Estimating a Model of Strategic Network Choice: The Convenience-Store Industry in Okinawa

Mitsukuni Nishida

Johns Hopkins Univ.

Annual FTC-NU conference
Motivation: Why Model Location Choice of Chains?

- We often observe store-location choices of multi-store firms.
  - Convenience stores (Family Mart, LAWSON), discount retailers (Wal-Mart, Target), groceries (Whole Foods, Trader Joe’s)

- Two features: (1) internalizing a trade-off due to clustering own stores and (2) taking a rival chain’s store locations into account

- What are the underlying primitives that generate the observed store networks? Can we explain these networks as the outcomes of games?
- Can we predict new store networks after a merger (or deregulation)?
  - "The proposed settlement doesn’t resolve the competitive problem that would lead to these higher prices." (FTC, Staples-Office Depot merger, 1997)

- This paper develops a new framework to estimate a game in which two chains choose store networks.
There is a trade-off between

1. **Own Business-Stealing Effect**: revenue reduction due to presence of own chain stores and
2. **Cost Savings** due to presence of own chain stores.

A trade-off can be within a market (red) or across markets (pink).
Underlying Difficulties in Chain-Entry Game

- Family Mart Store
- LAWSON Store

\[ N_{FM} = (0, 1, 0, 0, 0, 3, 1, 1, 0, 1, 0, 1, 0, 1, 0, 0) \]

Issues: Huge number of

1. possible store networks: \( 5^{16} = 1.5 \times 10^{11} \)
2. possible outcomes of the game: \( (5^{16})^2 = 2.3 \times 10^{22} \)
My Approach

- This paper proposes a general framework for estimating a chain-entry model.
- New features: a chain is allowed to
  1. decide where and how densely to open stores and
  2. internalize a trade-off due to clustering own stores.
- Methodological improvements
  1. Provide algorithms to reduce burden of solving for a Nash Equilibrium.
  2. Integrate chain-entry model with post-entry outcome, correcting for selection for entrants by simulations
- Apply to convenience stores in Okinawa to evaluate hypothetical merger and deregulation
- Empirical findings
  1. Trade-off due to clustering stores is important consideration for a chain.
  2. Merger: Acquirer increases in number of stores in city centers but decreases in suburbs.
Empirical Entry Models

- Traditional unit of analysis is the single-store firm.
  - Markets are independent both in demand and costs

- Analysis on multi-store firms
  - Jia (2008): equilibrium store-network choice model

- Integration of post-entry outcomes into entry model
Two players $i \in \{ \text{FamilyMart, LAWSON} \}$

Complete information, simultaneous move

Markets denoted $m = 1, \ldots, M$

Strategy profile: $N_i = [N_{i,1}, \ldots N_{i,m}, \ldots, N_{i,M}]'$

Each player maximizes total profits:

$$\Pi_i(N_i, N_j) = \sum_{m=1}^{M} \pi_{i,m}(N_i, N_j)$$

Nash equilibrium: a pair of store networks that are best responses

$N_{i,m} \in \{0, 1, \ldots, K\}$
Profit Function and Revenue Equation

\[ \pi_{i,m}(N_i, N_j) = r_{i,m}(N_i, N_j) - c_{i,m}(N_i), \text{ where} \]

- Profits, market level
- Revenue
- Costs

\[ r_{i,m}(N_i, N_j) = N_{i,m} \times [\delta_{own, within} \log(\max(N_{i,m}, 1)) - \delta_{own, adj} \sum_{l \neq m} \frac{D_{i,l}}{Z_{m,l}}] \]

business-stealing effect, own chain stores

\[ -\delta_{rival, within} \log(N_{j,m} + 1) - \delta_{rival, adj} \sum_{l \neq m} \frac{D_{j,l}}{Z_{m,l}} \]

business-stealing effect, rival chain stores

\[ -\delta_{local, within} \log(N_{local,m} + 1) - \delta_{local, adj} \sum_{l \neq m} \frac{D_{local,l}}{Z_{m,l}} \]

business-stealing effect, local stores

\[ + \chi_m \beta + \mu_{\text{LAWSON}} \times 1(i \text{ is LAWSON}) + \lambda_1(\sqrt{1 - \rho_1^2 \epsilon_m} + \rho_1 \eta_{i,m}) \]

demographics brand fixed effect, LAWSON revenue shocks
Cost Equation

\[ c_{i,m}(N_i) = N_{i,m} \times \left[ -\alpha_{\text{saving, within}} \log(\max(N_{i,m}, 1)) \right] \]

