ECON 200A: MICROECONOMICS ("DECISIONS")

Fall 2005 | **Tues, Thurs 8:00-9:50pm** | **ECON 300**

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TA: Lindsay Oldenski | **ECON 114** | **Thurs 3:30-5:30**

The topics of this course are the economic theories of consumer and producer behavior.

The texts for the 200A/B/C sequence are:

Kreps, D., *A Course in Microeconomic Theory*. Princeton: Princeton Univ. Press, 1990.

Mas-Colell, A., M. Whinston and J. Green ("MWG"), *Microeconomic Theory,* Oxford: Oxford Univ. Press, 1995.

Varian, H., *Microeconomic Analysis, 3rd ed.* New York: W.W. Norton & Co., 1992.

There will also be a Mathematical Handout for this course, and additional in-class handouts.

An extremely useful book of problems, designed to hone your analytical ability is:

Dixon, P., S. Bowles and D. Kendrick, *Notes and Problems in Microeconomic Theory*, 1985, (Amsterdam: North-Holland)

Other useful readings include the relevant chapters of:

Debreu, G., *Theory of Value*, 1959, (New York: Wiley).

Henderson, J. and R. Quandt, *Microeconomic Theory: A Mathematical Approach*, 3rd ed., 1980 (New York: McGraw-Hill)

Malinvaud, E., *Lectures on Microeconomic Theory*, 1972 (Amsterdam: North-Holland)

Russell, R. and M. Wilkinson, *Microeconomics: A Synthesis of Modern and Neoclassical Theory*, 1979, (New York: Wiley)

EXAMS: Your grade in the course will be determined on the basis of two midterms (dates to be determined) and the final exam (Tuesday, December 6, 8:00-11:00am).

OPTIONAL QUESTIONS: For those who would like prior practice working with the material at a more basic level, or whose microeconomics background is not strong, there is an Econ 100A package available at Soft Reserve. This package contains approximately ∞ practice questions, which sometimes accidentally find their way onto Econ 200A midterms and final exams. Even onto Micro Qualifiers ...

ECONOMICS 200A COURSE OUTLINE

Fall 2005 **Mark Machina**

I. INTRODUCTION AND BASIC MATHEMATICAL IDEAS

a. Some Introductory Ideas

Domain of Microeconomic Analysis
Role of Models in Economics
The Circular Flow Diagram
Stocks versus Flows and the Dimensions of Economic Variables

b. Elasticity

c. Level Curves of Functions

d. Possible Properties of Functions

Cardinal vs. Ordinal Properties of Functions
Scale Invariance and Constant Returns to Scale
Homogeneous Functions and Euler's Theorem
Homotheticity
Concavity and Convexity
Quasiconcavity and Quasiconvexity
Additive and Multiplicative Separability

e. Systems of Linear Equations and Cramer's Rule

II. MATHEMATICS OF OPTIMIZATION

a. The General Structure of Optimization Problems

Objective Functions, Control Variables, Parameters, Constraints
Solution Functions and Optimal Value Functions

b. Unconstrained Optimization

First Order Conditions
Second Order Conditions

c. Constrained Optimization

First Order Conditions
- Lagrangians
- Corner Solutions

Second Order Conditions

d. Comparative Statics of Solution Functions – Implicit Differentiation

Differentiation of First Order Conditions
A Related Application: Comparative Statics of Equilibria

e. Comparative Statics of Optimal Value Functions – The Envelope Theorem

Unconstrained Case: Differentiation of the Objective Function
Constrained Case: Differentiation of the Lagrangian

III. CONSUMER PREFERENCES AND THE UTILITY FUNCTION

a. The Choice Space

- The Objects of Choice
- The Relevant Time Period
- The Issue of Divisibility

b. The Consumer's Preference Ranking

- Weak Preference, Strict Preference and Indifference
- Preferences are Defined over Commodity Bundles, *not* Individual Commodities
- General Properties of the Preference Ranking:
  - Completeness, Reflexivity and Transitivity
  - Continuity
    - Alternative Definitions of Continuity
    - Example of Non-Continuous Preferences: Lexicographic Preferences
- Possible Additional Properties of the Preference Ranking
  - Weak Monotonicity/Strong Monotonicity
  - Local Nonsatiation
  - Weak Convexity/Convexity/Strong Convexity

