Live Exercise 2: Replacement Effect and Social Value of Innovation

Gerhard Riener

Group exercise ($\approx$20 minutes)

- Work in groups of 2–3.
- Show all intermediate steps — the algebra matters.
- Full market coverage assumed throughout.

Problem: Replacement effect and social value

A pharmaceutical company has discovered a new manufacturing process (Tech P) that reduces the marginal cost of producing a drug from $c_0 = 60$ to $c_1 = 30$. Market demand for the drug is

$$P(Q) = 100 - Q.$$

Assume Tech P is available exclusively to the one firm that acquires it (patent protection is perfect).

(a) Is the innovation drastic?

Use the monopoly pricing formula to determine whether Tech P is drastic or non-drastic. State the condition and evaluate it numerically.

Recall: a process innovation is drastic if $P^m(c_1) < c_0$, where $P^m(c) = \frac{A+c}{2}$ under linear demand $P = A - Q$.

(b) Monopoly and competitive WTP

Compute the maximum willingness to pay (WTP) for Tech P of:

1. a monopolist (not threatened by entry)
2. a competitive innovator — a firm that operates in a competitive market before acquiring the patent, then gains exclusive rights to Tech P

Hint for (2): use your result from (a) to determine whether the competitive innovator limit-prices at $p = c_0$ after acquiring the patent.

(c) Social planner's value

For linear demand $P = A - Q$ with efficient production (price equals marginal cost), total surplus is $W(c) = \frac{(A-c)^2}{2}$.

1. Compute the social planner's value of the innovation, $\Delta W = W(c_1) - W(c_0)$.

2. Arrange the three values $-\Delta\pi^m$, competitive WTP, ΔW $-$ in increasing order.
3. State Arrow's replacement effect in one sentence. Using the numbers from (b), explain what drives the gap between $\Delta\pi^m$ and the competitive WTP. Why is ΔW larger than both?

Bibliography