Economics for Managers

Session 3-5| 14-July-2019

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Today

- Recap of last session
- Demand & supply in the real world: back to Oil market
- Impact of price ceilings & floors on consumer welfare
- Demand (& supply) elasticity
- Consumer Theory:
  - Deriving the demand curve (from session 1) through optimization behaviour by individual consumer
  - Indifference Curves & Budget Constraints
  - Price change decomposed into substitution effect and income effect

Recap of last session

1. 3 fundamental questions of Microeconomics: all solved with prices
   a. What goods & services should be produced?
   b. How to produce these goods & services?
   c. Who gets these goods & services?
2. Key assumptions (including rationality of decision makers)
3. Law of demand- relationship b/w price & qty demanded; other factors
4. Law of supply- relationship b/w price & qty supplied; other factors
5. Equilibrium (vs excess demand & supply)
6. Consumer Surplus & Producer Surplus (Trade is beneficial)

$$Qd_X = f(P_X, I, P_Y, T)$$

$\Delta Qd_X/\Delta P_X < 0$ (consider Px & Qd_X only- all else constant)

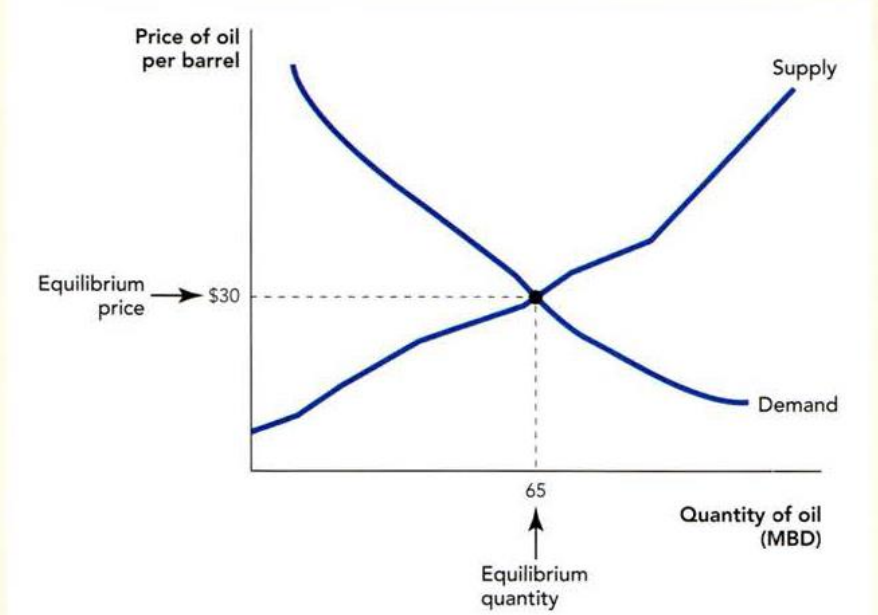
$\Delta Qd_X/\Delta I > 0$ if a good is normal (eg. cars)

$\Delta Qd_X/\Delta I < 0$ if a good is inferior (eg. entry-level bikes)

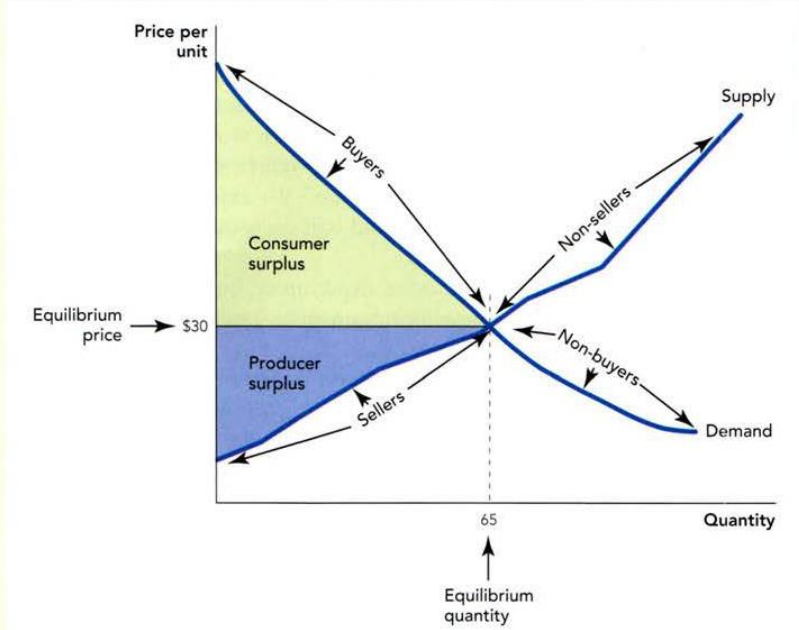
$\Delta Qd_X/\Delta P_Y > 0$ if X and Y are substitutes (eg. Pepsi and Coke)

$\Delta Qd_X/\Delta P_Y < 0$ if X and Y are complements (eg. printers & cartridges)

Equilibrium (Demand = Supply) & Gains from Trade

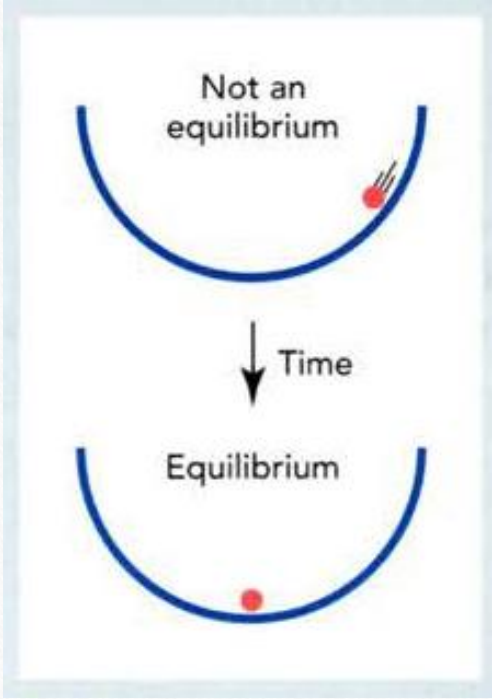


Price Is Determined by Supply and Demand Equilibrium occurs when the quantity demanded equals the quantity supplied. The quantity demanded equals the quantity supplied only when the price is $30 and the quantity exchanged is 65; hence, $30 is the equilibrium price and 65 the equilibrium quantity.



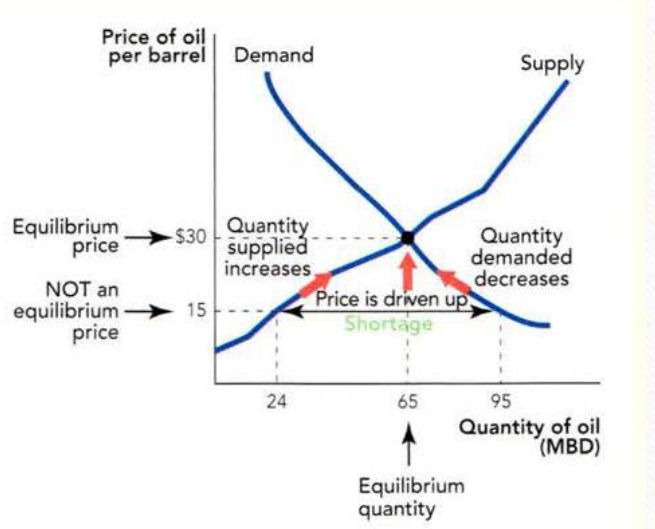
A Free Market Maximizes Producer Plus Consumer Surplus (the Gains from Trade) A free market maximizes the gains from trade because (1) buyers are willing to pay more for the good than non-buyers, (2) sellers are willing to sell the good at a lower price than non-sellers, and (3) there are no mutually profitable deals between non-sellers and non-buyers.

Thinking about equilibrium



Excess Demand & Excess Supply

A Surplus Drives Prices Down At a price of $50 there is a surplus of oil. When there is a surplus, sellers have an incentive to decrease their price and buyers have an incentive to offer lower prices. The price decreases until at $30 the quantity demanded equals the quantity supplied and there is no longer an incentive for price to fall.

