County assessor's office data on commercial premises

- ▶ Square footage, year built, last year renovated
- ▶ Variables describing economic activity on a given parcel

Covariate Balance of Store Characteristics Around the Licensure Threshold – Corelogic Sample			
	(1)	(2)	(3)
<i>Panel A: Descriptive Statistics</i>			
	All Potential Alcohol Retail Records	Selected Land Use Codes	Selected Building Codes
Number of Records	18,224	1,193	1,423
Square Footage, 10 th Percentile	960	1,641	1,650
Square Footage, 50 th Percentile	3,749	4,151	3,438
Square Footage, 90 th Percentile	19,664	46,821	51,300
Year Built, 10 th Percentile	1923	1929	1945
Year Built, 50 th Percentile	1974	1974	1980
Year Built, 90 th Percentile	2003	2000	2001
Percentage Ever Renovated	37.04%	57.67%	49.05%
Year Renovated, 10 th Percentile	1964	1964	1970
Year Renovated, 50 th Percentile	1982	1985	1988
Year Renovated, 90 th Percentile	1997	2000	2000
Percentage Renovated Post 2012	0.04%	0.08%	0.00%
% Renovated Post 2012, If Ever Renova	0.10%	0.15%	0.00%
<i>Panel B: Discontinuity at Licensure Cutoff</i>			
	All Potential Alcohol Retail Records	Selected Land Use Codes	Selected Building Codes
Year Built	-0.559 (3.119)	-35.309** (16.441)	-13.309 (13.602)
Ever Renovated	0.096** (0.046)	0.307 (0.221)	-0.204 (0.218)
Year Renovated, If Ever Renovated	1.073 (1.918)	-5.280 (7.923)	-2.794 (6.809)
Renovated Post 2012	-0.001 (0.001)	0.010 (0.010)	- -
Renovated Post 2012, If Ever Renovated	0.000 (0.000)	- -	- -
McCrary Test P-Value	0.30	0.48	0.26

Notes: This table presents results of a local polynomial regression-discontinuity design model with robust bias-corrected confidence intervals and an optimal bandwidth, estimated in Stata via the "rdrobust" command using techniques in Calonico, Cattaneo and Titiunik (2014), Calonico, Cattaneo and Farrell (2016) and Calonico, Cattaneo, Farrell and Titiunik (2016). The relevant sample is the set of Corelogic property tax records of potential alcohol retailers, as defined in Appendix B. Column 2 further

Map of Store Locations by Eligibility

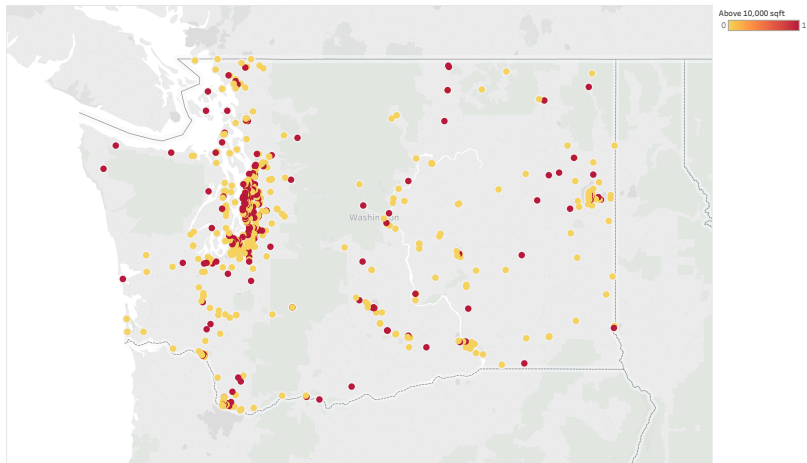


Figure: All Stores

◀ Back to regression spec

License Eligibility and Entry - Results

RD Estimates of the Effect of Licensure on Entry				
	(1)	(2)	(3)	(4)
	All Stores	Independent Stores	Chain Stores	Large Chains (10+ Stores)
Licensure Discontinuity	0.26** (0.112)	-0.03 (0.133)	0.86*** (0.153)	0.88*** (0.160)
Observations	4605	2599	2006	1870
Effective Observations – Below	194	102	103	23
Effective Observations – Above	130	87	55	40
Bandwidth	4149.9	3634.8	3397.6	2867.5
McCrary Test P-Value	0.379	0.620	0.545	0.981

