Review of 1st half of course

- A thumbnail outline of major elements
- Intended as a study guide
- Emphasis on key points to be mastered

Four Parts to Mid-term

1. Concepts concerning Flexibility
2. Concepts of Evaluation and Production Functions
3. Mechanics of Deterministic Evaluation
4. Mechanics of Production Functions

1. Concepts Concerning Flexibility

- **Recognition of Uncertainty**
  - **It exists – how much? What is reasonable?**
  - **Can we hope to avoid it?**
  - **Will better statistics eliminate much of it?**

- **Value of Flexibility**
  - **How does it add value? Avoids downside, positions for upside…**
  - **Why emphasis on Expected Value?**
  - **Is Flexibility "win-win"? Why?**

Recognition of Risk

- **Descriptively: Forecast "always wrong"**
  - **Reasons: "surprises", "trend-breakers"**
  - **Examples: technical, market, political**

- **Theoretically: Forecasts => "house of cards"**
  - **Data range**
  - **Drivers of phenomenon (independent variables)**
  - **Form of these variables**
  - **Equation for model**

Contribution of Flexibility

- **Designers can implement flexible plans**
  - **Defer investments (lowers present costs)**
  - **Skip investments (if never needed)**
  - **Build larger to increase NPV (if opportunities)**
  - **… at cost of lost economies of scale**
- **System design: Garage case as mental model**
  - **Traditional design to specs gives wrong answer**
  - **Uncertainty leads to different values**
  - **Flexibility can be cheaper! Win-win possibilities**
  - **Flexibility shifts VARG to right**

2. Concepts … Production Functions

- **Precise Understanding demonstrated by exact definitions (see mid-terms on web)**
  - **Production Function**
  - **Technical Efficiency**
  - **Isoquant**
  - **Optimal Technical Design**
  - **Returns to Scale**
  - **Economic Efficiency**
  - **Optimality Conditions for Econ. Efficiency**
  - **Balanced Design**
  - **Expansion Path**
  - **Output Cost Function**

Modeling of Production Possibilities

- **Basic Concept: Production Function**
  - **locus of technical efficiency**
  - **defined in terms of technology only**
- **Characteristics**
  - **marginal products, marginal rates of substitution**
  - **isoquants -- loci of equal production**
  - **returns to scale (≠ economies of scale!)**
  - **convexity of feasible region? Know when!**
- **Generally defined by systems models that define possibilities (e.g.: satellite systems)**

Optimization -- Marginal Analysis

- **Economic efficiency merges technical opportunities (Prod. Fcn) and Values (Costs)**
- **For continuous functions, convex feasible region in domain of isoquants**
  - **Optimum if all MP/MC equal (same 'bang for buck')**
  - **Expansion path is locus of resources combinations that define optimal designs**
  - **Cost function: Cost = f(Optimum Production)**
  - **Economies of Scale (≠ increasing returns to scale)**
- **Good Concepts, often not applicable in detail**

Optimization -- Dealing with Constraints

- **Equality Constraints:**
  - **Lagrangean Equation**
  - **Lagrangean multipliers = shadow prices**
  - **What is a "shadow price"?**

3. Evaluation of Projects

- **Calculation of**
  - **Net Present Value**
  - **Benefit-Cost**
  - **Pay Back Period**

Valuation Issues -- over time

- Resources have value over time
  - Discount rate (DR) , r %/period What is concept?
  - Formulas; e^{rt} for continuous compounding
- Choice of discount rate defined by best alternatives, at the margin
- DR ~ 10% or more -- long term benefits beyond 20 years have little consequence
- Money may change value via inflation
- Make sure you are comparing like with like

Valuation Issues – choice of rate

- Basic Idea – Opportunity cost
  - A project should return at least as much as next best alternative opportunity
  - … this is "at the margin"
- WACC – an average measure
  - How does this work?
- CAPM – includes idea that discount rate should reflect uncertainty – of activity
  - However, may be possible to diversity risk of individual projects

Valuation issues-- criteria

- Many types -- none best for all cases
  - Net Present value -- no measure of scale
  - Benefit/ Cost -- sensitive to recurring costs
  - Cost / Effectiveness -- no notion of value
  - Internal Rate of Return -- ambiguity, does not reflect actual time value of money
  - Pay-Back Period -- omits later returns
- Choose according to situation (if allowed)
- In practice, people may use several criteria

4. Mechanics of Production Functions

- Z = R exp 0.3 S exp 0.6
- C = 1.5 R exp 0.8 + 2 S exp 1.2

- Returns to scale?
- Expansion Path?
- Cost Function?
- Economies of Scale?

Questions?

Best Wishes!

Test will be on material covered

Know it, and you will do well

The teachers' objective is that you all learn material and do excellently!

We hope you'll make us look good!