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Elasticity:
(Own) Price Elasticity of Demand

Previously

- Demand and supply balance the desires of consumers and producers.
- Demand and supply steer the market price toward equilibrium.
- We learned the direction of changes in quantity demanded and quantity supplied as a result of a price change.
- In this chapter, studying elasticity will help us understand the sensitivity of consumers and producers to changes in price.

(Own) Price Elasticity of Demand

- Elasticity
  - Responsiveness of buyers and sellers to changes in market conditions.
- Why is it useful?
  - Prices or other demand and supply determinants could change.
  - Understanding elasticity will help us improve the predictive power of our basic economic model.
  - Instead of just knowing the direction of a variable change, we can study the size of the change.

(Own) Price Elasticity of Demand

- Recall the law of demand
  - Demand curve is downward-sloping
  - This gives us the direction of the relationship between these two variables.
- Price elasticity of demand
  - A measure of the responsiveness of quantity demanded to a change in price
  - This gives us the sensitivity of the relationship between these two variables.

(Own) Price Elasticity of Demand

- Demand is elastic if
  - Quantity demanded changes significantly as the result of the price change
  - Elastic = “sensitive” or “responsive”

- Demand is inelastic if
  - Quantity demanded changes a small amount as the result of the price change
  - Inelastic = “insensitive” or “unresponsive”

The Determinants of the (Own) Price Elasticity of Demand

1. Existence of substitutes
   - Goods with lots of substitutes
     - Canned vegetables, breakfast cereals, many types of products with multiple brands
     - More elastic
   - Goods with no good substitutes
     - Broadway theatre, rare coins, autographs, drinking water, electricity, Super Bowl tickets.
     - More inelastic

The Determinants of the (Own) Price Elasticity of Demand

2. Share of the budget spent on the good
   - Demand is more elastic for “big ticket” items that make up a large portion of income.
   - Demand is more inelastic for inexpensive items.
   - Which would you react to more?
     - 20% sale on a new vehicle you want
     - 20% sale on candy bar

The Determinants of the (Own) Price Elasticity of Demand

3. Time and adjustment process
   - Generally, demand for goods tends to become more elastic over time.
   - Over time, consumers are
     - More able to find substitutes
     - More able to adjust for price changes in other ways

Time Periods of Market Response

Time period name	How long?	Demand

Economics in *The Simpsons*

Homer misjudges the (own) price elasticity of demand for elephant services

http://www.criticalcommons.org/Members/AdrianFohr/clips/elasticity-necessity-or-luxury

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Elasticity:
Computing the (Own) Price Elasticity of Demand

Computing the (Own) Price Elasticity of Demand

- Elasticity can help answer questions such as:
  - Should a firm raise or lower the price of a good to increase revenues?
  - If an excise tax is placed on a good, how much tax revenue will be generated?

The (Own) Price Elasticity of Demand Formula

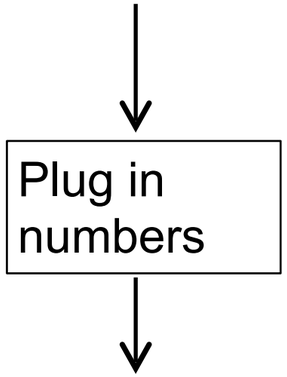
$$E_d = \frac{\%\Delta Q_d}{\%\Delta P}$$

P & Q For the same good!

Δ = change

Example

- University parking pass prices increase by 50%.
- As a result, 25% less people demand a parking pass.



$$E_d = \frac{\%\Delta Q_d}{\%\Delta P} = \frac{-25\%}{+50\%} = -0.5$$

Example

$$E_d = \frac{\%\Delta Q_d}{\%\Delta P} = \frac{-25\%}{+50\%} = -0.5$$

- What does the numerical result mean?
  - In this case, the quantity demanded response was relatively small (compared to the price change).
  - Demand is inelastic for parking.
- Why is it negative?
  - There is an inverse relationship between price and quantity demanded.

The Percent Formula has a problem.

- One issue with using the percent change formula.
  - Price decreases from $100 to $80
    - A 20% change
  - Price increases from $80 to $100
    - A 25% change!

- Thus, the “direction” of the variable change will change our numerical elasticity result. How can we fix this?

Midpoint Method

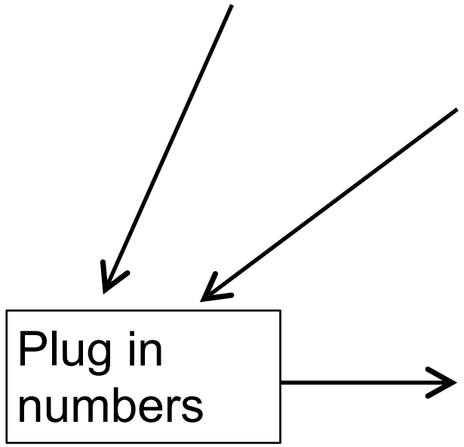
- The Midpoint Method is an alternative way to find elasticity. The formula is more complicated.

$$E_d = \frac{(\Delta Q_d)/(\text{average of } Q_d)}{(\Delta P)/(\text{average of } P)}$$

$$E_d = \frac{(Q_2 - Q_1)/[(Q_1 + Q_2)/2]}{(P_2 - P_1)/[(P_1 + P_2)/2]}$$

Midpoint Method

- Example:
  - "Old" price. P_1 = \$6 results in Q_1 = 15
  - "New" price. P_2 = \$4 results in Q_2 = 25



$$E_d = \frac{(Q_2 - Q_1)/[(Q_1 + Q_2)/2]}{(P_2 - P_1)/[(P_1 + P_2)/2]}$$

$$E_d = \frac{(25 - 15)/[(15 + 25)/2]}{(4 - 6)/[(6 + 4)/2]}$$

$$E_d = \frac{10/20}{-2/5} = -1.25$$

Economics in *Seinfeld*

Jerry and George likely have different **(own)** price elasticity of demand for “The jacket”