c. Indifference Curves and the Marginal Rate of Substitution

- Better-Than Sets, Worse-Than Sets and Indifference Sets
- Typical Properties of Indifference Curves
  - One Through Each Point
  - Downward Sloping and "Thin"
  - Can't Cross
- Marginal Rate of Substitution (MRS)
  - Definition of MRS
  - Graphical Interpretation: Slope of the Indifference Curve
  - Convexity of Preferences and Hypothesis of Diminishing MRS

d. Utility Functions

- Representation of a Preference Ranking by a Utility Function
- Monotonic Invariance of Utility Functions
- Possible Properties of a Utility Function:
  - Weak/Strong Monotonicity
  - Weak/Strong Quasiconcavity
  - Homotheticity
  - Additive/Multiplicative Separability
- Expressing the MRS in Terms of Marginal Utilities
- Monotonic Invariance of the MRS
- Hypothesis of Diminishing MRS
  - Algebraic Condition for Hypothesis of Diminishing MRS
- Important Examples of Utility Functions
  - Linear
  - Cobb-Douglas
  - Leontief
  - Constant Elasticity of Substitution (CES)

IV. UTILITY MAXIMIZATION AND DEMAND FUNCTIONS

a. Utility Maximization Subject to a Budget Constraint

- Graphical Illustration
- First Order Conditions for Utility Maximization
  - Two Interpretations of the First Order Conditions
  - Monotonic Invariance of the First Order Conditions
- "Marginal Utility of Income"
- Second Order Conditions (Hypothesis of Diminishing MRS)
- Algebraic Examples: Cobb-Douglas, Leontief, Linear
- Corner Solutions

b. Regular or "Marshallian" Demand Functions

- Definition of Regular Demand Functions
  - Examples: Cobb-Douglas, Leontief, Linear
- General Properties of Demand Functions:
  - *Not* Necessarily Nonincreasing in "Own Price"
  - Walras' Law
  - Scale Invariant in Prices and Income
  - Relationship between Price Elasticities & Income Elasticity for a Good
- Market Demand Functions

c. The Indirect Utility Function

- Properties:
  - Increasing in Income, Nonincreasing in Prices
  - Scale Invariant in Prices and Income
  - Quasiconvex in Prices and Income
- Utility-Income Curves
- Price Indifference Curves
- Effect of Monotonic Transformation of Utility
- Examples: Cobb-Douglas, Leontief, Linear

d. Compensated Demand Functions and the Expenditure Function

- The Expenditure Minimization Problem
  - First Order Conditions for Expenditure Minimization
- Compensated or "Hicksian" Demand Functions
  - Properties:
    - Scale Invariant in Prices
    - Nonincreasing in "Own Price"
  - Identities Linking the Marshallian and Hicksian Demand Functions
  - Examples: Cobb-Douglas, Leontief, Linear
- The Expenditure Function
  - Properties:
    - Increasing in Utility, Nondecreasing in Prices
    - Homogeneous of Degree One in Prices
    - Concave in Prices
  - Identities Linking the Expenditure and Indirect Utility Functions

V. COMPARATIVE STATICS OF DEMAND

a. Changes in Income

Income-Consumption Loci
Engel Curves: Definition and Graphical Derivation
Income Elasticity
- Superior, Normal and Inferior Goods
- Income Elasticity and Budget Shares
- Relationship Between Income Elasticities of All Goods

Algebraic Derivation of the Effect of an Income Change
Relationship Between Income Elasticities for All Goods

b. Changes in Prices

Price-Consumption Loci
Graphical Derivation of Marshallian Demand Curves
Own Price Elasticity
- Price Elasticity and Budget Shares

Cross Price Elasticity
- Gross Substitutes and Gross Complements

Algebraic Derivation of the Effect of a Price Change
Relationship Between All Price and Income Elasticities for a Good

c. Compensated Price Changes

Graphical Illustration of a Compensated Price Change
Graphical Illustration of a Compensated Demand Curves
Algebraic Derivation of the Effect of a Compensated Price Change
Nonpositivity of Own Compensated Price Effect
Compensated Cross Price Elasticity
- Net Substitutes and Net Complements

d. The Slutsky Equation

Expressing Each of the Three Basic Changes in Terms of the Other Two
Graphical Illustration
Algebraic Formulation
Giffen Goods

e. Some Important Results

Economic Interpretation of the Lagrangian Multiplier
Roy’s Identity (Linking the Indirect Utility and Demand Functions)
Relationship Between the Expenditure and Compensated Demand Functions
A One-Line Proof of the Slutsky Equation
Justification of the Two-Good Approach: The Composite Commodity Theorem

