

Industry dynamics and the value of variety in nightlife: evidence from Chicago Based on Cosman (2017)

Presented by Minhae Kim

The Ohio State University

kim.6488@osu.edu

February 6, 2019

Outline

- 1 Introduction
- 2 Model
- 3 Estimation
- 4 Data
- 5 Results and discussion
- 6 Conclusion

Introduction

- This study examines consumer preferences for variety in nightlife to understand these preferences and their impact on nightlife industry dynamics.
 - 1 Consumer preferences' for variety
 - 2 Nightlife industry dynamics (venue profit, entry/exit)
- We develop a continuous-time structural model that parameterizes consumer preferences and describes venue entry and exit in the nightlife industry using a panel of liquor license data from Chicago.

Literature

	Arguments	Literature
Consumer preference	Access to a variety of nightlife venues	<ul style="list-style-type: none">- Currid (2007)- Picone, Ridley, Zandbergen (2009)
	Consumer preference for variety	<ul style="list-style-type: none">- Feenstra (1994): framework- Broda & Weinstein (2006): trade data- Li (2012), Handbury & Weinstein (2011): grocery- Broda & Weinstein (2010): barcode data- Couture (2014): restaurants
Industry dynamics	Colocation of economic activity in cities	<ul style="list-style-type: none">- Rosenthal & Strange (2004), Puga (2010)- Wolinsky (1983): consumers' imperfect info- Fischer & Harrington (1996), Konishi (2005): taste uncertainty
	Estimating profit function from entry/exit data	<ul style="list-style-type: none">- Bresnahan and Reiss (1991), Pesendorfer and Schmidt-Dengler (2003), Aguirregabiria and Mira (2007), Ryan (2012), Collard-Wexler (2013)- ABBE (2012): continuous-time framework

Research questions

- 1 Do consumers prefer access to variety in nightlife venues?
→ Elasticity of substitution for venues
- 2 How do these preferences impact nightlife industry dynamics and the level of nightlife services provided?
→ Profit function using entry/exit data, Continuous-time dynamic discrete choice model

Outline

1 Introduction

2 Model

3 Estimation

4 Data

5 Results and discussion

6 Conclusion

Model outline

- Building the model in stages
 - ① Static model for demand/venue profit
 - ② Dynamic model to describe nightlife venue entry and exit

Static model: Demand

- Static model of nightlife industry consists of venues and consumers.
- n_l venues of each type $l \in 1, 2, \dots, L$
- A continuum of consumers of measure \bar{N}
- Each consumer has a budget w for nightlife services and decides whether to go out and consume nightlife services based on the realization of a reservation utility shock.
- Demand function: based on **constant elasticity of substitution (CES)** utility

$$q_{li}^D = p_{li}^{-1} \left(\frac{p_{li}}{P_l} \right)^{-\rho} \left(\frac{P_l}{P} \right)^{-\eta} w$$

- ▶ ρ_l : elasticity of substitution between venues of type l
- ▶ η : elasticity of substitution across venues of different types
- ▶ $P_l = (\sum_i p_{li}^{1-\rho_l})^{\frac{1}{1-\rho_l}}$, $P = (\sum_l P_l^{1-\eta})^{\frac{1}{1-\eta}}$
- ▶ $V(p)$: indirect utility

Static model: Profit function

- Venues face the demand q_{li}^D from measure $N = \bar{N} \min\{V(p), 1\}$.

$$\pi_{li} = \max_{p_{li}} \left\{ (p_{li} - c_l) \left(\frac{p_{li}}{P_l} \right)^{-\rho} \left(\frac{P_l}{P} \right)^{-\eta} P^{-1} \bar{N} \min\{V(p), 1\} w - \kappa_l \right\}$$

