Chapter 5

MODERN PRINCIPLES OF ECONOMICS
Third Edition

Elasticity and its Applications

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Outline

- The Elasticity of Demand
- Applications of Demand Elasticity
- The Elasticity of Supply
- Applications of Supply Elasticity
- Using Elasticities for Quick Predictions
- Appendix 1: Other Types of Elasticities
- Appendix 2: Using Excel to Calculate Elasticities

Introduction

- In this chapter, we develop the tools of demand and supply elasticity.
- In Chapter 4, we discussed how to shift the supply and demand curves to produce ***qualitative*** predictions about changes in prices and quantities.
- Estimating elasticity is the first step in ***quantifying*** how changes in demand and supply will affect prices and quantities.

Definition

Elasticity of Demand:

measures how responsive the quantity demanded is to a change in price

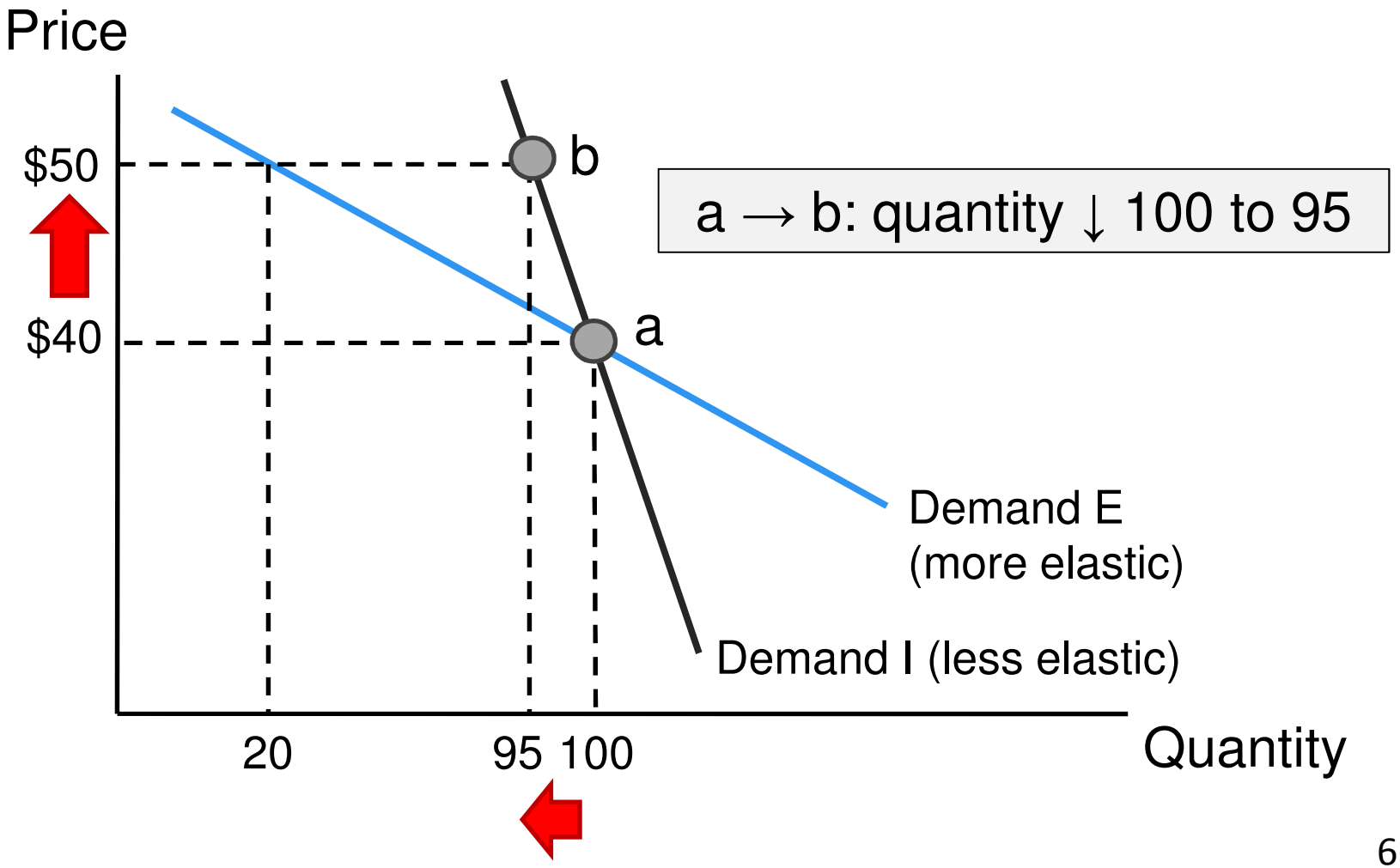
more responsive = more elastic.

Elasticity of Demand

- Elasticity is not the same as slope, but they are related.
- *Elasticity rule:* If two linear demand (or supply) curves run through a common point, then the curve that is flatter is more elastic.

Elasticity of Demand

When Price increases from $40 to $50:



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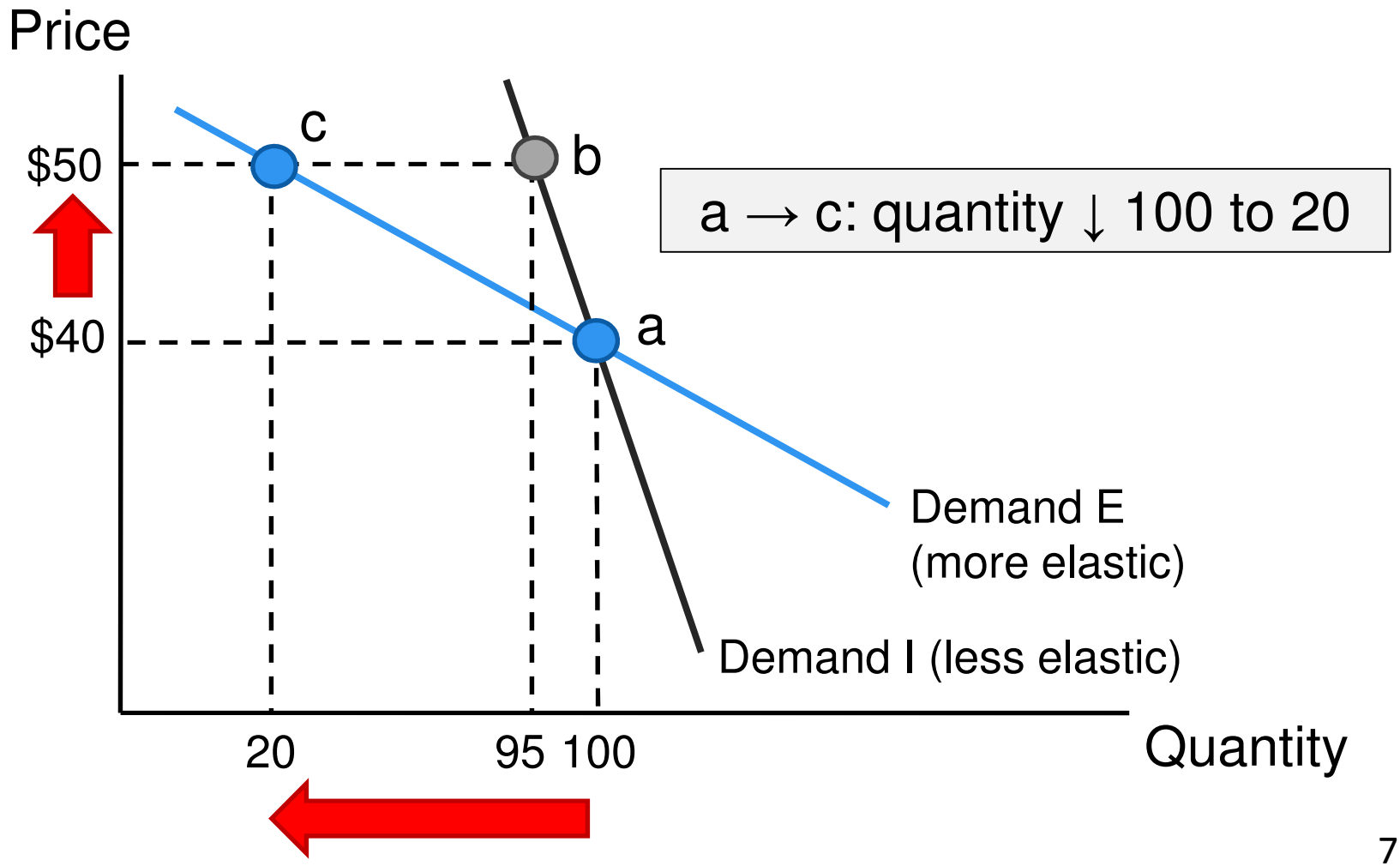

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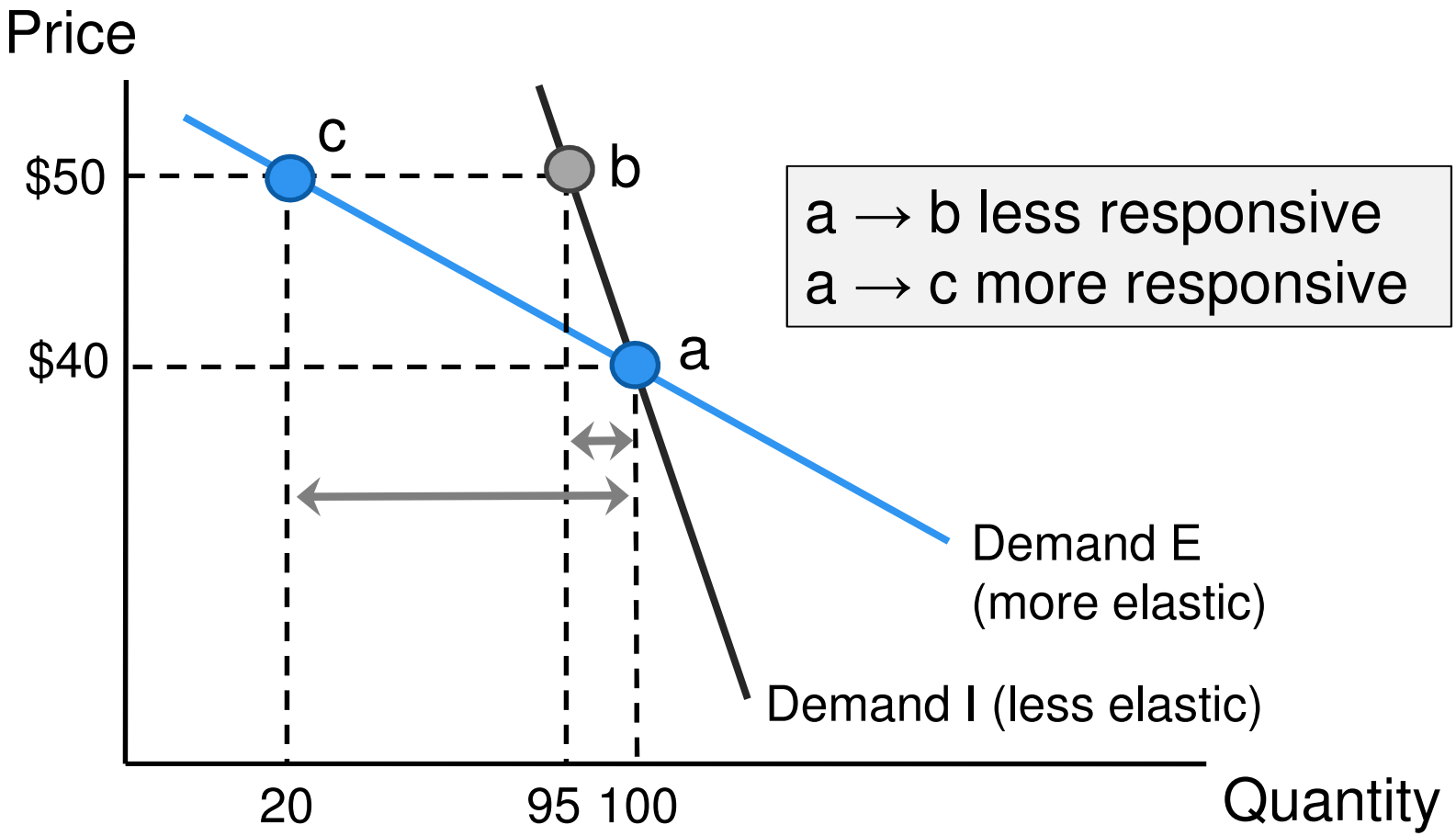


Determinants of Elasticity of Demand

- ***Ease in finding substitutes***
  - Easier to substitute → greater elasticity
- ***Time to adjust to price change***
  - More time → more substitutes → greater elasticity
- ***The definition of the commodity***
  - Narrow definition / specific brand → more substitutes → greater elasticity

Determinants of Elasticity of Demand

- ***Necessities vs. luxuries***.
  - Demand for luxuries → greater elasticity
- ***Share of budget devoted to the good***.
  - Larger share → greater elasticity

Example

When the patent expires on a brand-name drug and 5 generic drugs come on the market, what happens to elasticity of demand?

a) It rises

b) It falls

Determinants of Elasticity of Demand

TABLE 5.1 Some Factors Determining the 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

Self-Check

Would demand for BMW cars be more elastic or less elastic than demand for cars in general?

a. More elastic.
b. Less elastic.

