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**
   - \[ r_e = r_f + \beta_{equity} \left( r_m - r_f \right) \]  \hspace{1cm} (1*)
   - Risk free rate
   - Risk rel. to market
   - Market risk premium
   - 5.16% + 1.14% (6%) = 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 \( \tau = 39.6\% \)

4. **Weighted Average Cost of Capital**
   - \[ WACC = r_e \left( \frac{E}{E+D} \right) + r_d \left( \frac{D}{E+D} \right) (1-\tau) \]  \hspace{1cm} (2*)
   - 12.0% \( \left( \frac{6.21}{4.7+6.21} \right) \)
   - 9% \( \left( \frac{4.7}{4.7+6.21} \right) (1-39.6\%) = 9.2\% \)

(*) 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

\[
\ln(AC \text{ per Lot}) = \alpha + \beta \ln(\text{Cumulative Lot Number})
\]

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