Slide 1

Review of Intermediate Econ Material
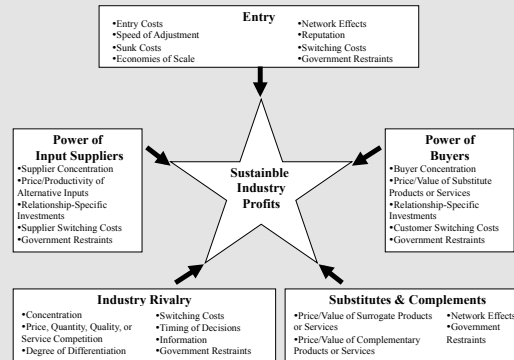
Drawn from Baye Chapters 1-3

Updated by DF 9/12

Slide 2

The Five Forces Framework

Entry
- Entry Costs
- Speed of Adjustment
- Sunk Costs
- Economies of Scale
- Network Effects
- Reputation
- Switching Costs
- Government Restraints

Power of Input Suppliers
- Supplier Concentration
- Price/Productivity of Alternative Inputs
- Relationship-Specific Investments
- Supplier Switching Costs
- Government Restraints

Sustainble Industry Profits

Power of Buyers
- Buyer Concentration
- Price/Value of Substitute Products or Services
- Relationship-Specific Investments
- Customer Switching Costs
- Government Restraints

Industry Rivalry
- Concentration
- Price, Quantity, Quality, or Service Competition
- Degree of Differentiation
- Switching Costs
- Timing of Decisions
- Information
- Government Restraints

Substitutes & Complements
- Price/Value of Surrogate Products or Services
- Price/Value of Complementary Products or Services
- Network Effects
- Government Restraints

Slide 3

Market Interactions

- Consumer-Producer Rivalry
  - Consumers attempt to locate low prices, while producers attempt to charge high prices.
- Consumer-Consumer Rivalry
  - Scarcity of goods reduces the negotiating power of consumers as they compete for the right to those goods.
- Producer-Producer Rivalry
  - Scarcity of consumers causes producers to compete with one another for the right to service customers.
- The Role of Government
  - Disciplines the market process.

Slide 4

Ch 1 Summary.

- Make sure you include all opportunity costs and benefits when making decisions, but exclude sunk costs and benefits.
- When decisions span time, make sure you are comparing apples to apples (use PV).
- Optimal economic decisions are made at the margin (MB=MC or corner solution).

Slide 5

Chapter 2 Overview

I. Market Demand Curve
- The Demand Function
- Determinants of Demand
- Consumer Surplus

II. Market Supply Curve
- The Supply Function
- Supply Shifters
- Producer Surplus

III. Market Equilibrium

IV. Price Restrictions

V. Comparative Statics

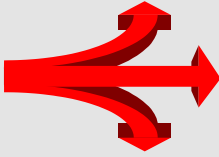## Slide 6

Market Demand Curve

- *Def*: the amount of a good that customers are willing and able to purchase as a fn of price, holding other factors constant.
- *"Law" of Demand*: The demand curve is downward sloping.
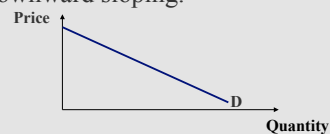
Price

D

Quantity

Demand Shifters

- Income
  - Normal good
  - Inferior good
- Prices of Related Goods
  - Prices of substitutes
  - Prices of complements
- Advertising and consumer tastes
- Population
- Consumer expectations

The Demand Function

- A general equation representing the demand curve

$$Q_x^d = f(P_x, P_Y, M, H)$$

  - Q_x^d = quantity demand of good X.
  - P_x = price of good X.
  - P_Y = price of a related good Y.
    - Substitute good.
    - Complement good.
  - M = income.
    - Normal good.
    - Inferior good.
  - H = any other variable affecting demand.

