Research objective

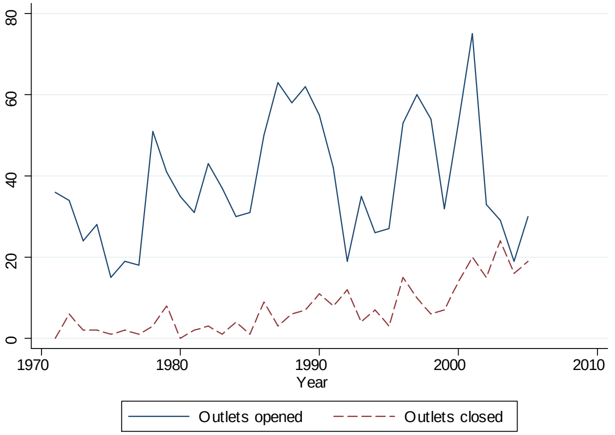
Setting

-

Entry and exit decisions

Aggregate dynamics

Figure: Total number of outlets opened/closed in Canada over time.

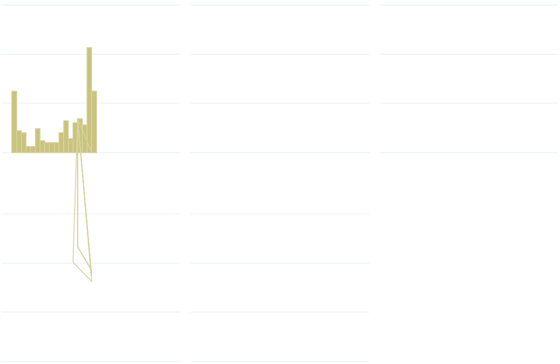


First movers

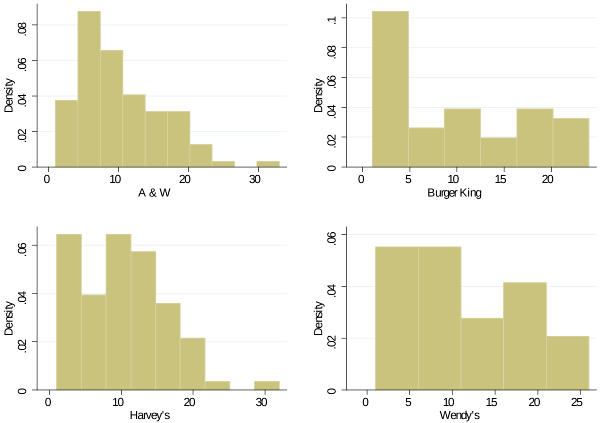
Table: Tabulation of the total number of markets that a chain was the (unique) …rst entrant.

Chain	First entrant
A & W	100
Burger King	50
Harvey 's	65
McDonald 's	334
Wendy 's	34

Time of entry



Time of exit


Density
0
.02
.04
.06
.08
0
10
20
30
A & W
Density
0
.02
.04
.06
.08
.1
0
5
10
15
20
Burger King
Density
0
.02
.04
.06
0
10
20
30
Harvey's
Density
0
.02
.04
.06
0
5
10
15
20
25
Wendy's

Market characteristics

Table: Summary statistics for markets that were occupied in 1970, and for markets that were occupied after 1970.

	Occupied 1970		Occupied after 1970	
Variable	Mean	Std. Dev	Mean	Std. Dev
Population (persons)	21,144	7,433	23,895	12,809
Population density (persons per sq km)	2,892.93	3,276.488	1,615.26	2,271.38
Total sales (billion CDN)	1.410	1.160	2.330	1.170
Total retail locations	483	364	850	408
Income (dollars)	57,579	14,082.81	55,518.77	18,571.69
Property value (million CDN)	0.322	0.168	0.259	0.161

Results

Table:

Beliefs about market unobserved heterogeneity

$$\omega_m \quad \begin{array}{llll} \eta_m \ 1 \quad \sigma_i & \text{w.p.} & \lambda_{imt} & \\ \eta_m & \text{w.p.} & 1 \quad \lambda_{imt} & \end{array} .$$

-

Two ways to learn

- Learning through entry: Within a year of entering a market, a retailer resolves its uncertainty about the size of the market.
  - λ_{imt} 0 if the retailer entered at time t 1.
  - $\lambda_{imt\ s}$ 0 for all s 0 if λ_{imt} 0.
- Learning from others: A potential entrant who has not previously entered (and left) the market already can learn from the observed past decisions of their informed rivals.
  - Updates the beliefs, λ_{imt}, using Baye's rule and observed past stay/exit decisions among informed rivals.