VI. PRODUCTION, COST AND DUALITY

a. Factors of Production

The Stock-Flow Distinction
Types of Factors and Their Income

b. Production Functions and Production Sets

Definition and Important Examples of Production Functions
Marginal Products and the Law of Diminishing Marginal Returns
Average Products and the Average-Marginal Relationship
Returns to Scale
Technical Progress
- Three Implications of Technical Progress
- Hicks-Neutral, Harrod-Neutral and Solow-Neutral Technical Progress
- Continuous Technical Progress

Production Sets and Input Requirement Sets

c. Isoquants and the Marginal Rate of Technical Substitution (MRTS)

Definition and General Properties of Isoquants
Definition of MRTS
Expressing MRTS in Terms of Marginal Products
Hypothesis of Diminishing MRTS
Elasticity of Substitution

d. The Nature of Cost

Definition of Cost
Accounting Cost vs. Opportunity Cost of Owned Factors
Cost of Entrepreneurial Ability and Definition of "Normal Profits"
Short Run versus Long Run Planning Horizons

e. Long Run Minimization and Long Run Cost Functions

Isocost Lines
Long Run Cost Minimization
- First Order Conditions and Output-Constrained Factor Demands
  - Two Interpretations of the First Order Conditions
- Second Order Conditions and the Hypothesis of Diminishing MRTS
- Equivalence to Constrained Output Maximization

The Long Run Expansion Path
Long Run Total Cost Function (LTC)
- Properties of LTC:
  - Increasing in Output, Nondecreasing in Factor Prices
  - Homogeneous of Degree One in Factor Prices
  - Concave in Factor Prices
- Deriving Output-Constrained Factor Demands from LTC

Long Run Marginal Cost Function (LMC)
- Relation of LMC to Marginal Products and Factor Prices

Long Run Average Cost Function (LAC)
- Returns to Scale and Long Run Average Cost
- Average-Marginal Relationship

Relation Between Long Run and Short Run Total, Average and Marginal Cost Curves

f. Short Run Cost Functions

Expansion Path in the Short Run
Graphical Derivation of the Short Run Total Cost Curve
Algebraic Derivation of Short Run Total Cost Function (STC)
  Examples: Linear, Leontief, Cobb-Douglas
Short Run Variable Cost Function (SVC)
Short Run Fixed Cost Function (SFC)
Short Run Marginal Cost Function (SMC)
  Relation of SMC to Marginal Product of Labor and Wage Rate
Short Run Average Total Cost Function (SATC)
Short Run Average Variable Cost Function (SAVC)
Short Run Average Fixed Cost Function (SAFC)
Average-Marginal Relationships
Effects and Interpretation of "Changes in Fixed Capital $\bar{K}$"

g. Duality Between Production and Cost

Equivalence of Cost Minimization and Constrained Output Maximization
Convexification of Input Requirement Sets and Competitive Production
Recovery of Production Function and Cost Functions from Each Other
Characterization of Cost Functions:
  Positive
  Nondecreasing in Output and Factor Prices
  Homogeneous Degree One in Factor Prices
  Concave in Factor Prices
Relationship Between Isocost Curves (in the Factor Price Plane) and Isoquants

VII. PROFIT MAXIMIZATION AND SUPPLY

a. Long Run Profit Maximization and Supply

Long Run Profit Maximization (Graphical Illustration and Algebraic Formulation)
  First Order Conditions and Interpretation
  Second Order Condition (Increasing Marginal Cost)
The Long Run Supply Function of the Firm
  Properties:
    Increasing in Price, Nonincreasing in Factor Prices
    Scale Invariant in Output and Factor Prices
    Long Run Elasticity of Supply
  Cobb-Douglas Example
The Long Run Profit Function
  Properties:
    Increasing in Price, Nonincreasing in Factor Prices
    Homogeneous of Degree One in All (Output and Factor) Prices
    Convex in Output and Factor Prices
  Cobb-Douglas Example
Identity Linking the Long Run Profit and Supply Functions

b. Short Run Profit Maximization and Supply

The Three Relevant Regions and the Shut Down Decision
- Illustration in Terms of STC and SVC Curves
- Illustration in Terms of SATC and SAVC Curves
- The Short Run Supply Curve of the Firm

The Short Run Supply Function of the Firm
- Properties:
  - Increasing in *p*, Nonincreasing in (*w*,*r*)
  - Scale Invariant in (*p*,*w*)
  - Effects of Changes in $\bar{K}$
- Short Run Elasticity of Supply
- Cobb-Douglas Example