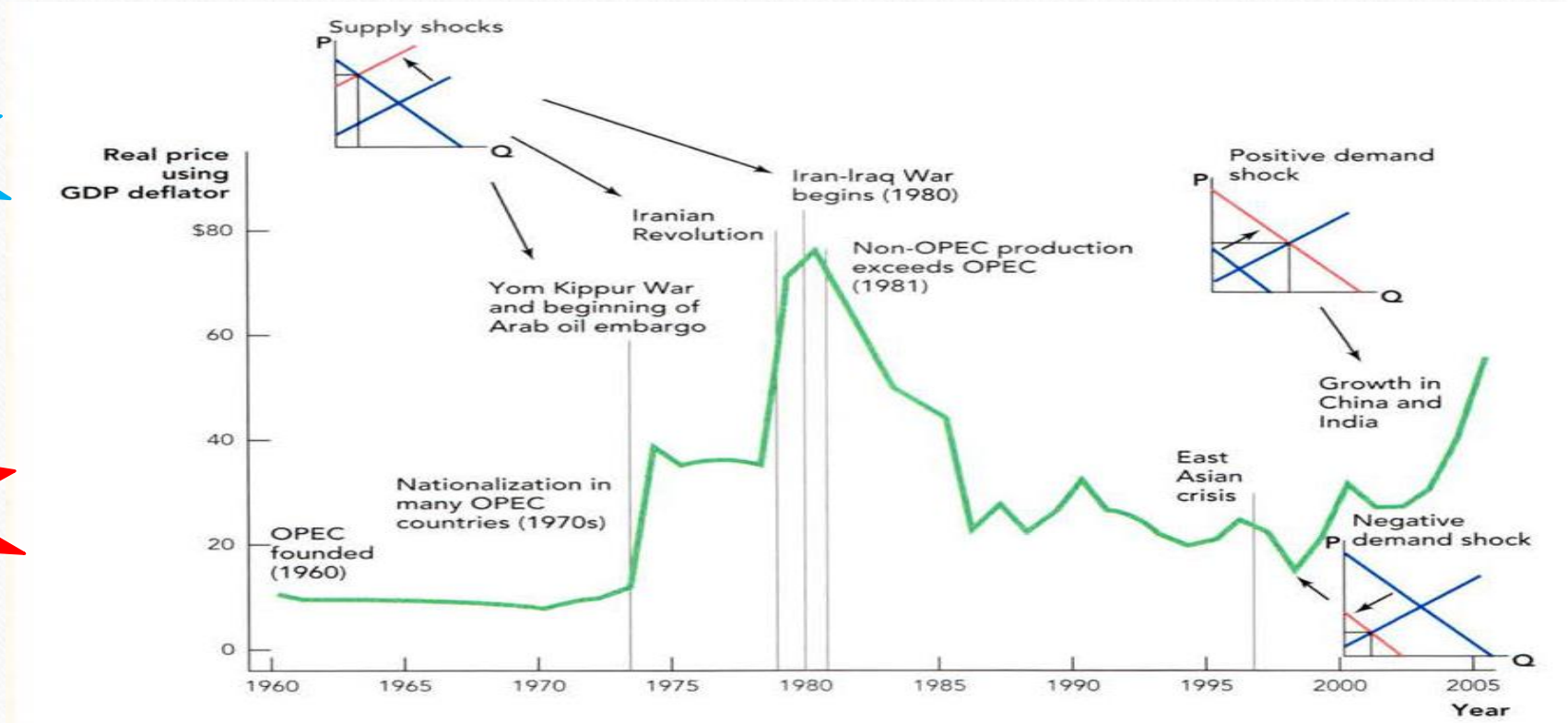


A Shortage Drives Prices Up At a price of $15 there is a shortage of oil. When there is a shortage, sellers have an incentive to increase the price and buyers have an incentive to offer higher prices. The price increases until at $30 the quantity supplied equals the quantity demanded and there is no longer an incentive for the price to rise.

Economics in the real world: back to Oil market

In blue are original demand & supply curves

In red are '<u>shifted</u>' demand & supply curves

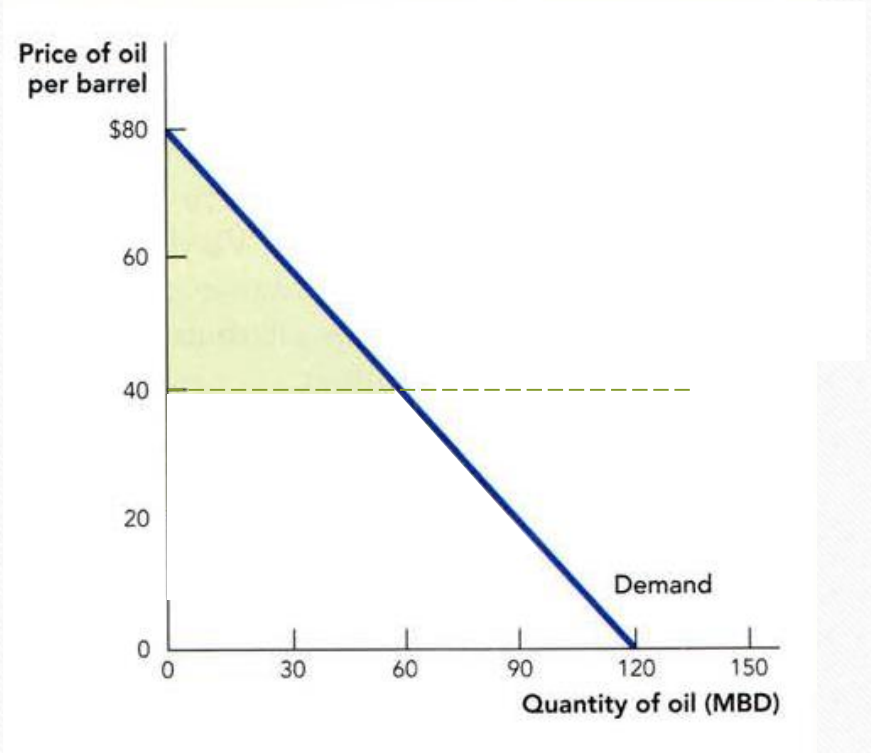


The Price of Oil, 1960–2005

Source: *BP Statistical Review of World Energy*, June 2006
Note: Corrected for inflation using the GDP deflator (2005 dollars).

A bit of algebra

- Calculate consumer surplus when market price is 40



The Algebra of Demand, Supply, and Equilibrium

- Equation for Demand Curve: $Q_D = 10\text{-}4P$
- Equation for Supply Curve $Q_S = -2+8P$

Q1- Find the equilibrium price and quantity

a. Graphical method

b. Algebraic method

Q2- Is there excess demand or excess supply at p = 2 and at p = 0.5?

Price	Q_D	Q_S
0	10	-2
0.25	9	0
0.5	8	2
0.75	7	4
1	6	6
1.25	5	8
1.5	4	10
1.75	3	12
2	2	14
2.25	1	16
2.5	0	18

Interfering with the Market: Price Ceiling

- Rent-control is an example of **interfering with the market**, or changing the price of a good from its equilibrium value.
- Rent control is a **price ceiling**, which allows the rent to only go up to a certain value.
- The price ceiling creates a shortage of apartments at that price, not allowing people who would be willing to pay more to find an apartment.

Example of Price Ceiling: Rent Control

- Rent control also gives landlords incentives to forgo improvements and maintenance in order to cut costs.
- Because the return on new construction is now lower, new housing is not constructed as much.
- Unfair means of allocation replace price allocation.

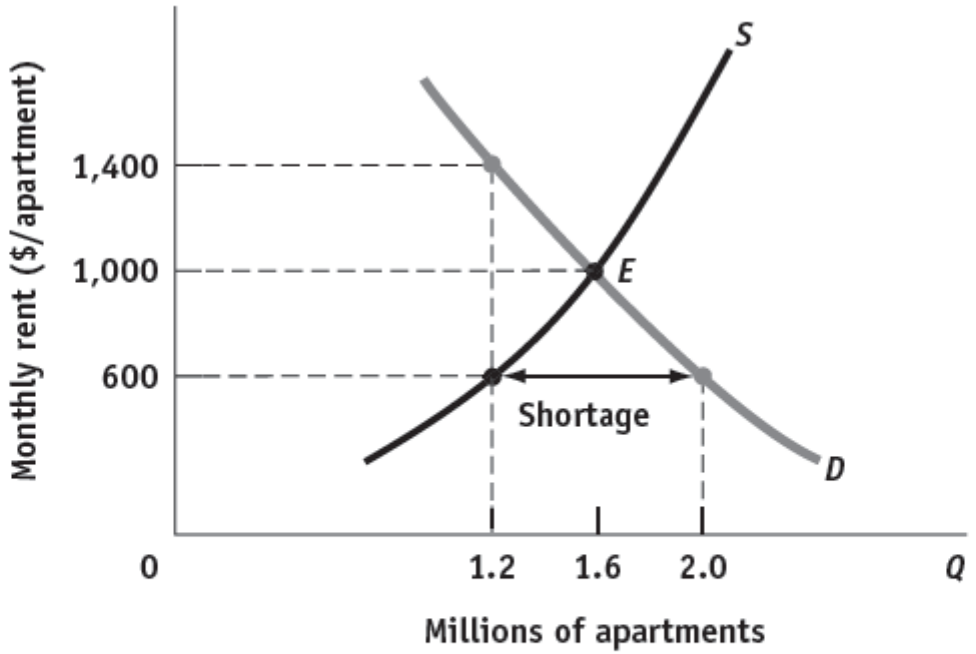


FIGURE 2-17 Rent Control At the controlled rent of $600 per month, 2.0 million apartments could be rented. Only 1.2 million apartments are available at that rent, so there is a shortage of 800,000 million apartments. Apartment seekers would be willing to pay a rent of $1,400 per month when only 1.2 million apartments are available.

Interfering with the Market: Price Floor

- Minimum Support Price- a **price floor** for certain agri products: the price could only go so low.
- The price floor creates a surplus as farmers produce more than necessary and consumers buy less than they would at the equilibrium price.
- The government buys up the surplus to feed low-income families or to throw away.

