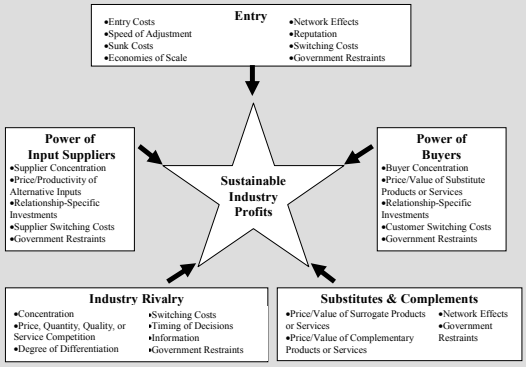
Review of Intermediate Econ Material

Drawn from Baye Chapters 1-3

Updated by DF 1/07

The Five Forces Framework



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.

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).

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

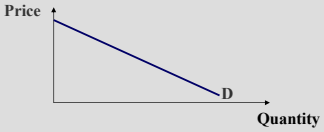
III. Market Equilibrium

IV. Price Restrictions

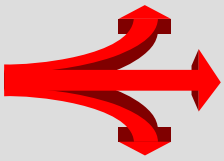
V. Comparative Statics

Market Demand Curve

- Shows the amount of a good that will be purchased at alternative prices, holding other factors constant.
- *Law of Demand*
  - The demand curve is downward sloping.



Determinants of Demand



- 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

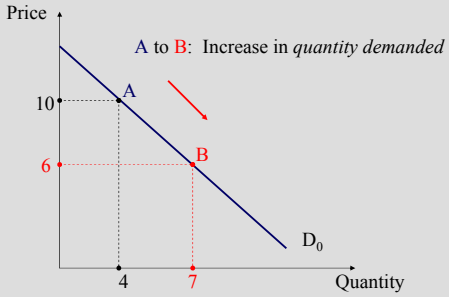
$$Q_x^d = f(P_x, P_Y, M, H)$$

  - 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.

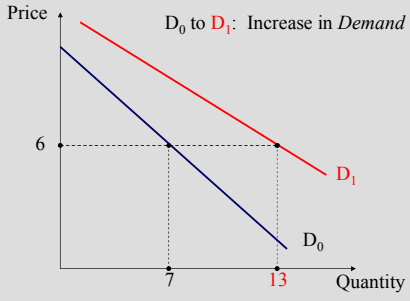
Inverse Demand Function

- 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



Change in Demand



Consumer Surplus:

- The value consumers get from a good but do not have to pay for.

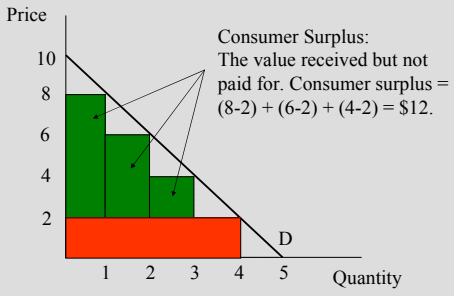
I got a great deal!

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

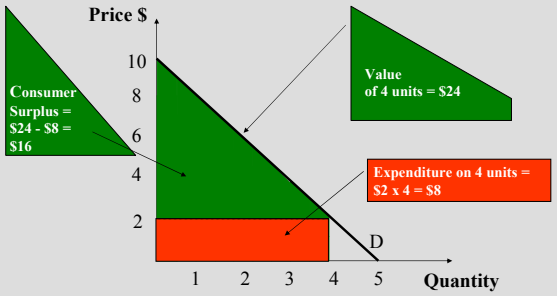
I got a lousy deal!

- 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

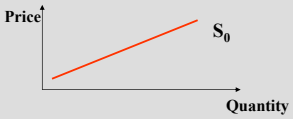


Consumer Surplus: The Continuous Case

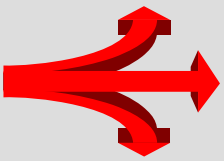


Market Supply Curve

- The supply curve shows the amount of a good that will be produced at alternative prices.
- *Law of Supply*
  - The supply curve is upward sloping.



Supply Shifters



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

The Supply Function

- An equation representing the supply curve:

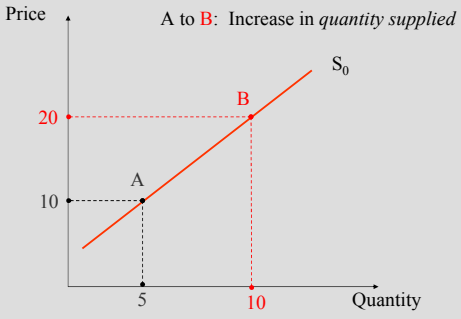
$$Q_x^S = f(P_x, P_R, W, H)$$

  - 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.