Inverse Demand Function

- Price as a function of quantity demanded.
- Example:
  - Demand Function
    - $Q_x^d = 10 - 2P_x$
  - Inverse Demand Function:
    - $2P_x = 10 - Q_x^d$
    - $P_x = 5 - 0.5Q_x^d$

Change in Quantity Demanded

A to B: Increase in *quantity demanded*

Shift in Demand

D_0 to D_1: Increase in *Demand*
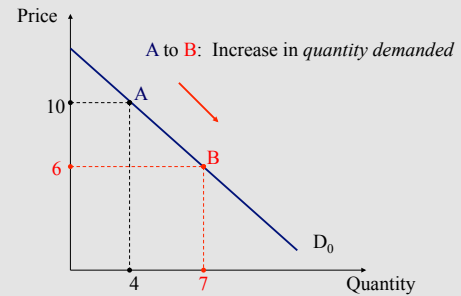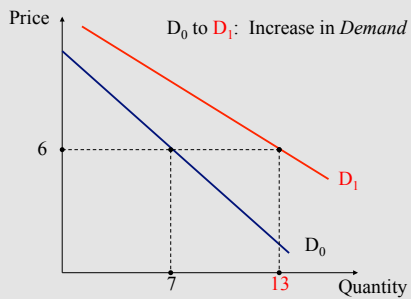
Consumer Surplus:

- The value consumers get from a good beyond the price paid.

I got a great deal!
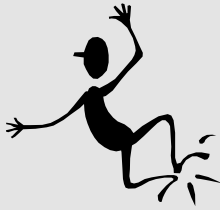
- That company offers a lot of bang for the buck!
- Apple provides good value.
- Total value greatly exceeds total amount paid.
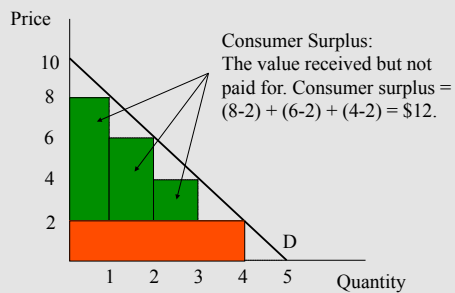- Consumer surplus is large.

I got a lousy deal!

- That car dealer drives a hard bargain!
- I almost decided not to buy it!
- They tried to squeeze the very last cent from me!
- Total amount paid is close to total value.
- Consumer surplus is low.

Consumer Surplus: The Discrete Case

Price

Consumer Surplus: The value received but not paid for. Consumer surplus = $(8-2) + (6-2) + (4-2) = \$12$.

10
8
6
4
2

D

1 2 3 4 5   Quantity

Consumer Surplus: The Continuous Case
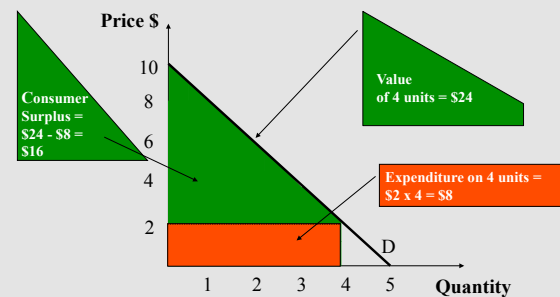
Price $

Consumer Surplus = $24 - \$8 = \$16$

Value of 4 units = $24

Expenditure on 4 units = $2 x 4 = \$8$

10
8
6
4
2

D

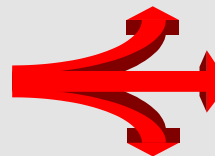1 2 3 4 5   Quantity

Market Supply Curve

- *Def*: the amount of a good that suppliers are willing and able to produce as a fn of price.
- *Law of Supply*: The supply curve is upward sloping.

Price

S_0

Quantity

Supply Shifters

- Input prices
- Technology or government regulations
- Number of firms
  - Entry
  - Exit
- Substitutes in production
- Taxes
  - Excise tax
  - Ad valorem tax
- Producer expectations

3

The Supply Function

- An equation representing the supply curve:

$$Q_x^S = f(P_x, P_R, W, H)$$

- Q_x^S = quantity supplied of good X.
- P_x = price of good X.
- P_R = price of a production substitute.
- W = price of inputs (e.g., wages).
- H = other variable affecting supply.

Inverse Supply Function

- Price as a function of quantity supplied.
- Example:
  - Supply Function
    - $Q_x^s = 10 + 2P_x$
  - Inverse Supply Function:
    - $2P_x = 10 + Q_x^s$
    - $P_x = 5 + 0.5Q_x^s$