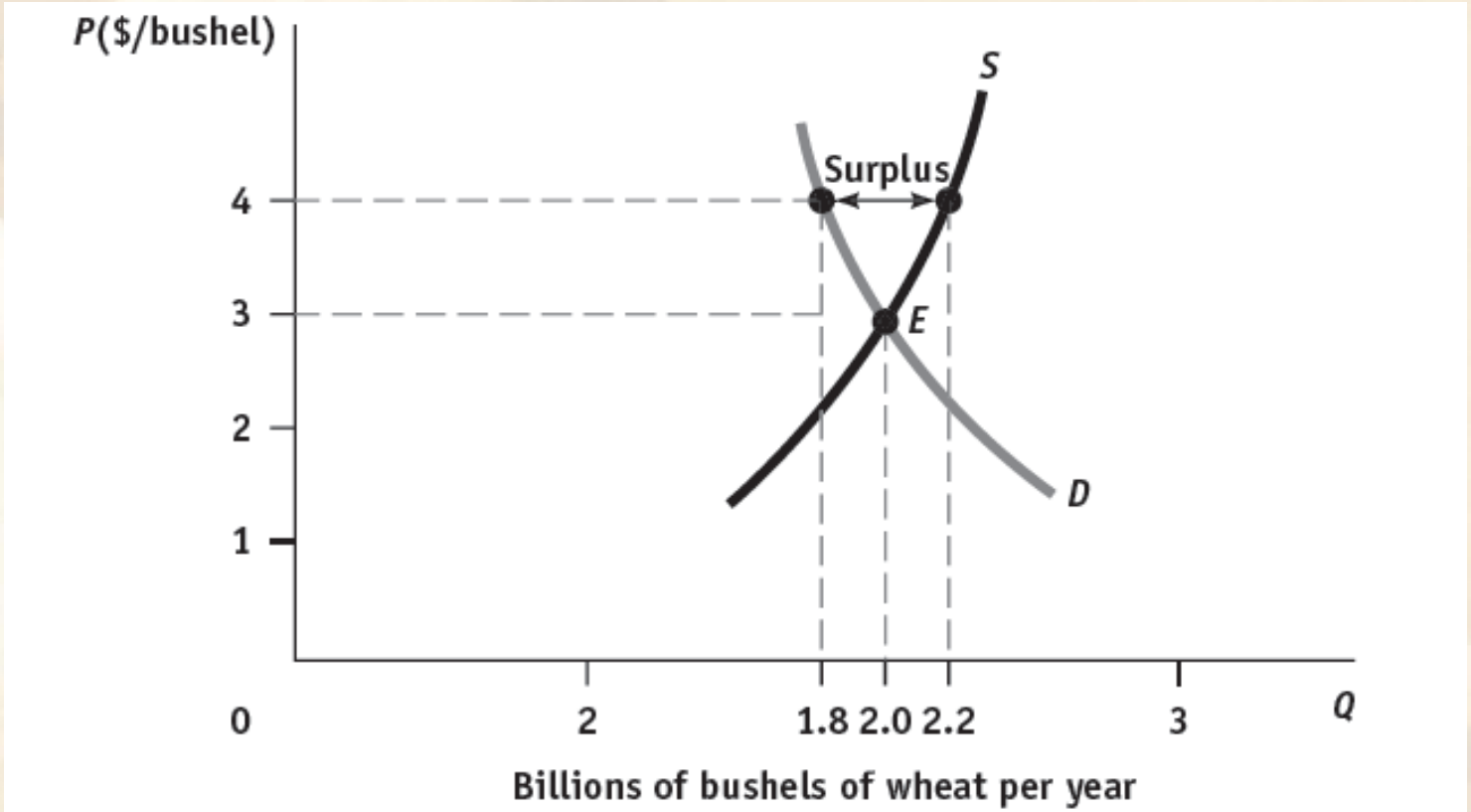
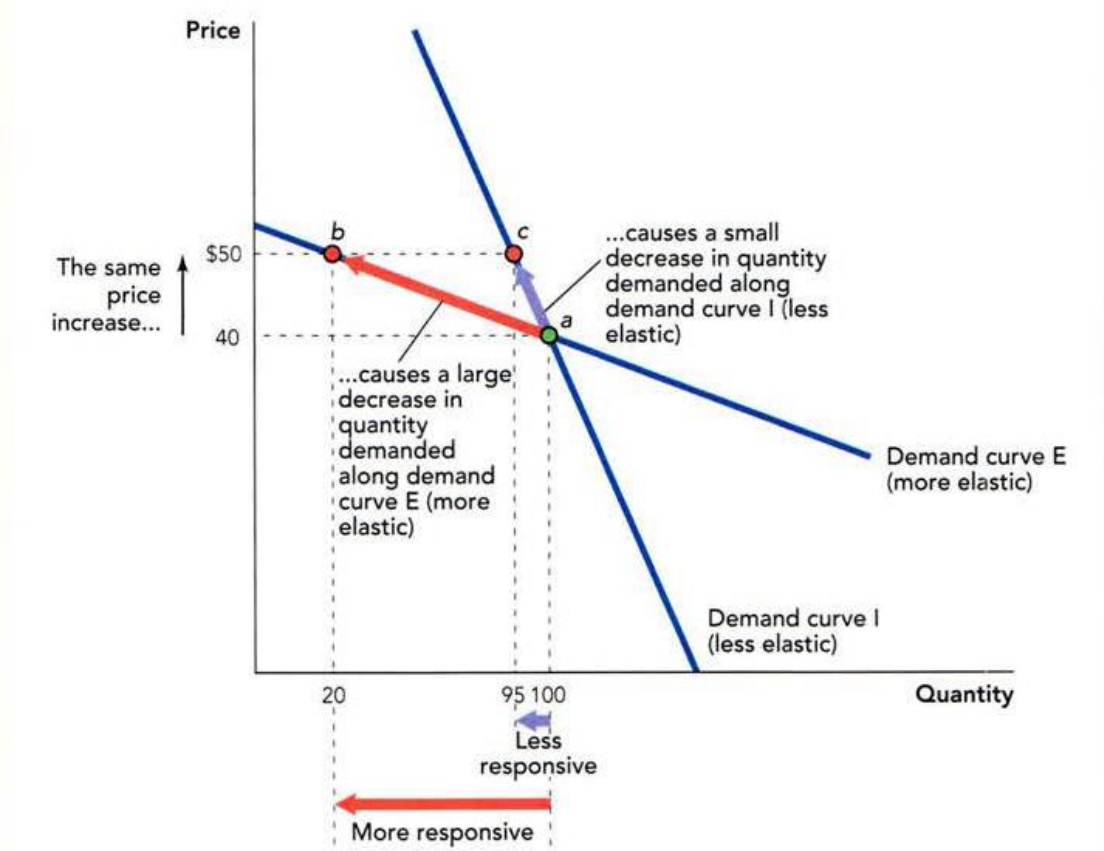


FIGURE 2-18 Agricultural Support Programs At the price floor of $4 per bushel, farmers supply 2.2 billion bushels, consumers purchase 1.8 billion bushels, and the government purchases the surplus of 0.4 billion bushels at a total cost of $1.6 billion.

Quantitative assessment of demand- Elasticity

- We know the qualitative relationship: negative relationship b/w price and quantity demanded
- But how much will quantity demanded go up if price falls by 10%?
- Price elasticity of demand measures this quantitative relationship
  - Measures % change in quantity demanded for a % change in price
  - Always with reference to a range/ portion of the demand curve
- Various measures of elasticity (remember price is a function of own price, prices of other goods, income etc)



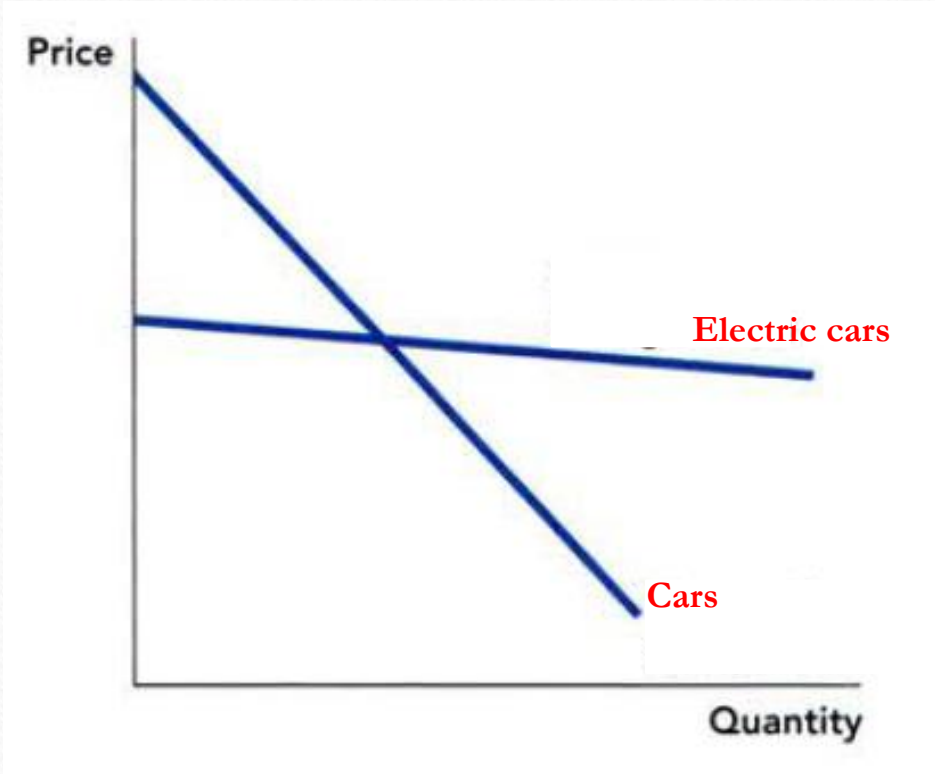
The More Responsive Quantity Demanded Is to a Change in Price, the More Elastic Is the Demand Curve Beginning at point *a*, an increase in price from $40 to $50 causes a big decrease in quantity demanded along demand curve E, from 100 units to 20 units at point *b*. But the same increase in price causes only a small decrease in quantity demanded along demand curve I from 100 to 95 units at point *c*. Since the quantity demanded is more responsive to a change in price along demand curve E, demand curve E is more elastic than demand curve I.

Determinants of Elasticity of Demand

Less Elastic	More Elastic
Fewer substitutes	More substitutes
Short run (less time)	Long run (more time)
Categories of product	Specific brands
Necessities	Luxuries
Small part of budget	Large part of budget

Elasticity usually has a time reference as well. A certain price change can have short-run & long-run effects on demand. So, important for managers to know short-run or long-run elasticity.

Which is the demand curve for cars and for electric cars?



