Econ 11: Intermediate Microeconomics

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- Office Hours
  - Tuesday, 11am-12:30pm or by appointment

Preliminaries

- Textbook
  - Recommended: Friedman, The Hidden Order: The Economics of Everyday Life
  - Recommended: Sowell, Basic Economics: A Citizen’s Guide to the Economy
- Requirements
  - 4 Problem Sets (20% of grade)
  - Midterm Exam (25% of grade)
  - Final Exam (55% of grade)

Teaching Assistants

- There are 5 Teaching Assistants
  - Becky Acosta (rajacosta@ucla.edu)
  - Alex Alencar (aalenca@ucla.edu)
  - Chuling Chen (chench@ucla.edu)
  - Chris McKelvey (mckelvey@aristotle.sscnet.ucla.edu)
  - Rodrigo Penaloza (rodrigo@ucla.edu)
- Each will hold weekly sessions to work on problems and take questions.

Introduction to Price Theory

- Price theory is concerned with the behavior of consumers and firms facing resource constraints
- The main questions addressed by price theory include:
  - What role do prices play in determining the consumption and production of goods in an economy?
  - How are prices set in a free market?
  - How efficiently are goods allocated in a free market?
- By the end of the quarter, everyone should be able to answer the diamond-water paradox.

Preferences, Technology, and Constraints

- A recurring theme of the course is that preferences, technology, and constraints are conceptually different items.
- Price theory does not explain consumer preferences nor producer technology—they are taken as given.
- All of the power of price theory derives from preferences and technology interacting with constraints to ultimately determine choices.

The Neoclassical Model

- Consumers pick a combination of goods within their constraints (given prices) that make them happiest.
- Firms maximize profits, taking prices as given, by combining inputs (capital and labor) to produce goods.
- Prices are set by the interaction of firms and consumers in the market.
Supply and Demand

- Another major theme of this course is a careful consideration of phenomena that shift supply and demand curves.
- Demand curves slope downward—why?
- Supply curves slope upward—why?
- Changes in the price of the good imply shifts along the curve
- Changes in other determinants of demand/supply imply shifts of the curve

Law of Demand

- Quantity demanded (by consumers) falls as price rises

\[ D = Q^d = Q^d(P) \]

Supply Curves Slope Upwards

- Quantity supplied (by firms) rises as price rises

\[ S = Q^s = Q^s(P) \]

Equilibrium of Supply and Demand

- Price > P*: Supply exceeds Demand
- Price < P*: Demand exceeds Supply
- Equilibrium price and quantity are determined by the intersection of supply and demand

Shifts in Demand

- Demand curve shifts:
  - Increase in income generally shifts demand right
  - Increase in preference for the good shifts demand right
    - But how are preferences distinct from demand?
    - Change in the price of other goods can shift demand right or left
    - Does a change in the price of the good shift demand?
- We will formalize each of these statements as the quarter progresses.
Shifts in Supply

- Supply curve shifts:
  - improvements in technology shift supply right
  - decreases in the prices of inputs generally shift supply right
- ‘Right’ shift means that, at any given price, the firm will produce more of the good.

‘Right’ Shift in Supply

- Equilibrium price falls
- Equilibrium quantity rises

\[ P', Q' \]

Mathematical Review

- This class is about economics, not mathematics.
- At times, you will doubt this statement.
- Read Ch. 2 of Nicholson for a more leisurely review than this lecture.
- Bottom line: Everyone should be comfortable taking derivatives and solving systems of equations at the start of the course.

Maximizing Functions

- At a local maximum point, continuous functions have zero derivative (slope).
- Why?
  - If the derivative at the maximum were positive, then you could move in the direction of the positive derivative to increase the function.
  - If the derivative at the maximum were negative, then you could move in a direction away from the negative derivative to increase the function.

