Monopoly
Monopoly: Why?

- Natural monopoly (increasing returns to scale), e.g. (parts of) utility companies?
- Artificial monopoly
  - a patent; e.g. a new drug
  - sole ownership of a resource; e.g. a toll bridge
  - formation of a cartel; e.g. OPEC
Monopoly: Assumptions

- Many buyers
- Only one seller i.e. not a price-taker
- (Homogeneous product)
- Perfect information
- Restricted entry (and possibly exit)
Monopoly: Features

- The monopolist’s demand curve is the (downward sloping) market demand curve.
- The monopolist can alter the market price by adjusting its output level.
Monopoly: Market Behaviour

Higher output $y$ causes a lower market price, $p(y)$.
Suppose that the monopolist seeks to maximize economic profit

$$\Pi(y) = p(y)y - c(y)$$

$$\Pi = TR - TC$$

What output level \( y^* \) maximizes profit?
Monopoly: Market Behaviour

At the profit-maximizing output level, the slopes of the revenue and total cost curves are equal, i.e.

\[ MR(y^*) = MC(y^*) \]
Marginal Revenue: Example

\[ p = a - by \] (inverse demand curve)

\[ TR = py \] (total revenue)

\[ TR = ay - by^2 \]

Therefore,

\[ MR(y) = a - 2by < a - by = p \] for \( y > 0 \)
Marginal Revenue: Example

$\text{MR} = a - 2by < a - by = p$

for $y > 0$
Monopoly: Market Behaviour

The aim is to maximise profits $MC = MR$

$$MR = p + y \frac{\partial p}{\partial y} < p$$

$MR$ lies inside/below the demand curve

Note: Contrast with perfect competition ($MR = P$)
Monopoly: Equilibrium
Monopoly: Equilibrium

Diagram showing the relationship between price (P), marginal cost (MC), marginal revenue (MR), demand, and output (y).
Monopoly: Equilibrium
Monopoly: Equilibrium

Output Decision
MC = MR

MC = MR

Demand

YM

MR

AC

MC

P

Y

y

y
Monopoly: Equilibrium

$P_m = \text{the price}$

$P_m$ = the price
Monopoly: Equilibrium

- Firm = Market
- Short run equilibrium diagram = long run equilibrium diagram (apart from shape of cost curves)
- At $q_m$: $p_m > AC$ therefore you have excess (abnormal, supernormal) profits
- Short run losses are also possible
Monopoly: Equilibrium

The shaded area is the excess profit.
Monopoly: Elasticity

\[ \Delta TR = p\Delta y + y\Delta p \]

WHY? Increasing output by \( \Delta y \) will have two effects on profits

1) When the monopoly sells more output, its revenue increase by \( p\Delta y \)

2) The monopolist receives a lower price for all of its output
Monopoly: Elasticity

\[ \Delta TR = p\Delta y + y\Delta p \]

Rearranging we get the change in revenue when output changes i.e. MR

\[
MR = \frac{\Delta TR}{\Delta y} = p + \frac{\Delta p}{\Delta y} y
\]

\[
MR = \frac{\Delta TR}{\Delta y} = p \left( 1 + \frac{y \Delta p}{p \Delta y} \right)
\]
Monopoly: Elasticity

\[ MR = \frac{\Delta TR}{\Delta y} = p \left( 1 + \frac{y \Delta p}{p \Delta y} \right) \]

\[ = \frac{1}{\varepsilon} \]

\( \varepsilon = \text{elasticity of demand} \)
Monopoly: Elasticity

Recall $MR = MC$, therefore,

$$MR = \frac{\Delta R}{\Delta y} = p \left( 1 + \frac{1}{\varepsilon} \right) = MC > 0$$

Therefore, in the case of monopoly, $\varepsilon < -1$, i.e. $|\varepsilon| \geq 1$. The monopolist produces on the elastic part of the demand curve.
MC curve is assumed to be constant (for ease of analysis)
Application: Tax Incidence in Monopoly

- **Claim**

  When you have a linear demand curve, a constant marginal cost curve and a tax is introduced, price to consumers increases by “only” 50% of the tax, i.e. “only” 50% of the tax is passed on to consumers
Application: Tax Incidence in Monopoly

Output decision is as before, i.e. \( MC = MR \)

So \( Y_{bt} \) is the output before the tax is imposed.
Application: Tax Incidence in Monopoly

Price is also the same as before.

\[ P_{bt} = \text{price before tax is introduced} \]
Application: Tax Incidence in Monopoly

The tax causes the MC curve to shift upwards.
Application: Tax Incidence in Monopoly

The tax will cause the MC curve to shift upwards.
Application: Tax Incidence in Monopoly

Price post tax is at $P_{pt}$ and it higher than before.
Application: Tax Incidence in Monopoly

Formal Proof

Step 1: Define the linear (inverse) demand curve

\[ P = a - bY \]

Step 2: Assume marginal costs are constant

\[ MC = C \]

Step 3: Profit is equal to total revenue minus total cost

\[ \Pi = TR - TC \]
Application: Tax Incidence in Monopoly

Formal Proof

Step 4: Rewrite the profit equation as

$$ \Pi = PY - CY $$

Step 5: Replace price with

$$ P = a - bY $$

$$ \Pi = (a - bY)Y - CY $$

Profit is now a function of output only
Application: Tax Incidence in Monopoly

Formal Proof

Step 6: Simplify

\[ \Pi = Ya - bY^2 - CY \]

Step 7: Maximise profits by differentiating profit with respect to output and setting equal to zero

\[ \Pi' = a - 2bY - C = 0 \]
Application: Tax Incidence in Monopoly

Formal Proof

Step 8: Solve for the profit maximising level of output ($Y_{bt}$)

\[-2bY = C - a\]

\[Y_{bt} = \frac{a - C}{2b}\]
Application: Tax Incidence in Monopoly

Formal Proof

Step 9: Solve for the price \( P_{bt} \) by substituting \( Y_{bt} \) into the (inverse) demand function

\[
Y_{bt} = \frac{a - C}{2b}
\]

Recall that \( P = a - bY \) therefore

\[
P_{bt} = a - b\left(\frac{a - C}{2b}\right)
\]
Application: Tax Incidence in Monopoly

Formal Proof

Step 10: Simplify

\[ P_{bt} = a - b \left( \frac{a - C}{2b} \right) \]

Multiply by \(-b\)

\[ P_{bt} = a + \left( \frac{-ba + bC}{2b} \right) \]

\[ P_{bt} = a + \left( \frac{-a + C}{2} \right) \]

b cancels out
Application: Tax Incidence in Monopoly

Formal Proof

\[ P_{bt} = a + \left( \frac{-a}{2} + \frac{C}{2} \right) \]

\[ P_{bt} = a + \left( \frac{-1}{2} a + \frac{C}{2} \right) \]

\[ P_{bt} = \frac{1}{2} a + \frac{C}{2} \]

\[ P_{bt} = \frac{a + C}{2} \]
Application: Tax Incidence in Monopoly

Formal Proof

Step 11: Replace $C = MC$ with $C = MC + t$
(one could repeat all of the above algebra if unconvinced)

$$P_{bt} = \frac{a + C}{2}$$

Price before tax

$$P_{at} = \frac{a + C + t}{2}$$

So price after the tax $P_{at}$ increases by $t/2$