Calculating the Elasticity of Demand

$$\text{Elasticity of demand} = E_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

$$= \frac{\%\Delta Q_{Demanded}}{\%\Delta Price}$$

$|E_d| > 1 =$ ***Elastic***

$|E_d| < 1 =$ ***Inelastic***

$|E_d| = 1 =$ ***Unit Elastic***

Calculating the Elasticity of Demand (cont.)

$$\text{Elasticity of demand} = E_d = \frac{\%\Delta Q_{Demanded}}{\%\Delta Price}$$

$$= \frac{\dfrac{\text{Change in quantity demanded}}{\text{Average quantity}}}{\dfrac{\text{Change in price}}{\text{Average price}}} = \frac{\dfrac{Q_{After} - Q_{Before}}{(Q_{After} + Q_{Before})/2}}{\dfrac{P_{After} - P_{Before}}{(P_{After} + P_{Before})/2}}$$

Numerical example

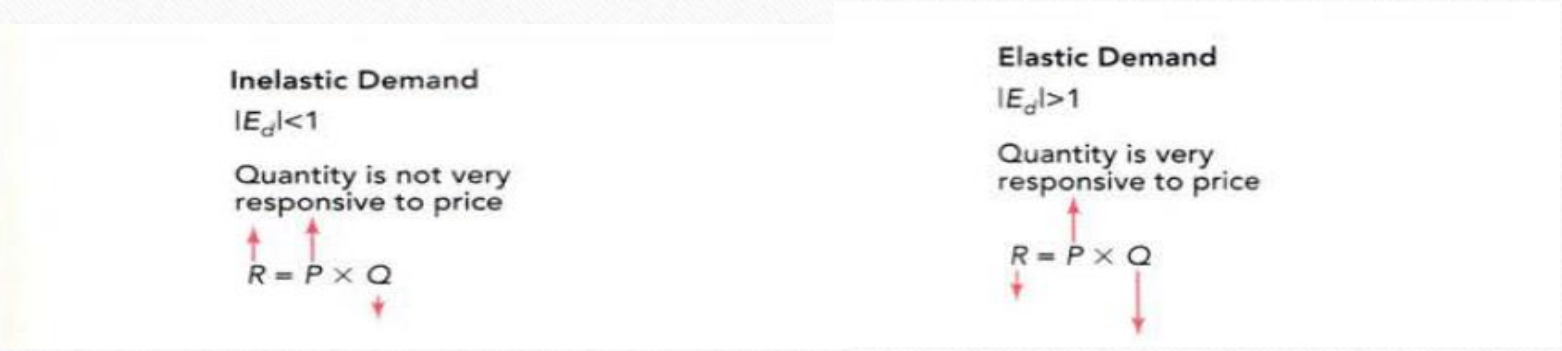
	Price	Quantity Demanded
Point *a*	$40	100
Point *b*	$50	20

$$E_d = -133.3\%/22.2\% = -6$$

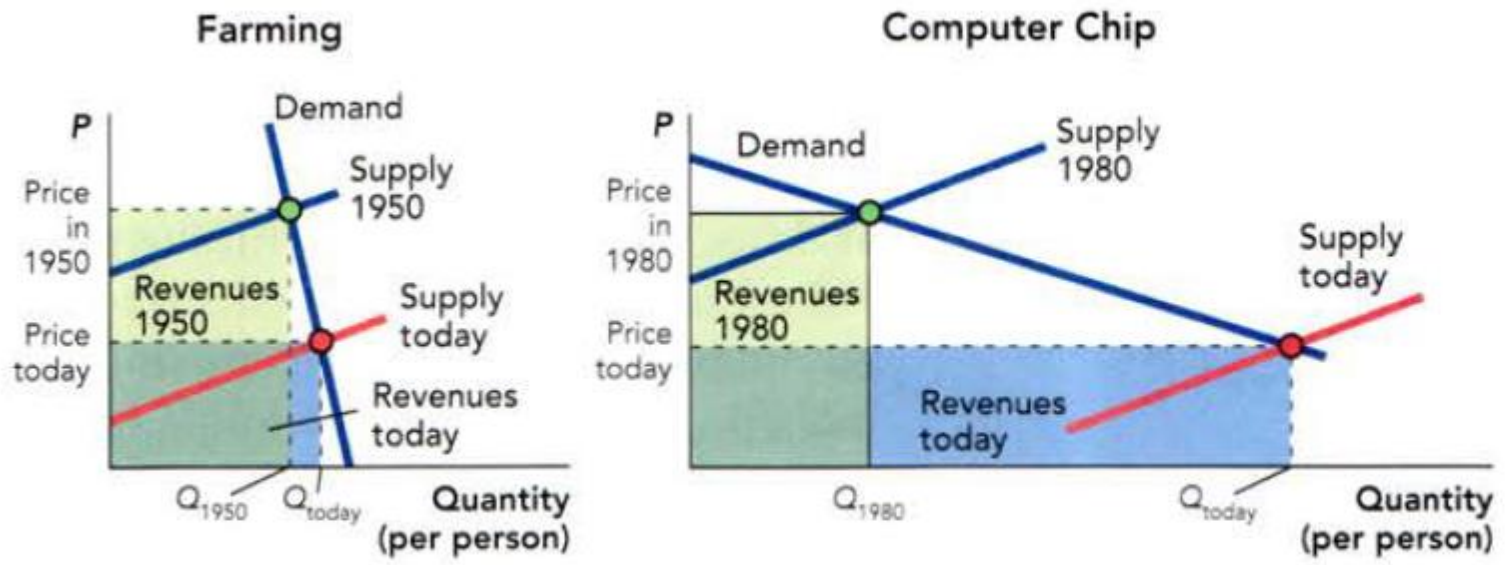
Elasticity of Demand & Total Revenues

$$\text{Revenue} = \text{Price} \times \text{Quantity}$$

$$R = P \times Q$$



Case study: demand for food vs computer chips

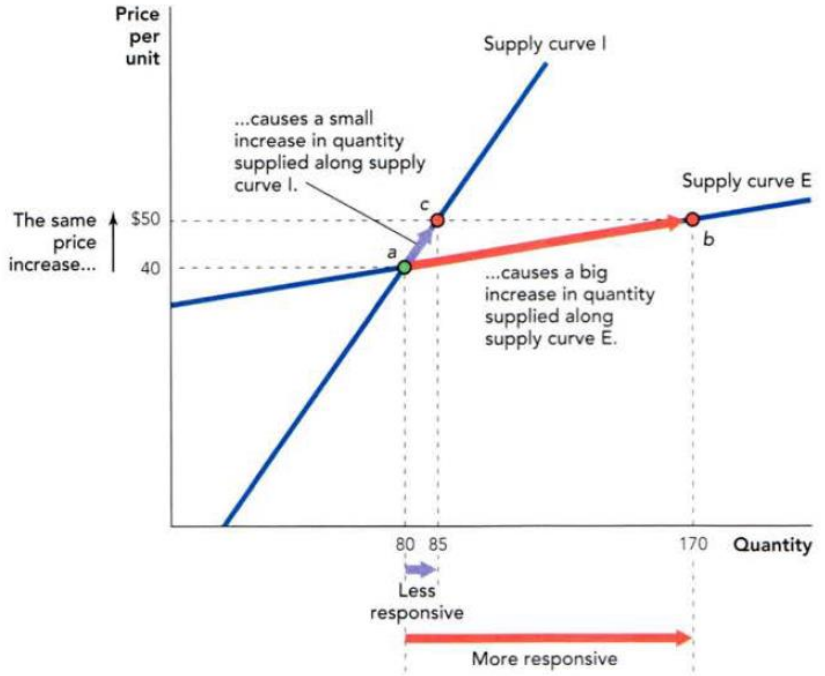


Farming/Computer Chips Productivity improvements have increased the supply of food and the supply of computer chips, thus reducing the prices of these goods. The demand for food, however, is inelastic, while the demand for computer chips is elastic. As a result, the decrease in the price of food has driven down farm revenues, while the decrease in the price of computer chips has driven up computer chip revenues.

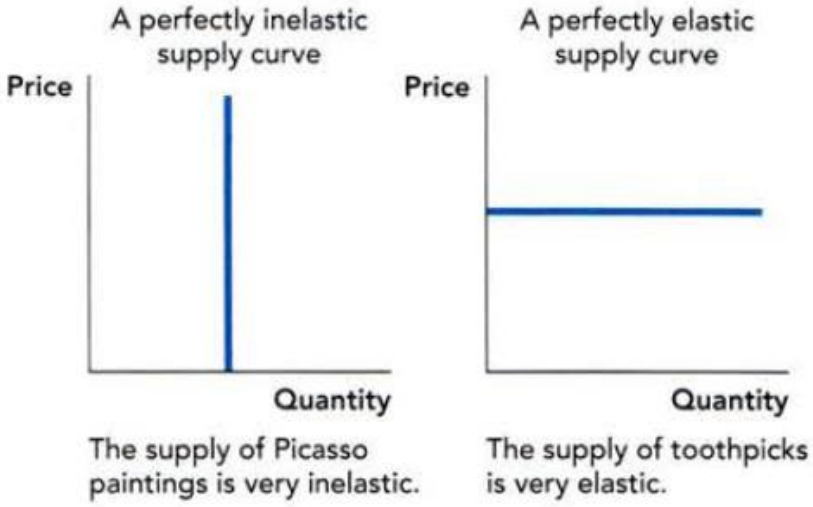
Elasticity of Demand & Total Revenues

Absolute Value of Elasticity	Name	How Revenue Changes with Price
$\lvert E_d \rvert < 1$	Inelastic	Revenue and price move together.
$\lvert E_d \rvert > 1$	Elastic	Revenue and price move in opposite directions.
$\lvert E_d \rvert = 1$	Unit Elastic	Revenue stays the same when price changes.

Elasticity of Supply (analogous to elasticity of demand)



The More Responsive Quantity Supplied Is to a Change in Price, the More Elastic the Supply Curve Beginning at point *a*, an increase in price from $40 to $50 causes a small increase in quantity supplied along supply curve I, from 80 to 85 units (at point *c*). But the same increase in price causes a big increase in quantity supplied along supply curve E, from 80 to 170 units (at point *b*). Since the quantity supplied is more responsive to a change in price, supply curve E is more elastic than supply curve I.



