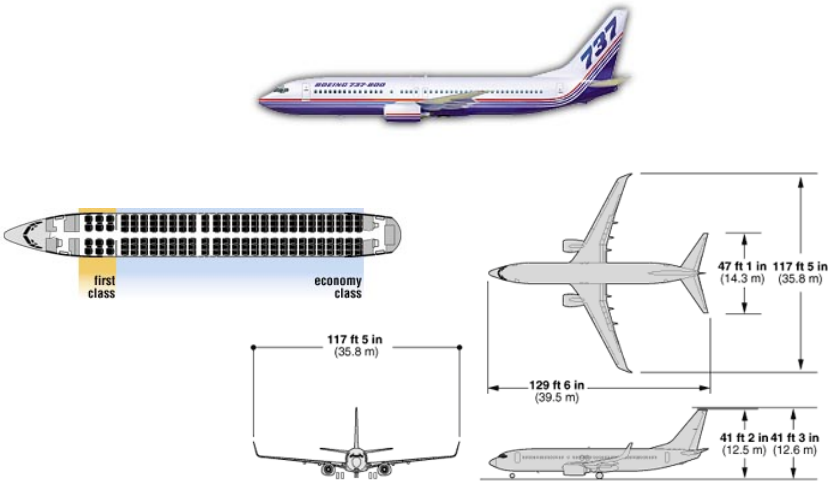
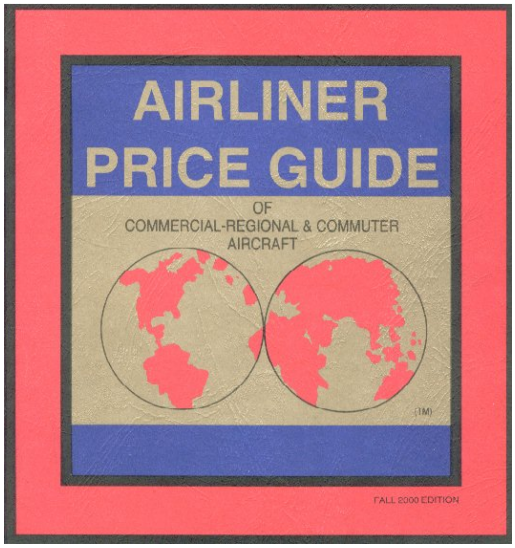
Overview: Production and Cost II

- Opportunity Costs in Practice
  - Example: Valuing a 1998 Boeing 737-700
- Economies of Scale and Scope
- Learning Effects

The 1998 Boeing 737-700



Check the Airliner Price Guide



Cost Saving From a 1998 737-700

- The User Cost of Capital

  $UCC_t = rV_t + (V_t - V_{t+1})$

  $= r(\$27.4\text{ m}) + (\$27.4\text{m} - \$25.8\text{m})$

  $= 9.2\%(\$27.4\text{ m}) + (\$27.4\text{m} - \$25.8\text{m})$

  $= \$\ 4.11\text{ m}$

- Equivalently, in terms of percent depreciation,

  $UCC_t = (r + \%\text{dep'n})V_t$

  $\%\text{ dep'n} = (V_t - V_{t+1})/V_t$

  $= (27.4 - 25.8)/27.4 = 5.8\%$

Calculating Delta's cost of capital, r

Four steps:

1. Determine Debt/Equity Structure

   Total Market value of Debt D: \$4.7 Bn

   (from Moody's or Annual Report)

   Market Capitalization E: \$6.21 Bn

   (from Yahoo Finance – spring 2001)

2. Calculate Cost of Equity with CAPM

$$r_e = r_f + \beta_{equity}\left(r_m - r_f\right) \qquad (1^*)$$

Risk free rate ↓ 5.16% + Risk rel. to market ↓ 1.14 (6%) Market risk premium ↓ = 12.0%

Calculating Delta's cost of capital (cont.)

3. Calculate Cost of Debt

   Weighted average of cost of each maturity of debt used by Delta (from Moody's): r_d = 9%. Corporate tax rate τ = 39.6%.

4. Weighted Average Cost of Capital

$$WACC = r_e\left(\frac{E}{E+D}\right) + r_d\left(\frac{D}{E+D}\right)(1-\tau) \qquad (2^*)$$

$$12.0\%\left(\frac{6.21}{4.7+6.21}\right)+9\%\left(\frac{4.7}{4.7+6.21}\right)(1-39.6\%)=\underline{9.2\%}$$

(*) If relevant, equations (1) and (2) will be provided to you on the exam.