► Return

Covariate Balance for Neighbor Distance Specification

Covariate Balance Across License-Eligible Stores with Differing Numbers of License-Eligible Neighbors within Distance Bandwidths											
Square Footage Bandwidth = 5000 square feet											
Distance to Store (miles):		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Own Square Footage	Independents	-148,609	-156,240	-144,910	-131,324	-120,365	-216,465	-214,798	-210,730	-169,579	-160,530
		(141,434)	(155,816)	(142,820)	(129,377)	(119,254)	(215,033)	(215,408)	(209,958)	(171,333)	(161,219)
	Chains	57,396	52,761	55,561	56,511	56,103	-77,600	-73,903	-61,106	-48,547	-41,103
		(61,103)	(55,096)	(54,851)	(55,885)	(57,455)	(76,861)	(75,644)	(62,317)	(50,479)	(42,379)
Earliest Alcohol Licensure Date (Days)	Independents	83.6	630.6*	339.1	324.0	288.8	161.8	73.6	212.6	86.9	92.5
		(512.2)	(323.8)	(271.0)	(222.2)	(179.6)	(148.5)	(148.4)	(134.8)	(125.8)	(114.4)
	Chains	-497.9	-95.1	-112.8	-25.2	66.5	78.1	-0.8	42.6	-1.2	-32.8
		(332.9)	(245.9)	(197.1)	(185.1)	(157.7)	(131.3)	(131.1)	(112.6)	(100.3)	(100.4)
Total Alcohol-Related Fines Paid in 2010	Independents	65.5	26.0	-8.6	-6.7	-0.2	1.9	-1.9	-2.4	-0.2	-6.7
		(52.3)	(26.6)	(23.3)	(20.3)	(15.0)	(13.1)	(13.0)	(12.7)	(11.6)	(9.8)
	Chains	14.0	9.1	-12.1	-14.4	-9.9	-3.6	-6.4	-6.5	-5.8	-6.7
		(12.4)	(11.0)	(13.7)	(11.4)	(8.5)	(6.7)	(6.5)	(6.3)	(5.7)	(5.2)
Total Alcohol-Related Fines Paid in 2011	Independents	-26.4	-4.9	-14.3	-21.4	-30.6	-34.4**	-15.4	-17.5	-13.9	-14.8
		(18.6)	(26.0)	(19.2)	(15.1)	(22.7)	(17.1)	(20.1)	(18.9)	(15.1)	(17.5)
	Chains	58.1	31.1	23.8	23.4	7.9	3.1	0.7	1.7	3.2	1.7
		(40.2)	(23.4)	(18.9)	(15.3)	(15.0)	(8.5)	(8.0)	(7.2)	(7.8)	(9.9)
Total Alcohol-Related Fines Paid in 2012 (Pre-Liberalization)	Independents	-9.5	-4.8	2.2	1.4	0.3	1.0	1.5	-0.8	-0.2	-1.5
		(8.8)	(4.3)	(7.2)	(4.1)	(3.0)	(2.2)	(2.3)	(2.0)	(1.5)	(1.6)
	Chains	-10.2	3.6	0.4	2.3	1.4	4.1	3.0	0.5	1.5	0.1
		(8.4)	(7.2)	(5.9)	(5.8)	(4.5)	(3.4)	(2.8)	(2.2)	(1.8)	(1.8)
Zip Code Population	Independents	3,913	-890	807	1,339	227	1,466	2,088	1,926	1,214	2,121
		(4699)	(3550)	(3269)	(2492)	(2431)	(1764)	(1711)	(1642)	(1429)	(1395)
	Chains	1,277	1,775	2,706	2,122	1,573	1,190	1,220	1,034	841	702
		(2158)	(1792)	(1668)	(1614)	(1665)	(1341)	(1370)	(1232)	(1220)	(1259)
Zip Code Population Over 21	Independents	4,239	812	1,781	1,852	980	1,791	2,160*	1,989*	1,492	2,114**
		(3371)	(2344)	(2168)	(1711)	(1635)	(1208)	(1165)	(1170)	(1001)	(953)
	Chains	2,139	2,228*	2,616**	2,139*	1,904*	1,507	1,376	1,207	1,133	1,015
		(1550)	(1236)	(1162)	(1138)	(1149)	(916)	(910)	(836)	(839)	(838)
Zip Code African American Population	Independents	75	152	-113	-157	-187	-74	-162	-190	-323**	-139
		(75)	(152)	(-113)	(-157)	(-187)	(-74)	(-162)	(-190)	(-323)	(-139)
	Chains	-195	173	236	137	5	-92	-169	-180	-170	-186
		(-195)	(173)	(236)	(137)	(5)	(-92)	(-169)	(-180)	(-170)	(-186)
Zip Code Hispanic Population	Independents	-1,831	-2,220	-1,463	-824	-1,408	-930	-685	-604	-599	-403
		(1176)	(1176)	(1176)	(1176)	(1176)	(1176)	(1176)	(1176)	(1176)	(1176)
	Chains	-1,567	-1,495	-851	-554	-862	-695	-311	-282	-378	-378
		(1977)	(1458)	(1226)	(951)	(1103)	(869)	(852)	(792)	(794)	(794)
Zip Code Median Age	Independents	1.6	-0.2	0.0	-0.4	-0.4	-0.5	-0.3	-0.1	0.0	-0.1
		(2.4)	(1.3)	(1.3)	(1.1)	(1.0)	(0.7)	(0.7)	(0.7)	(0.6)	(0.5)
	Chains	0.4	0.1	0.2	0.1	0.1	0.4	0.2	0.4	0.4	0.3
		(0.4)	(0.1)	(0.2)	(0.1)	(0.1)	(0.4)	(0.2)	(0.4)	(0.4)	(0.3)