The Elasticity of Supply of Toothpicks and Picasso Paintings The supply of Picasso paintings is very inelastic because Picasso won't paint any more no matter how high the price rises. The supply of toothpicks is very elastic because it's easy for suppliers to make more in response to even a small increase in price.

Determinants of elasticity of supply & calculation

Less Elastic	More Elastic
Difficult to increase production at constant unit cost (e.g., some raw materials)	Easy to increase production at constant unit cost (e.g., some manufactured goods)
Large share of market for inputs	Small share of market for inputs
Global supply	Local supply
Short run	Long run

$$E_s = \frac{\%\Delta Q_{Supplied}}{\%\Delta Price}$$

TABLE 3-2 Estimated Short-run and Long-run Price Elasticities of Demand (E_p) for Selected Commodities

Commodity	Elasticity	
	Short Run	Long Run
Clothing (U.S.)[a]	0.90	2.90
Tobacco products (U.S.)[b]	0.46	1.89
Jewelry and watches (U.S.)[b]	0.41	0.67
Beer (U.S.)[c]	1.72	2.17
Cheese (UK)[d]	1.36	—
Wine (Canada)[e]	0.88	1.17
Household natural gas (U.S.)[f]	1.40	2.10
Electricity (household, U.S.)[b]	0.13	1.89
Public transport (England)[g]	0.51	0.69
Public transport (France)[g]	0.32	0.61
Gasoline (U.S.)[g]	0.25	0.92
Gasoline (Canada)[g]	0.15	0.60
Gasoline (Australia)[g]	0.12	0.58
Petrol[h]	–0.209	–0.319
Kerosene[i]	–0.171	–0.360
LPG[j]	–0.936	–1.030
Export Demand[k]	–1.160	–10.39
Public Bus[l]	–0.374	–0.523
Gold Import[m]	–5.460	–1.010

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Other types of demand elasticities

- **Cross price elasticity of demand:** measures how responsive the qty demanded of A is to the price of B

$$\text{Cross-price elasticity of demand} = \frac{\text{Percentage change in quantity demanded of good } A}{\text{Percentage change in price of good } B} = \frac{\%\Delta Q_{Demanded,\ A}}{\%\Delta P_{Price,\ B}}$$

> If the cross-price elasticity >0, then goods *A* and *B* are substitutes.
> If the cross-price elasticity <0, then goods *A* and *B* are complements.

- **Income elasticity of demand:** measures how responsive the qty demanded of A is to the changes to the changes in income

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}} = \frac{\%\Delta Q_{Demanded}}{\%\Delta_{Income}}$$

> If the income elasticity of demand > 0, then the good is a normal good.
> If the income elasticity of demand < 0, then the good is an inferior good.
> If the income elasticity of demand > 1, then the good is a luxury good.

TABLE 3-3 Estimated Income Elasticity of Demand (E_i) for Selected Commodities

Commodity	Income Elasticity	Commodity	Income Elasticity
Wine (Canada)[a]	2.59	Domestic cars (U.S.)[e]	1.63
Beef (U.S.)[b]	1.06	Gasoline (U.S.)[c]	1.20
Cheese (UK)[c]	0.37	Cigarettes (U.S.)[f]	0.50
Chicken (U.S.)[b]	0.28	Petrol[g]	2.682
Potatoes (UK)[c]	–0.32	Kerosene[h]	0.884
Flour (U.S.)[d]	–0.36	LPG[i]	1.680
Electricity (household, U.S.)[d]	1.94	Public Bus[j]	–0.027
European cars (U.S.)[e]	1.93	Gold Import[k]	2.230
Asian cars (U.S.)[e]	1.65	Milk[l]	0.820

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TABLE 3-4 Estimated Cross-Price Elasticity of Demand (E_{xy}) between Selected Commodities

Commodity *X*	Commodity *Y*	Elasticity
Margarine (U.S.)	Butter (U.S.)	1.53[a]
Pork (U.S.)	Beef (U.S.)	0.40[a]
Mutton/lamb (UK)	Beef/veal (UK)	0.28[b]
Pork (UK)	Beef/veal (UK)	0.00[b]
Natural gas (U.S.)	Electricity (U.S.)	0.80[c]
Coal (Ireland)	Oil (Ireland)	0.70[d]
Coal (Ireland)	Natural gas (Ireland)	0.40[d]
Entertainment (U.S.)	Food (U.S.)	–0.72[e]
European cars	U.S. domestic & Asian cars	0.76[f]
Asian cars	U.S. domestic & European cars	0.61[f]
U.S. domestic cars	European & Asian cars	0.28[f]
Automobile (Australia)	Bus transportation (Australia)	0.07[b]

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Demand Elasticities for Alcoholic Beverages In the United States

TABLE 3-5 Price, income, and Cross-Price Elasticities of Demand for Beer, Wine, and Spirits in the United States

Beer	Wine	Spirits
$E_{XP} = -0.23$	$E_{YP} = -0.40$	$E_{ZP} = -0.25$
$E_{XI} = -0.09$	$E_{YI} = 5.03$	$E_{ZI} = 1.21$
$E_{XY} = 0.31$	$E_{YX} = 0.16$	$E_{ZX} = 0.07$
$E_{XZ} = 0.15$	$E_{YZ} = 0.10$	$E_{ZY} = 0.09$

Legend: X = beer, Y = wine, Z = spirits, I = income

Source: X. M. Gao, E. J. Wiles, and G. L. Kramer, "A Microeconometric Model of the U.S. Consumer Demand for Alcoholic Beverages," *Applied Economics* (January 1995), pp. 59–69.

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Indifference Curves (more than 1 good)

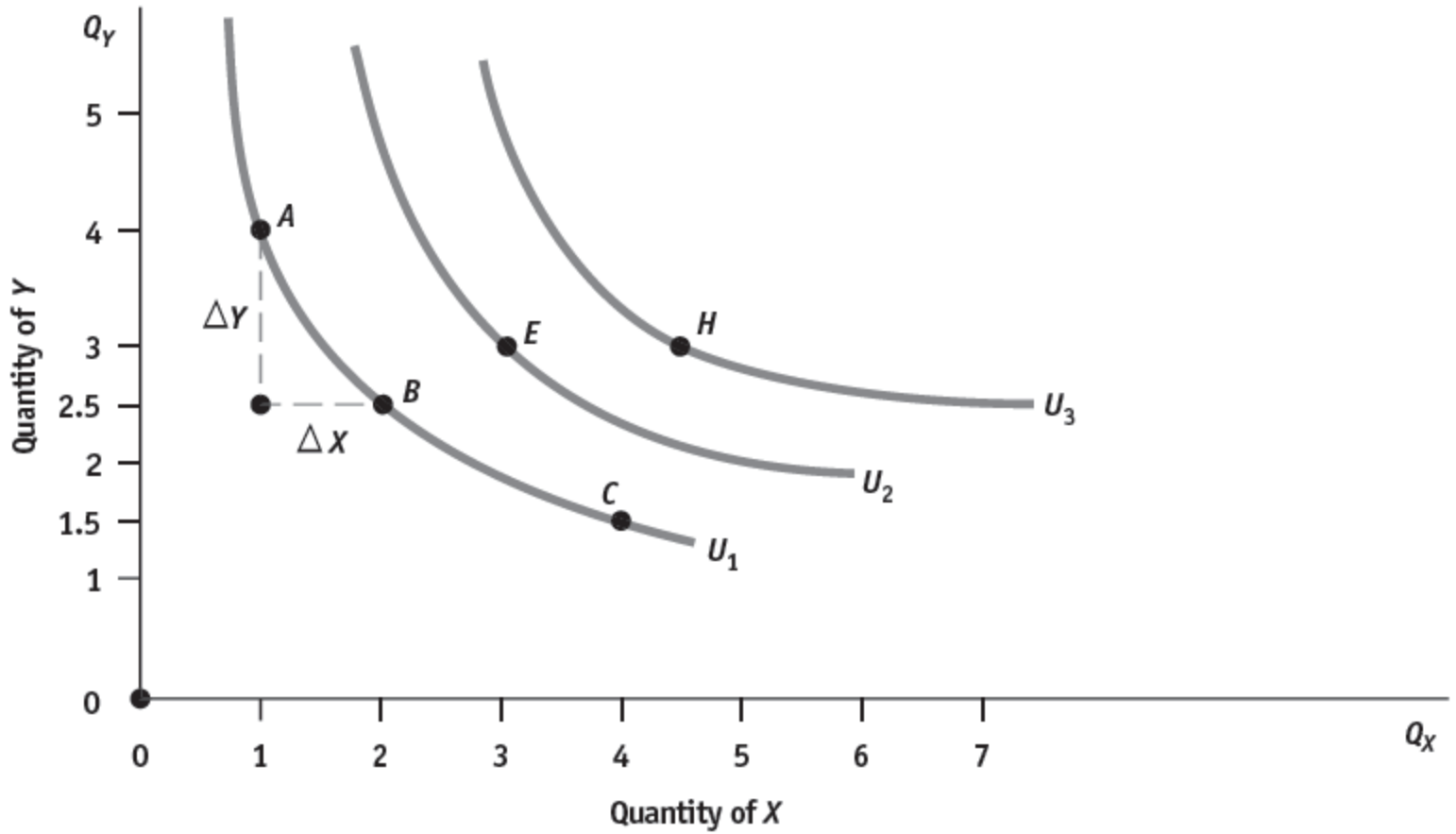
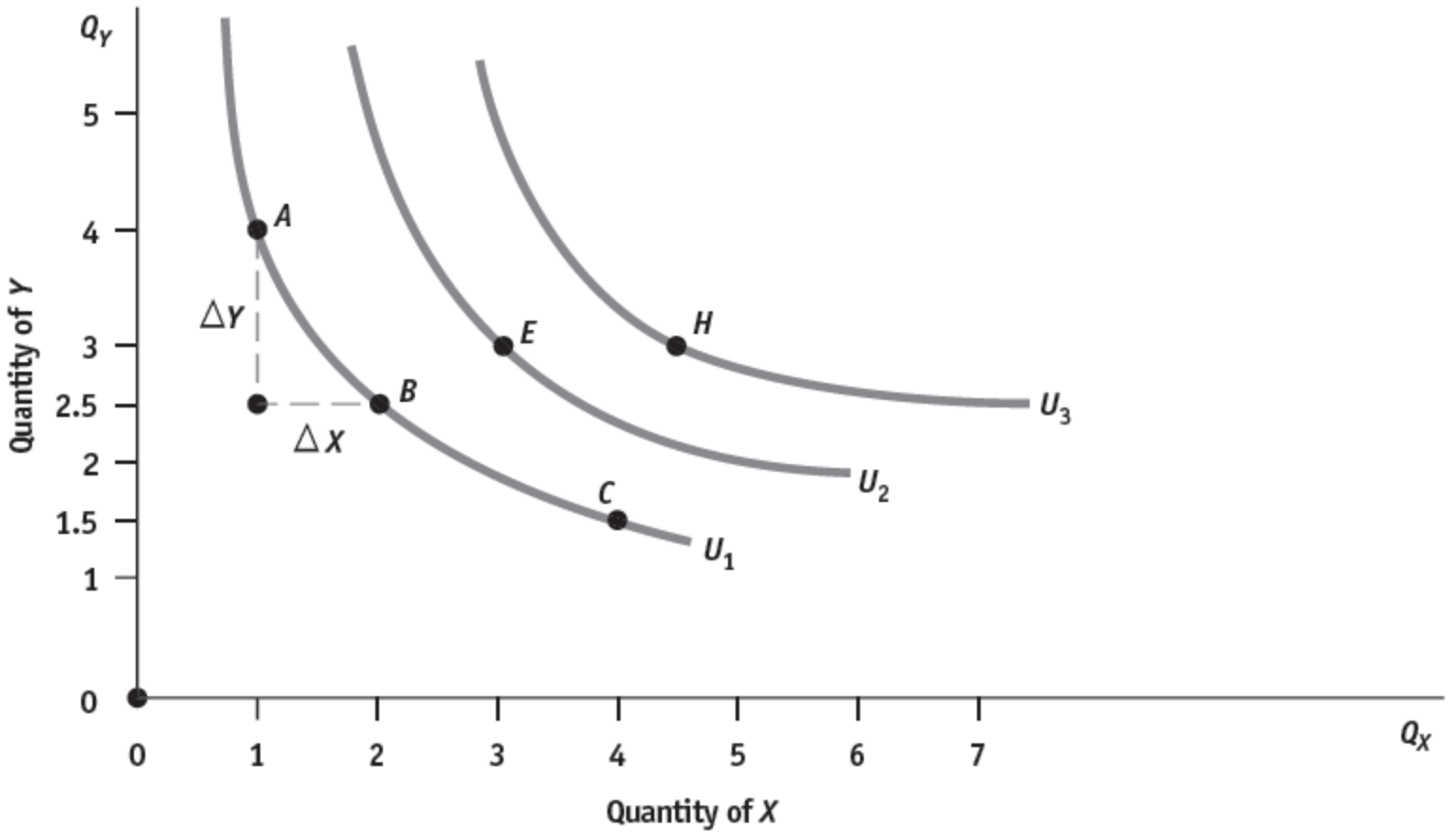