The Short Run Profit Function
- Properties
  - Increasing in *p*, Nonincreasing in (*w*,*r*)
  - Homogeneous Degree One in (*p*,*w*,*r*)
  - Convex in (*p*,*w*,*r*)
- Effects of Changes in $\bar{K}$
- Cobb-Douglas Example

Identity Linking the Short Run Profit and Supply Functions

Comparison of Short Run and Long Run Profit Functions

Comparison of Short Run and Long Run Supply Elasticities

c. Factor Demand Functions

Maximizing Profits by Choosing Optimal Input Levels
- Marginal Value Product of a Factor of Production

Short Run Factor Demand
- First Order Condition for Short Run Profit Maximization
- Short Run Factor Demand Functions
  - Nonincreasing in Own Factor Price
  - Scale Invariant in Output Price and Prices of Variable Factors
  - Relation to Short Run Supply Function

Long Run Factor Demand
- First Order Conditions for Long Run Profit Maximization
- Long Run Factor Demand Functions
  - Nonincreasing in Own Factor Price
  - Scale Invariant in Output Price and Factor Prices
  - Relation to Long Run Supply Function
  - Relation to the Profit Function
  - Properties:
    - Nonincreasing in Own Price
    - Scale Invariant in (*p*,*w*,*r*)
    - Symmetric Cross Factor Price Effects

VIII. CHOICE UNDER UNCERTAINTY

a. Objective Uncertainty

Objects of Choice and Preference Functionals
Structure of Expected Utility Preferences
  Axiomatic Characterization of Expected Utility
Arrow-Pratt Characterization of Comparative Risk Aversion
  Risk Aversion and Wealth
Rothschild-Stiglitz Characterization of Comparative Risk
Demand for Insurance

b. Subjective Uncertainty

States, Events, Outcomes and Acts
Probabilistic Sophistication
Expected Utility Preferences over Subjective Acts
  State-Dependent Utility

c. Evidence and Alternative Models

Evidence on the Independence Axiom
Non-Expected Utility Preference Functionals
  Generalized Expected Utility Analysis
Evidence on Probabilistic Sophistication and the Stability of Preferences

IX. INTERTEMPORAL CHOICE & PRODUCTION: SUPPLY AND DEMAND FOR CAPITAL

a. Supply of Labor: The Labor-Leisure Decision

Income-Leisure Space and the Labor-Leisure Decision
First Order Conditions for Optimal Supply of Labor
Comparative Statics: Income and Substitution Effects
Backward Bending Supply of Labor Curves
Kinked Budget Lines and the Overtime Decision

b. Supply of Capital: The Consumption-Savings Decision

Intertemporal Income and Consumption Streams
Interest Rates and Discounted Present Value of a Stream
Intertemporal Utility Maximization
  First Order Conditions and Interpretation
Comparative Statics: Income and Substitution Effects

c. Intertemporal Production: The Demand for Capital

Two-Period Illustration
Finite-Period Production and Investment
Continuous Time Production: When to Cut a Tree

d. Relationship between Rental Market and Sales Market for Capital

X. SPECIFICATION AND ESTIMATION OF DEMAND, COST AND SUPPLY

a. Parametric Estimation of Demand Systems

b. Parametric Estimation of Production and Cost Systems

c. Nonparametric Testing of the Maximization Hypothesis

ECONOMICS 200A READINGS BY TOPIC

Fall 2005 Mark Machina

I. Introduction and Basic Mathematical Ideas
Required: Math Handout, Sections A through F; Kreps Ch.1
Also suggested: MWG App.A-E; Varian Ch.26

II. Mathematics of Optimization
Required: Mathematical Handout, Sections G through I
Also suggested: Kreps App.1; MWG App. J-L; Varian Ch.27

III. Consumer Preferences and the Utility Function
Required: Kreps Sect.2.1; MWG Ch.1, Sects.2A -2C,3A - 3C; Varian Sect. 7.1
Also suggested: Suggested readings will be provided in an in-class handout

IV. Utility Maximization and Demand Functions
Required: Kreps Ch.2; MWG Sects.2D,3D; Varian Sects.7.2-7.5
Also suggested: Henderson & Quandt, Sects.2.1-2.3

V. Comparative Statics of Demand
Required: MWG Sects.2E-2F, 3E-3J; Varian Chs. 8, 9
Also suggested: MWG Ch.4; Varian Ch.10, Henderson & Quandt, Sects.2.5-2.7