https://www.youtube.com/watch?v=E7YF6_ODMdM&feature=youtu.be

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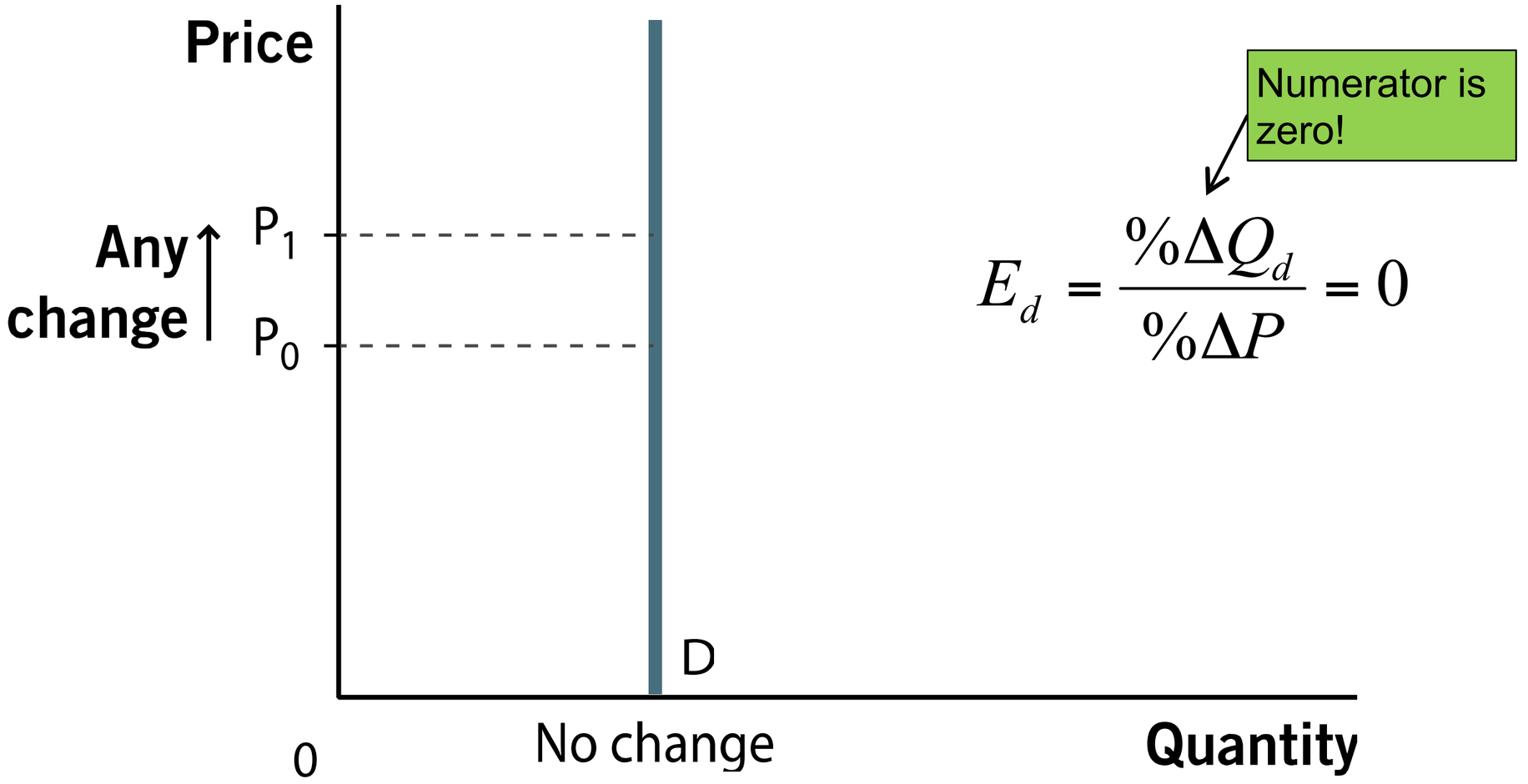
Elasticity:
Graphing the Price Elasticity of Demand

Graphing (Own) Price Elasticity

- If demand is relatively elastic
  - We are relatively sensitive to price changes
  - The demand curve is relatively flatter
- If demand is relatively inelastic
  - We are relatively insensitive to price changes
  - The demand curve is relatively steeper

Graphing (Own) Price Elasticity

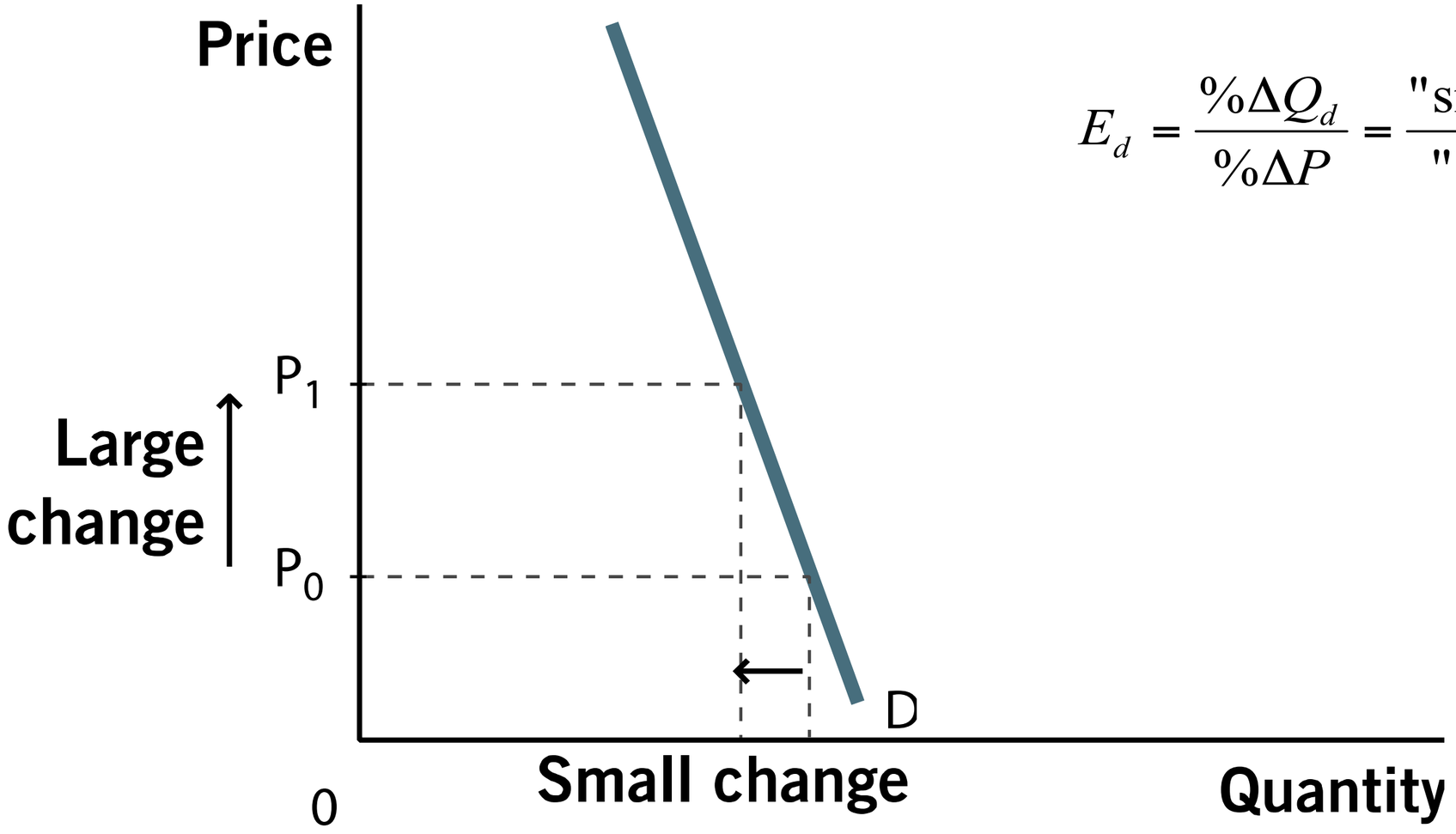


Numerator is zero!