Change in Quantity Supplied

A to B: Increase in *quantity supplied*

Shift in Supply

S_0 to S_1: Increase in supply
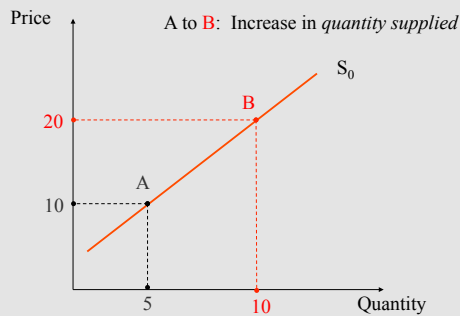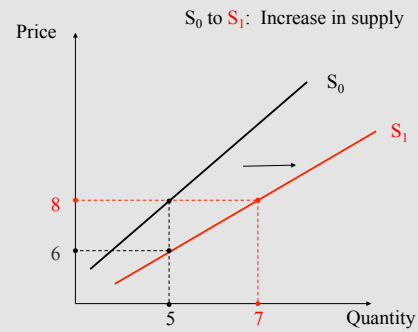
Producer Surplus

- The amount producers receive in excess of the amount necessary to induce them to produce the good.
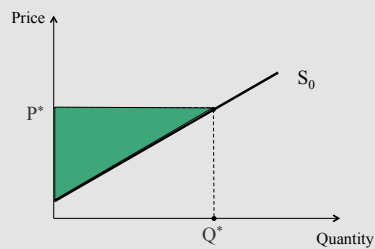
Market Equilibrium

- Balancing supply and demand
  - $Q_x^S = Q_x^d$
- Steady-state

If price is too low…

If price is too high…
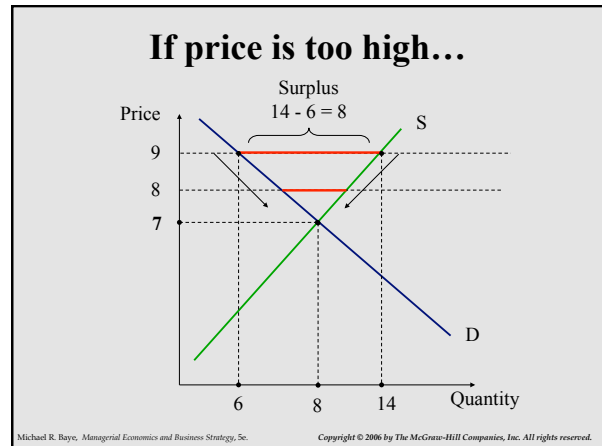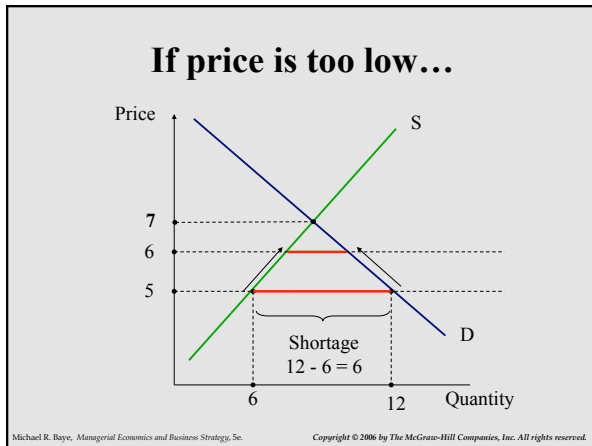
Price Restrictions

- Price Ceilings
  - The *maximum* legal price that can be charged.
  - Examples:
    - Gasoline prices in the 1970s.
    - Housing in New York City.
    - Restrictions on ATM fees.
- Price Floors
  - The *minimum* legal price that can be charged.
  - Examples:
    - Minimum wage.
    - Agricultural price supports.

Impact of a Price Ceiling
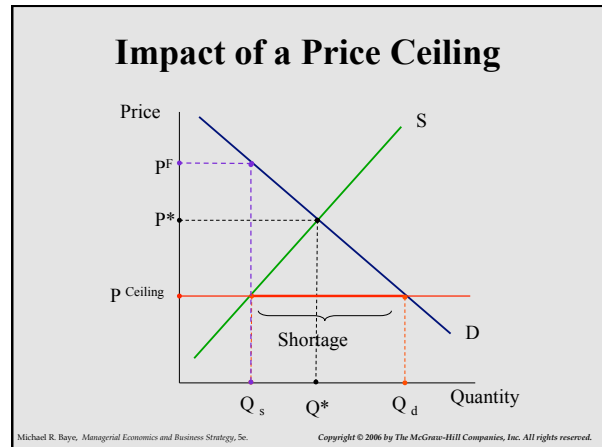
Full Economic Price

- The dollar amount paid to a firm under a price ceiling, plus the nonpecuniary price.

$$P^F = P^c + (P^F - P^C)$$

- P^F = full economic price
- P^C = price ceiling
- $P^F - P^C$ = nonpecuniary price

An Example from the 1970s

- Ceiling price of gasoline: $1.
- 3 hours in line to buy 15 gallons of gasoline
  - Opportunity cost: $5/hr.
  - Total value of time spent in line: $3 \times \$5 = \$15$.
  - Non-pecuniary price per gallon: $15/15=$1.
- Full economic price of a gallon of gasoline: $1+ $1=2.