FIGURE 2-5 Indifference Curves Indifference curve U_1 shows that the individual receives the same level of satisfaction from consuming 1*X* and 4*Y* (point *A*), 2*X* and 2.5*Y* (point *B*), and 4*X* and 1.5*Y* (point *C*). Indifference curve U_2 refers to a higher level of satisfaction than U_1, and U_3 to a still higher level. Indifference curves are negatively sloped, are convex to the origin, and cannot cross.

Indifference Curves

- Utility Function: $U = U(Q_X, Q_Y)$
- Marginal Utility > 0
  - $MU_X = \partial U/\partial Q_X$ and $MU_Y = \partial U/\partial Q_Y$



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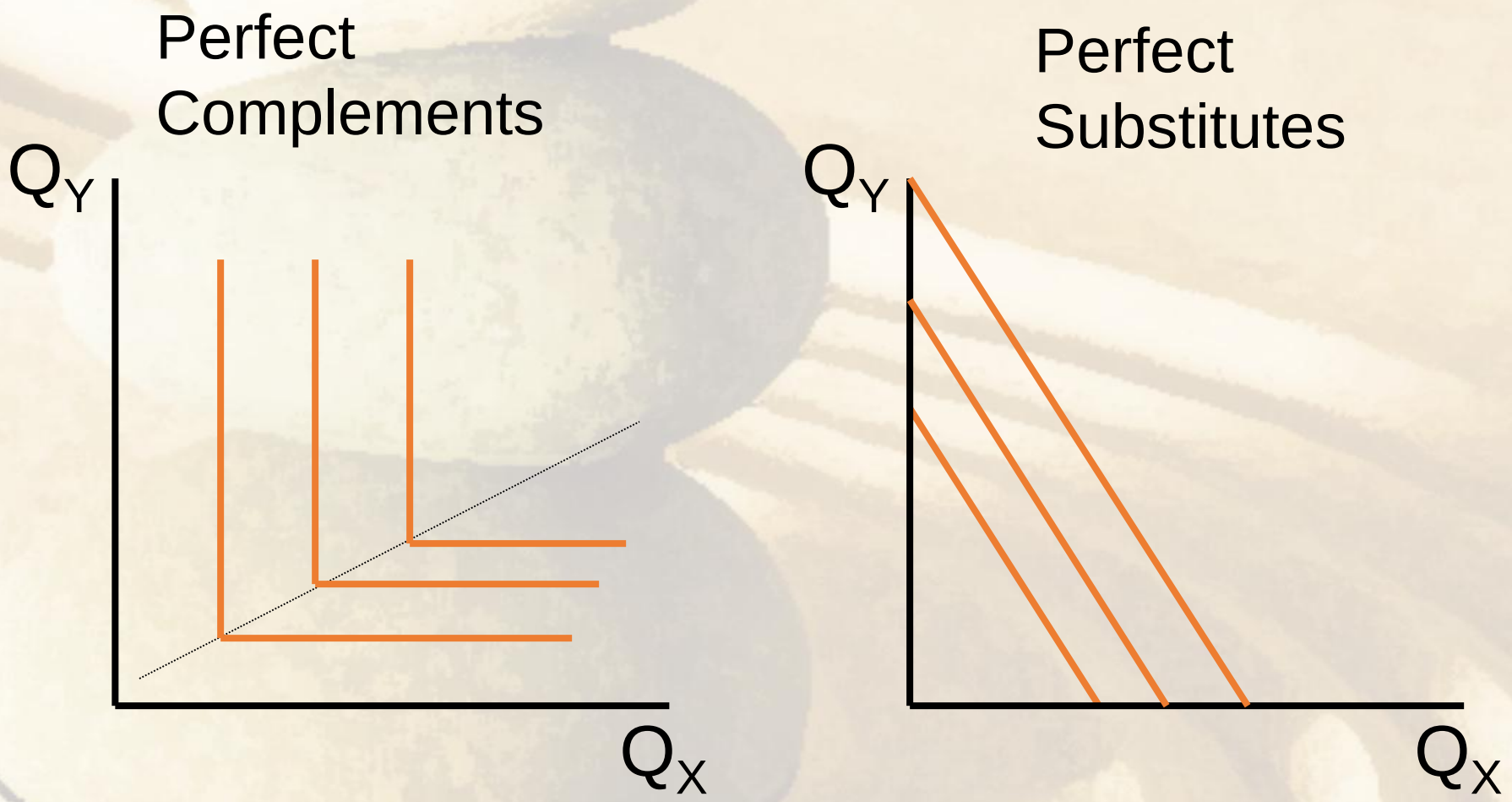
Marginal Rate of Substitution

- Rate at which one good can be substituted for another while holding utility constant