$$E_d = \frac{\%\Delta Q_d}{\%\Delta P} = 0$$

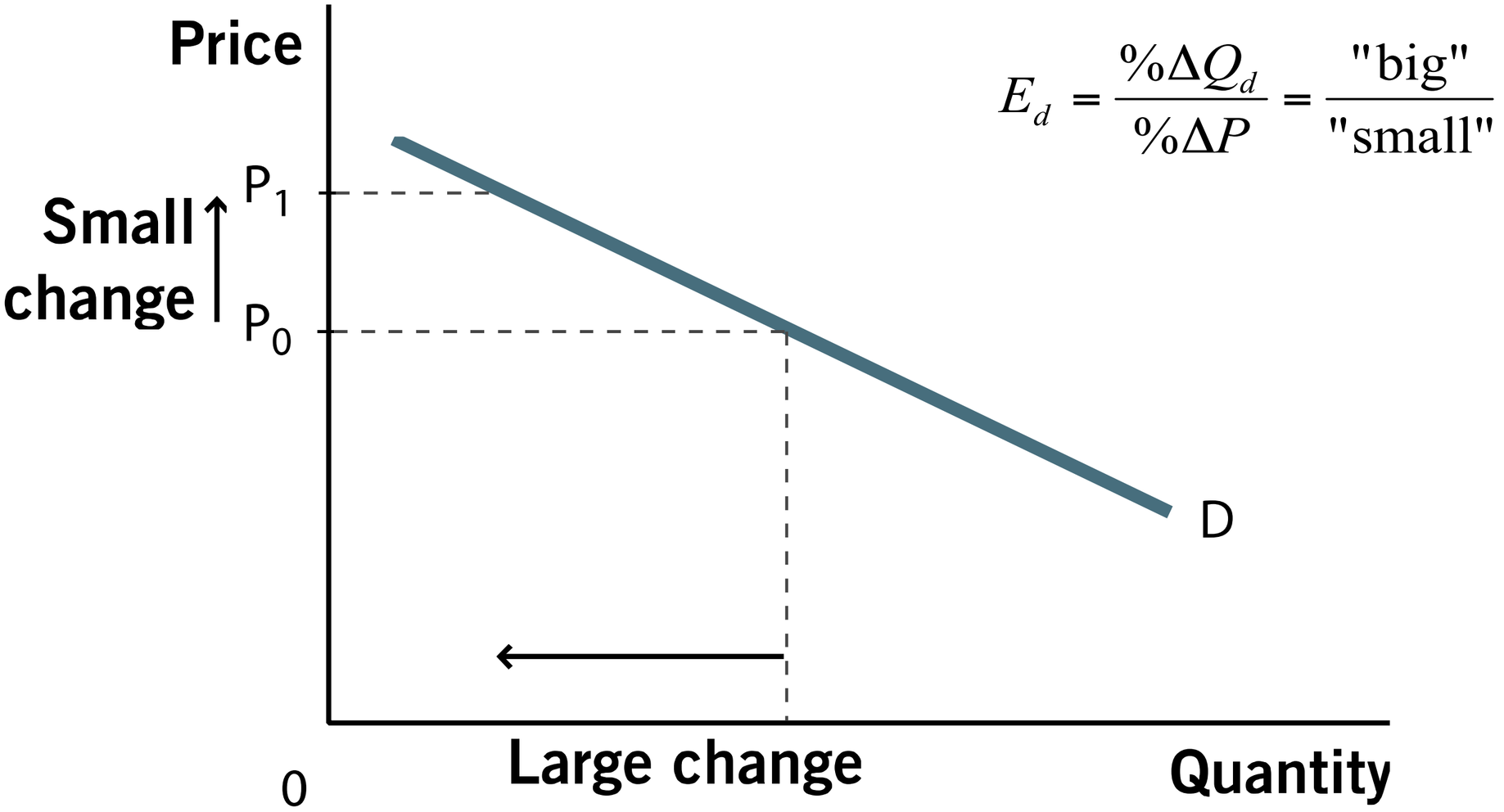
(a) Perfectly Inelastic

Graphing (Own) Price Elasticity



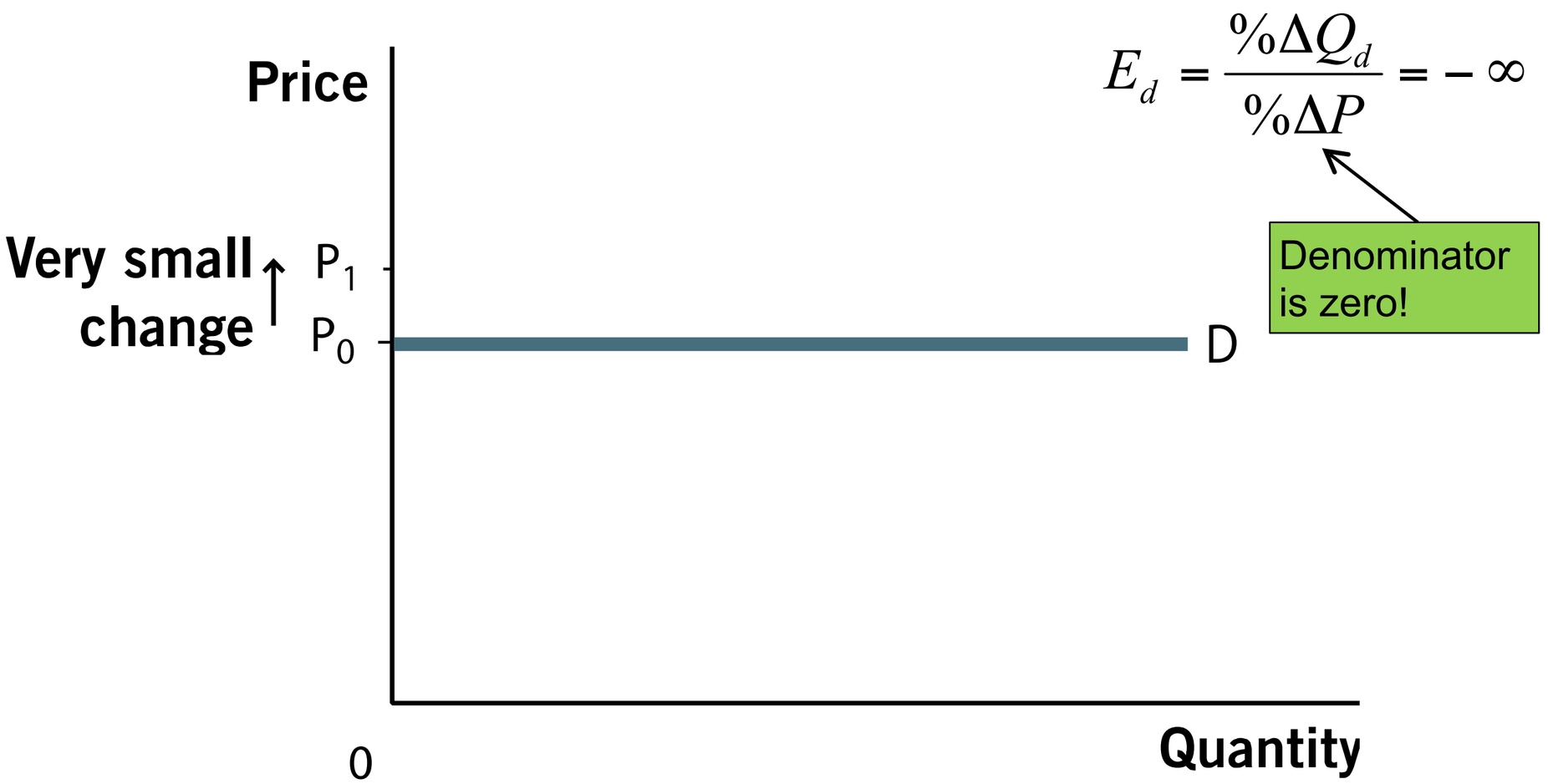
$$E_d = \frac{\%\Delta Q_d}{\%\Delta P} = \frac{\text{"small"}}{\text{"big"}}$$

