ECN 594: Final Review

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January 4, 2026

Plan for today

1. Review: Part 1 (Demand and Pricing)
2. Practice problems: Part 1

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3. Review: Part 2 (Competition)
4. Practice problems: Part 2
5. Exam logistics

Final exam format

- **Duration:** 70 minutes
- **Allowed:** Calculator + two-sided cheat sheet (letter-size paper)
- **Coverage:** Cumulative (Lectures 1-12)
- **Structure:**
  - Short answer (T/F/NEI, definitions, quick calculations)
  - Longer problems (derivations, multi-step)
- Emphasis on Part 2 material, but Part 1 is included

Part 1 Review: Demand and Pricing

Demand estimation: key concepts

- **Logit model:** $s_j = \frac{\exp(\delta_j)}{1+\sum_k \exp(\delta_k)}$
- **Berry inversion:** $\ln(s_j) - \ln(s_0) = \delta_j$
- **Elasticities:**

$$\eta_{jj} = \alpha p_j (1 - s_j) \quad \text{(own)}$$
$$\eta_{jk} = -\alpha p_k s_k \quad \text{(cross)}$$

- **Consumer surplus:** $CS = \frac{1}{|\alpha|} \ln \left[\sum_j \exp(\delta_j)\right]$
- **IIA problem:** Substitution proportional to share, not similarity

Identification and IVs

- **Problem:** $E[p_j \xi_j] \neq 0$ (price endogeneity)
- High unobserved quality $\rightarrow$ high price
- OLS: $\hat{\alpha}$ biased toward zero
- **Solution:** IVs correlated with p, uncorrelated with ξ
  - Hausman: prices in other markets
  - BLP: competitor characteristics
  - Cost shifters

Pricing and price discrimination

- **Lerner index:** $L = \frac{p-MC}{p} = \frac{1}{|\varepsilon|}$
- **Selection by indicators:**
  - Different prices for observable groups
  - Higher price in more inelastic market
- **Two-part tariff:** $F + p \times q$
  - Optimal: $p = MC$, $F = CS$
- **Self-selection:** IC binds for high type, IR for low type

Practice: Demand and pricing

- **Question 1:** Logit model with $\alpha = -0.4$. Product A has $p_A = 30$, $s_A = 0.15$. Calculate the own-price elasticity.

- **Question 2:** Two markets with $\varepsilon_1 = -2$, $\varepsilon_2 = -3$, $MC = 10$. Find optimal prices.

- **Question 3:** A firm uses two-part tariff. Individual demand is $q = 20 - 2p$, $MC = 2$. Find optimal F and p.

Take 5 minutes.

Practice: Demand and pricing (solutions)

- **Q1:** $\eta_{AA} = \alpha p_A(1 - s_A) = (-0.4)(30)(0.85) = -10.2$
- **Q2:** Using $p = \frac{MC}{1-1/|\varepsilon|}$:
  - $p_1 = 10/(1 - 0.5) = 20$
  - $p_2 = 10/(1 - 1/3) = 15$
- **Q3:** Optimal $p = MC = 2$. At $p = 2$: $q = 16$.
  - $CS = \frac{1}{2} \times 16 \times 8 = 64$ (triangle)
  - Optimal $F = 64$

Part 2 Review: Competition

Oligopoly models

- **Cournot:** Firms choose quantities
  - Lerner: $L = s_i / |\varepsilon|$
  - Positive profits
- **Bertrand (homogeneous):** $P = MC$, zero profits
- **Hotelling:** $p^* = c + t$ (markup = transport cost)
- Cournot applies with capacity constraints
- Product differentiation creates pricing power

Entry and mergers

- **Free entry:** $\pi(N^*) \geq F > \pi(N^* + 1)$
- **Entry deterrence:** Requires credible commitment
  - Capacity building
  - Solve by backward induction (SPE)
- **Mergers:** Internalize substitution $\rightarrow$ higher prices
- **Merger simulation:** Change ownership matrix, resolve FOCs
- **HHI:** $= \sum s_i^2 \times 10000$

Vertical relationships and collusion

- **Double marginalization:**
  - Two markups $\rightarrow$ price too high
  - Solutions: integration, two-part tariff
- **Collusion:**
  - $\delta^* = \frac{\pi^D - \pi^C}{\pi^D - \pi^{NE}}$
  - Cournot: $\delta^* = \frac{(N+1)^2}{N^2+(N+1)^2}$
  - Bertrand: $\delta^* = \frac{N-1}{N}$
- **Leniency programs:** Create "race to report"

Practice: Competition

- **Question 1:** Cournot duopoly. $P = 120 - Q$, $MC = 20$. Find equilibrium P, Q, and Lerner index.
- **Question 2:** Market has shares 50%, 30%, 20%. Top two firms merge. Calculate ΔHHI.
- **Question 3:** Bertrand duopoly. What is the minimum δ for collusion?

