Context and concepts

- **Context:** Many firms face a tradeoff between price and quantity: To sell more, they must charge less. What price should they set? Should they simply apply a markup to cost? Does a standard markup make sense?

- **Concepts:** demand elasticity and marginal revenue; marginal cost; competition and market power.

The idea

- **Theoretical insight:** When a firm has some control over price, the additional revenue from selling an extra unit is less than the price.

- **Implications:**
  - Firm sells fewer units than a competitive firm (which has no influence over price) and charges more
  - How much depends on how sensitive demand is to price (the elasticity)

Numerical example

- **Bagel factory has costs**
  - Fixed cost of $5/day
  - Marginal cost of $5/dozen

- **Inverse demand**
  \[ p = 10 - 0.5q \]

  (see table on next page)

- **What price generates the most profit?**

The numbers

<table>
<thead>
<tr>
<th>Price</th>
<th>Demand</th>
<th>Total Revenue</th>
<th>Total Cost</th>
<th>Marginal Revenue</th>
<th>Marginal Cost</th>
<th>Profit</th>
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Marginal revenue

- **Revenue:** \( R = p \times q \)
- **Average revenue:** \( AR = \frac{R}{q} = p \)
- **Marginal revenue:** \( MR = \text{extra revenue from extra unit} \)

Marginal revenue is less than average revenue (price).
Selling one extra unit implies

- Extra revenue from an extra unit \( (=p) \)
- But: must lower price on all other units sold, too

\[
MR = \frac{dR}{dq} = p - q \left( -\frac{dp}{dq} \right) < p
\]
Demand and marginal revenue

Marginal revenue is less than price

Profit maximization

Choose price using calculus:

\[
\text{Profit}(q) = R(q) - C(q)
\]

\[
\text{max Profit } \Rightarrow \frac{d\text{Profit}}{dq} = 0 \Rightarrow \frac{dR}{dq} - \frac{dC}{dq} = 0 \Rightarrow
\]

\[
MR = MC
\]

The elasticity rule

From definition of marginal revenue:

\[
MR = p + q \frac{dp}{dq} = p + q \frac{dp}{dq} = p + \frac{1}{\varepsilon} = p\left(1 + \frac{1}{\varepsilon}\right)
\]

Therefore, \(MR = MC\) implies

\[
p\left(1 + \frac{1}{\varepsilon}\right) = MC \quad \text{and} \quad m \equiv \frac{p - MC}{p} = \frac{1}{\varepsilon}
\]

where \(m\) is the optimal margin.

Quick review

- Since demand slopes down, we make more money if we raise price above MC.
- How much depends on how sensitive demand is to price:
  \[m = \frac{p - MC}{p} = -1/\varepsilon\]  
  (elasticity rule)
- Standard markup is a bad idea: you want higher markups for products with lower elasticities.
- Part of "branding" is generating inelastic demand.
- Higher price implies lower output than when \(p = MC\).
- We can think of perfect competition as a case with "very elastic demand" \(\varepsilon = -\infty\), implying \(MR = p = MC\).

Elasticity and margin

Optimal margin is inversely related to demand elasticity.
**Numerical example revisited**

- Inverse demand:
  \[ p = a - b \cdot q \]
- MC = \( c \)
- Profit\( (q) = R(q) - C(q) = (a-bq)q - cq \)
- Solution in general: \( q = \frac{(a-c)}{2b}, \ p = \frac{(a+c)}{2} \)
- Solution with numbers from above \((a=10, \ b=0.5, \ c=5)\): \( q = 5, \ p = 7.5 \)
- Warning: example in notes is different

**Takeaways**

- The optimal price depends on
  (a) marginal cost and
  (b) what the market will bear (demand elasticity).
- In a competitive market, the demand for your product is typically sensitive to price and the optimal markup is low.
- If demand for your product is insensitive to price (your product has unique characteristics and/or you’re the only producer), the optimal markup can be high.
- Common mistake: underestimate elasticity (set price too high)

**Pricing in practice**

“Given the downward slope of our demand curve and the ease with which other firms can enter the industry, we can strengthen our profit position only by equating marginal cost and marginal revenue. Order more jelly beans.”