Graphing (Own) Price Elasticity



$$E_d = \frac{\%\Delta Q_d}{\%\Delta P} = \frac{\text{"big"}}{\text{"small"}}$$

Graphing (Own) Price Elasticity



Remembering Own Price Elasticity

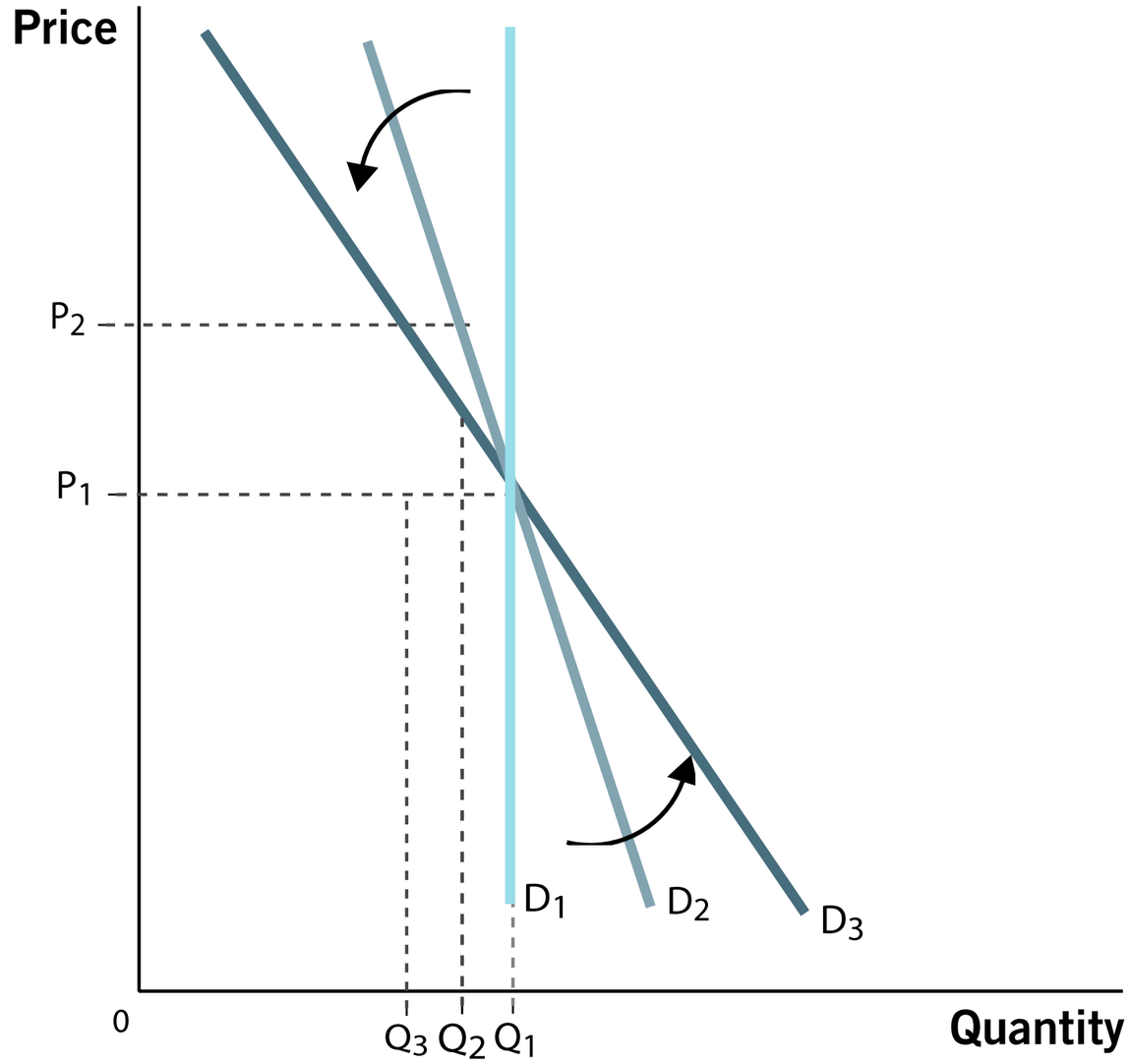
- Relatively shallow (flat) demand curves are relatively more elastic.
- Relatively steep demand curves are relatively more inelastic.
- Ways to remember:
  - Steep demand curve looks like the letter “I,” so it is “I”nelastic.
  - Steep demand curve has an almost “I”nfinite slope, and is “I”nelastic