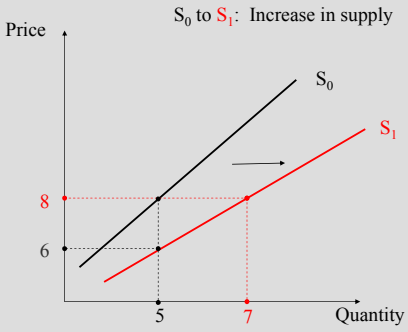
Inverse Supply Function

- 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

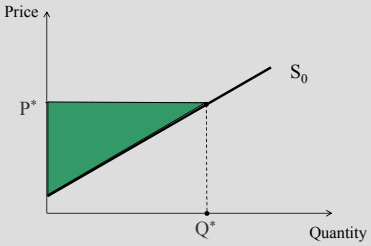


Change in Supply



Producer Surplus

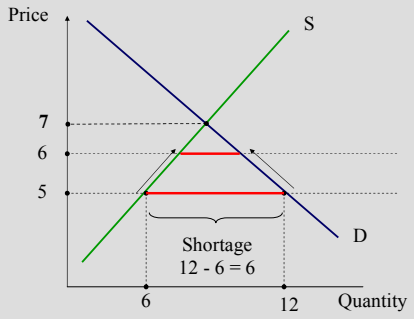
- The amount producers receive in excess of the amount necessary to induce them to produce the good.



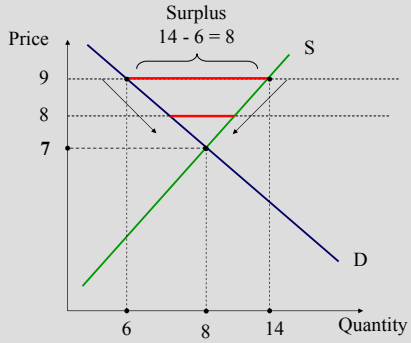
Market Equilibrium

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

If price is too low…



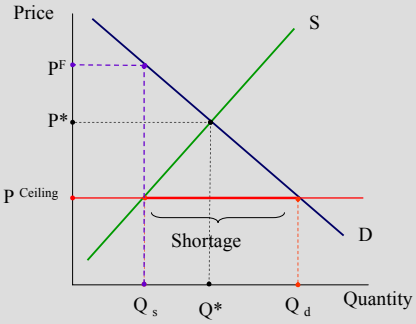
If price is too high…



Price Restrictions

- Price Ceilings
  - The *maximum* legal price that can be charged.
  - Examples:
    - Gasoline prices in the 1970s.
    - Housing in New York City.
    - Proposed 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.

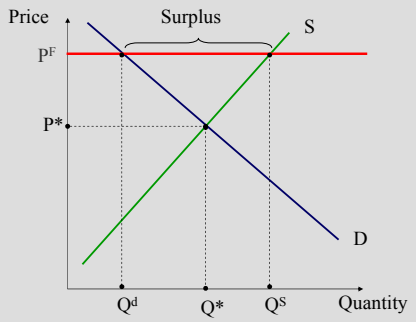
$$P^F = P^c + (P^F - P^C)$$

- 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.

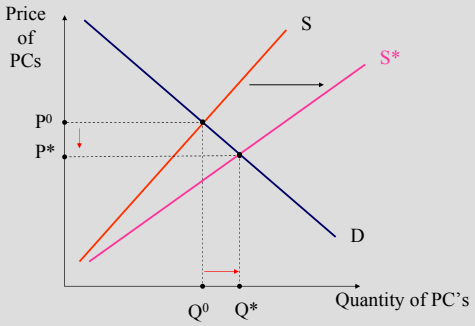
Use Comparative Static Analysis to see the Big Picture!

- *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



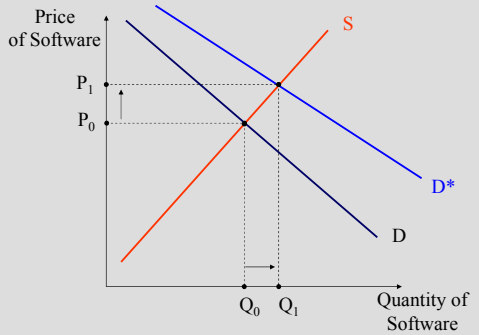
Big Picture Analysis: PC Market

- 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"

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

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.

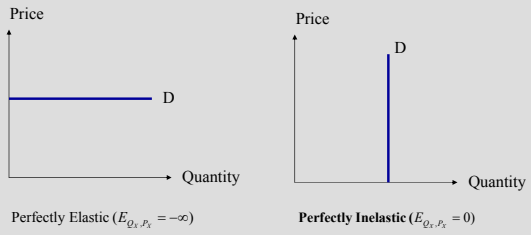
Own Price Elasticity of Demand

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

- Negative according to the "law of demand."