Answer: a – more elastic; specific brands are more elastic than general categories, and luxuries are more elastic than necessities.

Calculating Elasticity of Demand

Formula for elasticity of demand:

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

$$= \frac{\%\Delta Q_{\text{demanded}}}{\%\Delta P}$$

Calculating Elasticity of Demand

We use the **midpoint** (average) as the base:

$$E_d = \frac{\%\Delta Q_{demanded}}{\%\Delta Price} = \frac{\dfrac{\text{Change in quantity demanded}}{\text{Average quantity}}}{\dfrac{\text{Change in price}}{\text{Average price}}}$$

$$= \frac{\dfrac{Q_{after} - Q_{before}}{(Q_{after} + Q_{before})/2}}{\dfrac{P_{after} - P_{before}}{(P_{after} + P_{before})/2}}$$

Calculating Elasticity of Demand

Given:

	Price	Quantity Demanded
Before	$40	100
After	$50	20

$$E_d = \frac{\dfrac{20-100}{(20+100)/2}}{\dfrac{50-40}{(50+40)/2}} = \frac{\dfrac{-80}{60}}{\dfrac{10}{45}} = \frac{-1.33}{0.22} = -6.0$$

Self-Check

What is the elasticity of demand if a price drop from $4 to $3 causes quantity to increase from 120 to 150?

a. -1. 2857
b. -0.0635
c. -0. 7778

Answer: c -0.7778.

Self-Check

Price drop from $4 to $3
Quantity increase from 120 to 150

$$E_d = \frac{\frac{150-120}{(150+120)/2}}{\frac{3-4}{(3+4)/2}} = \frac{\frac{30}{135}}{\frac{-1}{3.5}} = \frac{0.22}{-0.2857} = -0.7778$$

Self-Check

If the price of oil increases by 10% and over a period of several years, the quantity demanded falls by 5%, then the long run elasticity of demand for oil is:

$$\frac{-5\%}{10\%} = -0.5$$

or 0.5 (in absolute terms)

Calculating Elasticity of Demand

Elasticity of demand is always negative, so it is usually interpreted using the absolute value (avoids a lot of confusion later on):

$$|E_d| > 1 = \text{Elastic}$$

$$|E_d| < 1 = \text{Inelastic}$$

$$|E_d| = 1 = \text{Unit Elastic}$$

Self-Check

A price elasticity of -1.27 means that demand is:

a. Elastic.
b. Inelastic.
c. Unit elastic.

Answer: a – elastic, because $|-1.27| > 1$.

Total Revenues and Elasticity

- A firm's revenues are equal to price per unit times quantity sold.

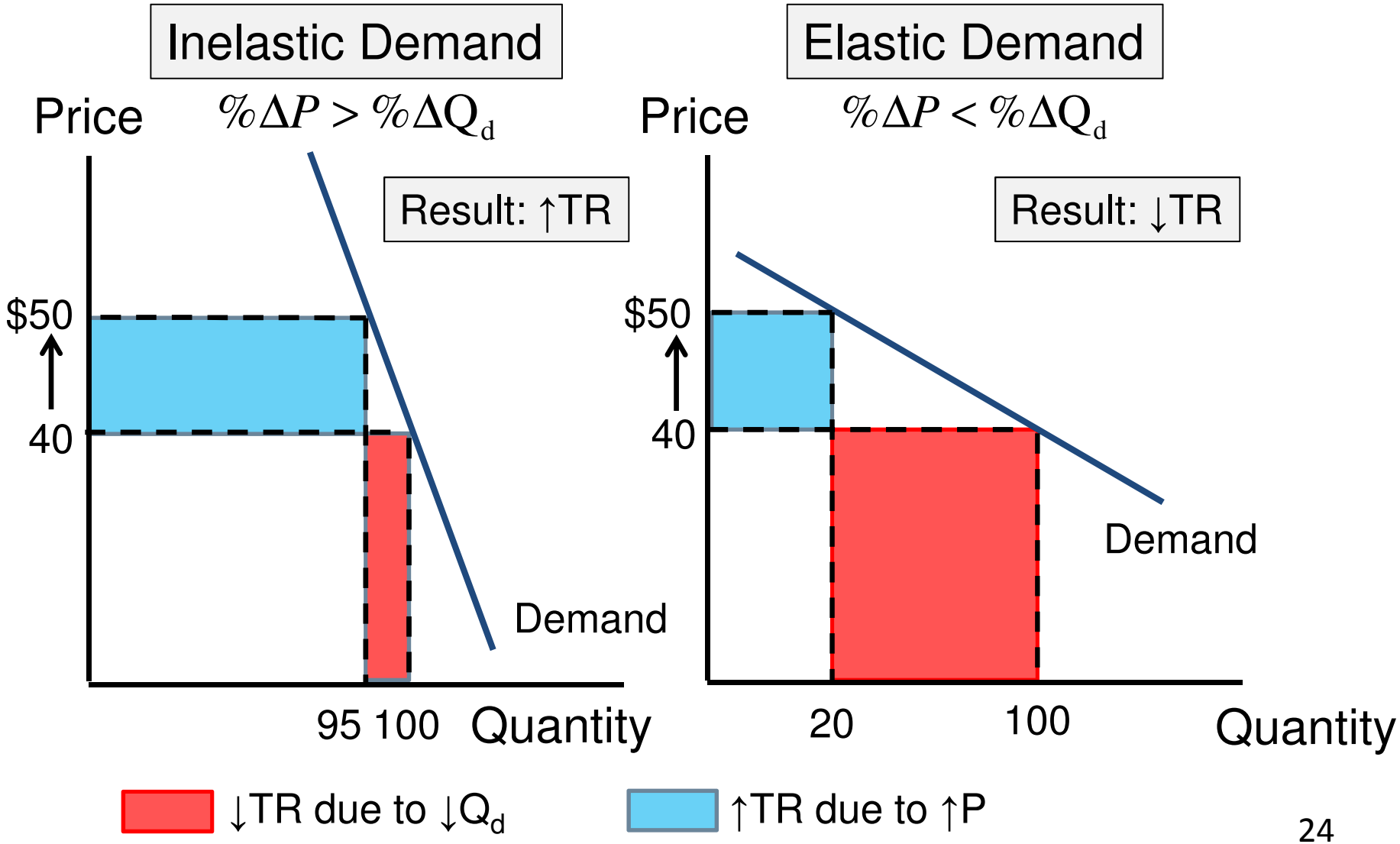
Revenue = Price × Quantity, or $R = P \times Q$

- Elasticity measures how much Q goes down when P goes up.