(cost savings from stores within a market)

\[-\alpha_{\text{saving, adj}} \sum_{l \neq m} \frac{D_{i,l}}{Z_{m,l}} \]

(cost savings from stores in adjacent markets)

\[ + \mu_{\text{dist}} \times Distance_{i,m} \]

(costs due to distance to distribution center)

\[ + \gamma \times 1 (\text{market } m \text{ is zoned}) \]

(fixed costs due to regulation)

\[ + \mu_{\text{cost}} \]

(fixed costs of opening a store)

\[ + \lambda_2 \left( \sqrt{1 - \rho_2^2 \epsilon_m^c} + \rho_2 \eta_{i,m}^c \right) \]

(cost shocks)
Motivation for Mult-Store Model

Multiple-choice model (1) has better coverage, (2) incorporates a trade-off within a market, (3) endogenizes all markets \(\Rightarrow\) enables merger simulation.

\[\begin{array}{c}
\text{Binary-Choice Model} \\
\text{Multiple-Choice Model}
\end{array}\]

\(\star\) : Family Mart Store

\(\circ\) : LAWSON Store
Motivation for Multi-Store Model

- Dense configuration of stores in Okinawa
Computational Challenges

Issues

1. Number of possible network choices is too large to evaluate:
   Five choices, 834 markets $\Rightarrow 5^{834} = 8 \times 10^{582}$

2. Need to solve for a Nash Equilibrium of the game
   Possible outcomes: $(5^{834})^2 = 6.4 \times 10^{1165}$

Use lattice theory to develop iterative algorithms under $K$-choice to

1. search for the profit maximizing network choice and
2. solve for a Nash Equilibrium.
Supermodular Game and Existence of Equilibrium

**Definition (Supermodular Game)**

A game is supermodular if (1) $\Pi_i(N_i, N_j)$ is supermodular in $N_i$ for fixed $N_j$, and (2) $\Pi_i(N_i, N_j)$ has increasing differences in $N_i$ and $N_j$.

**Theorem (Topkis 1979)**

The set of Nash Equilibria of a supermodular game is non-empty.
Lemma

The chain-entry game with $K$-choice is supermodular if

$$\delta_{own,adj} \leq \alpha_{saving,adj}.$$  

Remark: There are no restrictions on the within-market effect among own stores in a market. Within any given market, either positive spillover (delivery costs savings) or own business-stealing effect can dominate.
Algorithm to Calculate Nash Equilibrium

Theorem (Round-Robin Algorithm to Compute a Nash Equilibrium [Topkis 1998])

Each player proceeds to update her strategy by choosing a best response. This iterative decision-making process will converge to a Nash Equilibrium that yields the highest profits for the first mover in the algorithm.

Steps

1. Given $N_{LS}^0 = (0, 0, \ldots, 0)$, compute the best response of Family Mart $N_{FM}^1 = \arg \max_{N_{FM}} \sum_{m=1}^{M} \pi_{FM,m}(N_{FM}, N_{LS}^0)$.

2. Given $N_{FM}^1$, compute the best response of LAWSON $N_{LS}^1$.

3. Iterate 1 and 2 for $T$ times until we get convergence of either $N_{FM}^T$ or $N_{LS}^T$.

Issue

- Calculating the best response is burdensome.
Theorem (Fixed Point Theorem [Tarski 1955])

A set of fixed points of an increasing function $V$ that maps a lattice into itself is a lattice and has a greatest point and a least point.

- Consider the profit maximizing vector: $N_i^* = \arg\max_{N_i} \Pi_i(N_i, N_j)$.
- According to Tarski’s FPT, we know
  
  $$N_i^{UB} \geq N_i^* \geq N_i^{LB},$$

  where $N_i^{UB}$ and $N_i^{LB}$ are, respectively, the greatest and least fixed points of increasing function $V$.