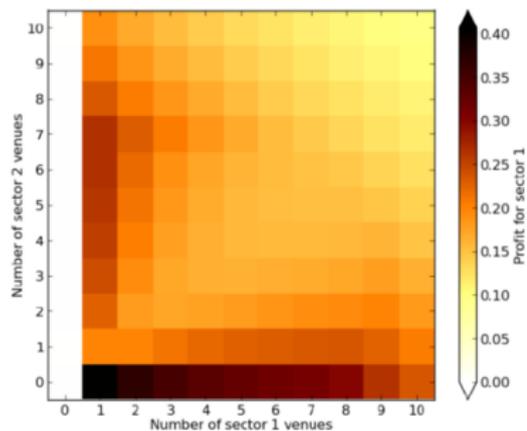
- ▶ c_l : constant marginal cost of production
- ▶ κ_l : fixed cost of production
- Solving the FOC,

$$p_{li} = \begin{cases} \left(1 + \frac{n_l}{n_l(\rho_l - 1) - (\rho_l - [1 + S_l^{\frac{\eta}{\eta-1}} \sum_{l'} (S_{l'}^{\frac{\eta}{\eta-1}})^{-1}] \eta) - 2(\eta-1)S_l} \right) c_l & \text{if } V(p) < 1 \\ \left(1 + \frac{n_l}{n_l(\rho_l - 1) - (\rho_l - \eta) - (\eta-1)S_l} \right) c_l & \text{if } V(p) \leq 1 \end{cases}$$

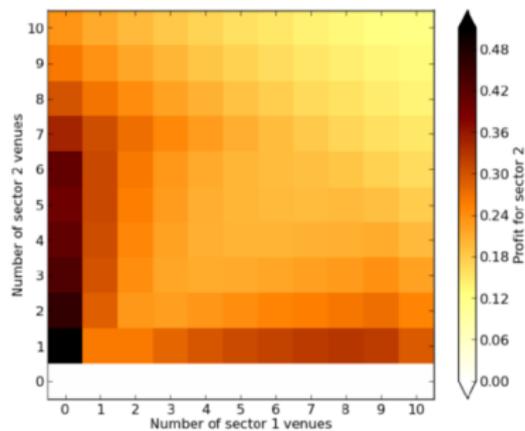
⇒ Proposition 1: There exists a unique set of prices p^* which solves the equation above.

Venue profit increasing in the number of venues

- Effects of one additional venue on an incumbent venue's profit
 - ① Positive: More consumers opt to go out and consume nightlife.
 - ② Negative: Additional competition
- The strength of positive effect depends on ρ_1 and η : Lower elasticity of substitution corresponds to stronger preferences for variety.