Total Revenues and Elasticity

- There is a relationship between elasticity and revenue:
  - If the demand curve is ***inelastic***, then revenues ↑ when price ↑.
  - If the demand curve is ***elastic***, then revenues ↓ when price ↑.
  - If the demand curve is ***unit elastic***, then revenues do not change when price changes

Total Revenues and Elasticity



Total Revenues and Elasticity

Summary		
Absolute Value of E_d	**Elasticity**	**Total Revenue and Price**
$\|E_d\| < 1$	**Inelastic**	**TR and P move together**
$\|E_d\| > 1$	**Elastic**	**TR and P move in opposite directions**
$\|E_d\| = 1$	**Unit Elastic**	**Price changes but TR remains the same**

Self-Check

If the price elasticity of demand for wine is 1.2, and the price of wine increases, the total revenues of the wine industry would:

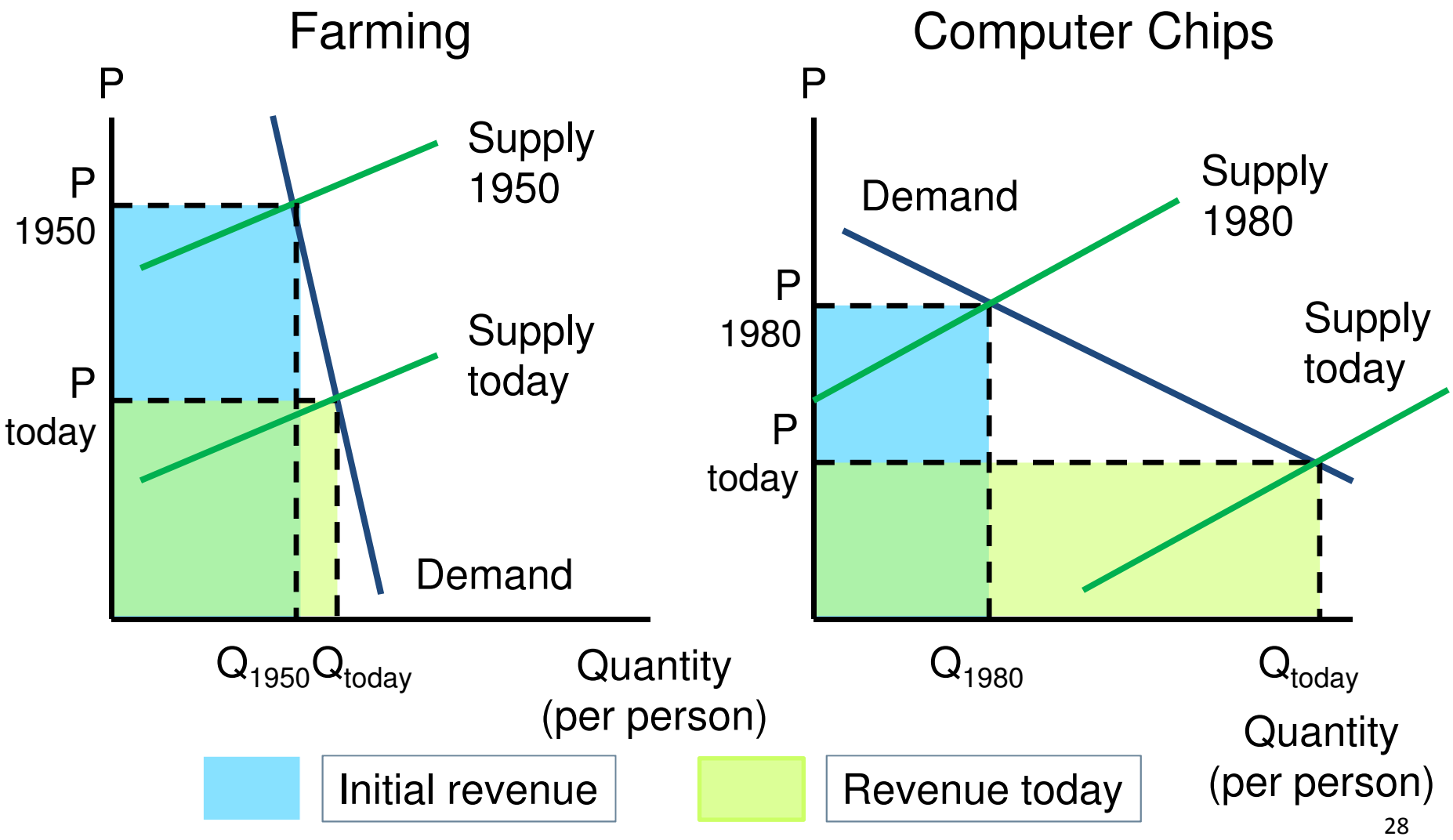
a. Increase.
b. Decrease.
c. Remain the same.

Answer: b – decrease; demand is elastic, so a price increase would cause revenues to decrease.

Applications of Demand Elasticity

- Productivity has increased in both farming and computer chips.
- Farming revenues have declined, while revenues for computer chips have increased.
- Demand for food is inelastic.
  - Increase in supply → lower price → lower revenues.
- Demand for computer chips is elastic.
  - Increase in supply → lower price → higher revenues.

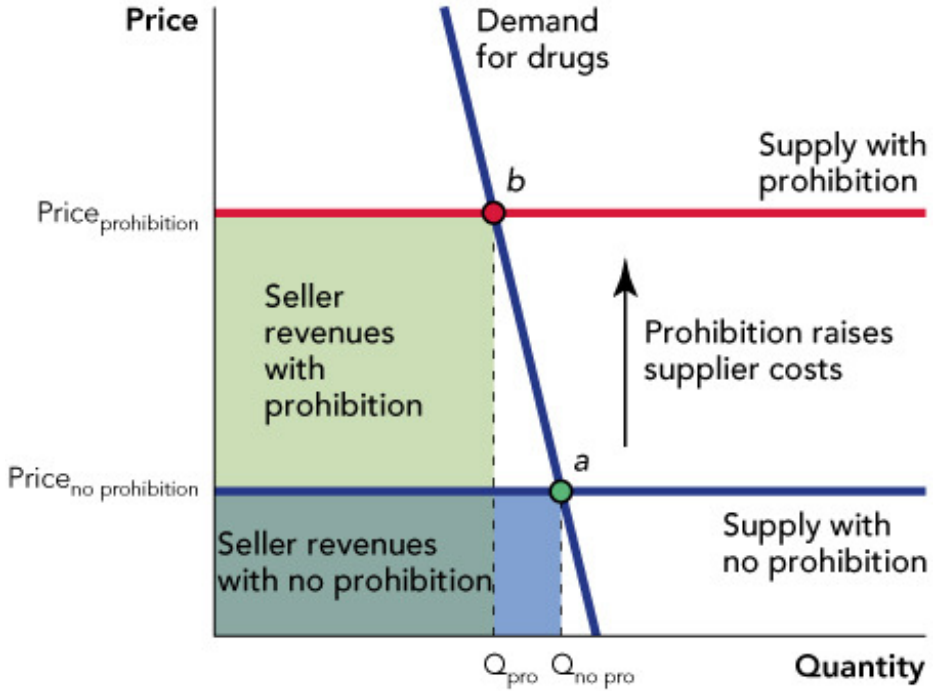
Applications of Demand Elasticity



Applications of Demand Elasticity

Why the War on Drugs is Hard to Win:

- ***Because* demand for most illegal drugs is inelastic, drug dealers earn greater revenue and gain more power as the drug war becomes more effective.**



Applications of Demand Elasticity

- Will a $15/hour minimum wage stimulate the economy via higher spending?
- Robert Reich thinks so:
  - https://www.youtube.com/watch?v=WXKLa2zfoTk

- Is there a "virtuous cycle?" Is all we have to do is to increase spending to propel economic growth?
- This is basic Keynesian thinking that relies on indebtedness and has failed consistently, especially recently.
- What about the labor market for unskilled workers and the $15/hour minimum wage?

Applications of Demand Elasticity

- For an inelastic demand curve, Total Revenues (TR) increase when price increases.
- And TR falls if there's a price increase on an elastic demand curve.
- So will a 107% increase in the minimum wage for unskilled labor occur on an elastic or inelastic portion of the demand curve?
- Arguments for an elastic unskilled labor demand curve:
  - Substitute capital for labor
  - Shut down business due to lack of profitability
  - Move the business away from high MW jurisdiction
  - Any others?

Applications of Demand Elasticity

- Arguments for inelastic demand curve for MW workers:
  - Any?
- Conclusion: the idea that raising the minimum wage will increase spending is dubious.
- Raising the price (min wage) on an elastic portion of a demand curve will cut total payments will reduce total labor compensation
- In other words, raising the minimum wage will lead to less labor income, less spending, and a slower economy.
- Univ of Washington minimum wage study of the Seattle $15 min wage found this result exactly

Self-Check

If demand for iPhones is inelastic, an increased supply of iPhones would result in:

a. Increased revenues.
b. Decreased revenues.
c. Unchanged revenues.

Answer: b – decreased revenues; the increase in quantity sold would be offset by a much larger decrease in price.

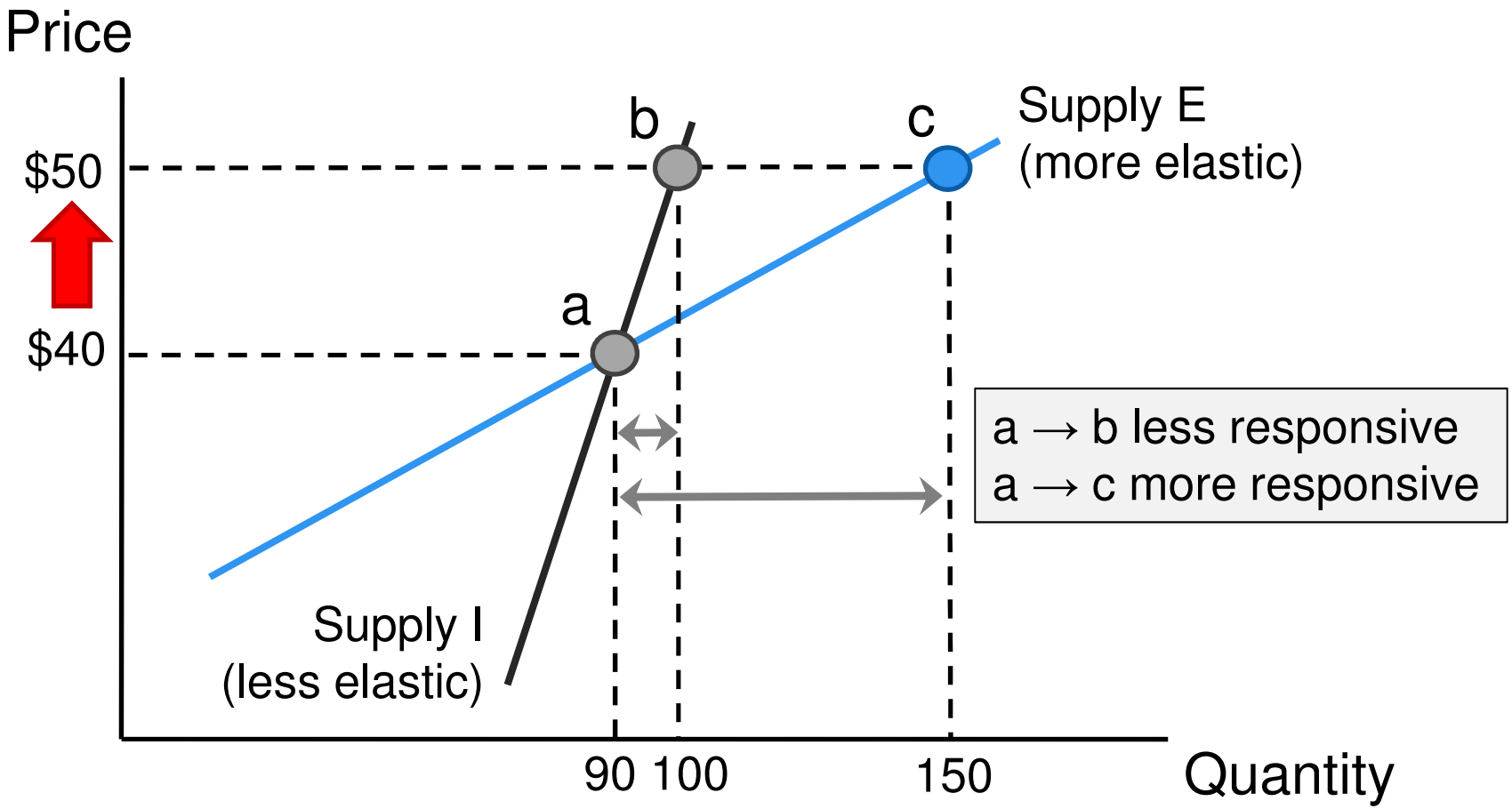
Definition

Elasticity of Supply:

measures how responsive the quantity supplied is to a change in price.

