

ECON 200A: MICROECONOMICS ("DECISIONS")

Fall 2003

Tu,Th 8:00-9:50am

ECON 300

Mark Machina

Office: ECON 217

Hours: Wed 10:00-2:00

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 the course will be determined on the basis of two midterms (dates to be determined) and the final exam (Tuesday, December 9, 8-11am).

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 2003

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

Homogeneous Degree Zero in Prices and Income

Quasiconvex in Prices

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:

Homogeneous Degree Zero 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

Linear

Leontief and Multi-Technique Leontief

Cobb-Douglas

Constant Elasticity of Substitution

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

Examples: Linear, Cobb-Douglas, Leontief

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

Numerical Example

Cost of Entrepreneurial Ability and Definition of "Normal Profits"

Short Run versus Long Run Planning Horizons

e. 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} "

f. 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

Examples: Linear, Leontief, Cobb-Douglas

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

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 2003

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	$U(x_1, \dots, x_n)$ utility function	$p_1 \cdot x_1 + \dots + p_n \cdot x_n = I$ budget constraint	x_1, \dots, x_n commodity levels	p_1, \dots, p_n, I prices and income	$x_i(p_1, \dots, p_n, I)$ regular demand functions	$V(p_1, \dots, p_n, I)$ indirect utility function
Expenditure Minimization Problem	$p_1 \cdot x_1 + \dots + p_n \cdot x_n$ expenditure level ('allowance')	$U(x_1, \dots, x_n) = \bar{u}$ desired utility level ('Jonathan's')	x_1, \dots, x_n commodity levels	p_1, \dots, p_n, \bar{u} prices and utility level	$h_i(p_1, \dots, p_n, \bar{u})$ compensated demand functions	$e(p_1, \dots, p_n, \bar{u})$ 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	$U(c_1, \dots, c_n)$ utility function	$\sum_{t=1}^n (1+i)^t \cdot (I_t - c_t) = 0$ budget constraint	c_1, \dots, c_n consumption levels	I_1, \dots, I_n, i income stream and interest rate	$c_i(I_1, \dots, I_n, i)$ consumption functions	$V(I_1, \dots, I_n, i)$ 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