Examples

$$E_d = \frac{\%\Delta Q_d}{\%\Delta P}$$

Elasticity	E_d coefficient	Interpretation	Example

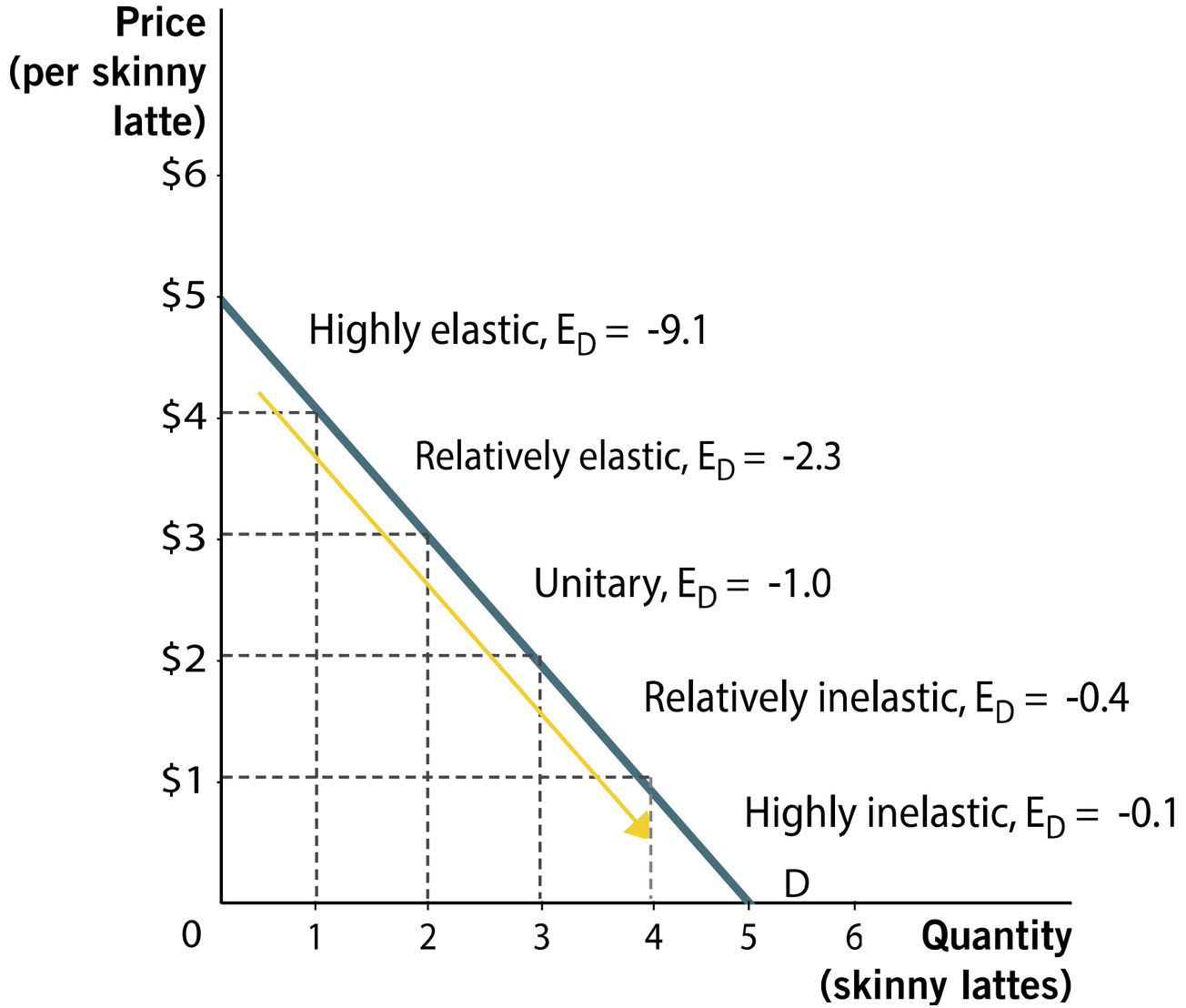
Time, Elasticity, and Demand Curve



Slope and Elasticity

- Elasticity and the slope of the demand curve are related, but are **NOT** the same.
- In fact, with a linear demand curve:
  - The slope will be the same at all points.
  - Elasticity will be different at all points.
  - Elasticity decreases (gets more inelastic) as we move down and right along a linear demand curve.

Slope ≠ Elasticity



Economics in *Jingle All the Way*

- Which good has the more relatively inelastic demand? Turbo Man or Booster?

https://www.youtube.com/watch?v=JpXKyo-ZeVI&feature=youtu.be

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Elasticity:
(Own) Price Elasticity of Demand and Revenue

Demand Elasticity and Total Revenues

- Demand elasticity changes along a linear demand function. Who cares?
- Elasticity is related to total revenues.
  - Firms are interested in increasing total revenues.
  - Firms will need to know whether to increase or decrease price to increase revenues.

- Total revenues = Price × Quantity Purchased
  - Graphically, this is a rectangle connecting the origin and a point on the demand curve.

Example

$$Q_d = 5 - P$$

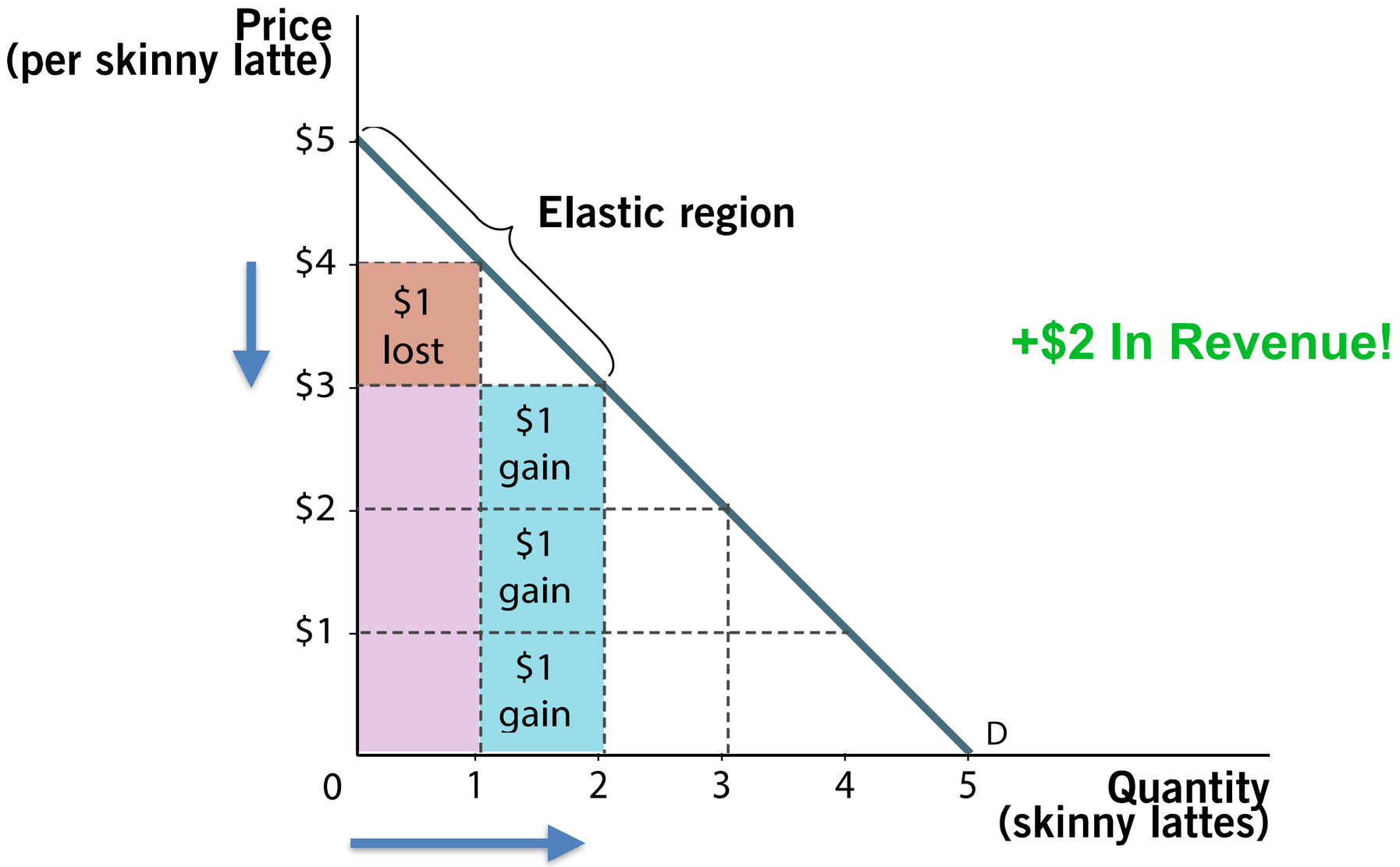
$$E_d = \frac{\%\Delta Q_d}{\%\Delta P}$$