(a) Profit in sector 1

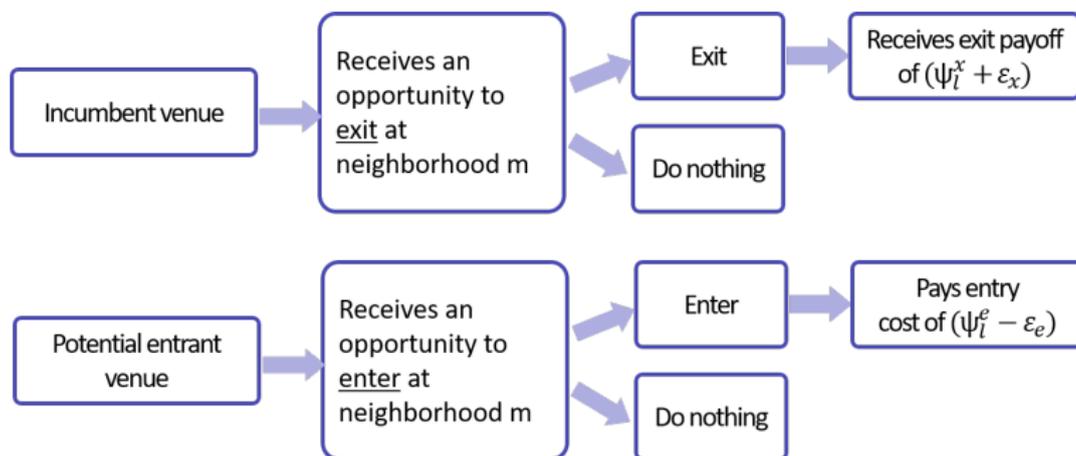


(b) Profit in sector 2

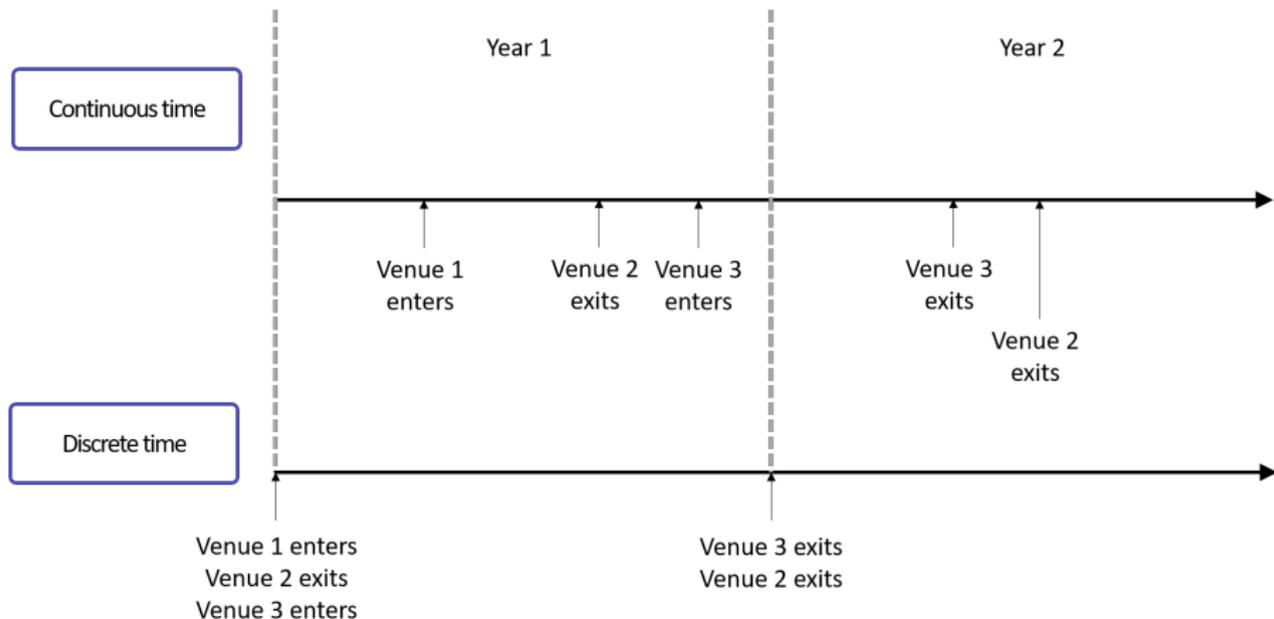
Figure 1: Profit by sector in a two-sector example.

Dynamic model: Setting

- Agents are assigned to neighborhoods indexed by m .
- Each neighborhood has $n_m = (n_{m1}, n_{m2}, \dots, n_{mL})$ incumbent venues of each type $l \in 1, 2, \dots, L$ and v_l entrants of type l .
- Incumbent venues receive opportunity to exit according to a Poisson process with a rate of α_l .
- Potential entrant venues receive opportunity to enter according to a Poisson process with a rate of λ_l .



Continuous time vs Discrete time



- Allows for use of the full information present in the data
- Simultaneous moves by two agents represents a measure-zero event.
- Stochastic decision times likely represent a closer approximation to reality.

Incumbent's value function

- Each agent forms its value function based on its consistent belief of other agents' entries & exits and its expectations of its own move opportunities.
- An incumbent venue of type l 's value function

$$\begin{aligned} V_l^c(n_m, d_m, r_m) = & \left[\delta + \sum_{l'} (v_{l'} \alpha_{l'} + n_{l'} \lambda_{l'}) \right]^{-1} \times \left[\pi(n_m, d_m) + \right. \\ & \sum_{l'} ((n_{l'} - I(l, l')) \lambda_{l'} \sigma_{l'}^x(n_m, d_m, r_m) V_l^c(n_m + \iota_{l'}, d_m, r_m) \\ & + v_{l'} \alpha_{l'} \sigma_{l'}^e(n_m, d_m, r_m) V_l^c(n_m - \iota_{l'}, d_m, r_m)) \\ & \left. + \lambda_l \mathbb{E}[\max\{V_l^c(n_m, d_m, r_m), \psi_l^x + \epsilon_x\}] \right] \end{aligned}$$

- ▶ ι_l : a vector with 1 as element l and 0 as all other elements
- ▶ d_m : demographic attributes
- ▶ r_m : regulatory stringency