VI. Production, Cost and Duality
Required: Kreps Sect. 7.1 ; MWG Ch.5; Varian Chs.1,4,5,6
Also suggested: Henderson & Quandt, Chs.4,5

VII. Profit Maximization and Supply
Required: Kreps Ch.7; MWG Ch.5; Varian Chs.2,3
Required: Viner, J. (1931). "Cost Curves and Supply Curves," *Zeitschrift für Nationalökonomie* III. 23-46.
Also suggested: Kreps Chs.19,20

VIII. Choice Under Uncertainty
Required: Kreps Ch.3; MWG Ch.6; Varian Ch.11;
Required: Pratt J. (1964). "Risk Aversion in the Small and in the Large," *Econometrica* 32, 122-136.
Also suggested: Rothschild, M. & J. Stiglitz (1970). "Increasing Risk: I. A Definition," *Journal of Economic Theory* 2, 225-243;
Machina, M. (1987). "Choice Under Uncertainty: Problems Solved and Unsolved," *Journal of Economic Perspectives*, Summer 1987.

IX. Intertemporal Choice and Production
Required: MWG Sects.20A-20D; Varian Ch.19
Also suggested: Kreps Ch.4, Sect.6.5; MWG Sects.19A-19B

X. Specification and Estimation of Demand, Cost and Supply
Required: Varian Ch.12
Required: Ch. 3 of Deaton & Muellbauer (1980), *Economics and Consumer Behavior*.

ECON 200A: FAMOUS OPTIMIZATION PROBLEMS

Optimization Problem	Objective Function	Constraint	Control Variables	Parameters	Solution Functions	Optimal Value Function
Consumer's Problem	$U(x_1,\ldots,x_n)$ utility function	$p_1 \cdot x_1 + \ldots + p_n \cdot x_n = I$ budget constraint	$x_1,\ldots,x_n$ commodity levels	$p_1,\ldots,p_n, I$ prices and income	$x_i(p_1,\ldots,p_n,I)$ regular demand functions	$V(p_1,\ldots,p_n,I)$ indirect utility function
Expenditure Minimization Problem	$p_1 \cdot x_1 + \ldots + p_n \cdot x_n$ expenditure level	$U(x_1,\ldots,x_n) = \overline{u}$ desired utility level	$x_1,\ldots,x_n$ commodity levels	$p_1,\ldots,p_n, \overline{u}$ prices and utility level	$h_i(p_1,\ldots,p_n, \overline{u})$ compensated demand functions	$e(p_1,\ldots,p_n, \overline{u})$ expenditure function
Labor/Leisure Decision	$U(H,I)$ utility function	$I = I_0 + w \cdot (168 - H)$ budget constraint	H, I leisure time, disposable inc.	w, I_0 wage rate and nonwage income	$L(w,I_0) \equiv 168 - H(w,I_0)$ labor supply function	$V(w,I_0)$ indirect utility function
Intertemporal Optimization	$U(c_1,\ldots,c_n)$ utility function	$\sum_{t=1}^{n}(1+i)^t \cdot (I_t - c_t) = 0$ budget constraint	$c_1,\ldots,c_n$ consumption levels	$I_1,\ldots,I_n, i$ income stream and interest rate	$c_i(I_1,\ldots,I_n, i)$ consumption functions	$V(I_1,\ldots,I_n, i)$ indirect utility function
Long Run Cost Minimization	$w \cdot L + r \cdot K$ total cost	$F(L,K) = Q$ desired output	L, K factor levels	Q, w, r desired output and factor prices	$L(Q,w,r), K(Q,w,r)$ output-constrained factor demands	$LTC(Q,w,r)$ long run total cost function
Long Run Profit Maximization (in terms of Q)	$P \cdot Q - LTC(Q,w,r)$ total profit	none	Q output level	P, w, r output price and factor prices	$Q(P,w,r)$ long run supply function	$\pi(P,w,r)$ long run profit function
Long Run Profit Maximization (in terms of L, K)	$P \cdot F(L,K) - w \cdot L - r \cdot K$ total profit	none	L, K factor levels	P, w, r output price and factor prices	$L(P,w,r), K(P,w,r)$ factor demand functions	$\pi(P,w,r)$ long run profit function
Long Run Profit Maximization (in terms of Q, L, K)	$P \cdot Q - w \cdot L - r \cdot K$ total profit	$F(L,K) = Q$ production function	Q, L, K output and factor levels	P, w, r output price and factor prices	$Q(P,w,r), L(P,w,r), K(P,w,r)$ output supply & factor demand functions	$\pi(P,w,r)$ long run profit function