Context and concepts

- Context (continued from last class): You need to decide how much to produce (possibly zero). What costs should you take into account?
- Concepts: fixed cost, variable cost, average cost, marginal cost. Short run and long run.

Costs

Cost function is total cost of inputs the firm needs to produce output q. Denoted C(q).
- Fixed cost (FC): the cost that does not depend on the output level, C(0).
- Variable cost (VC): that cost which would be zero if the output level were zero, C(q) – C(0).
- Average cost (AC) (aka "unit cost"): total cost divided by output level, C(q)/q.
- Marginal cost (MC): the unit cost of a small increase in output.
- Derivative of cost with respect to output, dC/dq
- Approximated by C(q)-C(q-1)

Examples

- Bagels: modest fixed cost (space), relatively constant marginal cost (labor and materials).
- Electricity generation: large fixed cost (plant), initially declining marginal cost (large plants are more efficient, and many plants have "startup" costs). [More on this in Assignment 1.]
- Music CDs: large fixed cost (recording), small marginal cost (production and distribution)
- Computer software: ditto.
- Airlines: ditto.

T-shirt factory example

To produce T-shirts:
- Lease one machine at $20 / week.
- Machine requires one worker.
- The machine, operated by the worker, produces one T-shirt per hour.
- Worker is paid $1/hour on weekdays (up to 40 hours), $2/hour on Saturdays (up to 8 hours), $3 on Sundays (up to 8 hours).

T-shirts: costs

Suppose output level is 40 T-shirts per week. Then,
- Fixed cost: FC = $20.
- Variable cost: VC = 40 × $1 = $40.
- Average cost: AC = (20+40)/40 = $1.5
- Marginal cost: MC = $2.
- Note that producing an extra T-shirt would imply working on Saturday, which costs more.

Similar calculations can be made for other output levels, leading to the cost function ...
Mac

T-shirts: how many to make

Scenario A: Benetton™, sole buyer of T-shirts, offers price \( p = $1.8 \) per T-shirt.
- Benetton™ is willing to buy as many T-shirts as factory wants to sell (at given price).

Should factory increase output beyond 40 T-shirts/week, thus operating on Saturdays?
- \( p = 1.8, \ AC = 1.5, \ MC = 2 \)
- Although factory is making money at \( q=40 \) (because \( p > AC \)), profits would be lower if it produced more (because \( p < MC \)). It would lose money at the margin. (Verify: compute profit at \( q=40,41 \))

Scenario B: Benetton™ offers \( p = $1.3 \) per T-shirt.
- No matter how much factory produces, price is below per-unit cost, i.e., no matter how much factory produces, it will lose money:
  \[ p < AC \quad \text{implies} \quad q \times p < q \times AC \]
  \[ \text{Revenue < Cost} \]
- Optimal decision is not to produce at all.

Important lesson:
Marginal cost: how much to produce
Average Cost: whether to produce

Supply curve

Supply curve: how much a firm produces at each price.
Generalizing from previous example:
- Firm can sell all it wants at given price ("competitive").
- If price is below minimum average cost, \( p_0 \), then firm is better off by shutting down. (What if fixed cost is sunk? More shortly.)
- If price is greater than \( p_0 \), say \( p' \), then firm should sell output \( q' \) such that \( MC=p' \).

Supply curve is given by MC curve for values of \( p \) greater than the minimum of AC, zero for values of \( p \) below minimum of AC.
Short and long run

- Suppose it’s Monday morning. Lease for machine has already been paid. Price offered by Benetton is $1.3. Should factory shut down?
- Answer: not this week (short run). Lease has already been paid, nothing I can do about it. I would keep the factory open for any price above $1 per T-shirt.
- Suppose it’s Friday afternoon and I have to decide whether to pay the fixed cost (machine lease) for next week. Then analysis is as before (long-run): shut down if price is $1.3 (in fact, any price below $1.5).
- General result: you typically have more control over costs in long run than short run.

Examples revisited

- Airlines: the combination of high fixed costs and low marginal costs means they’re willing to fly even at low prices. But these prices may not be consistent with long-run profitability.
- How to avoid the p=MC trap:
  - Limit capacity (electricity)
  - Monopoly (software, pharmaceuticals)
  - Product differentiation (music CDs, software)
  - Regulation (cable, electricity)
- More on this later.

Takeaways

- In a competitive market, a firm can sell all it wants at the market price.
- A competitive firm will
  - Use AC to decide whether to product or shut down (produce if p > AC, otherwise shut down).
  - Use MC to decide how much to produce (produce as long as p > MC). In fact, MC defines the firm’s supply function.
- In industries with low MC, market pressures may produce prices that are inconsistent with long-run profitability.