Elasticity of Supply

When Price increases from $40 to $50:



Determinants of Elasticity of Supply

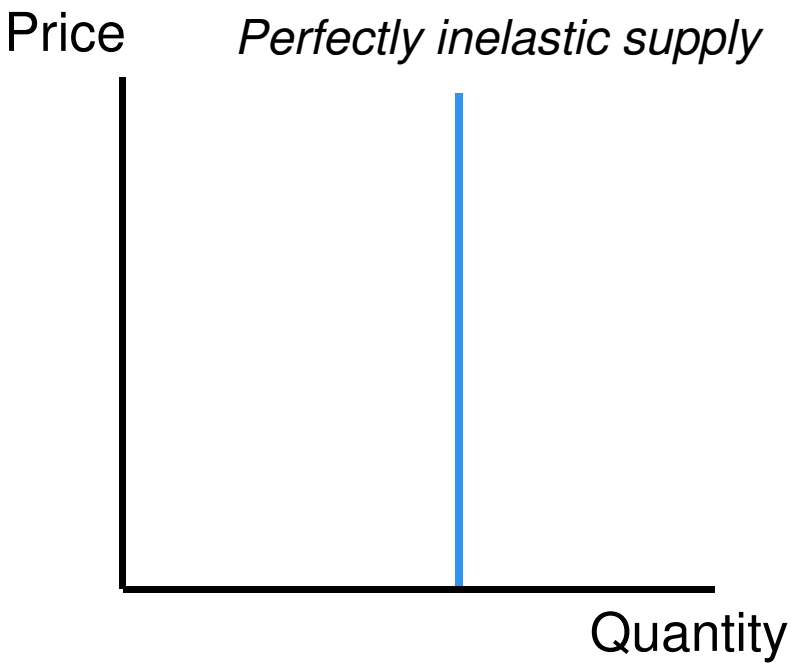
- The fundamental determinant is how quickly per-unit costs increase with an increase in production.
  - If increased production requires much higher per-unit costs, then supply will be inelastic.
  - If production can increase without increasing per-unit costs very much, then supply will be elastic.

Determinants of Elasticity of Supply

- Supply is more elastic when the industry can be expanded without causing a big increase in the demand for that industry's inputs.
- The local supply of a good is much more elastic than the global supply.
- Supply tends to be more elastic in the long run than in the short run.

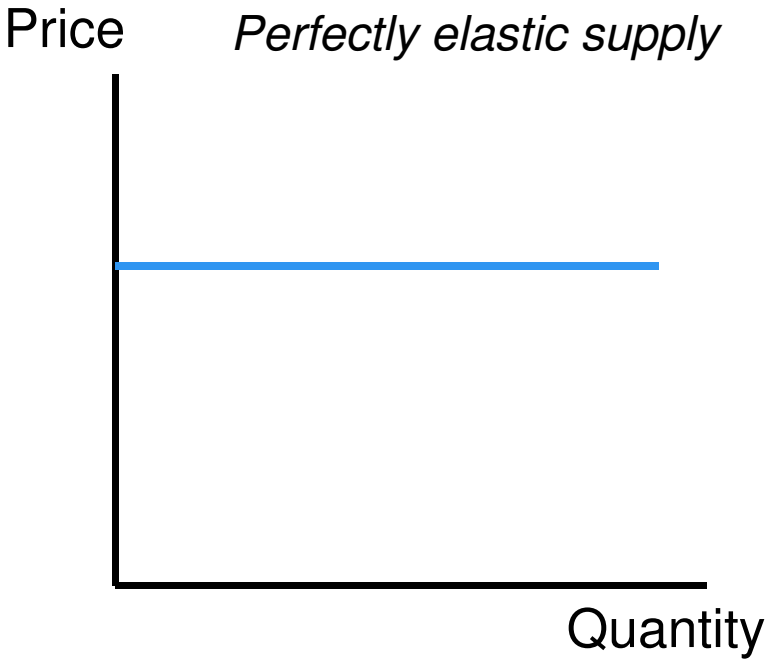
Determinants of Elasticity of Supply

Picasso painting



The supply of Picasso paintings is inelastic because Picasso won't paint any more no matter how high the price rises.

Toothpicks



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

TABLE 5.3 Primary Factors Determining the Elasticity of Supply

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

Self-Check

Would the supply of roofing nails in Fargo, North Dakota be relatively elastic or inelastic?

a. Elastic.
b. Inelastic.

Answer: a – relatively elastic; it would be easy to increase production at constant unit cost; nails are a small share of the market for galvanized steel; and local supply in Fargo is more elastic than global supply.

Calculating Elasticity of Supply

Formula for elasticity of supply:

$$E_s = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

$$= \frac{\%\Delta Q_{\text{supplied}}}{\%\Delta P}$$

Calculating Elasticity of Supply

We use the ***midpoint*** (average) as the base:

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$$= \frac{\dfrac{Q_{after} - Q_{before}}{(Q_{after} + Q_{before})/2}}{\dfrac{P_{after} - P_{before}}{(P_{after} + P_{before})/2}}$$