- Slope of an indifference curve
  - $dQ_Y/dQ_X = -MU_X/MU_Y$

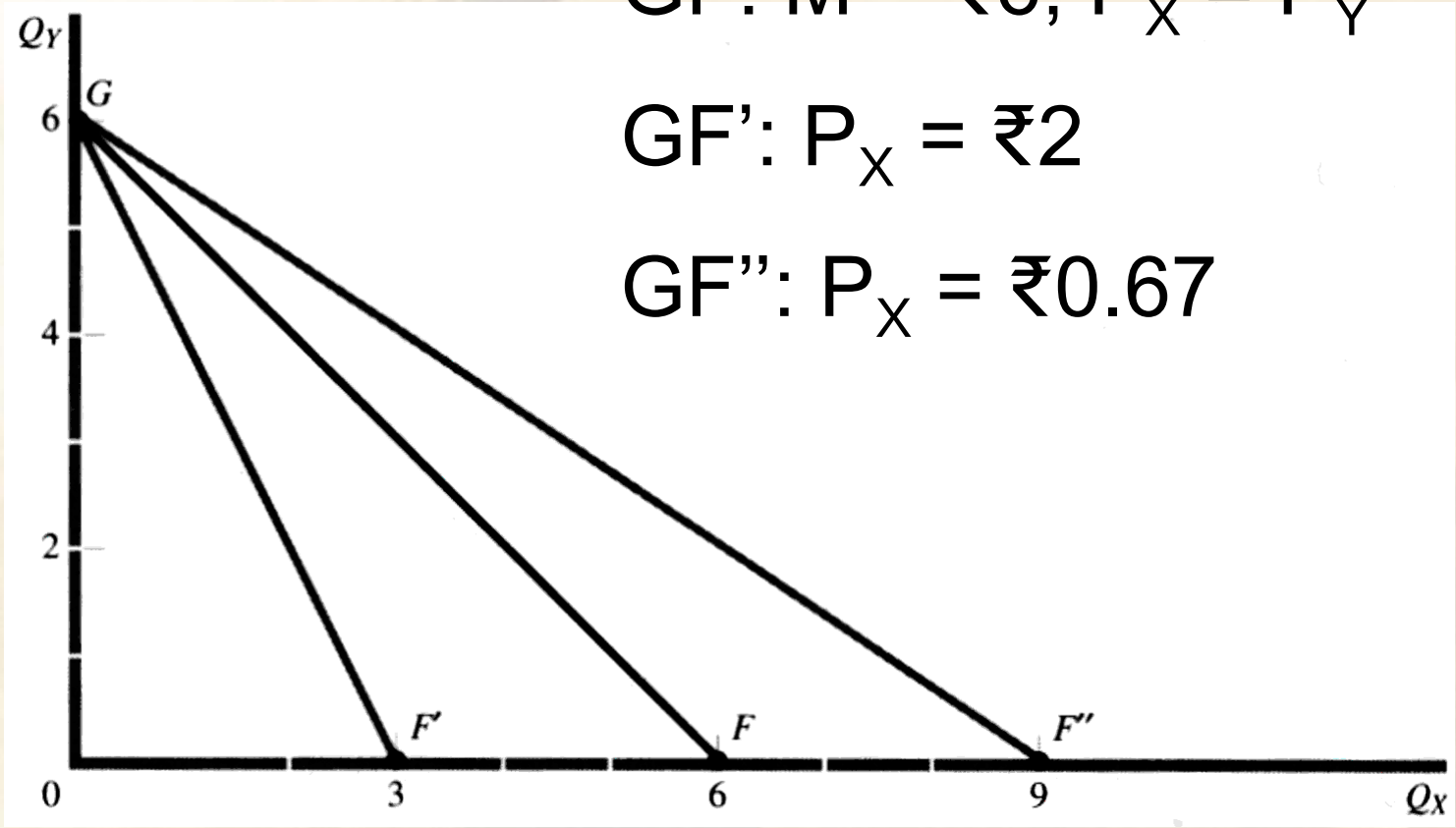
Indifference Curves: Complements and Substitutes



The Budget Line

- Budget = $M = P_X Q_X + P_Y Q_Y$
- Slope of the budget line
  - $Q_Y = M/P_Y - (P_X/P_Y)Q_X$
  - $dQ_Y/dQ_X = - P_X/P_Y$

Budget Lines: Change in Price

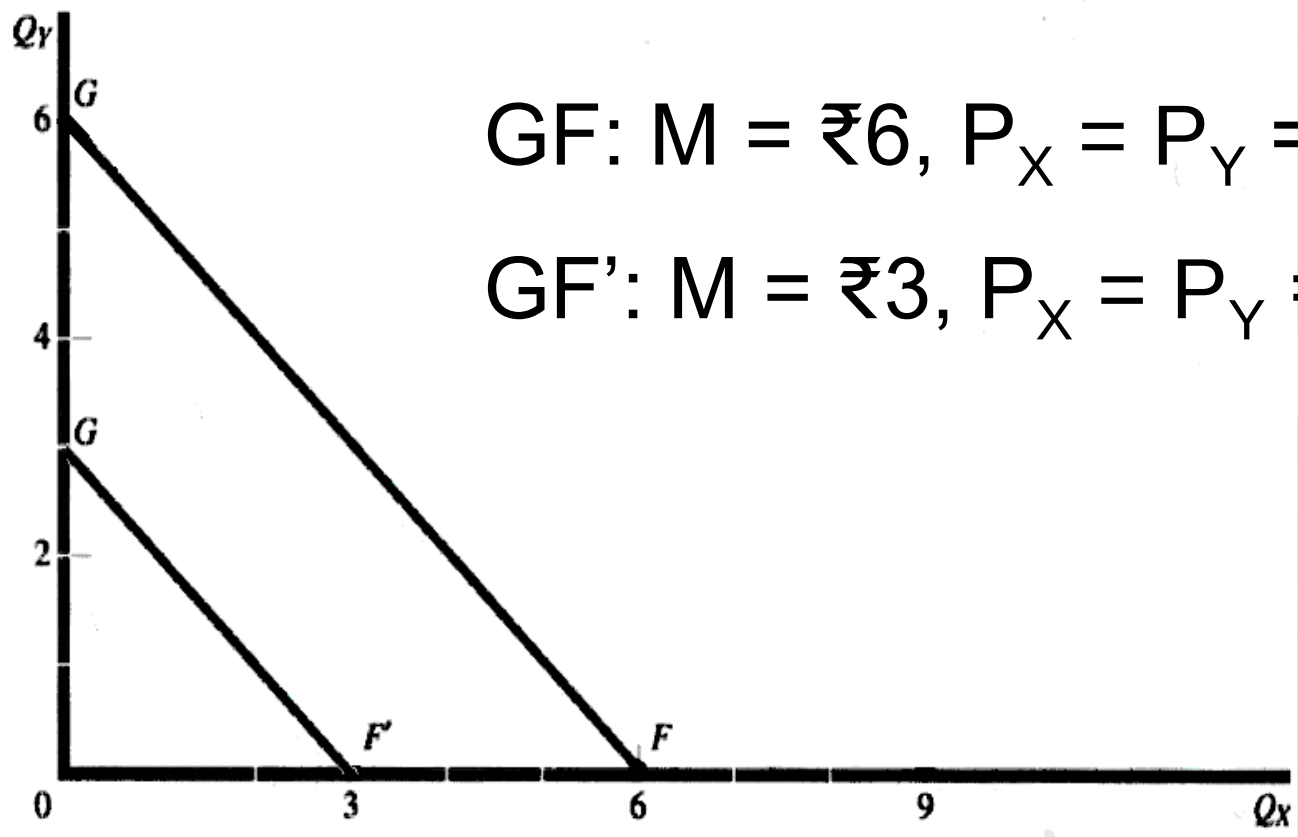


GF: M = ₹6, $P_X = P_Y$ = ₹1

GF': P_X = ₹2

GF'': P_X = ₹0.67

Budget Lines: Change in Income



GF: M = ₹6, $P_X = P_Y$ = ₹1

GF': M = ₹3, $P_X = P_Y$ = ₹1

Consumer Equilibrium

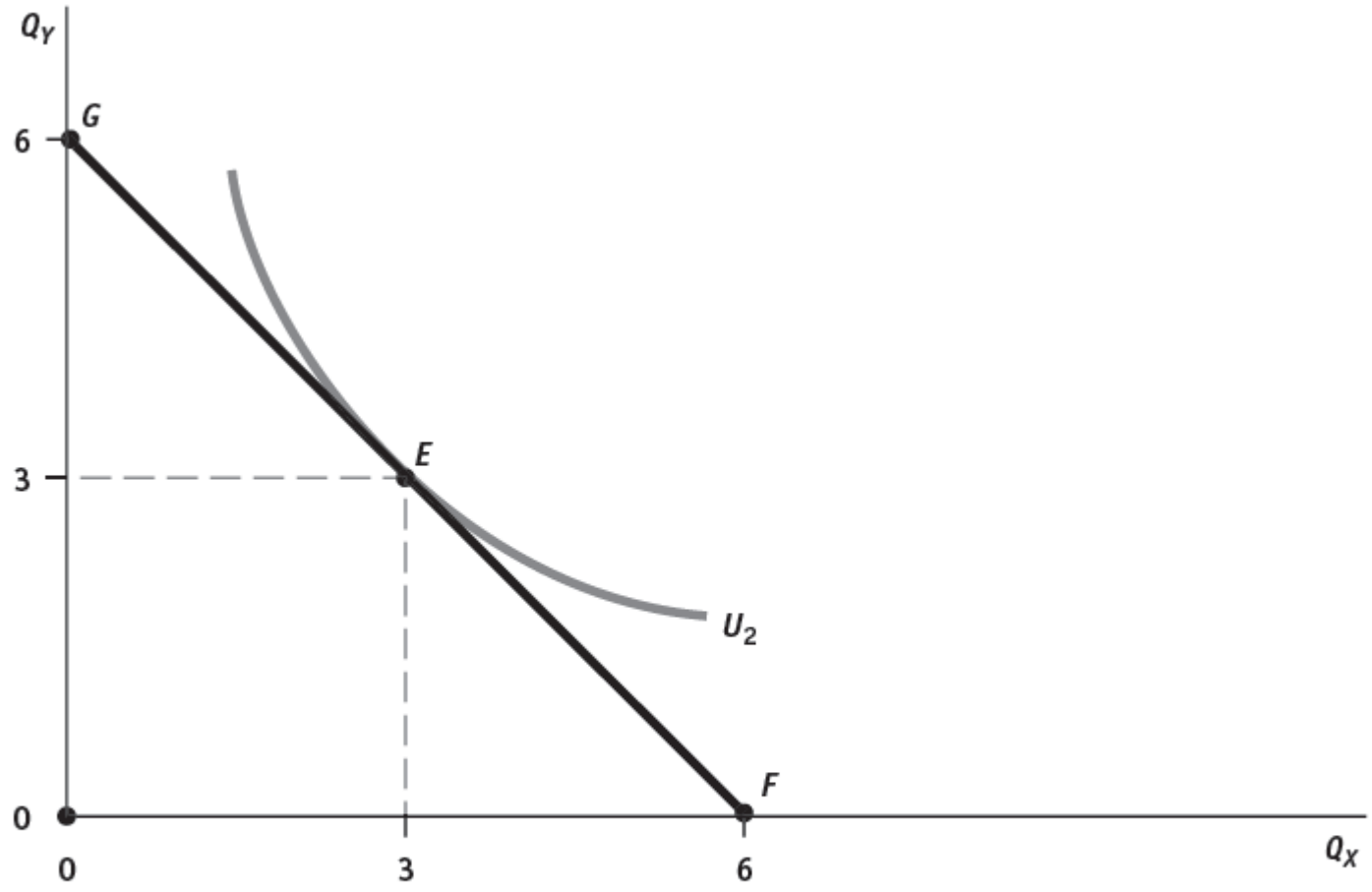


FIGURE 2-7 The Consumer's Equilibrium Given budget line *GF*, the consumer is in equilibrium when he or she consumes 3*X* and 3*Y* (point *E*), where budget line *GF* is tangent to the indifference curve U_2 (the highest indifference curve that the consumer can reach with his or her budget line).