P	Q_d	TR = (P) × (Q_d)	%ΔP	%ΔQ_d	E_d	Interpretation
$5	0	$0				
			-22%	200%	-9.1	*Highly elastic*
$4	1	$4				
			-29%	67%	-2.3	*Relatively elastic*
$3	2	$6				
			-40%	40%	-1.0	*Unitary*
$2	3	$6				
			-67%	29%	-0.4	*Relatively inelastic*
$1	4	$4				
			-200%	22%	-0.1	*Highly inelastic*
$0	5	$0				

Elasticity and Revenue

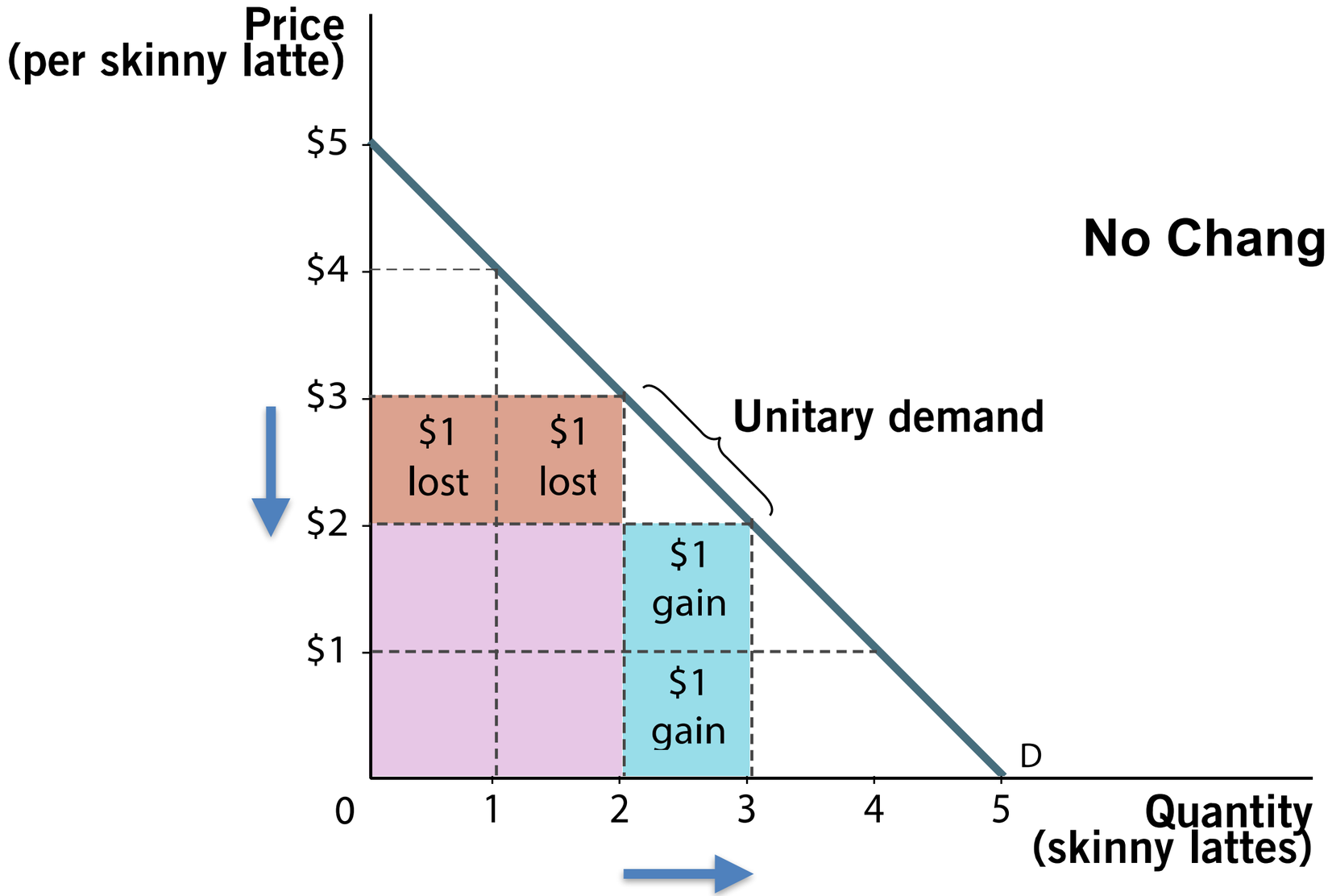
- The previous table illustrated that:
  - Revenue is related to elasticity.
  - Revenue is maximized at the unit elastic point on the linear demand function.
- Graphically, we can also show trade-offs when a firm changes the price of its good.
  - Increase price
    - Higher price per unit, but sell less units
  - Lower price
    - Lower price per unit, but sell more units