Elastic: $|E_{Q_X,P_X}| > 1$
Inelastic: $|E_{Q_X,P_X}| < 1$
Unitary: $|E_{Q_X,P_X}| = 1$

Perfectly Elastic & Inelastic Demand



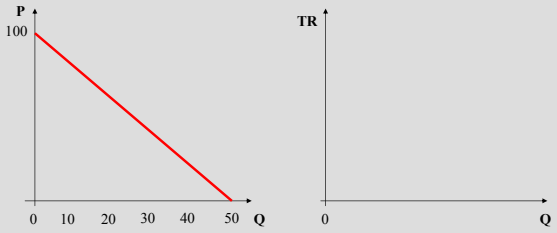
Perfectly Elastic ($E_{Q_X,P_X} = -\infty$)

Perfectly Inelastic ($E_{Q_X,P_X} = 0$)

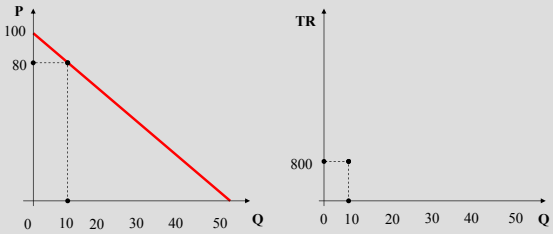
Own-Price Elasticity and Total Revenue

- 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.

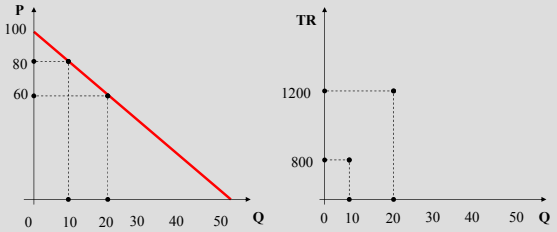
Elasticity, Total Revenue and Linear Demand



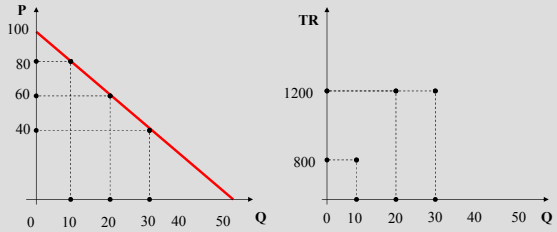
Elasticity, Total Revenue and Linear Demand



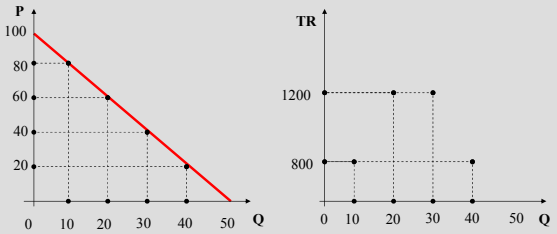
Elasticity, Total Revenue and Linear Demand



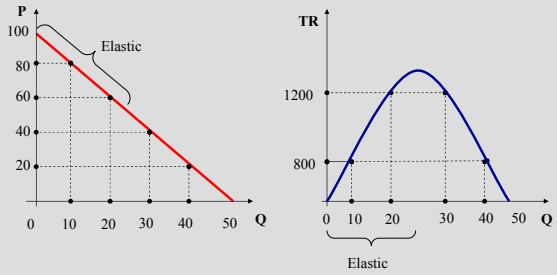
Elasticity, Total Revenue and Linear Demand



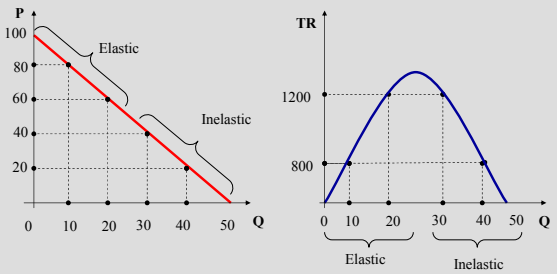
Elasticity, Total Revenue and Linear Demand



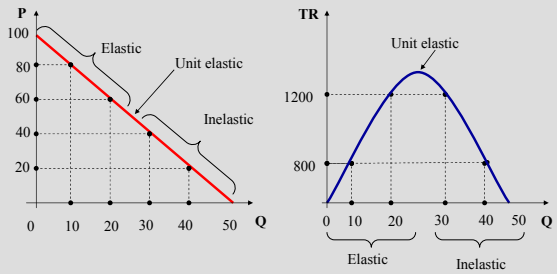
Elasticity, Total Revenue and Linear Demand



Elasticity, Total Revenue and Linear Demand



Elasticity, Total Revenue and Linear Demand



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:

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

$E_{Q_X,P_X} = \alpha_X \frac{P_X}{Q_X}$ Own Price Elasticity

$E_{Q_X,P_Y} = \alpha_Y \frac{P_Y}{Q_X}$ Cross Price Elasticity

$E_{Q_X,M} = \alpha_M \frac{M}{Q_X}$ Income 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:

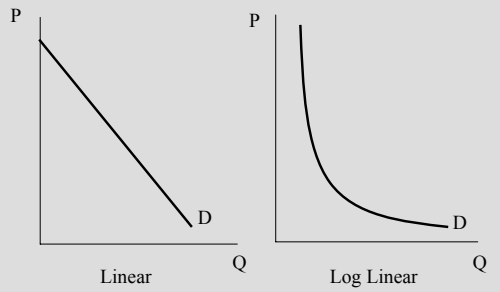
$$\ln Q_X^{\,d} = \beta_0 + \beta_X \ln P_X + \beta_Y \ln P_Y + \beta_M \ln M + \beta_H \ln H$$

Own Price Elasticity: β_X
Cross Price Elasticity: β_Y
Income Elasticity: β_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



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.