Perfect Competition
Outline

• Competition
  – Short run
  – Implications for firms
  – Implication for supply curves

• Perfect competition
  – Long run
  – Implications for firms
  – Implication for supply curves

• Broader implications
  – Implications for tax policy.
  – Implication for R&D
Competition vs Perfect Competition

• Competition
  – Each firm takes price as given.
    • As we saw => Price equals marginal cost

• Perfect competition
  – Each firm takes price as given.
  – Profits are zero
  – As we will see
    • P=MC=Min(Average Cost)
    • Production efficiency is maximized
    • Supply is flat
Competitive industries

- One way to think about this is market share
- Any industry where the largest firm produces less than 1% of output is going to be competitive
- Agriculture?
  - For sure
- Services?
  - Restaurants?
    - What about local consumers and local suppliers
- manufacturing
  - Most often not so.
Competition

• Here only assume that each firm takes price as given.
  – It want to maximize profits
• Two decisions.
• (1) if it produces how much
  \( \Pi(q) = pq - C(q) \Rightarrow p - C'(q) = 0 \)
• (2) should it produce at all
  \( \Pi(q^*) > 0 \) produce, if \( \Pi(q^*) < 0 \) shut down
Competitive equilibrium

• Given \( n \), firms each with cost \( C(q) \) and \( D(p) \) it is a pair \((p^*, q^*)\) such that

1. \( D(p^*) = n q^* \)
2. \( MC(q^*) = p^* \)
3. \( \Pi(p^*, q^*) > 0 \)

1. Says demand equals supply, 2. firm maximize profits, 3. profits are non negative.

If we fix the number of firms. This may not exist.
Step 1 Max $\Pi$

- Marginal Cost
- Average Costs
- Short Run Average Cost
  Or
  Average Variable Cost

Profits

Costs
Step 1 Max $\Pi$, 

- Marginal Cost
- Average Costs
- Price
- Short Run Average Cost
- Or
- Average Variable Cost
So entry exit matters

• Individual firm decision
  – If \( P = MC(q^*) \Rightarrow q^*(P) \)

• Suppose there are \( n \) firms each with cost \( C(q) \)
  – Each takes price as given sets \( q \) so that \( P = MC(q^*) \)
  – Total supply is \( nq^* \)

• Is that consistent with demand?
• n firms,
• demand for good is \( p = a - bQ \)
  – Let \( C(q) = F + (0.5q^2/c) \)
  – \( MC = q \) so if \( P = MC \Rightarrow S_i(P) = P/c \Rightarrow S(P) = Pn/c \)
• Market equilibrium
  – \( P = a - bQ \) and \( Q = Pn/c \)
  – \( a - bQ = Qc/n \Rightarrow Q = a/(b+c/n) \Rightarrow P = a/n(b+c/n), \)
  \( q = a/n(b+c/n) \)
• Firm rationality
  \( \Pi = pq - C(q) \Rightarrow (a/n(b+c/n))^2 - F - 0.5 \left( a/n(b+c/n) \right)^2 \)
  \( \Pi = 0.5(a/n(b+c/n))^2 - F. \)
• If \( F \) large enough not be an equilibrium
Suppose $\Pi = 0.5\left(a/n(b+c/n)\right)^2 - F < 0$

- Still what happens
- Can ask given $F$ what is the largest $n$ ($n^*$) such that $\Pi = 0.5\left(a/n(b+c/n)\right)^2 - F > 0$
- $n^*$ is the largest number of firms that can be in the market and make a profit
- If $n > n^*$ there are too many firms and some one will have to exit
- If $n < n^*$ there are too few firms. It would pay for at least one firm to invest and enter. Because it would make profits
Competitive equilibrium in production with endogenous entry

- Given $C(q)$ and $D(p)$ it is a triplet $(p^*, n^*, q^*)$ such that
  - 1. $D(p^*) = n^* q^*$
  - 2. $MC(q^*) = p^*$
  - 3. $\Pi(p^* (n^*), q^* (n^*)) > 0$
  - 4. $\Pi(p^* (n^* + 1), q^* (n^* + 1)) < 0$

1. Says demand equals supply, 2. firm maximize profits, 3. profits are non negative, 4. can’t squeeze any more firms
Perfect competition

- Perfect competition
  - Each firm takes price as given.
  - Profits are zero
  - As we will see
    - \( P = MC = \text{Min(Average Cost)} \)
    - Production efficiency is maximized
    - Supply is flat

- Perfect competition is a competitive equilibrium with endogenous entry neglecting the discrete number of firms
Why perfect

• Competition is:
  – Price taking behavior
• Competition is
  – More firms reduce profits
• But profits are non negative
  – So optimality must imply they are zero.
• Its perfect because producers are maximizing profits but they are not having any
Zero profit

Zero profit implies cost = revenue
If I divide both sides by q => price = average cost
But recall price=marginal cost
So perfect competition => p=AC=MC
That leads to efficiency because

MC=AC <=> Min AC

\[ 0 = \frac{d}{dq} \frac{C(q)}{q} = \frac{C'(q)}{q} - \frac{C(q)}{q^2} \Rightarrow C'(q) = \frac{C(q)}{q} \]
Shut down

• Firm shuts down when price < average cost
• Firm shuts down in short run when price < short run average cost = \min \text{average variable cost}
• Firm exits in long run when price < long run average cost = \min \text{average total cost}
Firm Costs

Marginal Cost

Average Costs_{LRATC}

Price if
Competition
is perfect

Short Run Average Cost
Or
Average Variable Cost

p

q
Firm Reaction to Price Changes

Short run supply

MC

ATC

AVC

p

q
Long-run Equilibrium

\[ LRATC = LRS \]

Diagram showing supply and demand curves with equilibrium at \( p_0 \) and \( Q_0 \).
• Under perfect competition
• Supply curve is flat and dictated by the long run (total) average cost curve.
• Changes in demand are completely compensated by changes in quantities (thus by entry or exit)
• Implication, any change in taxes or regulation is completely passed through to consumers
Increase in Demand
Large Decrease in Demand

Diagram showing the effect of a large decrease in demand on the supply and demand curves. The diagram includes the supply and demand functions, SRS$_0$, SRS$_1$, and SRS$_2$, and the demand curves, D$_0$ and D$_1$. The diagram illustrates the supply and demand adjustments leading to a new equilibrium point.
Competitive producers Key points

• Competitive equilibrium
• Perfect competition
• Role of entry and exit
• Short run vs long run adjustment