Impact of a Price Floor
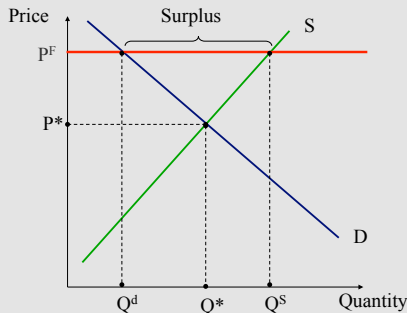
Comparative Static Analysis

- How do the equilibrium price and quantity change when a determinant of supply and/or demand change?

Applications of Demand and Supply Analysis

- Event: The *WSJ* reports that the prices of PC components are expected to fall by 5-8 percent over the next six months.
- Scenario 1: You manage a small firm that manufactures PCs.
- Scenario 2: You manage a small software company.

Use Comparative Static Analysis to see the Big Picture!

- *Comparative static analysis* shows how the equilibrium price and quantity will change when a determinant of supply or demand changes.
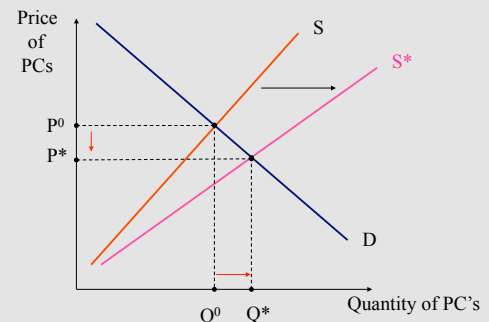
Scenario 1: Implications for a Small PC Maker

- Step 1: Look for the "Big Picture."
- Step 2: Organize an action plan (worry about details).

Big Picture: Impact of decline in component prices on PC market

Big Picture Analysis: PC Market

- Equilibrium price of PCs will fall, and equilibrium quantity of computers sold will increase.
- Use this to organize an action plan
  - contracts/suppliers?
  - inventories?
  - human resources?
  - marketing?
 - do I need quantitative estimates?

Scenario 2: Software Maker

- More complicated chain of reasoning to arrive at the "Big Picture."
- Step 1: Use analysis like that in Scenario 1 to deduce that lower component prices will lead to
  - a lower equilibrium price for computers.
  - a greater number of computers sold.
- Step 2: How will these changes affect the "Big Picture" in the software market?

Big Picture: Impact of lower PC prices on the software market
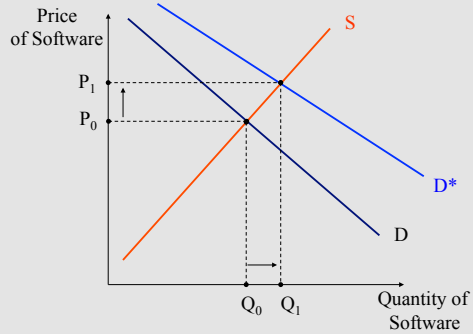
Big Picture Analysis: Software Market

- Software prices are likely to rise, and more software will be sold.
- Use this to organize an action plan.

Conclusion

- Use supply and demand analysis to
  - clarify the "big picture" (the general impact of a current event on equilibrium prices and quantities).
  - organize an action plan (needed changes in production, inventories, raw materials, human resources, marketing plans, etc.).

Ch. 3 Overview

I. The Elasticity Concept
  - Own Price Elasticity
  - Elasticity and Total Revenue
  - Cross-Price Elasticity
  - Income Elasticity

II. Demand Functions
  - Linear
  - Log-Linear

III. Regression Analysis

The Elasticity Concept

- How responsive is variable "G" to a change in variable "S"

$$E_{G,S} = \frac{d \ln G}{d \ln S} = \frac{dG}{dS}\frac{S}{G} = \cdot\frac{\%\Delta G}{\%\Delta S}$$

If $E_{G,S} > 0$, then S and G are directly related.
If $E_{G,S} < 0$, then S and G are inversely related.
If $E_{G,S} = 0$, then S and G are unrelated.

