Econ 11: Intermediate Microeconomics

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

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Preliminaries

- Textbook
  - Nicholson, *Microeconomic Theory: Basic Principles and Extensions , 7th ed.*
    - 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)

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Teaching Assistants

- There are 5 Teaching Assistants
  - Becky Acosta (rjacosta@ucla.edu)
  - Alex Alencar (aalencar@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.

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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.

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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.

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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.

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‘Supply and Demand’ Set Prices

- 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

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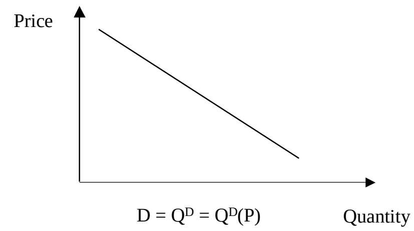
‘Law of Demand’

- Quantity demanded (by consumers) falls as price rises



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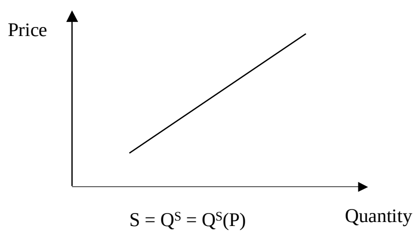
Supply Curves Slope Upwards

- Quantity supplied (by firms) rises as price rises



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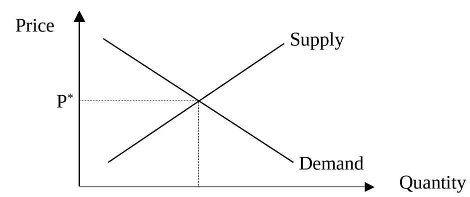
Equilibrium of Supply and Demand

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



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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.

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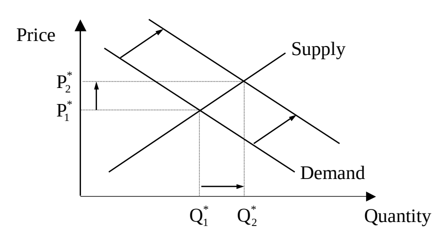
A ‘Right’ Shift in Demand

- Equilibrium price rises
- Equilibrium quantity rises



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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.

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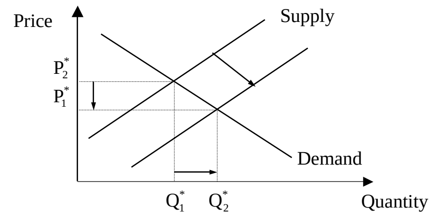
'Right' Shift in Supply

- Equilibrium price falls
- Equilibrium quantity rises



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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.

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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.

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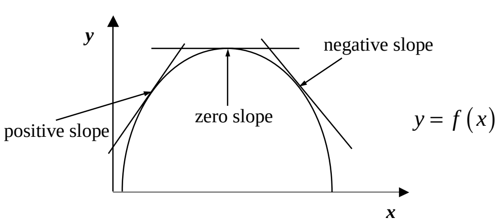
Example: Univariate Maximization



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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.

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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:

$$\frac{\partial^2 y}{\partial x^2} < 0$$

$$\frac{\partial^2 y}{\partial x^2}\frac{\partial^2 y}{\partial z^2} - \left[\frac{\partial^2 y}{\partial x \partial z}\right]^2 > 0$$

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:

$$\frac{\partial y}{\partial x} = -4(x-3) = 0 \quad \text{and} \quad \frac{\partial y}{\partial z} = -16(z+5) = 0$$

Example I (continued)

- The second-order conditions are also met:

$$\frac{\partial^2 y}{\partial x^2} = -4 < 0$$

$$\frac{\partial^2 y}{\partial x^2}\frac{\partial^2 y}{\partial z^2} - \left[\frac{\partial^2 y}{\partial x \partial z}\right]^2 = (-4)*(-16) - 0^2 = 64 > 0$$

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:

$$\frac{\partial y}{\partial x} = -4(x-3) - z = 0$$

$$\frac{\partial y}{\partial z} = -16(z+5) - (x-1) = 0$$

Example II (continued)

- The solution to the system is:

$$x = \frac{271}{63} \quad \text{and} \quad z = -\frac{328}{63}$$

- The second order condition is also satisfied:

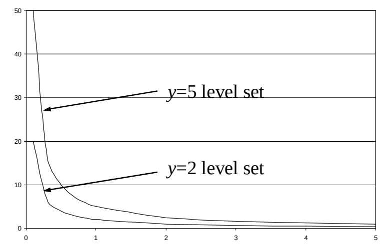
$$\frac{\partial^2 y}{\partial x^2} = -4 < 0$$

$$\frac{\partial^2 y}{\partial x^2}\frac{\partial^2 y}{\partial z^2} - \left[\frac{\partial^2 y}{\partial x \partial z}\right]^2 = (-4)*(-16) - (-1)^2 = 63 > 0$$

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: $y = xz$
- (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?

Level Sets (continued)



Constrained Maximization

- Price theory is about maximizing an objective function under constraints.
- Example:

$$\max_{x,y} xy$$

$$\text{subject to: } x + y = 1$$

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

$$L = xy - \lambda\left(x + y - 1\right)$$

Interpreting λ

- The derivative of the new objective (L) with respect to λ 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 λ 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: $x = \frac{1}{2}, y = \frac{1}{2}$
- Homework:
  - Read about second order conditions for constrained optimization in Nicholson Ch. 2 Appendix.
  - Read about the Envelope theorem in Nicholson Ch. 2.

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