- Define a mapping $V : N_i \rightarrow N_i$ that updates $N_{i,m}^0$ given $N_{i,l \neq m}^0$ and $N_j^0$:
  
  $$N_{i,m}^1 = V_m(N_i^0) = \arg\max_{N_{i,m} \in \{0,1,\ldots,4\}} \Pi_i(N_{i,l}^0, N_{i,m}^0, N_j^0).$$

- The profit maximizing vector $N_i^*$ satisfies $V(N_i^*) = N_i^*$.
Lemma (Nondecreasing Coordinatewise Optimality Condition)

\[ V_i(N_i) \text{ is nondecreasing in } N_i \text{ if } \delta_{\text{own},\text{adj}} \leq \alpha_{\text{saving},\text{adj}}. \]
Algorithm to Find Best Response: Example

- Two markets, up to 4 stores: How do we find the maximizer?
  1. Brute force: check all $5 \times 5 = 25$ possibilities
  2. Or we can narrow down to 4 by calculating lower and upper bound:
     $N^i_{UB} = (3, 3), N^i_{LB} = (2, 2)$
     $\Rightarrow N^*$ is one of \{(2, 2), (2, 3), (3, 2), (3, 3)\}. 

\[ N^0 = (0, 0) \]
\[ N^1 \]
\[ N^2 = N_{ub} \]
\[ N^3 = N_{lb} \]
\[ N^0 = (4, 4) \]
Data

- Market definition: $1\text{km}^2$ grid, 834 markets in total

- Cross-sectional market-level data
  1. # of Convenience Stores: Convenience Store Almanac, 2001
  3. Distance to distribution center
  4. # of people living: Census of Population, 2000
  5. # of people working: Establishment Census, 2001
Estimation Methodology: Method of Simulated Moments

- Construct population and sample moment conditions:

\[
g_{i,\text{store}}(\theta) \equiv E\left[ (N_{i,m} - E[N_{i,m}(X, \epsilon, \theta|X)]) \right] * f_m(X) | X]
\]

\[
g_{i,\text{store},M}(\theta) \equiv \frac{1}{M} \sum_{m=1}^{M} \left( N_{i,m} - E[N_{i,m}(X, \epsilon, \theta)|X] \right) * f_m(X).
\]

- Use a simulator for number of stores to obtain

\[
\hat{g}_{i,\text{store},M}(\theta) = \frac{1}{M} \sum_{m=1}^{M} \left( N_{i,m} - \frac{1}{S} \sum_{s=1}^{S} N_{i,m}^{s}(X, \epsilon^{s}, \theta) \right) * f_m(X).
\]

- Parameter estimates are obtained by solving

\[
\hat{\theta}_{MSM} = \arg \min_{\theta} \left[ \hat{g}_M(\theta) \right]' \mathbf{W} \left[ \hat{g}_M(\theta) \right],
\]

where \( \mathbf{W} \) is a weighting matrix.
Use of Revenue Data: Moment Conditions for Revenue

- Construct population and sample moment conditions:

\[ g_{rev}(\theta) \equiv E[(l_m R_m^* - E[l_m R_m^*(X, \epsilon, \theta|X)])] \ast f_m(X) | X] \]

\[ g_{rev,M}(\theta) \equiv \frac{1}{M} \sum_{m=1}^{M} (l_m R_m^* - E[l_m R_m^*(X, \epsilon, \theta|X)]) \ast f_m(X). \]

- Use a simulator for aggregate revenue at the market level to obtain

\[ \hat{g}_{rev,M}(\theta) \equiv \frac{1}{M} \sum_{m=1}^{M} (l_m R_m^* - \frac{1}{S} \sum_{s=1}^{S} l_m R_{m,s}^*(X, \epsilon^s, \theta)) \ast f_m(X). \]
Avoiding Selectivity Problem

- Post-entry outcome is available only for the market where a firm decided to open
- Example: a revenue function

\[
(Total\ revenue)_m = \theta_a + \theta_b N_{i,m} + \epsilon_m
\]