Own Price Elasticity of Demand

$$E_{Q_X,P_X} = \frac{\%\Delta Q_X^d}{\%\Delta P_X}$$

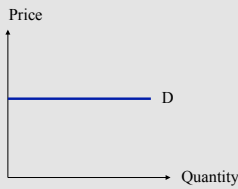- Negative according to the "law of demand."

Elastic: $\left|E_{Q_X,P_X}\right| > 1$

Inelastic: $\left|E_{Q_X,P_X}\right| < 1$

Unitary: $\left|E_{Q_X,P_X}\right| = 1$

Perfectly Elastic & Inelastic Demand

Perfectly Elastic $(E_{Q_X,P_X} = -\infty)$
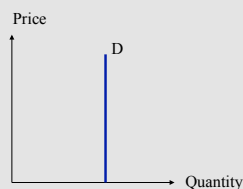
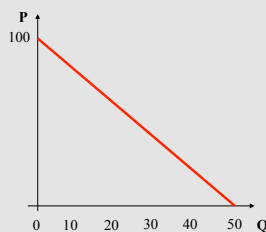Perfectly Inelastic $(E_{Q_X,P_X} = 0)$

Own-Price Elasticity and Total Revenue

- Elastic
  - Increase (a decrease) in price leads to a decrease (an increase) in total revenue.
- Inelastic
  - Increase (a decrease) in price leads to an increase (a decrease) in total revenue.
- Unitary
  - Total revenue is maximized at the point where demand is unitary elastic.
  - Valve says demand for their videogames is unit elastic over a wide range of prices.

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

8

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

Elasticity, Total Revenue and Linear Demand

9

Factors Affecting Own Price Elasticity

- Available Substitutes
  - The more substitutes available for the good, the more elastic the demand.
- Time
  - Demand tends to be more inelastic in the short term than in the long term.
  - Time allows consumers to seek out available substitutes.
- Expenditure Share
  - Goods that comprise a small share of consumer's budgets tend to be more inelastic than goods for which consumers spend a large portion of their incomes.

Cross Price Elasticity of Demand

$$E_{Q_X, P_Y} = \frac{\%\Delta Q_X^d}{\%\Delta P_Y}$$

If $E_{Q_X P_Y} > 0$, then X and Y are substitutes.

If $E_{Q_X P_Y} < 0$, then X and Y are complements.

Predicting Revenue Changes from Two Products

Suppose that a firm sells to related goods. If the price of X changes, then total revenue will change by:

$$\Delta R = \left(R_X \left(1 + E_{Q_X, P_X} \right) + R_Y E_{Q_Y, P_X} \right) \times \%\Delta P_X$$

Income Elasticity

$$E_{Q_X, M} = \frac{\%\Delta Q_X^d}{\%\Delta M}$$

If $E_{Q_X M} > 0$, then X is a normal good.

If $E_{Q_X M} < 0$, then X is a inferior good.

Uses of Elasticities

- Pricing.
- Managing cash flows.
- Impact of changes in competitors' prices.
- Impact of economic booms and recessions.
- Impact of advertising campaigns.
- And lots more!

Example 1: Pricing and Cash Flows

- According to an FTC Report by Michael Ward, AT&T's own price elasticity of demand for long distance services is -8.64.
- AT&T needs to boost revenues in order to meet it's marketing goals.
- To accomplish this goal, should AT&T raise or lower it's price?

Answer: Lower price!

- Since demand is elastic, a reduction in price will increase quantity demanded by a greater percentage than the price decline, resulting in more revenues for AT&T.

Example 2: Quantifying the Change

- If AT&T lowered price by 3 percent, what would happen to the volume of long distance telephone calls routed through AT&T?

Answer

- Calls would increase by 25.92 percent!

$$E_{Q_X,P_X} = -8.64 = \frac{\%\Delta Q_X^{\,d}}{\%\Delta P_X}$$

$$-8.64 = \frac{\%\Delta Q_X^{\,d}}{-3\%}$$

$$-3\% \times (-8.64) = \%\Delta Q_X^{\,d}$$

$$\%\Delta Q_X^{\,d} = 25.92\%$$

Example 3: Impact of a change in a competitor's price

- According to an FTC Report by Michael Ward, AT&T's cross price elasticity of demand for long distance services is 9.06.
- If competitors reduced their prices by 4 percent, what would happen to the demand for AT&T services?