Incumbent's value function

- An incumbent venue of type l 's value function

$$\begin{aligned} V_l^c(n_m, d_m, r_m) = & \left[\delta + \sum_{l'} (v_{l'} \alpha_{l'} + n_{l'} \lambda_{l'}) \right]^{-1} \times \left[\pi(n_m, d_m) + \right. \\ & \sum_{l'} ((n_{l'} - I(l, l')) \lambda_{l'} \sigma_{l'}^x(n_m, d_m, r_m) V_l^c(n_m + \iota_{l'}, d_m, r_m) \\ & + v_{l'} \alpha_{l'} \sigma_{l'}^e(n_m, d_m, r_m) V_l^c(n_m - \iota_{l'}, d_m, r_m)) \\ & \left. + \lambda_l \mathbb{E}[\max\{V_l^c(n_m, d_m, r_m), \psi_l^x + \epsilon_x\}] \right] \end{aligned}$$

- ▶ 1st line: discount rate, all moving opportunities, flow payoff
- ▶ 2nd & 3rd line: entries and exits by other agents
- ▶ 4th line: the incumbent's decision to remain or exit conditional on receiving a move opportunity

Entrant's value function

- Similar as before but no flow profit:

$$\begin{aligned} V_I^e(n_m, d_m, r_m) = & [\delta + \sum_{I'} (v_{I'} \alpha_{I'} + n_{I'} \lambda_{I'})]^{-1} \times [0 + \\ & \sum_{I'} ((n_{I'} - I(I, I')) \lambda_{I'} \sigma_{I'}^x(n_m, d_m, r_m) V_I^c(n_m + \iota_{I'}, d_m, r_m) \\ & + v_{I'} \alpha_{I'} \sigma_{I'}^e(n_m, d_m, r_m) V_I^c(n_m - \iota_{I'}, d_m, r_m)) \\ & + \lambda_I \mathbb{E}[\max\{V_I^e(n_m, d_m, r_m), V_I^c(n_m, d_m, r_m) - \psi_e(r_m) + \epsilon_e\}]] \end{aligned}$$

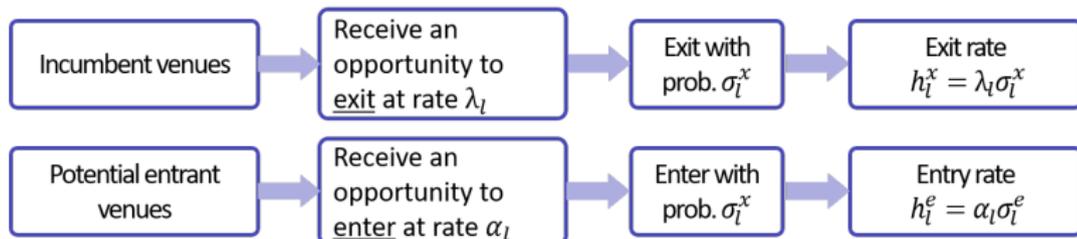
Conditional choice probability

- Assume that the stochastic components in instantaneous payoffs follow iid T1EV.
- Conditional choice probability for entry σ_l^e and exit σ_l^x are

$$\sigma_l^e(n, d, r) = 1 - \exp(-\exp(-V_l^e(n, d, r) - V_c(n, d, r) + \psi_e(r))))$$

$$\sigma_l^x(n, d, r) = 1 - \exp(-(\exp(-V_l^e(n, d, r) - \psi_x)))$$

- Exit and entry rates



Identification of colocation benefits

Arguments

Production cost advantage

Learning effects

Role of strategic siting by retail chains

Unobserved neighborhood attributes
(neighborhoods with more foot traffic/commercial districts)

Issues

Average nightlife venue's costs are unlikely to vary significantly within a city.

The cost of acquiring information is likely relatively low in Chicago.

Concentration in the nightlife industry in Chicago is very low.