Consumer Equilibrium

- Combination of goods that maximizes utility for a given set of prices and a given level of income
- Represented graphically by the point of tangency between an indifference curve and the budget line
  - $MU_X/MU_Y = P_X/P_Y$
  - $MU_X/P_X = MU_Y/P_Y$

From a Consumer's Equilibrium to her Demand Curve

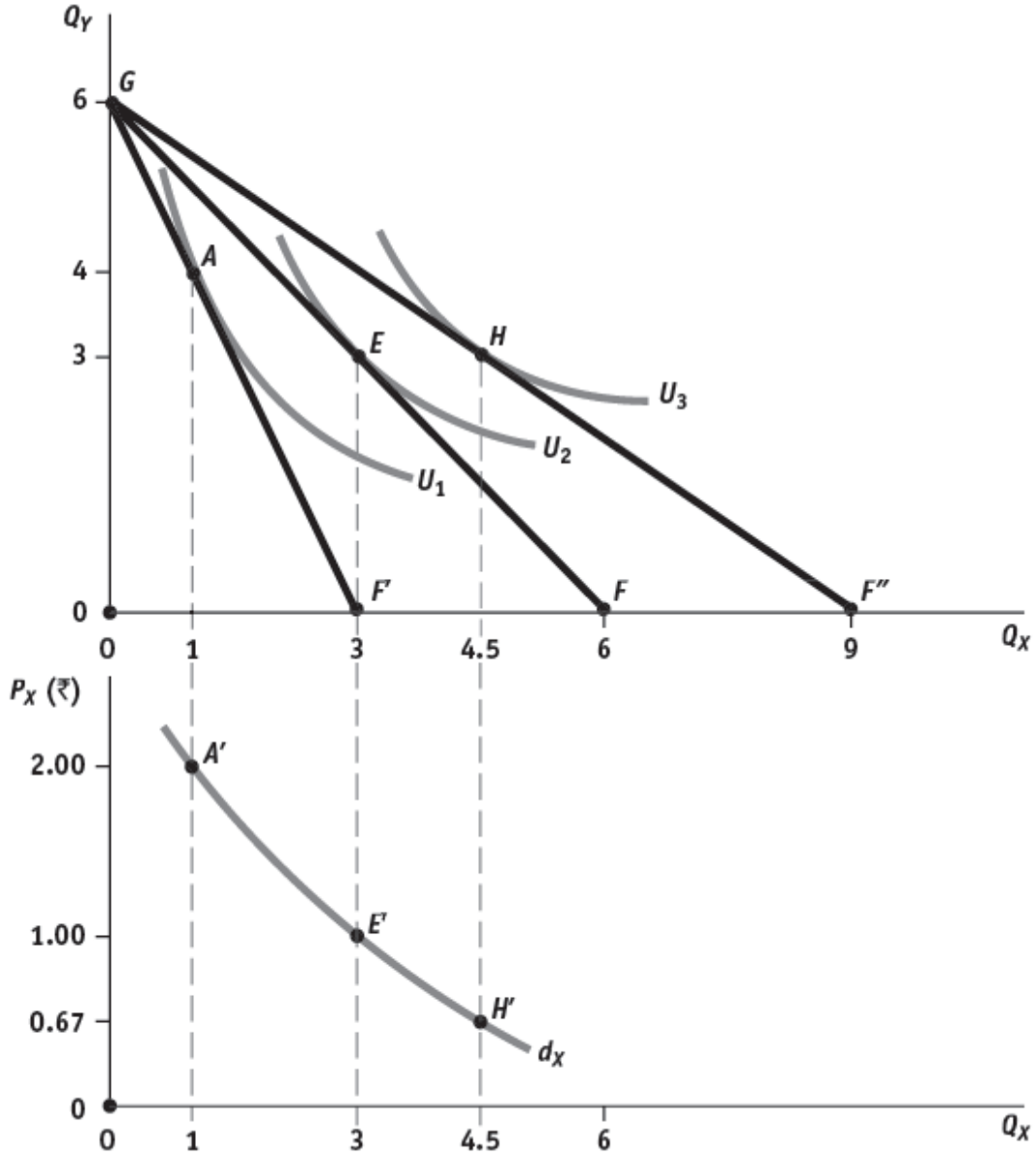


FIGURE 2-8 Derivation of the Consumer's Demand Curve The top panel shows that with $P_X = ₹2$, $P_X = ₹1$, and $P_X = ₹0.67$, we have budget lines GF', GF, and GF'', and consumer equilibrium points A, E, and H, respectively. From equilibrium points A, E, and H in the top panel, we derive points A', E', and H', in the bottom panel. By joining points A', E', and H', we derive d_X, the consumer's demand curve for commodity X.

Effect of Price Change decomposed into Substitution & Income effects

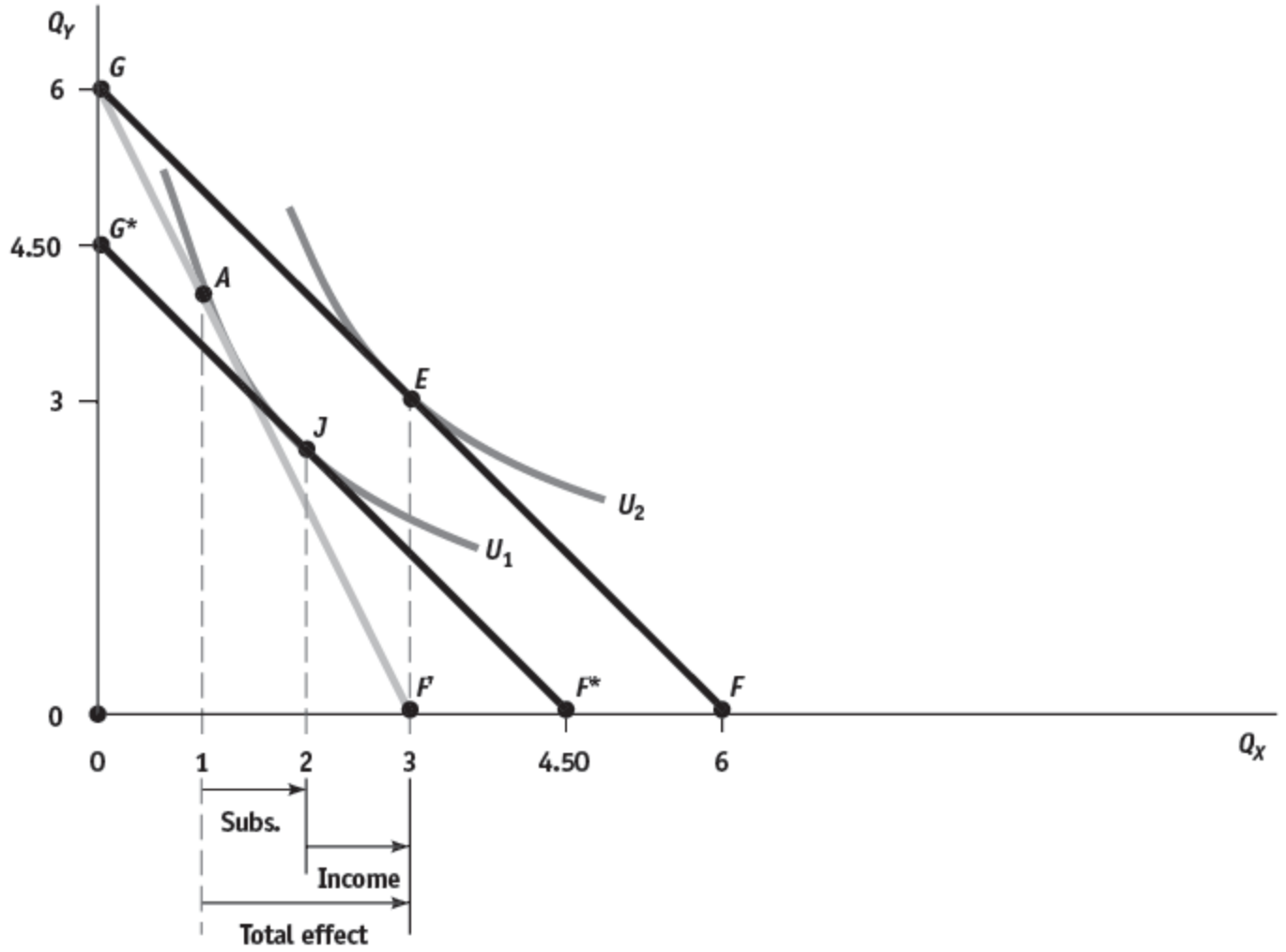


FIGURE 2-9 Separation of the Substitution from the Income Effect of a Price Change The individual is in equilibrium at point *A* with $P_X = ₹2$ and at point *E* with $P_X = ₹1$ (as in the top panel of Figure 2-8). To isolate the substitution effect, we draw hypothetical budget line *G*F**, which is parallel to *GF* and tangent to U_1, at point *J*. The movement along U_1, from point *A* to point *J* is the substitution effect and results from the relative reduction in P_X only (i.e., with real income constant). The shift from point *J* on U_1 to point *E* on U_2 is then the income effect. The total effect ($AE = 2X$) equals the substitution effect ($AJ = 1X$) plus the income effect ($JE = 1X$).

Next sessions

- Violations of assumptions ~ Introduction to Behavioural Economics
- Economics of Production/ Producer Theory