Answer

- AT&T's demand would fall by 36.24 percent!

$$E_{Q_X,P_Y} = 9.06 = \frac{\%\Delta Q_X^{\,d}}{\%\Delta P_Y}$$

$$9.06 = \frac{\%\Delta Q_X^{\,d}}{-4\%}$$

$$-4\% \times 9.06 = \%\Delta Q_X^{\,d}$$

$$\%\Delta Q_X^{\,d} = -36.24\%$$

Interpreting Demand Functions

- Mathematical representations of demand curves.
- Example:

$$Q_X^{\,d} = 10 - 2P_X + 3P_Y - 2M$$

- X and Y are substitutes (coefficient of P_Y is positive).
- X is an inferior good (coefficient of M is negative).

Linear Demand Functions

- General Linear Demand Function:

$$Q_X{}^d = \alpha_0 + \alpha_X P_X + \alpha_Y P_Y + \alpha_M M + \alpha_H H$$

$$E_{Q_X, P_X} = \alpha_X \frac{P_X}{Q_X} \qquad E_{Q_X, P_Y} = \alpha_Y \frac{P_Y}{Q_X} \qquad E_{Q_X, M} = \alpha_M \frac{M}{Q_X}$$

Own Price   Cross Price   Income
Elasticity   Elasticity   Elasticity

Example of Linear Demand

- Q^d = 10 - 2P.
- Own-Price Elasticity: (-2)P/Q.
- If P=1, Q=8 (since 10 - 2 = 8).
- Own price elasticity at P=1, Q=8:
  - (-2)(1)/8= - 0.25.

Log-Linear Demand

- General Log-Linear Demand Function:

$$\ln Q_X{}^d = \beta_0 + \beta_X \ln P_X + \beta_Y \ln P_Y + \beta_M \ln M + \beta_H \ln H$$

Own Price Elasticity : $\qquad \beta_X$

Cross Price Elasticity : $\qquad \beta_Y$

Income Elasticity : $\qquad \beta_M$

Example of Log-Linear Demand

- $\ln(Q^d)$ = 10 - 2 ln(P).
- Own Price Elasticity: -2.

Graphical Representation of Linear and Log-Linear Demand
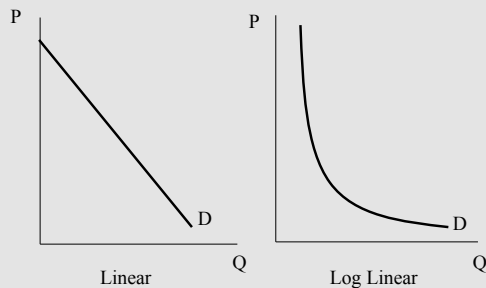
Linear   Log Linear

Regression Analysis

- One use is for estimating demand functions.
- Important terminology and concepts:
  - Least Squares Regression: Y = a + bX + e.
  - Confidence Intervals.
  - *t*-statistic.
  - *R*-square or Coefficient of Determination.
  - *F*-statistic.

An Example

- Use a spreadsheet to estimate the following log-linear demand function.

$$\ln Q_x = \beta_0 + \beta_x \ln P_x + e$$

Summary Output

Regression Statistics				
Multiple R	0.41			
R Square	0.17			
Adjusted R Square	0.15			
Standard Error	0.68			
Observations	41.00			

ANOVA					
	df	SS	MS	F	Significance F
Regression	1.00	3.65	3.65	7.85	0.01
Residual	39.00	18.13	0.46		
Total	40.00	21.78			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	7.58	1.43	5.29	0.000005	4.68	10.48
ln(P)	-0.84	0.30	-2.80	0.007868	-1.44	-0.23

Interpreting the Regression Output

- The estimated log-linear demand function is:
  - $\ln(Q_x) = 7.58 - 0.84 \ln(P_x)$.
  - Own price elasticity: -0.84 (inelastic).
- How good is our estimate?
  - *t*-statistics of 5.29 and -2.80 indicate that the estimated coefficients are statistically different from zero.
  - *R*-square of .17 indicates we explained only 17 percent of the variation in $\ln(Q_x)$.
  - *F*-statistic significant at the 1 percent level.

Conclusion

- Elasticities are tools you can use to *quantify* the impact of changes in prices, income, and advertising on sales and revenues.
- Given market or survey data, regression analysis can be used to estimate:
  - Demand functions.
  - Elasticities.
  - A host of other things, including cost functions.
- Managers can quantify the impact of changes in prices, income, advertising, etc.