- My approach uses (1) and (2) jointly to estimate \( \theta = (\theta_1, \theta_2) \)

\[
\begin{align*}
\text{outcome } & E[g_1(\theta_1)] = 0 \quad (1) \\
\text{selection } & E[g_2(\theta_1, \theta_2)] = 0 \quad (2)
\end{align*}
\]
## Revenue Equation (thousand USD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nighttime Population ($\beta_{pop}$)</td>
<td>69.1</td>
<td>26.3</td>
</tr>
<tr>
<td>Daytime Population ($\beta_{bus}$)</td>
<td>46.7</td>
<td>14.4</td>
</tr>
<tr>
<td>Business-Stealing Effect by Own Chain Store, within a Market ($\delta_{own\ within}$)</td>
<td>280.1</td>
<td>133.4</td>
</tr>
<tr>
<td>Own Chain Store, Adjacent Markets ($\delta_{own\ adi}$)</td>
<td>33.0</td>
<td>111.0</td>
</tr>
<tr>
<td>Rival Chain Store, within a Market ($\delta_{rival\ within}$)</td>
<td>364.2</td>
<td>180.0</td>
</tr>
<tr>
<td>Rival Chain Store, Adjacent Markets ($\delta_{rival\ adi}$)</td>
<td>1.1</td>
<td>11.9</td>
</tr>
<tr>
<td>Local Store, within a Market ($\delta_{local\ within}$)</td>
<td>24.4</td>
<td>81.8</td>
</tr>
<tr>
<td>Local Store, Adjacent Markets ($\delta_{local\ adi}$)</td>
<td>0.1</td>
<td>1.41</td>
</tr>
<tr>
<td>LAWSON Store ($\mu_{LAWSON}$)</td>
<td>4.7</td>
<td>38.5</td>
</tr>
<tr>
<td>Constant in Revenue Equation ($\mu_{revenue}$)</td>
<td>512.5</td>
<td>475.9</td>
</tr>
<tr>
<td>Correlation Parameter in Revenue Shocks ($\rho$)</td>
<td>0.89</td>
<td>0.31</td>
</tr>
<tr>
<td>Standard Deviation of the Unobserved Revenues ($\lambda$)</td>
<td>215.3</td>
<td>76.5</td>
</tr>
</tbody>
</table>
## Cost Equation & Model Fit (thousand USD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Savings Effect by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own Chain Store, within a Market (( \alpha \text{ saving within} ))</td>
<td>125.3</td>
<td>127.5</td>
</tr>
<tr>
<td>Own Chain Store, Adjacent Markets (( \alpha \text{ saving adj} ))</td>
<td>37.6</td>
<td>122.8</td>
</tr>
<tr>
<td>Distance from the Distribution Center (( \mu \text{ distance} ))</td>
<td>16.2</td>
<td>42.3</td>
</tr>
<tr>
<td>Zoned Area (( \gamma ))</td>
<td>41.4</td>
<td>45.4</td>
</tr>
<tr>
<td>Constant in Cost Equation (( \mu \text{ cost} ))</td>
<td>1,038.7</td>
<td>255.0</td>
</tr>
<tr>
<td>Correlation Parameter in Cost Shocks (( \rho_2 ))</td>
<td>0.02</td>
<td>0.25</td>
</tr>
<tr>
<td>Standard Deviation of the Unobserved Costs (( \lambda_2 ))</td>
<td>229.6</td>
<td>118.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model Prediction</th>
<th>Data</th>
<th>Prediction</th>
<th>Std.Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>139</td>
<td>139.9</td>
<td>8.7</td>
</tr>
<tr>
<td>LAWSON</td>
<td>100</td>
<td>97.1</td>
<td>9.8</td>
</tr>
<tr>
<td>Number of Stores in Adjacent Markets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>1041</td>
<td>1023.4</td>
<td>67.4</td>
</tr>
<tr>
<td>LAWSON</td>
<td>725</td>
<td>705.6</td>
<td>80.0</td>
</tr>
<tr>
<td>Sales (thousand USD)</td>
<td>169,334</td>
<td>173,992</td>
<td>11,506</td>
</tr>
</tbody>
</table>
Differences in # of Stores and Population Density

Mitsukuni Nishida (Johns Hopkins Univ.)

Estimating a Model of Strategic Network Choice

Annual FTC-NU conference
Why Increase in # of Stores after Merger?

