ECON 200A: MICROECONOMICS ("DECISIONS")

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

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


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

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


Other useful readings include the relevant chapters of:


EXAMS: Your grade in the course will be determined on the basis of in-class two midterms (Tuesday, Oct. 21 and Thursday, Nov. 20) and a final exam (Tuesday, Dec. 9, 8:00-11:00am).

PRACTICE 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 a package of approximately ∞ practice questions available. These questions sometime accidentally find their way onto Econ 200A midterms and final exams. Even onto Micro Qualifiers ...

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
   Equivalent Variation versus Compensation Variation

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
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
   Also suggested: Kreps Chs.19,20

VIII. Choice Under Uncertainty
   Required: Kreps Ch.3; MWG Ch.6; Varian Ch.11;

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

<table>
<thead>
<tr>
<th>Optimization Problem</th>
<th>Objective Function</th>
<th>Constraint</th>
<th>Control Variables</th>
<th>Parameters</th>
<th>Solution Functions</th>
<th>Optimal Value Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer’s Problem</td>
<td>$U(x_1,\ldots,x_n)$ utility function</td>
<td>$p_1x_1+\ldots+p_nx_n = I$ budget constraint</td>
<td>$x_1,\ldots,x_n$ commodity levels</td>
<td>$p_1,\ldots,p_n,I$ prices and income</td>
<td>$V(p_1,\ldots,p_n,l)$ indirect utility function</td>
<td></td>
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<tr>
<td>Expenditure Minimization Problem</td>
<td>$p_1x_1+\ldots+p_nx_n$ expenditure level</td>
<td>$U(x_1,\ldots,x_n) = u$ desired utility level</td>
<td>$x_1,\ldots,x_n$ commodity levels</td>
<td>$p_1,\ldots,p_n,u$ prices and utility level</td>
<td>$h_k(p_1,\ldots,p_n,u)$ compensated demand functions</td>
<td>$e(p_1,\ldots,p_n,u)$ expenditure function</td>
</tr>
<tr>
<td>Labor/Leisure Decision</td>
<td>$U(H,I)$ utility function</td>
<td>$I = I_0 + w(168 - H)$ budget constraint</td>
<td>$H, I$ leisure time, disposable inc.</td>
<td>$w, I_0$ wage rate and nonwage income</td>
<td>$L(w,I_0) = 168 - H(w,I_0)$ labor supply function</td>
<td>$V(w,I_0)$ indirect utility function</td>
</tr>
<tr>
<td>Intertemporal Optimization</td>
<td>$U(c_1,\ldots,c_n)$ utility function</td>
<td>$\sum_{i-1}^n(1+i)^t(I_t-c_t) = 0$ budget constraint</td>
<td>$c_1,\ldots,c_n$ consumption levels</td>
<td>$I_1,\ldots,I_n, i$ income stream and interest rate</td>
<td>$c(I_1,\ldots,I_n, i)$ consumption functions</td>
<td>$V(I_1,\ldots,I_n, i)$ indirect utility function</td>
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<tr>
<td>Long Run Cost Minimization</td>
<td>$wL + rK$ total cost</td>
<td>$F(L,K) = Q$ desired output</td>
<td>$L, K$ factor levels</td>
<td>$Q, w, r$ desired output and factor prices</td>
<td>$L(Q, w, r), K(Q, w, r)$ output-constrained factor demands</td>
<td>$LTC(Q, w, r)$ long run total cost function</td>
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<tr>
<td>Long Run Profit Maximization (in terms of $Q$)</td>
<td>$PQ - LTC(Q, w, r)$ total profit</td>
<td>none</td>
<td>$Q$ output level</td>
<td>$P, w, r$ output price and factor prices</td>
<td>$Q(P, w, r)$ long run supply function</td>
<td>$\pi(P, w, r)$ long run profit function</td>
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<tr>
<td>Long Run Profit Maximization (in terms of $L, K$)</td>
<td>$PFL(L, K) - wL - rK$ total profit</td>
<td>none</td>
<td>$L, K$ factor levels</td>
<td>$P, w, r$ output price and factor prices</td>
<td>$L(P, w, r), K(P, w, r)$ factor demand functions</td>
<td>$\pi(P, w, r)$ long run profit function</td>
</tr>
<tr>
<td>Long Run Profit Maximization (in terms of $Q, L, K$)</td>
<td>$PQ - wL - rK$ total profit</td>
<td>$F(L,K) = Q$ production function</td>
<td>$Q, L, K$ output and factor levels</td>
<td>$P, w, r$ output price and factor prices</td>
<td>$Q(P, w, r), L(P, w, r), K(P, w, r)$ output supply &amp; factor demand functions</td>
<td>$\pi(P, w, r)$ long run profit function</td>
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