Total Revenue Trade-offs



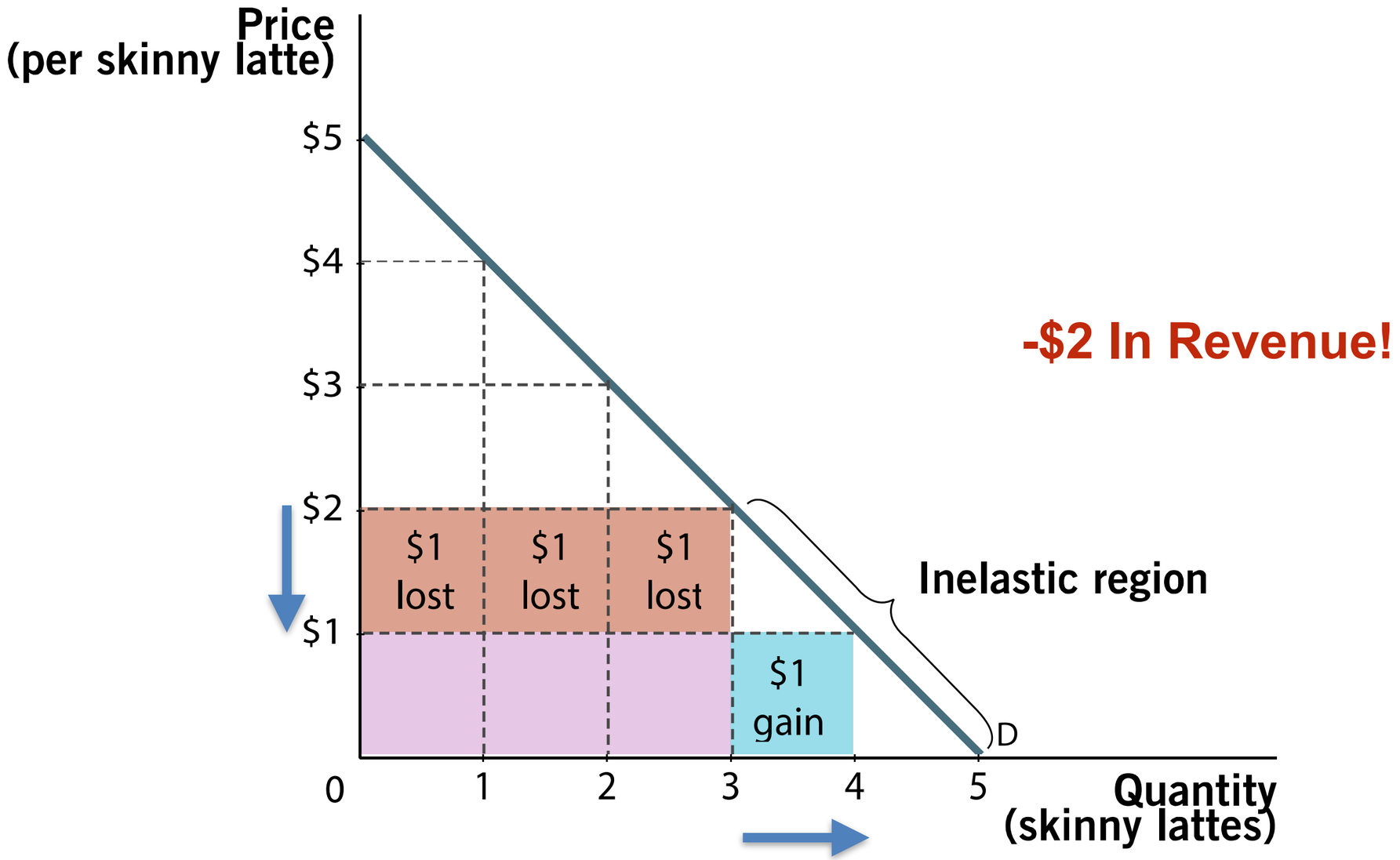
+$2 In Revenue!

Total Revenue Trade-offs



No Change In Revenue!

Total Revenue Trade-offs



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Elasticity:
Other Elasticity of Demand

Income Elasticity

- Changes in price
  - Cause a movement along a demand curve
  - Affect your consumption of a good
- Changes in income
  - Shift the demand curve
  - Also affects your consumption of a good
- Income elasticity
  - Responsiveness of the change in quantity purchased as a result of a change in income

Income Elasticity

$$E_I = \frac{\%\Delta Q_d}{\%\Delta I}$$

- Is this ratio positive or negative?
  - Income elasticity could be positive or negative, depending on the good.
  - If income elasticity is positive, there is also interest in whether it is a big or small positive number.

Income Elasticities

- Normal goods
  - Goods we purchase more of when income rises
- Inferior goods
  - Goods we purchase less of when income rises

- Normal goods fall into two categories:
  - Luxuries
    - Purchase a lot more when income rises
  - Necessities
    - Purchase a little more when income rises

Income Elasticities

$$E_I = \frac{\%\Delta Q_d}{\%\Delta I}$$

Type of good	Subcategory	Income elasticity	Example

Cross-Price Elasticity

- While studying demand determinants, we learned that two goods can be related.
- Recall the intuition of substitute and complement goods.
- Cross-price elasticity
  - Measures the responsiveness of the quantity demanded of one good to a change in the price of *another* good

$$E_C = \frac{\%\Delta Q_d(\text{A})}{\%\Delta P(\text{B})}$$

Cross-Price Elasticities

Relationship between goods	Cross-price elasticity	Example

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Elasticity:
Own-Price Elasticity of Supply

Own-Price Elasticity of Supply

- Producers of different goods have different sensitivities to changes in price.
- If the price of a good increases…
  - Will a firm produce a lot more of that good?
  - Will a firm increase production by only a small amount?
  - Why?
- Price elasticity of supply
  - Measure of the responsiveness of the quantity supplied to a change in price

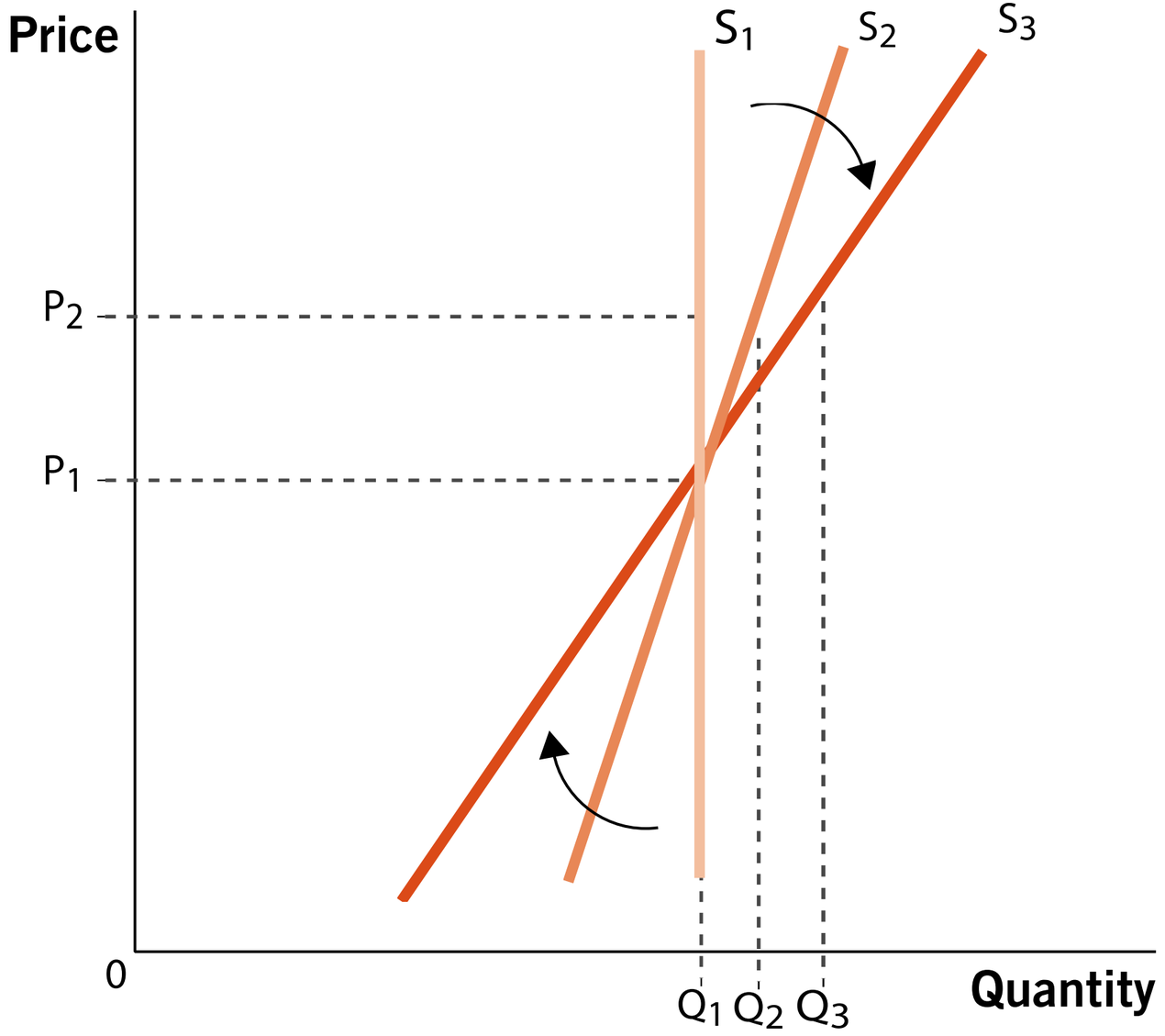
Own-Price Elasticity of Supply Determinants