Bayesian updating notation

- Set of informed retailers who made informed decisions at $t \quad 1$ is J_{mt}.
- Vector of informed decisions made at $t \quad 1$ is $a_{mt \quad 1}$.

$$\lambda_{imt} \quad \frac{\Pr \; a_{mt \quad 1} \; \omega_m \quad 0 \; \lambda_{imt \quad 1}}{\Pr \; a_{mt \quad 1} \; \omega_m \quad 0 \; \lambda_{imt \quad 1} \quad \Pr \; a_{mt \quad 1} \; \omega_m \quad 0 \quad 1 \quad \lambda_{imt \quad 1}}$$

$$\Pr \; a_{mt \quad 1} \qquad \prod_{j \quad J_{mt}} P_{jm}^{\quad a_{jmt \quad 1}} \quad 1 \quad P_{jm}^{\quad 1 \quad a_{jmt \quad 1}}$$

Markov Perfect Equilibrium (MPE)

$$_i \; X_{mt}, \varepsilon_{imt}, \eta \qquad \arg \max_{a_{imt} \quad 0,1} E \; \Pi_{imt} \quad \beta V_i \quad X_{mt \quad 1}, \varepsilon_{imt \quad 1}, \eta_m \qquad [$$

- Strategies $_i \; X_{mt}, \varepsilon_{imt}, \eta_m \quad i$ assumed to depend on state variables, $X_{mt}, \varepsilon_{imt}, \eta_m$ where

$$X_{mt} \qquad a_{mt \quad 2}, a_{mt \quad 1}, \lambda_{mt \quad 1}, Z_{mt} \quad .$$

- $V_i \quad X_{mt \quad 1}, \varepsilon_{imt \quad 1}, \eta_m$ is the continuation value.
- Π_{imt} is one shot payo¤ evaluated at strategies $_i \; X_{mt}, \varepsilon_{imt}, \eta_m \quad i$.
- Integrating strategy function with respect to ε_{imt} yields best response function $P_i \; X_{mt}, \eta_m$.
- MPE obtained as …xed point.

Identi…cation of structural model

- Strategic interactions (θ_{2ij}).
  - Chain's incumbency status has direct impact on its own ‡ow pro…ts through entry costs, but will only a¤ect rival through best response probability.
  - This is true if chain was not already active 2 perio?(s)-33rr ifae ae(s)-33eraiity.

  - e bu2ci(eny)-333va2ril i2

Simple DID test for learning

$$\delta \quad \Pi_i^P \; 0, 1 \quad \Pi_i^P \; 0, 0 \quad \Pi_i^P \; 1, 1 \quad \Pi_i^P \; 1, 0$$

- Lets focus on two chains.
- Chain i is either a potential entrant or incumbent, while its rival j either stayed or exited at t 1.
- Set β 0 and let ε_{imt} be uniformly distributed.
- $\Pi_i^P \; a_{imt \;\; 1}, a_{jmt \;\; 1}$ is one-shot payo(ot)Td[()]5G3t4iven7(y)28(ed)015.13

Simple DID test for learning

- Under null hypothesis of no learning ($\sigma_i \quad 0$):

$$\delta_0 \quad \theta_{2ij}\theta_{2ji} \quad P_i \;\; 0, 1 \quad P_i \;\; 0, 0 \qquad P_i \;\; 1, 1 \quad P_i \;\; 1, 0 \quad .$$

- Also possible to write δ_0, based on assumptions above, as:

$$\delta_0 \quad P_i \;\; 0, 1 \quad P_i \;\; 0, 0 \qquad P_i \;\; 1, 1 \quad P_i \;\; 1, 0 \quad .$$

- Therefore learning holds i¤ DID is zero:

$$\sigma_i \quad 0 \quad \delta_0 \quad P_i \;\; 0, 1 \quad P_i \;\; 0, 0 \qquad P_i \;\; 1, 1 \quad P_i \;\; 1, 0 \qquad 0.$$

DID regression

- Let $\Pi_i^P \; 0, 1 \quad \Pi_i^{01}$, $\Pi_i^P \; 0, 0 \quad \Pi_i^{00}$, $\Pi_i^P \; 1, 1 \quad \Pi_i^{11}$, and $\Pi_i^P \; 1, 0 \quad \Pi_i^{10}$.
- Based on the assumptions above, and some algebra, regression can be written as:

$$E \;\; a_{imt} \; a_{mt \;\; 1}, Z_{mt} \qquad \Pi_i^{00} \qquad a_{imt \;\; 1} \qquad a_{jmt \;\; 1}$$

Implications of learning: Strategic delay

Table: Average number of years before …rst entering a market.

	With uncertainty	Without uncertainty
A & W	5.0	4.0
Burger King	3.3	4.5
Harvey 's	3.3	8.2
McDonald 's	7.7	5.8
Wendy 's	11.7	11.9

Future directions

-

Thank you!