Covariate Balance for n-Nearest Neighbors Specification

Covariate Balance Across License-Eligible Stores with Differing Numbers of License-Eligible N-Nearest Neighbors											
Bandwidth = 5000 square feet											
Neighbors Included:		1	2	3	4	5	6	7	8	9	10
Own Square Footage	Independents	-148,609 (141,434)	-156,240 (155,816)	-144,910 (142,820)	-131,324 (129,377)	-120,365 (119,254)	-216,465 (215,033)	-214,798 (215,408)	-210,730 (209,958)	-169,579 (171,333)	-160,530 (161,219)
	Chains	57,396 (61,103)	52,761 (55,096)	55,561 (54,851)	56,511 (55,885)	56,103 (57,455)	-77,600 (76,861)	-73,903 (75,644)	-61,106 (62,317)	-48,547 (50,479)	-41,103 (42,379)
Earliest Alcohol Licensure Date (Days)	Independents	83.6 (512.2)	630.6* (323.8)	339.1 (271.0)	324.0 (222.2)	288.8 (179.6)	161.8 (148.5)	73.6 (148.4)	212.6 (134.8)	86.9 (125.8)	92.5 (114.4)
	Chains	-497.9 (332.9)	-95.1 (245.9)	-112.8 (197.1)	-25.2 (185.1)	66.5 (157.7)	78.1 (131.3)	-0.8 (131.1)	42.6 (112.6)	-1.2 (100.3)	-32.8 (100.4)
Total Alcohol-Related Fines Paid in 2010	Independents	65.5 (52.3)	26.0 (26.6)	-8.6 (23.3)	-6.7 (20.3)	-0.2 (15.0)	1.9 (13.1)	-1.9 (13.0)	-2.4 (12.7)	-0.2 (11.6)	-6.7 (9.8)
	Chains	14.0 (12.4)	9.1 (11.0)	-12.1 (13.7)	-14.4 (11.4)	-9.9 (8.5)	-3.6 (6.7)	-6.4 (6.5)	-6.5 (6.3)	-5.8 (5.7)	-6.7 (5.2)
Total Alcohol-Related Fines Paid in 2011	Independents	-26.4 (18.6)	-4.9 (26.0)	-14.3 (19.2)	-21.4 (15.1)	-30.6 (22.7)	-34.4** (17.1)	-15.4 (20.1)	-17.5 (18.9)	-13.9 (15.1)	-14.8 (17.5)
	Chains	58.1 (40.2)	31.1 (23.4)	23.8 (18.9)	23.4 (15.3)	7.9 (15.0)	3.1 (8.5)	0.7 (8.0)	1.7 (7.2)	3.2 (7.8)	1.7 (9.9)
Total Alcohol-Related Fines Paid in 2012 (Pre-Liberalization)	Independents	-9.5 (8.8)	-4.8 (4.3)	2.2 (7.2)	1.4 (4.1)	0.3 (3.0)	1.0 (2.2)	1.5 (2.3)	-0.8 (2.0)	-0.2 (1.5)	-1.5 (1.6)
	Chains	-10.2 (8.4)	3.6 (7.2)	0.4 (5.9)	2.3 (5.8)	1.4 (4.5)	4.1 (3.4)	3.0 (2.8)	0.5 (2.2)	1.5 (1.8)	0.1 (1.8)
Zip Code Population	Independents	3,913 (4699)	-890 (3550)	807 (3269)	1,339 (2492)	227 (2431)	1,466 (1764)	2,088 (1711)	1,926 (1642)	1,214 (1429)	2,121 (1395)
	Chains	1,277 (2158)	1,775 (1792)	2,706 (1668)	2,122 (1614)	1,573 (1665)	1,190 (1341)	1,220 (1370)	1,034 (1232)	841 (1220)	702 (1259)
Zip Code Population Over 21	Independents	4,239 (3371)	812 (2344)	1,781 (2168)	1,852 (1711)	980 (1635)	1,791 (1208)	2,160* (1165)	1,989* (1170)	1,492 (1001)	2,114** (953)
	Chains	2,139 (1550)	2,228* (1236)	2,616** (1162)	2,139* (1138)	1,904* (1149)	1,507 (916)	1,376 (910)	1,207 (836)	1,133 (839)	1,015 (838)
Zip Code African American Population	Independents	75 (75)	152 (152)	-113 (-113)	-157 (-157)	-187 (-187)	-74 (-74)	-162 (-162)	-190 (-190)	-323** (-323)	-139 (-139)
	Chains	-195 (-195)	173 (173)	236 (236)	137 (137)	5 (5)	-92 (-92)	-169 (-169)	-180 (-180)	-170 (-170)	-186 (-186)
Zip Code Hispanic Population	Independents	-1,831 (1176)	-2,220 (1176)	-1,463 (1176)	-824 (1176)	-1,408 (1176)	-930 (1176)	-685 (1176)	-604 (1176)	-599 (1176)	-403 (1176)
	Chains	-1,567 (1977)	-1,495 (1458)	-851 (1226)	-554 (951)	-862 (1103)	-695 (869)	-311 (852)	-282 (792)	-378 (794)	-378 (794)