Marginal profits from one more store, before merger:

$$\Delta \pi_{5, \text{before}} = 3 \times (\text{spillovers}) - 1 \times (\text{business stealing})$$

After merger:

$$\Delta \pi_{5, \text{after}} = 6 \times (\text{spillovers}) - 1 \times (\text{business stealing})$$
Increase in # of Stores: before and after Deregulation

Family Mart

LAWSON
Conclusion

This paper

1. Develops a new framework to solve and estimate a general class of chain-entry games.
2. Applies the model to the convenience-store industry in Okinawa.
3. Answers merger and deregulation exercises, which cannot be dealt with otherwise.

Findings

- The chain-entry model with $K$-store openings allows for a trade-off due to clustering being positive or negative.
- Trade-off due to clustering stores is important for a chain.
- Merger: Acquirer increases the total number of stores in city centers but decreases the total number of stores in rural markets.
Conclusion

This paper

1. Develops a new framework to solve and estimate a general class of chain-entry games.
2. Applies the model to the convenience-store industry in Okinawa.
3. Answers merger and deregulation exercises, which cannot be dealt with otherwise.

Findings

- The chain-entry model with $K$-store openings allows for a trade-off due to clustering being positive or negative.
- Trade-off due to clustering stores is important for a chain.
- Merger: Acquirer increases the total number of stores in city centers but decreases the total number of stores in rural markets.

Applications to Other Contexts

1. **ATM location choice**
2. **Product-line decision**: Extend Moorthy (1984) to duopoly setting.
Extensions

1 Strategic pricing in the U.S. airline industry
   - A market is a city pair (e.g., New York to Chicago).
   - Pricing in a market can depend on pricing in other markets (spillovers):
     \[
     P_{United} = [P_{u,1}, \ldots, P_{u,M}]
     \]
     \[
     P_{American} = [P_{a,1}, \ldots, P_{a,M}].
     \]
   - Research questions: Is the industry competitive or collusion? Predicted pricing after merger?

2 Relaxing the "# of players ≤ 2" restriction
   - In reality, we observe more than two players.
   - Will exploit other classes of games.
## Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>0.17</td>
<td>0.55</td>
<td>0</td>
<td>7</td>
<td>142</td>
</tr>
<tr>
<td>LAWSON</td>
<td>0.12</td>
<td>0.43</td>
<td>0</td>
<td>6</td>
<td>102</td>
</tr>
<tr>
<td>Number of Stores in Adjacent Markets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>1.248</td>
<td>2.675</td>
<td>0</td>
<td>19</td>
<td>1,041</td>
</tr>
<tr>
<td>LAWSON</td>
<td>0.869</td>
<td>1.923</td>
<td>0</td>
<td>15</td>
<td>725</td>
</tr>
<tr>
<td>Geographical Distance to Its Distribution Center (kilometer)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>29.7</td>
<td>20.8</td>
<td>0.35</td>
<td>84.86</td>
<td>-</td>
</tr>
<tr>
<td>LAWSON</td>
<td>30.8</td>
<td>21.0</td>
<td>0.55</td>
<td>86.18</td>
<td>-</td>
</tr>
<tr>
<td>Nighttime Population</td>
<td>1,434</td>
<td>2,588</td>
<td>0</td>
<td>18,977</td>
<td>1,195,787</td>
</tr>
<tr>
<td>Daytime Population</td>
<td>580</td>
<td>1,612</td>
<td>0</td>
<td>32,776</td>
<td>484,097</td>
</tr>
<tr>
<td>Store-level Sales (=Total Sales / # of Stores), thousand US dollars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>1,430</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAWSON</td>
<td>1,456</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Before and after Merger (million USD)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline Prediction</th>
<th>No Costs Prediction</th>
<th>% Δ</th>
<th>Closing Prediction</th>
<th>% Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Number of Stores</strong></td>
<td>237.0</td>
<td>207.9</td>
<td>-12.3%</td>
<td>215.4</td>
<td>-9.1%</td>
</tr>
<tr>
<td><strong>Number of Stores to:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintain (Own Chain)</td>
<td></td>
<td></td>
<td></td>
<td>139.9</td>
<td></td>
</tr>
<tr>
<td>Open (Own Chain)</td>
<td></td>
<td></td>
<td></td>
<td>25.3</td>
<td></td>
</tr>
<tr>
<td>Close (Own Chain)</td>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Close (Rival Chain)</td>
<td></td>
<td></td>
<td></td>
<td>46.9</td>
<td></td>
</tr>
<tr>
<td>Remodel Rival Stores</td>
<td></td>
<td></td>
<td></td>
<td>50.2</td>
<td></td>
</tr>
<tr>
<td><strong>Total Sales</strong></td>
<td>$234.6</td>
<td>$209.9</td>
<td>-10.5%</td>
<td>$214.6</td>
<td>-8.5%</td>
</tr>
<tr>
<td>Sales per Store</td>
<td>$0.97</td>
<td>$1.01</td>
<td>4.2%</td>
<td>$1.00</td>
<td>2.8%</td>
</tr>
<tr>
<td><strong>Total Profits</strong></td>
<td>$58.7</td>
<td>$65.9</td>
<td>12.3%</td>
<td>$58.5</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Profits per Store</td>
<td>$0.24</td>
<td>$0.32</td>
<td>34.1%</td>
<td>$0.27</td>
<td>15.0%</td>
</tr>
</tbody>
</table>
Robustness Check: Costs(left) & LAWSON(right)
1968 Urban Planning Law

