ECON 357

Lecture 4: endogenous mark-ups

Thomas Chaney

University of Chicago

Melitz and Ottaviano (REStud 2005)

Endogenous mark-ups and selection:

- Linear demand system.
- Variable mark-ups.
- Finite marginal utility at 0 $\Rightarrow$ endogenous selection.

Preferences

- Quadratic preferences,

$$U^c = q_o^c + \alpha \int_{\omega \in \Omega} q^c(\omega)\, d\omega - \frac{1}{2}\gamma \int_{\omega \in \Omega} q^c(\omega)^2\, d\omega - \frac{1}{2}\eta \left(\int_{\omega \in \Omega} q^c(\omega)\, d\omega \right)^2$$

1. higher γ (> 0) $\Rightarrow$ more product differentiation between varieties.
2. higher α or η (> 0) $\Rightarrow$ more demand for differentiated varieties relative to the homogenous good.
3. Finite marginal utility even at 0.

Linear (affine) demand system

- Inverse demand function,

$$p(\omega) = \alpha - \gamma q^c(\omega) - \eta Q^c$$

with $Q^c = \int_{\omega \in \Omega} q^c(\omega)\, d\omega$.

- Aggregate demand for ω,

$$q(\omega) \equiv L q^c(\omega) = \frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p(\omega) + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \bar{p}, \ \forall \omega \in \Omega^*$$

- "Choke price,"

$$p(\omega) \leq \frac{\gamma \alpha + \eta N \bar{p}}{\eta N + \gamma}$$

Indirect utility

$$U^c = I^c + \frac{1}{2}\left(\eta + \frac{\gamma}{N}\right)^{-1}(\alpha - \bar{p})^2 + \frac{1}{2}\frac{N}{\gamma}\sigma_p^2$$

- Welfare decreases with average prices, $\bar{p}$.
- Welfare rises with the variance of price, σ_p^2 (reallocation).
- "Love for variety:" welfare increases with the number of varieties available, N.

Entry and production

- Fixed entry cost f_E.
- Constant marginal cost c drawn from $G(\cdot)$ over $[0, c_M]$.

Optimal pricing

- Profits are quadratic in quantities,

$$\begin{aligned}\pi(q) &= (p(q) - c)\, q \\ &= \left(\frac{\alpha\gamma}{\eta N + \gamma} + \frac{\eta N}{\eta N + \gamma}\bar{p} - \frac{\gamma}{L} q - c\right) q\end{aligned}$$

- Optimal quantity,

$$2\frac{\gamma}{L} q = \frac{\alpha\gamma}{\eta N + \gamma} + \frac{\eta N}{\eta N + \gamma}\bar{p} - c$$

- Linear demand gives optimal price,

$$q(c) = \frac{L}{\gamma}(p(c) - c)$$

- Exit threshold,

$$c_D = \frac{\alpha\gamma + \eta N \bar{p}}{\eta N + \gamma}$$

Equilibrium

$$
\begin{aligned}
p(c) &= \frac{1}{2}(c_D + c) \\
\mu(c) &= \frac{1}{2}(c_D - c) \\
q(c) &= \frac{L}{2\gamma}(c_D - c) \\
r(c) &= \frac{L}{4\gamma}\left(c_D^2 - c^2\right) \\
\pi(c) &= \frac{L}{4\gamma}(c_D - c)^2
\end{aligned}
$$

1. Lower cost firms charge lower prices.
2. Lower cost firms earn higher revenues and profits.
3. Lower cost firms set higher mark-ups.

General Equilibrium

- Free entry and zero-cutoff profits conditions,

$$\frac{L}{4\gamma}\int_0^{c_D}(c_D - c)^2\, dG(c) = f_E \tag{FE}$$

$$N = \frac{2\gamma}{\eta}\frac{a - c_D}{c_D - \bar{c}} \tag{ZCP}$$

1. Higher entry cost, higher average productivity.
2. More substitutability (γ low), higher average productivity.
3. Larger market, higher average productivity.
4. α and η affects number of firms but not selection.
5. "Tougher" competition in larger markets: lower prices, lower mark-ups.

Analytical results with Pareto distributions

$$G(c) = \left(\frac{c}{c_M}\right)^k, \; c \in [0, c_M], \; k \geq 1$$

1. In larger markets, bigger firms and higher profits (market size dominates lower prices and mark-ups).
2. In larger markets, lower mark-ups (tougher competition outweighs high mark-up firms).
3. Average profitability $(\bar{\pi}/\bar{r})$ invariant to market size (both average profits and average sales increase proportionally).
4. In larger markets, lower variance of costs, prices and mark-ups (the support of the distribution of cost draws shrinks).
5. In larger markets, higher variance of firm size (market size magnification dominates narrower support).

Open economy

- Two countries, home (L) and foreign (L^*).
- Iceberg transportation costs (τ).

Selection into domestic and foreign market

- Domestic choke price,

$$\begin{aligned} p_D &= \frac{\alpha\gamma + \eta N \bar{p}}{\eta N + \gamma} = c_D \\ p_D^* &= \frac{\alpha\gamma + \eta N^* \bar{p}^*}{\eta N^* + \gamma} = c_D^* \end{aligned}$$

- Export choke price,

$$\begin{aligned} p_X &= \frac{p_D^*}{\tau} = c_X \\ p_X^* &= \frac{p_D}{\tau} = c_X^* \end{aligned}$$

- Note that firms charge different mark-ups in different markets,

$$p_X(c) \neq \tau p_D(c)$$

Equilibrium with Pareto distributions

$$
\begin{aligned}
c_D &= \left(\frac{1}{1+\tau^{-k}}\frac{\gamma\phi}{L}\right)^{\frac{1}{k+2}} \left(< c_D^{Autarky}\right) && (FE)\\
c_D^* &= \left(\frac{1}{1+\tau^{-k}}\frac{\gamma\phi}{L^*}\right)^{\frac{1}{k+2}} && (FE^*)\\
N &= \left(\frac{2(k+1)\gamma}{\eta}\right)\frac{\alpha-c_D}{c_D} \left(> N^{Autarky}\right) && (ZCP)\\
N^* &= \left(\frac{2(k+1)\gamma}{\eta}\right)\frac{\alpha-c_D^*}{c_D^*} && (ZCP^*)
\end{aligned}
$$

1. With Pareto, number of varieties consumed increases (not general).
2. As in Melitz, trade induces tougher selection (general).

The impact of trade on prices...

- Opening up to trade is similar to increasing size:
  1. Lower mark-ups (foreign competition dominates selection of best firms).
  2. Lower prices (better firms + lower mark-ups).
  3. Bigger firms, more profits, more varieties.
- With costly trade ($\tau > 1$), size still matters:
  1. Larger country has lower cutoff, higher productivity, more varieties, lower mark-ups and prices.
  2. With Pareto, foreign size doesn't matter for domestic variables.

Gravity equation

$$X = \left(\frac{c_M^{-k}}{2\,(k+1)\,\gamma} \right) N_E L^* c_D^{*k+2} \tau^{-k}$$

- Aggregate trade is made of intensive and extensive margins.
- As in Chaney and Eaton/Kortum, sensitivity to trade barriers unaffected by subsitutability, γ.