Review of 1st half of course

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

Major Elements Covered

- Valuation of Projects
  - Discount rates; evaluation criteria
- Modeling of production possibilities
- Optimization of production and cost
  - Constrained optimization; marginal analysis
- Recognition of Uncertainty
- Decision Analysis; Value of Information
- Contribution of Flexibility
  - Specifically, in capacity expansion
Valuation Issues -- over time

- Resources have value over time
  - Discount rate (DR), r%/period
  - 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
- 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

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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)
Trade Space

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

Recognition of Risk

- Psychologically
  - Resistance to acceptance of this basic fact
- 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
Analysis under Uncertainty

- **Primitive Models**
  - sensitivity to irrelevant alternatives, states
  - sensitivity to basis of normalization

- **Decision Analysis**
  - Organization of Tree
  - Analysis

- **Results**
  - ≠ those on Average forecasts (flaw of averages)
  - Middle road, that provides flexibility to respond
  - Second best choices, flexibility costs

Value of Information

- **Extra information has value**
  - Value taken as improvement over base case
  - Is compared to cost of getting information

- **Value of Perfect Information**
  - Purely hypothetical / Easy to calculate
  - Provides easy upper bound

- **Value of Sample information**
  - Bayes’ Theorem
  - Repeated calculations; likelihood ratios
  - Worthwhile in important choices
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 expansion cases: Garage ; satellite
  - Take-aways:
    - Traditional design to specs gives wrong answer
    - Uncertainty leads to different values
    - Flexibility shifts VAR to right

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!