- Permission system for developing a store in zoned area

Procedures:

1. Submit preliminary application [applicant]
2. Receive application, send to civil engineering bureau [city]
3. Review application, conduct a field survey [prefecture]
4. Notify the applicant of the outcome and issues, if any [prefecture]
5. Submit final application [applicant]
Zoned Areas (Red)
## Before and after Deregulation (million USD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline Prediction</th>
<th>No Zoning Prediction</th>
<th>% Δ</th>
<th>Zoning in All Markets Prediction</th>
<th>% Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>139.9</td>
<td>143.2</td>
<td>2.3%</td>
<td>123.2</td>
<td>-11.9%</td>
</tr>
<tr>
<td>(in originally zoned 140 markets)</td>
<td>11.9</td>
<td>15.0</td>
<td>26.9%</td>
<td>11.8</td>
<td>-0.5%</td>
</tr>
<tr>
<td>LAWSON</td>
<td>97.1</td>
<td>99.2</td>
<td>2.2%</td>
<td>86.0</td>
<td>-11.4%</td>
</tr>
<tr>
<td>(in originally zoned 140 markets)</td>
<td>8.3</td>
<td>10.4</td>
<td>26.2%</td>
<td>8.2</td>
<td>-0.3%</td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>$135.6</td>
<td>$137.9</td>
<td>1.7%</td>
<td>$124.0</td>
<td>-8.6%</td>
</tr>
<tr>
<td>(in originally zoned 140 markets)</td>
<td>$10.1</td>
<td>$12.5</td>
<td>23.1%</td>
<td>$10.1</td>
<td>-0.3%</td>
</tr>
<tr>
<td>LAWSON</td>
<td>$99.0</td>
<td>$100.6</td>
<td>1.7%</td>
<td>$90.9</td>
<td>-8.2%</td>
</tr>
<tr>
<td>(in originally zoned 140 markets)</td>
<td>$7.5</td>
<td>$9.1</td>
<td>22.6%</td>
<td>$7.4</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Total Profits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Mart</td>
<td>$33.1</td>
<td>$33.6</td>
<td>1.6%</td>
<td>$29.1</td>
<td>-11.9%</td>
</tr>
<tr>
<td>LAWSON</td>
<td>$25.6</td>
<td>$26.0</td>
<td>1.5%</td>
<td>$22.7</td>
<td>-11.5%</td>
</tr>
<tr>
<td>Costs of Zoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Stores</td>
<td>-$2.1</td>
<td>$0.0</td>
<td>-100%</td>
<td>-$17.5</td>
<td>742.6%</td>
</tr>
<tr>
<td>Family Mart and LAWSON</td>
<td>-$0.8</td>
<td>$0.0</td>
<td>-100%</td>
<td>-$8.7</td>
<td>940.5%</td>
</tr>
</tbody>
</table>
Convenience-Store Industry in Okinawa

Estimating a Model of Strategic Network Choice: The Convenience-Store Industry in Okinawa