Application of Supply Elasticity

Gun buyback programs

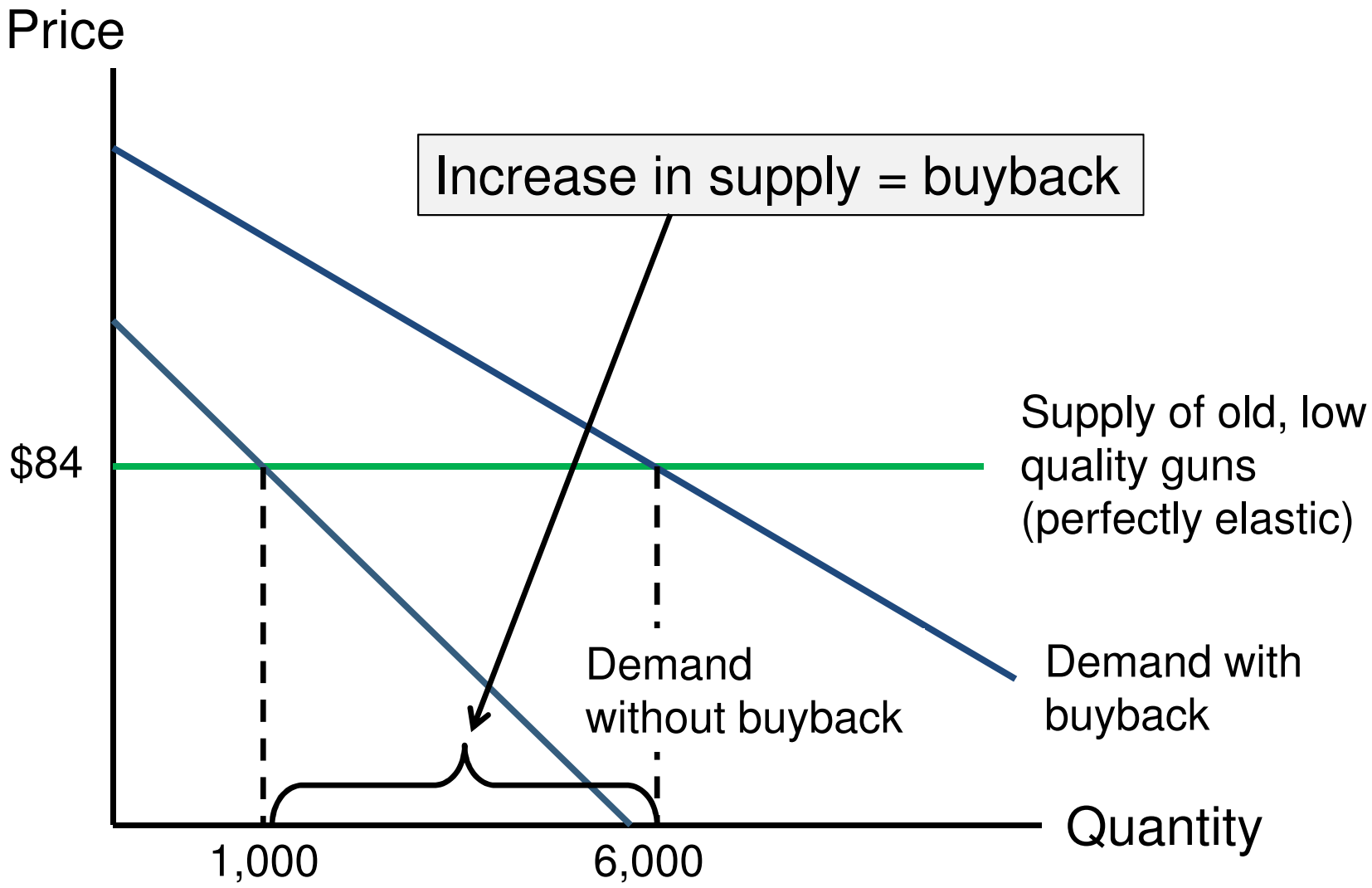
- Several cities in the U.S. have spent millions of dollars buying back guns.
- The objective is to reduce the number of guns in order to lower crime rates.
- Principles of economics predict these programs are unlikely to reduce the number of guns on the streets.

Application of Supply Elasticity

Gun buyback programs

- When police buy guns, the demand for guns increases.
- Since the supply of guns to a local region is very elastic, the street price of guns does not increase.
- As a result, there is no decrease in the number of guns on the street.

Application of Supply Elasticity

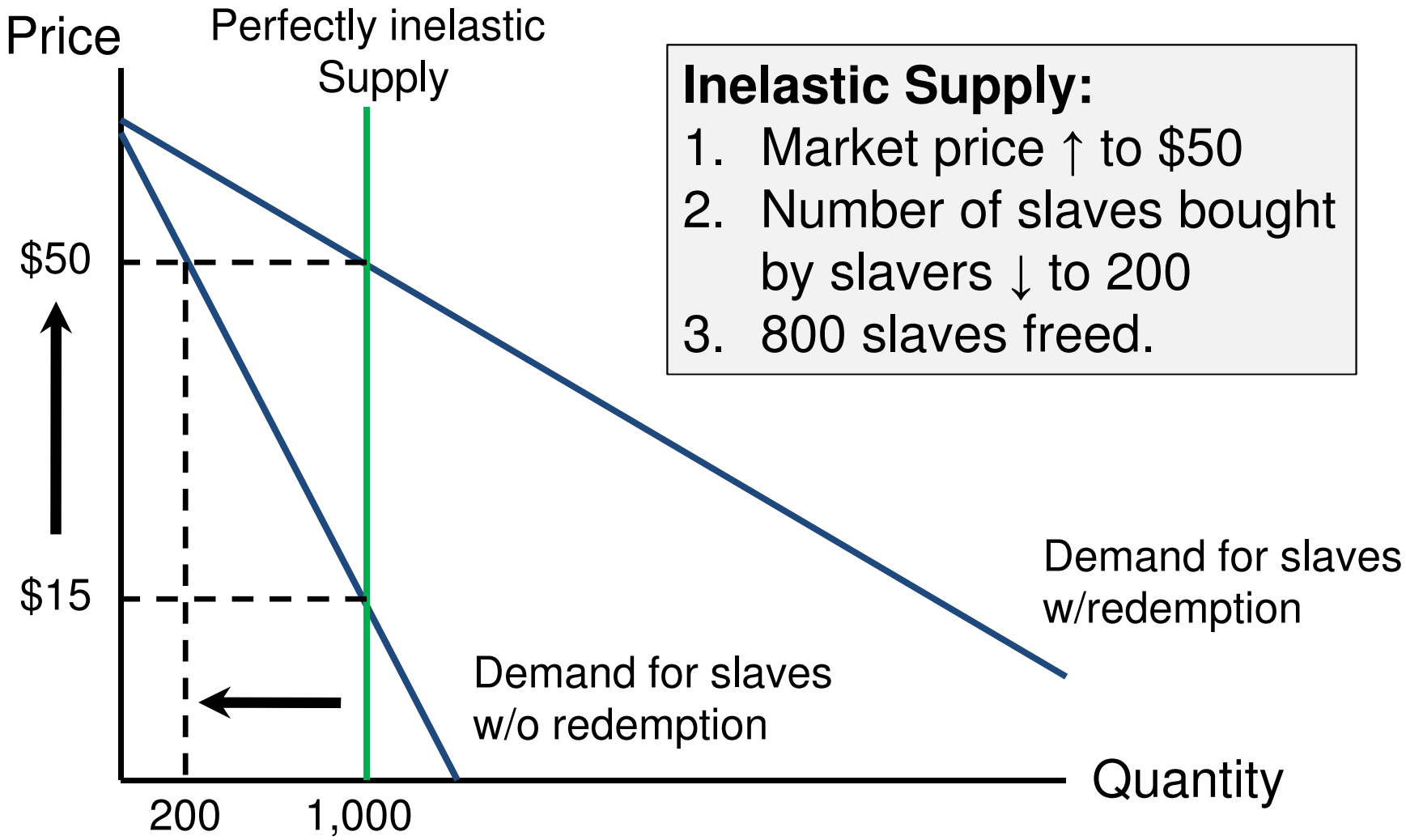


Application of Supply Elasticity

Slave Redemption

- The objective is to reduce the total number of slaves.
- Some argue that buying slaves will make matters worse.
- The solution depends on the elasticity of supply.