- Flexibility of producers
  - More production flexibility implies more elastic supply.
    - Firms will be very responsive to changes in price.
  - A firm will have more production flexibility if it is able to:
    - Have extra capacity
    - Maintain inventory
    - Relocate easily

Own-Price Elasticity of Supply Determinants

- Time and adjustment process
  - Immediate run
    - Suppliers are stuck with what they have on hand; no adjustment.
  - Short run, long run
    - The more time that passes, the more the firm is able to adjust to market conditions.
    - Supply becomes more elastic over time.

Supply Elasticity over Time



Own-Price Elasticity of Supply

- Price elasticity of supply mathematically
  - Quantity supplied change as a result of a change in price

$$E_S = \frac{\%\Delta Q_S}{\%\Delta P}$$

- Will this ratio be positive or negative? Why?
  - Price elasticity of supply is positive because of the direct relationship between price and quantity supplied.

Supply Elasticity Examples

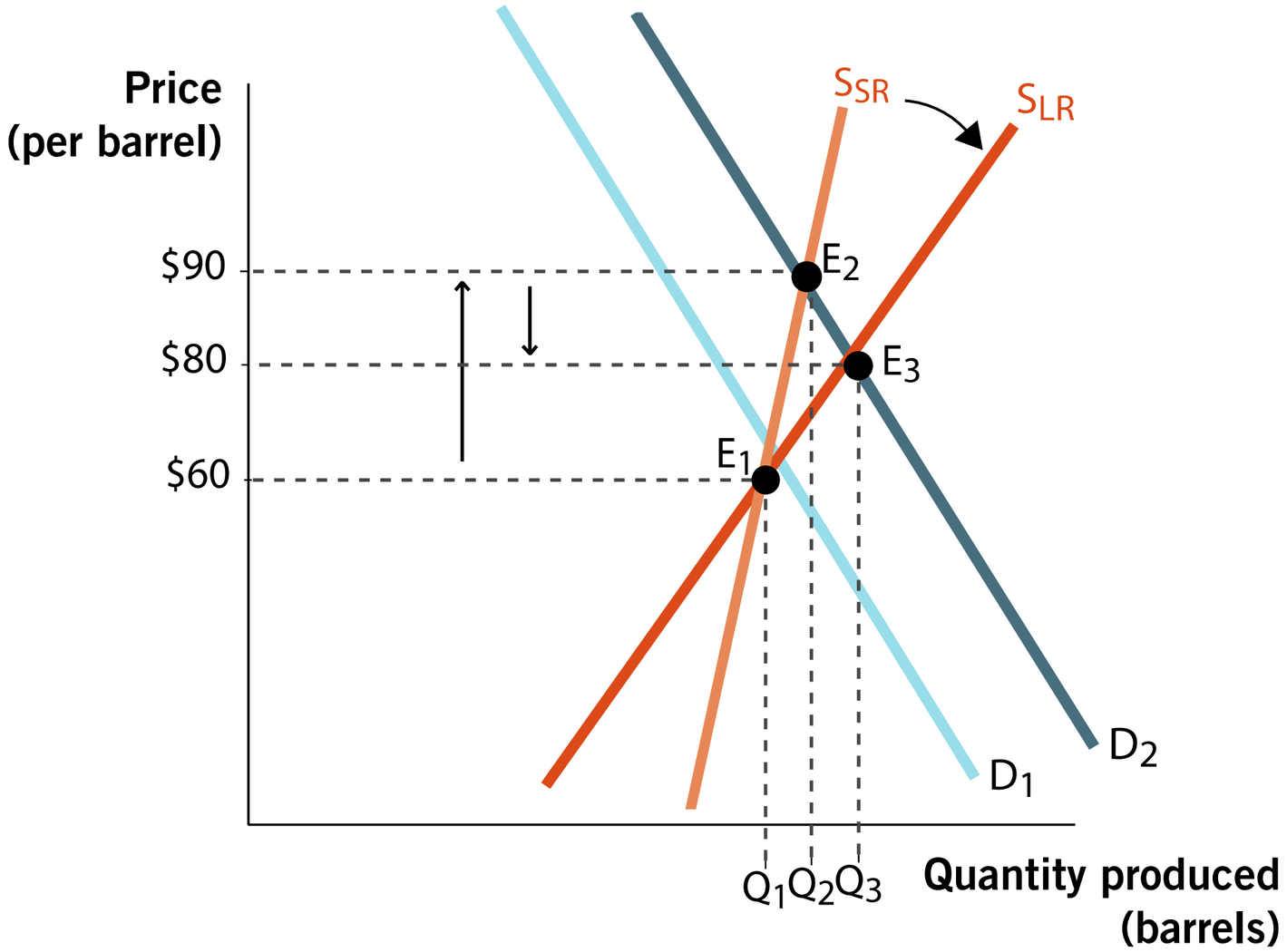
$$E_S = \frac{\%\Delta Q_S}{\%\Delta P}$$

Elasticity	Price elasticity of supply	Example

Combining Supply and Demand

- We’ve previously drawn shifts in demand and supply, and studied the changes in equilibrium price and quantity.
- How will the magnitude of the price and quantity change be affected if we change the demand or supply elasticity?

Oil Price Volatility



Conclusion

- Elasticity is a measure of sensitivity (responsiveness) between two variables.
- The ability to determine whether demand and supply are elastic or inelastic allows economists to calculate the effects of personal, business, and policy decisions.
- Understanding elasticity helps our economic model say much more about the world.