Market Structure and Productivity: A Concrete Example (Chad Syverson)

- Background: 85th-15th TFP percentile differences of between 2:1 and 4:1

- Within narrowly defined industries

- Sverson points to importance of product differentiation
Model (somewhat clunky but does the job)

Start with review of Salop circle model

- Suppose have circle with uniform distribution of consumers with density $D$ (circumference=1)

- Transportation cost $t$ per unit distance

- Sunk cost of $G$ to enter

- Two stage game.
—Stage 1: \( N \) firms enter. Then exogenously distributed evenly around the circle (clunky part)

—Stage 2: Engage in Bertrand competition
Second Stage

- Suppose firm at a point $x = 0$ on circle and neighbors set price $p^\circ$ and own price is $p$

- Let $\hat{x}$ be cutoff of marginal consumer

\[
p + t\hat{x} = p^\circ + \left(\frac{1}{N} - \hat{x}\right)t
\]

\[
2t\hat{x} = p^\circ - p + \frac{t}{N}
\]

\[
\hat{x} = \frac{p^\circ - p}{2t} + \frac{1}{2N}
\]

So

\[
Q = D2\hat{x}
\]

\[
\pi = (p - c)Q
\]
The FONC is

\[ 0 = (p - c) \frac{dQ}{dp} + Q \]

\[ = (p - c) \left( -\frac{D}{t} \right) + \frac{D}{N} \quad \text{(at } p = p^\circ) \]

Do

\[ p = c + \frac{t}{N} \]

\[ \pi = \frac{Dt}{N^2} \]

- First stage. \( N^* \) solves

\[ \frac{Dt}{N^{*2}} \geq F \]

\[ \frac{Dt}{(N^* + 1)^2} < F \]
• Comparative Statics with $D$

$- N$ increases

$- p$ decreases

$- Q$ increases
Syverson’s Extension

- Stage 1. $N$ enter and pay $G$ each like before

- Stage 2. Firms draw $c_j$

- Stage 3. Shakeout process ....

- Stage 4. Survivors pay fixed cost $F$ and play Bertrand game
Figure 1: Post-Shakeout Productivity Distribution Moments

- Qty-Wt Avg. Productivity
- Average Productivity
- Productivity Std. Dev.
Figure 2: Number of Plants at Entry, Post-Shakeout, and in Symmetric Cost Case
Figure 3: Fraction of Entrants Producing after Shakeout and Average Productivity
Figure 4: Average Post-Shakeout Markup and Profits
Figure 5: Average Plant Output after Shakeout ($D/N$)
Empirical Analysis

Technology (in logs)

\[ q_{it} = \gamma_0 + \beta_i + \gamma_d d_{mult,t} + \gamma_x x_{it} + \omega_{it} \]

where

\[ -\beta_i + \omega_{it} \text{ is productivity of } i \text{ at time } t \]

\[ -\gamma_d \text{ a difference for multiplant firms (why not part of productivity)} \]

\[ -\gamma_x \text{ returns to scale parameter} \]

\[ -x_{it} \text{ composite input} \]
• Could use divisia method to calculate $\beta_i + \omega_{it}$ (just assume $\gamma_d = 0, \gamma_x = 1$ (or whatever). Use input shares to calculate $x_{it}$ and back out $\beta_i + \omega_{it}$

• Instead starts with production function estimation (but not in revision)
Table 2: Production Function Estimation Results

This table shows instrumental variables production function estimates (first and second stage) for ready-mixed concrete plants, using local demand measures as instruments. For details see text.

<table>
<thead>
<tr>
<th>Instrument Set</th>
<th>N</th>
<th>1st Stage Stats</th>
<th>2nd Stage Coefficient Estimates</th>
<th>R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>R^2</td>
<td>Part. R^2</td>
</tr>
<tr>
<td>County</td>
<td>11,017</td>
<td>128.7</td>
<td>0.094</td>
<td>0.053</td>
</tr>
<tr>
<td>CEA</td>
<td>11,114</td>
<td>177.4</td>
<td>0.112</td>
<td>0.071</td>
</tr>
<tr>
<td>EA</td>
<td>11,114</td>
<td>176.2</td>
<td>0.111</td>
<td>0.071</td>
</tr>
</tbody>
</table>

(Standard errors in parentheses)
Table 4. Local Productivity Distribution Regressions—Main Results

A. Location-year observations with at least 5 non-Administrative Record producers, N=688. Heteroskedasticity-robust standard errors are in parentheses. An asterisk indicates significance at the 5% level.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Demand Controls:</th>
<th>Year Dummies:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Productivity Dispersion</td>
<td>R²</td>
<td></td>
</tr>
<tr>
<td>Demand Density Coefficient</td>
<td>-0.024*</td>
<td>-0.052*</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Median Productivity</td>
<td>R²</td>
<td></td>
</tr>
<tr>
<td>Demand Density Coefficient</td>
<td>0.030*</td>
<td>0.024*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Q-Wt. Avg. Productivity</td>
<td>R²</td>
<td></td>
</tr>
<tr>
<td>Demand Density Coefficient</td>
<td>0.030*</td>
<td>0.049*</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Plants per Demand Unit</td>
<td>R²</td>
<td></td>
</tr>
<tr>
<td>Demand Density Coefficient</td>
<td>-0.368*</td>
<td>-0.258*</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Average Output</td>
<td>R²</td>
<td></td>
</tr>
<tr>
<td>Demand Density Coefficient</td>
<td>0.228*</td>
<td>0.158*</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.024)</td>
</tr>
</tbody>
</table>
B. Summary of Demand Control Coefficients (See text for details.)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Significant, Positive Coefficients</th>
<th>Significant, Negative Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>Median Housing Price, 1987 Dummy</td>
<td>Marriages per Capita, Fraction with Bachelor’s, 2+ Auto Households</td>
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<tr>
<td>Dispersion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Productivity</td>
<td>Ciccone-Hall Density</td>
<td>Percentage Nonwhite, Fraction over 25, Fraction with Bachelor’s, 1982 and 1987 Dummies</td>
</tr>
<tr>
<td>Average Output</td>
<td>Marriages per Capita, Fraction with Bachelor’s, Median Housing Price, Ciccone-Hall Density, Demand Growth, 1987 Dummy</td>
<td>Fraction over 25, 2+ Auto Households, Primary Product Specialization Ratio, 1982 Dummy</td>
</tr>
</tbody>
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