Robustness check using the location of Starbucks
→ no relationship between Starbucks locations and nightlife venue profitability

Effect of the number of competitors firm profitability to consumers' preference for variety

Outline

1 Introduction

2 Model

3 Estimation

4 Data

5 Results and discussion

6 Conclusion

Estimation strategy

- Maximum likelihood strategy following ABBE (2016)
 - 1 Obtain nonparametric estimates \check{h}_i^e and \check{h}_i^x for the observed venue entry and exit rates.
 - 2 Use the estimates \check{h}_i^e and \check{h}_i^x to write the ccps of entry and exit in terms of structural parameters.
 - 3 Find the value of the structural parameters $\hat{\theta}$ which maximizes the likelihood function of the observed transitions. Likelihood function

Outline

- 1 Introduction
- 2 Model
- 3 Estimation
- 4 Data**
- 5 Results and discussion
- 6 Conclusion

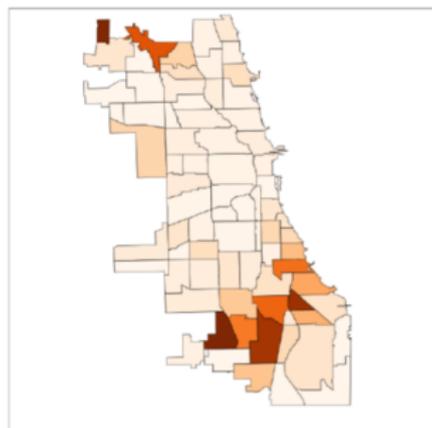
Data

- Chicago liquor license data (Jan 2006 - July 2014)
- A new license = a new entrant
An expired license = an exiting incumbent
- Types of night venues
 - 1 Amusement only
 - 2 Drinks only
 - 3 Drinks and amusement: no music/dance
 - 4 Drinks and music: drinks & music/dance

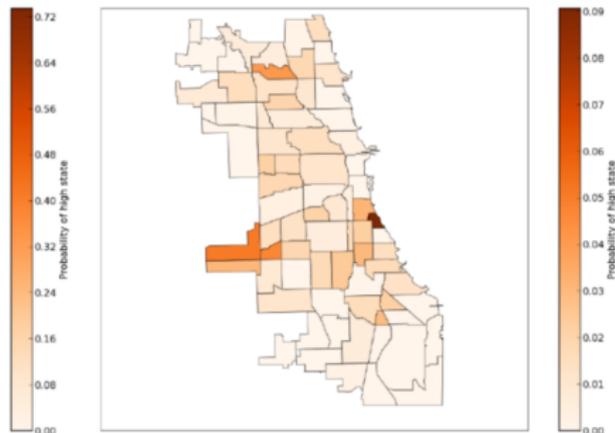
	Start of sample	Entries	Exits
Amusement only	93	33	54
Drinks only	643	134	268
Drinks and amusement	56	31	23
Drinks and music	85	7	31

Regulatory environment

- Citywide regulatory barriers: a licensing fee of at least \$4,400
- Local-level regulatory barriers
 - ▶ Bans: All incumbent venues must exit.
 - ▶ Moratoria: sets a minimum distance from existing primary liquor licenses



(a) Share of area dry (%)



(b) Share of area moratorium (%)

Outline

- 1 Introduction
- 2 Model
- 3 Estimation
- 4 Data
- 5 Results and discussion**
- 6 Conclusion

Elasticity of substitution

- Elasticities
 - ▶ η : elasticity of substitution across venues of different types
 - ▶ ρ_l : elasticity of substitution between venues of type l
- Lower elasticity of substitution \rightarrow Stronger preference for variety
- Results suggest a strong preference for variety in nightlife compared to other consumption goods (5th-25th percentile of elasticities for consumer goods reported in Broda and Weinstein, 2010).

Elasticity	Symbol	Estimate
Between sectors	η	2.04 (1.57×10^{-4})
Amusement only	ρ_1	4.90 (5.53×10^{-4})
Drinks only	ρ_2	2.15 (9.79×10^{-5})
Drinks and amusement	ρ_3	3.56 (3.89×10^{-3})
Drinks and music	ρ_4	7.96 (1.09×10^{-4})

The effect of dry precincts and moratoria on the barriers to entry

- Can be interpreted as elasticities
 - ▶ 1% increase in dry precincts → 0.47% increase in the barrier to entry
 - ▶ 1% increase in moratoria → 0.11% increase in the barrier to entry

	Parameter	
Entry cost	Amusement only baseline	2.11 (5.94×10^{-4})
	Drinks only baseline	2.17 (2.87×10^{-4})
	Drinks and amusement baseline	2.11 (1.89×10^{-4})
	Drinks and music baseline	1.81 (6.96×10^{-5})
	Role of dry precincts	0.470 (1.54×10^{-3})
	Role of moratoria	0.106 (1.88×10^{-4})
	Exit payoff	Amusement only
Drinks only		-4.06 (1.96×10^{-4})
Drinks and amusement		-2.76 (2.71×10^{-5})
Drinks and music		-3.23 (5.6×10^{-5})

Estimated sunk cost of entry

- Converted the estimated parameters for entry/exit payoffs to dollar value
- Exit payoff is substantially lower than the sunk cost of entry.