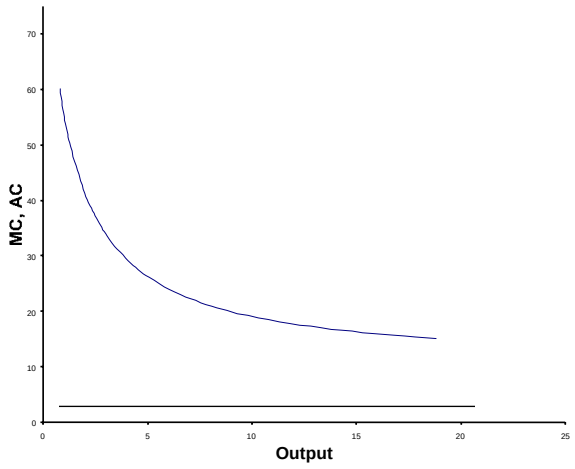
Economies of Scale and Scope

- Cost savings associated with ‘size’ of business
- Economies of Scale
  - Unit cost savings at higher scales of production
  - (AC falls with higher Q)
- Economies of Scope
  - Costs savings from producing multiple products
  - ‘Joint production economies’

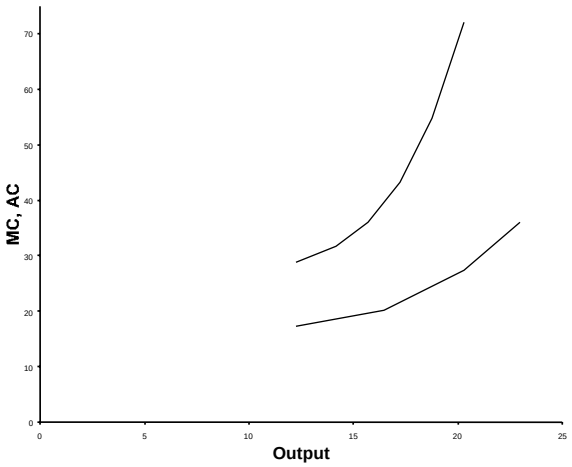
Economies of Scale, AC and MC

- Economies of Scale
  - AC decreases with Q, so MC < AC
- Constant Costs
  - AC constant with Q, so MC = AC
  - "Scalable Business"
- Diseconomies of Scale
  - AC increases with Q, so MC > AC

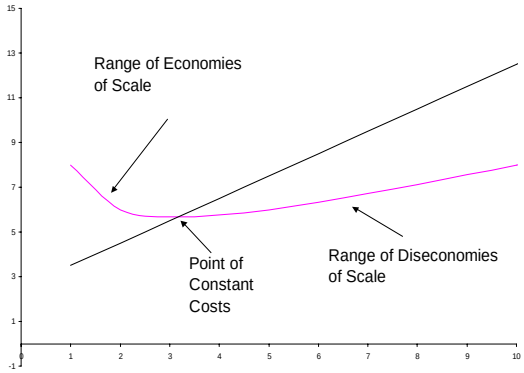
Example: Software or CD's



Example: Producing Near Full Capacity



Full Range: U-Shaped Average Cost



A Terminology Pothole

- "Returns to Scale" refers to physical properties of production
  - Double inputs yields more than double output
  - "Increasing returns to scale"
- With constant input prices, same concepts as scale economies
  - Increasing returns = economies of scale, etc.
- Other differences are not important for us

Economies of Scope

- Cost savings associated with the simultaneous production of several products
  - Unit costs are lower than if products are produced separately
- Sources?
- Examples

Learning Effects

- Costs savings that arise from repetition, practice or experience of ongoing production.
- Sources?
- Examples

Estimation of Learning Curves

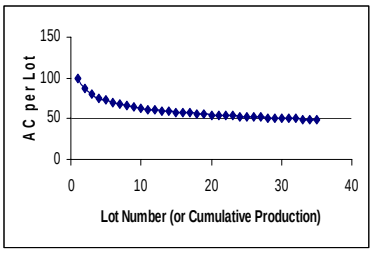
- How is the effect of learning on costs quantified?
  - With cost data, estimate learning curves
  - (use consultants if necessary)
- Why quantify the effect of learning on costs?
  - Only way to know precise benefit of today's production on tomorrow's costs

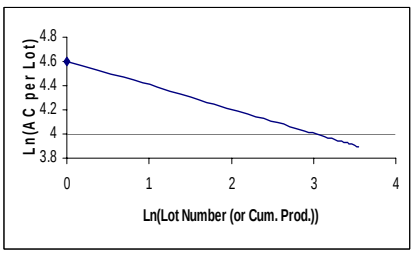
Empirical Learning Curves

Typically Log-Log Specification

$\text{Ln(AC per Lot)} = \alpha + \beta \text{ Ln(Cumulative Lot Number)}$

Why? Typical Data Pattern





Learning Curve ‘Strategy’

- Overproduce Now for Lower Costs in Future
- Needs to be undertaken with care
  - In the 1980’s, some people thought overproduction of this kind always made sense

Learning Curve ‘Strategy’: Assumptions

- Demand:
  - Will be sufficient to absorb higher output
- Learning:
  - Learning will occur, or can be managed
  - No “Technological risk”
  - Competitors cannot “free ride” on your learning
  - No forgetting

Take Away Points

- User cost of capital is an important component of economic costs. It consists of economic depreciation and the opportunity cost of capital.
- Scale and learning effects are important sources of competitive advantage and entry barriers.
- Scale effects refer to movements along the AC curve, learning effects are shifts of the AC curve