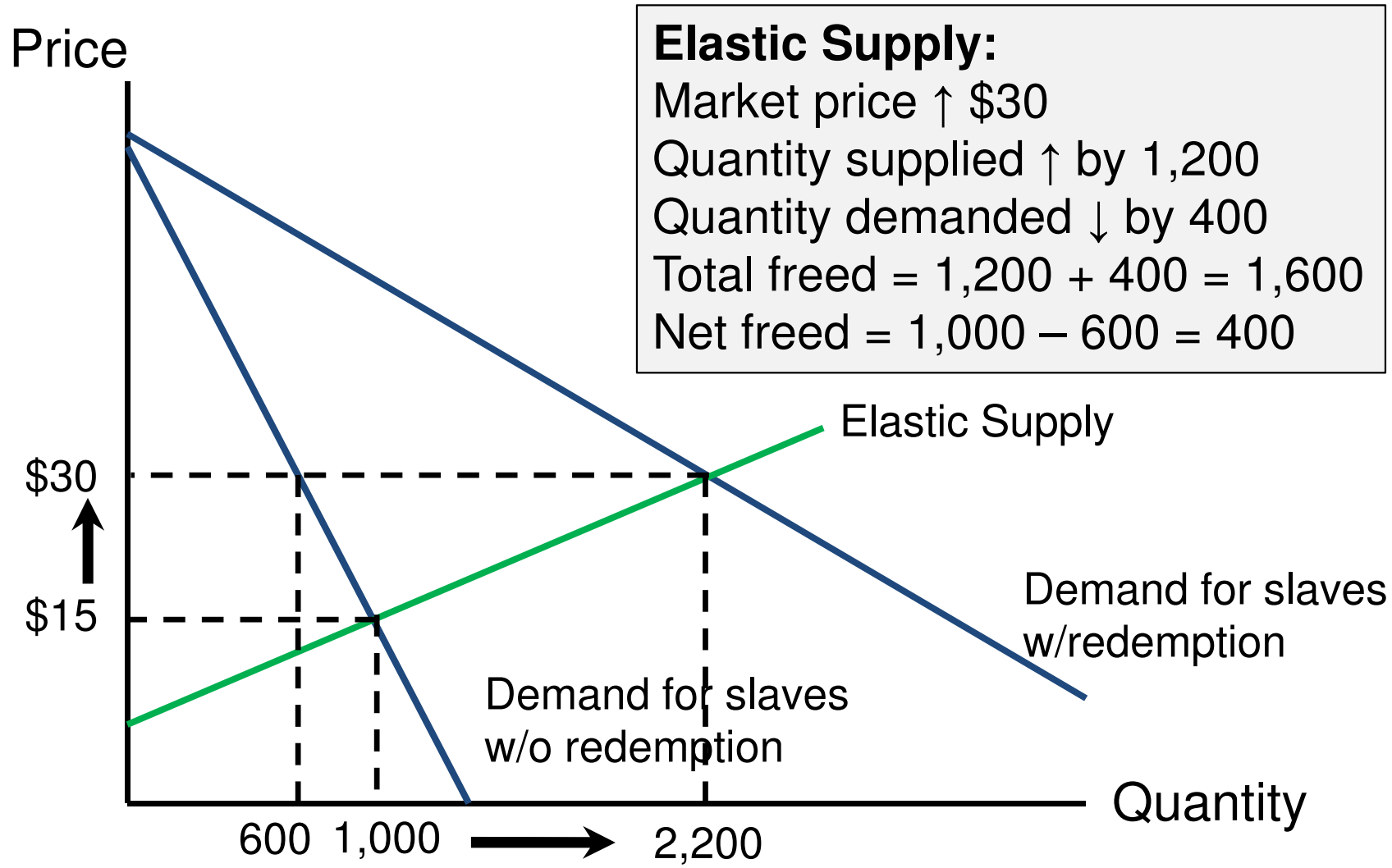
Applications of Supply Elasticity



Inelastic Supply:

1. Market price ↑ to $50
2. Number of slaves bought by slavers ↓ to 200
3. 800 slaves freed.

Applications of Supply Elasticity



Cross-Price Elasticity of Demand

The *Cross-Price Elasticity of Demand* measures how sensitive the quantity demanded of *good A* is to the price of *good B.*

Cross-Price Elasticity of Demand =

$$\frac{\text{Percentage Change in Quantity Demanded of Good A}}{\text{Percentage Change in Price of Good B}}$$

or

$$\frac{\%\ \Delta Q_{\text{demanded, A}}}{\%\ \Delta P_{\text{rice, B}}}$$

Cross-Price Elasticity of Demand

- **For substitutes, Cross-Price Elasticity of Demand is positive.**
  - **An increase in the price of one brand of milk will increase the demand for other brands.**

- **For complements, Cross-Price Elasticity of Demand is negative.**
  - **An increase in the price of milk causes a decrease in demand for Oreos.**

Income Elasticity of Demand

- The *Income Elasticity of Demand* measures how sensitive the quantity demanded of a good is to changes in income.
- Income Elasticity of Demand =

$$\frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}$$

or

$$\frac{\%\ \Delta Q_{\text{demanded}}}{\%\ \Delta \text{Income}}$$

Income Elasticity of Demand

The income elasticity of demand can be used to distinguish normal from inferior goods.

- **For normal goods, Income Elasticity is positive.**
- **For luxury goods, Income Elasticity is greater than one.**
- **For inferior goods, Income Elasticity is negative.**

Using Elasticities for Quick Predictions

Two useful price-change formulas:

$$\%\Delta\text{Price from a shift in demand} = \frac{\%\Delta\text{Demand}}{|E_d| + E_s}$$

$$\%\Delta\text{Price from a shift in supply} = -\frac{\%\Delta\text{Supply}}{|E_d| + E_s}$$

Using Elasticities for Quick Predictions

Drilling for Oil in the Arctic National Wildlife Refuge

- Estimated ↑ in production = 800,000 barrels/day
- Equals a 1% ↑ in world production
- $E_d = -0.5$; $E_s = 0.3$

$$\%\,\Delta\text{Price of oil from a } 1\% \text{ increase in supply} = -\frac{1\%}{|-0.5| + 0.3} = -1.25\%$$

- A 1% ↑ in production → 1.25% ↓ in price.

Takeaway

- Elasticity of demand measures how responsive the quantity demanded is to a change in price.
- Elasticity of demand also tells you how revenues respond to changes in price.
- If the $|Ed| < 1$, price and revenue move together.
- if $|Ed| > 1$, price and revenue move in opposite directions.
- Elasticity can be used to explain many real world problems.