		Value (thousands of dollars)
Entry cost	Amusement only baseline	862 [861, 863]
	Drinks only baseline	943 [943, 944]
	Drinks and amusement baseline	892 [891, 892]
	Drinks and music baseline	670 [670, 670]
	Exit payoff	Amusement only
	Drinks only	38.3 [38.3, 38.3]
	Drinks and amusement	42.9 [42.9, 42.9]
	Drinks and music	40.5 [40.5, 40.5]

Static counterfactuals

- Additional venue enters the market
- Effect on profits of one more venue of each type

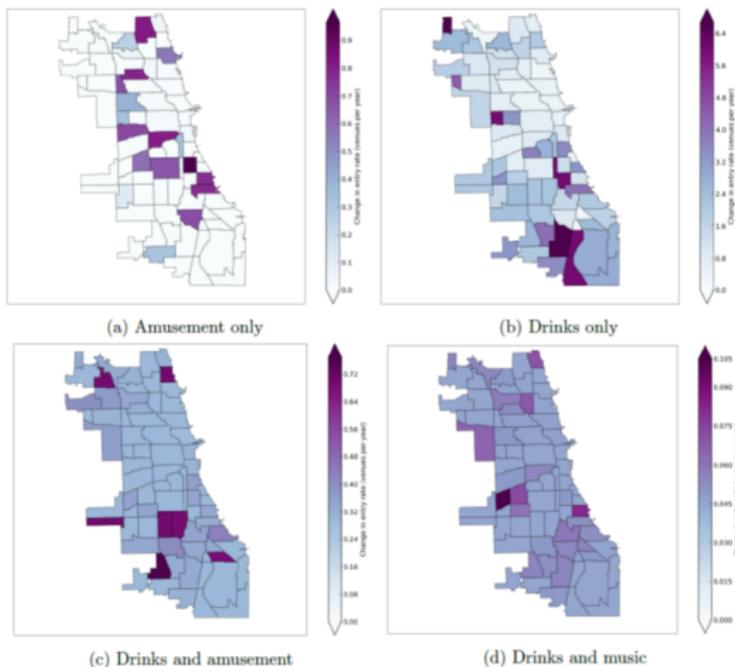
	Amusement only	Drinks only	Drinks and amusement	Drinks and music
Amusement only	-22.4 [-22.4,-22.4]	-4.1 [-4.1,-4.1]	-46.6 [-46.8,-43.9]	-2.5 [-2.3,-2.3]
Drinks only	-2.3 [-2.4,-2.3]	-2.7 [-2.7,-2.7]	-5.2 [-5.2,-5.1]	-2.2 [-2.2,-2.2]
Drinks and amusement	-0.2 [-0.2,-0.2]	-0.5 [-0.5,-0.5]	-72.7 [-72.3,-71.8]	-0.1 [-0.1,-0.1]
Drinks and music	-0.8 [-0.8,-0.8]	-1.5 [-1.5,-1.5]	-11.8 [-11.8,-11.7]	-20.3 [-20.3,-20.3]

- Proportion of observations where a new entry would increase the profit of incumbent venues

Amusement only	36.3 [36.3,36.3]	13.2 [13.2,13.2]	6.7 [6.7,6.7]	14.1 [14.1,14.1]
Drinks only	13.3 [13.3,13.3]	13.2 [13.2,13.2]	17.8 [17.8,17.8]	8.4 [8.4,8.6]
Drinks and amusement	0.0 [0.0,0.0]	1.1 [1.1,1.1]	32.2 [32.2,32.2]	12.4 [12.4,12.4]
Drinks and music	0.0 [0.0,0.]	1.1 [1.1,1.1]	13.3 [13.3,13.3]	25.3 [25.3,25.3]

Dynamic counterfactuals

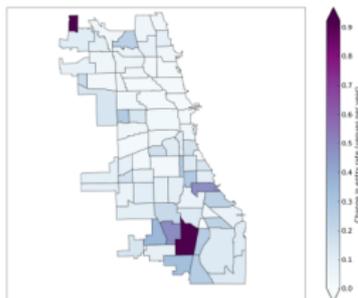
- Deterministic component of the sunk cost of entry is exogenously lowered by 25% for all potential entrants in all neighborhoods.