Example: Univariate Maximization

\[ y = f(x) \]

Multivariate Maximization

- For multivariate functions, slopes are defined along each argument of the function.
- First order conditions: All of these slopes must equal zero for a point to be a maximum.
- It is possible to meet first order conditions and still not have a maximum.
  - Need to meet second order condition as well.
Second Order Conditions (I)

- Second order conditions are automatically met for *concave* functions. That is, functions that look like inverted tea cups.
- In this class, the most complicated problems will involve functions of two variables:
  
  \[ y = f(x, z) \]

Second Order Conditions (II)

- For two variables, the second order condition is given by:

\[
\begin{align*}
\frac{\partial^2 y}{\partial x^2} &< 0 \\
\frac{\partial^2 y}{\partial x \partial z} &> 0
\end{align*}
\]

Example: Multivariate Maximization

\[ y = -2(x-3)^2 - 8(z+5)^2 \]

- In this case, the maximum is at \( x=3, z=-5 \), by inspection.
- The first-order conditions are:

\[
\begin{align*}
\frac{\partial y}{\partial x} &= -4(x-3) = 0 \\
\frac{\partial y}{\partial z} &= -16(z+5) = 0
\end{align*}
\]

Example I (continued)

- The second-order conditions are also met:

\[
\begin{align*}
\frac{\partial^2 y}{\partial x^2} &= -4 < 0 \\
\frac{\partial^2 y}{\partial x \partial z} &> 0
\end{align*}
\]

Example II: Multivariate Maximization

\[ y = -2(x-3)^2 - 8(z+5)^2 - (x-1)z \]

- The first-order conditions are a simultaneous equation system:

\[
\begin{align*}
\frac{\partial y}{\partial x} &= -4(x-3) - z = 0 \\
\frac{\partial y}{\partial z} &= -16(z+5) - (x-1) = 0
\end{align*}
\]

Example II (continued)

- The solution to the system is:

\[
\begin{align*}
x &= \frac{271}{63} \\
z &= -\frac{328}{63}
\end{align*}
\]

- The second order condition is also satisfied:

\[
\begin{align*}
\frac{\partial^2 y}{\partial x^2} &= -4 < 0 \\
\frac{\partial^2 y}{\partial x \partial z} &> 0
\end{align*}
\]

\[
\begin{align*}
\frac{\partial^2 y}{\partial x \partial z} &= -4 \cdot (-16) - (-1)^2 = 63 > 0
\end{align*}
\]
Level Sets

- Level sets are the set of points at which a function has a constant value.
- They are useful to represent multidimensional functions graphically.
- Example: \( y = x^2 \)
- \((x=1, z=2)\) and \((x=2, z=1)\) are both points in the \(y=2\) level set. Are there other points in this set?

Constrained Maximization

- Price theory is about maximizing an objective function under constraints.
- Example: \( \max_{x, y} xy \) subject to: \( x + y = 1 \)

Lagrange Multipliers

- We cannot just take derivatives of the objective \( xy \) to find the optimum—that would ignore the constraint \( x+y=1 \).
- Instead, we can do an algebraic trick:
  - Rewrite the constraint as \( x + y - 1 = 0 \)
  - Redefine the objective as \( L = xy - \lambda (x + y - 1) \)

Interpreting \( \lambda \)

- The derivative of the new objective \( L \) with respect to \( \lambda \) and setting it equal to zero just reproduces the constraint:
  \[ \frac{\partial L}{\partial \lambda} = x + y - 1 = 0 \]
- So if we maximize \( L \) over \( x, y, \) and \( \lambda \) we will find the maximum point for the original objective \( xy \), while respecting the constraint.

Constrained Maximization Example Solved

- First order conditions:
  \[ \frac{\partial L}{\partial x} = y - \lambda = 0 \]
  \[ \frac{\partial L}{\partial y} = x - \lambda = 0 \]
  \[ \frac{\partial L}{\partial \lambda} = x + y - 1 = 0 \]
Example Solved (continued)

• Solution: \[ x = \frac{1}{2}, \quad y = \frac{1}{2} \]

• Homework:
  – Read about second order conditions for constrained optimization in Nicholson Ch. 2 Appendix.
  – Read about the Envelope theorem in Nicholson Ch. 2.