Take 5 minutes.

Practice: Competition (solutions)

- **Q1:** FOC: $120 - 2q_i - q_j = 20$. Symmetric: $q^* = 100/3 \approx 33.3$.
  - $Q = 66.7$, $P = 53.3$
  - $L = (53.3 - 20)/53.3 = 0.625$ (or $s/|\varepsilon| = 0.5/0.8 = 0.625$)
- **Q2:** Shortcut: $\Delta HHI = 2 \times 50 \times 30 = 3000$
  - Pre: $50^2 + 30^2 + 20^2 = 3800$
  - Post: $80^2 + 20^2 = 6800$
- **Q3:** Bertrand with $N = 2$: $\delta^* = \frac{N-1}{N} = \frac{1}{2} = 0.5$

Practice: Double marginalization

- **Question:** Manufacturer ($MC = 5$) sells to retailer who sells to consumers. Demand: $q = 50 - p$.
- (a) Find integrated monopolist's price and profit.
- (b) Find prices with vertical separation.

Take 4 minutes.

Practice: Double marginalization (solution)

- **(a) Integrated:**
  - $MR = 50 - 2q = 5 \Rightarrow q = 22.5,\ p = 27.5$
  - $\pi = (27.5 - 5) \times 22.5 = 506.25$
- **(b) Separated:**
  - Retailer: $q = (50 - w)/2,\ p = (50 + w)/2$
  - Manufacturer: $\max_w (w - 5)(50 - w)/2$
  - FOC: $w = 27.5$
  - $p = (50 + 27.5)/2 = 38.75,\ q = 11.25$
- Price 41% higher, quantity 50% lower with separation

Exam Logistics

What's on the final

- **Part 1 topics:**
  - Logit, elasticities, IVs, consumer surplus
  - Lerner index, price discrimination, two-part tariffs
  - Self-selection (IC/IR)
- **Part 2 topics:**
  - Cournot, Bertrand, Hotelling
  - Entry, entry deterrence
  - Mergers, HHI, merger simulation
  - Double marginalization, vertical restraints
  - Collusion (δ^* formulas, leniency)

Key formulas for your cheat sheet

- Logit: $s_j = \exp(\delta_j) / [1 + \Sigma \exp(\delta_k)]$
- Berry: $\ln(s_j) - \ln(s_0) = \delta_j$
- Elasticities: $\eta_{jj} = \alpha p_j (1 - s_j)$, $\eta_{jk} = -\alpha p_k s_k$
- Lerner: $L = 1/|\varepsilon|$ (monopoly), $L = s_i/|\varepsilon|$ (Cournot)
- HHI: $\Delta = 2 s_1 s_2 \times 10000$
- Hotelling: $p^* = c + t$
- Collusion: $\delta^* = (\pi^D - \pi^C) / (\pi^D - \pi^{NE})$

Final tips

1. Work through practice exam carefully
2. Review HW1 and HW2 problems
3. Know the intuition behind formulas, not just formulas
4. Show your work for partial credit
5. Manage your time (70 minutes goes fast!)

Key Points: Part 1

1. Logit demand + Berry inversion for estimation
2. IVs needed: price endogeneity biases α toward zero
3. IIA problem: demographics partially help
4. Lerner index: $L = 1/|\varepsilon|$
5. Two-part tariff: $p = MC$, $F = CS$
6. Self-selection: IC binds for H, IR binds for L

Key Points: Part 2

1. Cournot: $L = s/|\varepsilon|$; Bertrand: $P = MC$
2. Hotelling: $p^* = c + t$
3. Free entry until $\pi(N^*) \geq F > \pi(N^* + 1)$
4. Entry deterrence requires credible commitment (SPE)
5. Merger simulation: change ownership matrix
6. Double marginalization: two markups hurt everyone
7. Collusion: $\delta^* = (\pi^D - \pi^C)/(\pi^D - \pi^{NE})$

Good luck on the final!

- Questions before the exam?