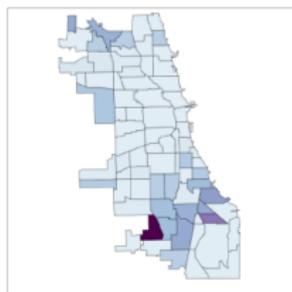
* Changes in entry probability

Dynamic counterfactuals

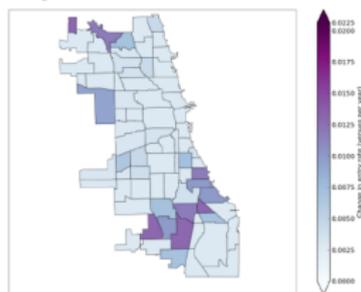
- A laissez-faire counterfactual where all local regulation are removed



(a) Drinks only



(b) Drinks and amusement



(c) Drinks and music

* Changes in entry probability

Outline

- 1 Introduction
- 2 Model
- 3 Estimation
- 4 Data
- 5 Results and discussion
- 6 Conclusion**

Conclusion

- Consumers have less of a strong preference for access to variety in venues with music and dance while they are very sensitive to variety in venues which serve drinks but do not offer additional amenities.
- Nightlife venues face very high barriers to entry. This limits the available variety of
- Future research: understanding the valuation and development of consumption amenities in cities, allowing greater flexibility in venue location choices

Back to research questions

- ① Q: Do consumers prefer access to variety in nightlife venues?
A: Consumers have a strong preference for variety in nightlife venues.
- ② Q: How do these preferences impact nightlife industry dynamics and the level of nightlife services provided?
A: It is possible that a new entrant increases the profit for incumbent competitors.

Q & A

Thank you.

Likelihood function

- For a given neighborhood m , let $t = 1, 2, \dots, T_m$ index the observed transitions.
- Let τ_{mt} be the wait time before transition t , let $n_{mt} = (n_{mt1}, n_{mt2}, \dots, n_{mtL})$ denote the vector of venues of each type l before transition t , and let e_{mtl} and x_{mtl} be indicator variables for whether transition t in neighborhood m was an entry of type l or an exit of type l .
- Then the log-likelihood function of the observed transitions $\{\tau_{mt}, n_{mt}, e_{mtl}, x_{mtl}\}$ can be written as a function of these entry and exit rates h_j^e and h_j^x is:

$$\begin{aligned} LLH(\{\tau_{mt}, n_{mt}, e_{mtl}, x_{mtl}\} | h_j^e, h_j^x) = \\ \sum_m \left[\sum_{t=1}^{T_m+1} (-\tau_{mt}) \sum_l (n_{mtl} h_l^x(n_{mt}, d_m, r_m) + v_l h_l^e(n_{mt}, d_m, r_m)) + \right. \\ \left. \sum_{t=1}^{T_m} \sum_l (x_{mtl} n_{mtl} \log h_l^x(n_{mt}, d_m, r_m) + e_{mtl} v_l \log h_l^e(n_{mt}, d_m, r_m)) \right] \end{aligned}$$

Likelihood function

- Log-likelihood function

$$\begin{aligned} LLH(\{\tau_{mt}, n_{mt}, e_{mtl}, x_{mtl}\} | h_j^e, h_j^x) = \\ \sum_m \left[\sum_{t=1}^{T_m+1} (-\tau_{mt}) \sum_l (n_{mtl} h_l^x(n_{mt}, d_m, r_m) + v_l h_l^e(n_{mt}, d_m, r_m)) + \right. \\ \left. \sum_{t=1}^{T_m} \sum_l (x_{mtl} n_{mtl} \log h_l^x(n_{mt}, d_m, r_m) + e_{mtl} v_l \log h_l^e(n_{mt}, d_m, r_m)) \right] \end{aligned}$$

- 1st sum: likelihood of observed wait time between transitions
- 2nd sum: likelihood of the observed type of each transition (conditional on observing a transition)