n-Nearest Neighbor Entry Effects

Effect of N-Nearest Neighbors' License Eligibility on Own Entry Decision											
Bandwidth = 5000 square feet											
Neighbors Included		1	2	3	4	5	6	7	8	9	10
Independents	# of Marginally License Eligible Neighbors	-0.044 (0.140)	-0.141 (0.099)	-0.145* (0.077)	-0.127* (0.069)	-0.137** (0.064)	-0.134** (0.055)	-0.139*** (0.052)	-0.127*** (0.049)	-0.103** (0.044)	-0.092** (0.041)
	Baseline Entry Probability	0.310*** (0.079)	0.370*** (0.062)	0.381*** (0.052)	0.386*** (0.049)	0.388*** (0.046)	0.389*** (0.045)	0.392*** (0.042)	0.395*** (0.041)	0.377*** (0.038)	0.359*** (0.037)
Chains	# of Marginally License Eligible Neighbors	-0.017 (0.063)	0.021 (0.036)	0.008 (0.026)	0.018 (0.026)	0.005 (0.023)	0.000 (0.021)	-0.005 (0.020)	0.003 (0.020)	-0.004 (0.018)	-0.001 (0.016)
	Baseline Entry Probability	0.917*** (0.041)	0.910*** (0.029)	0.936*** (0.020)	0.928*** (0.020)	0.937*** (0.017)	0.944*** (0.015)	0.949*** (0.014)	0.947*** (0.015)	0.952*** (0.013)	0.953*** (0.013)
# of Neighbors in the Bandwidth FE		x	x	x	x	x	x	x	x	x	x
N		132	276	399	495	586	668	733	775	856	887

▶ Return

How are less concentrated zip codes different?

Intensity of treatment: zip codes with below-median (< 4) large beer/wine merchants move from duopoly to triopoly.

Zip Code Demographics by Number of Competitors		
	Number of Large Stores	
	≥ 4	< 4
Population	30,023 (1,100)	11,903 (829)
% White	80.98 (1.21)	86.48 (1.02)
Log Median Income	10.95 (0.03)	10.86 (0.02)
Median Age	36.71 (0.45)	40.48 (0.57)
N	111	191

- ▶ Sample is zip codes with at least one beer/wine merchant between 5,000 – 10,000ft² in 1012.
- ▶ Large stores are those sized at least 20,000ft².

▶ Return