



# Supply, Demand and Markets

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# Economic Model

## Optimization

- Agents have **objects** they value
- Agents face **constraints**
- Make **tradeoffs** to maximize objectives within constraints



## Equilibrium

- Agents **compete** with others over **scarce** resources
- Agents **adjust** behaviors based on prices
- **Stable outcomes** when adjustments stop





# Markets

- Market is a broad concept
  - Any voluntary exchange between economic agents that leads to a transfer of ownership
  - Not a place
  - Not coerced
  - Clear transferable property rights
  - Only requires 2 'agents'
  - Doesn't have to be legal
  - Many types of institutions





# Competitive Markets

- Assumptions
  - Many buyers and sellers
  - Homogenous product
  - No barriers to entry
  - Perfect information
- Buyers and sellers have little market power
  - each buyer's or seller has a negligible effect on the market price





# Equilibrium Analysis: Questions to Answer

Where do prices come from?

How do they change?

How consumers and  
producers respond to  
changes?

What are the implications of  
different policies?





# Equilibrium Analysis

- An **equilibrium** is an allocation of resources such that no individual has an incentive to alter their behavior
- In markets: "**market-clearing**" prices where quantity supplied equals quantity demanded





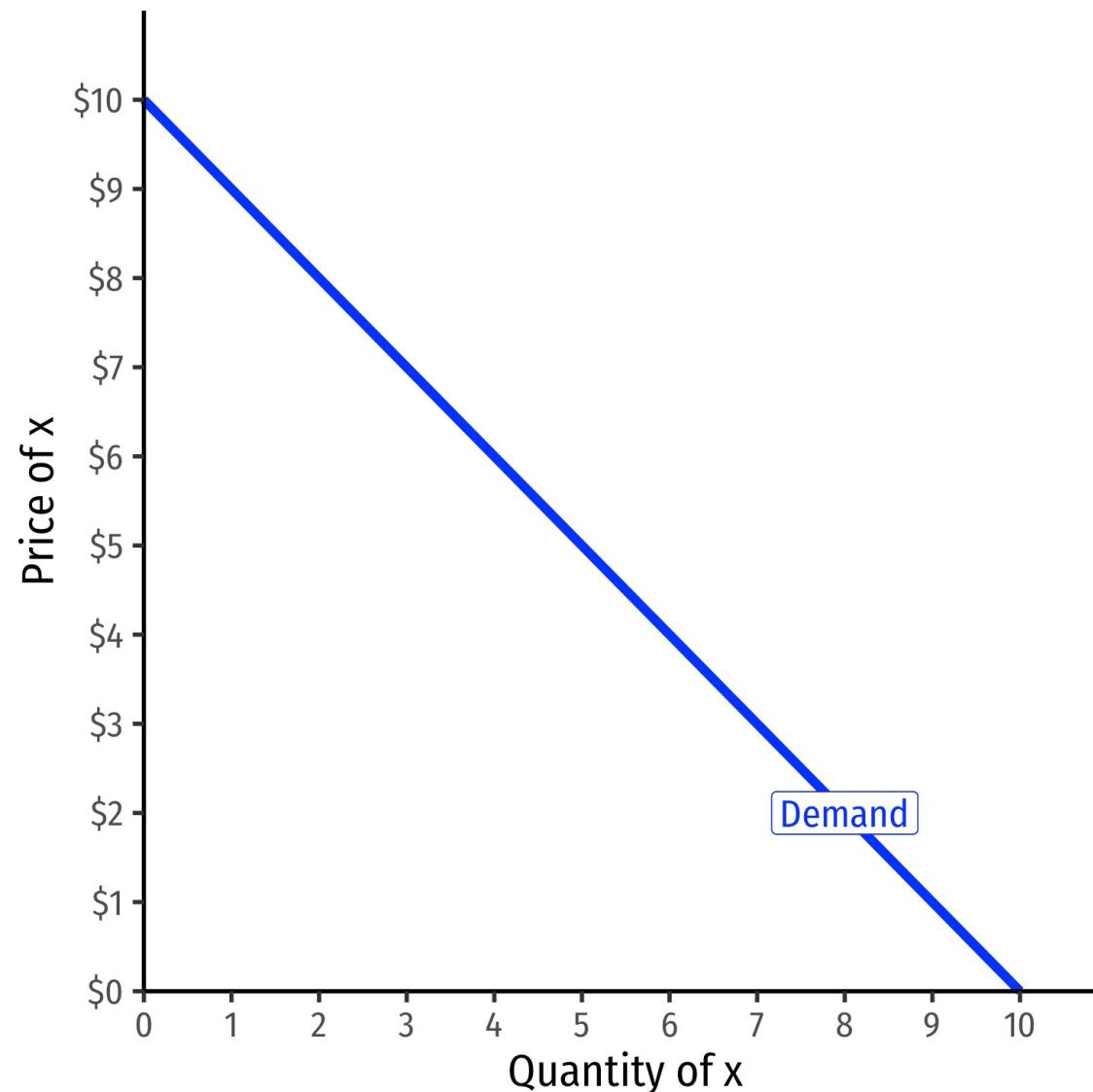
# Partial Equilibrium Analysis

- We will only look at "**partial equilibrium**" in a single market
- Changes in one market often affect other markets, affecting the "**general equilibrium**"





# (Inverse) Demand Function



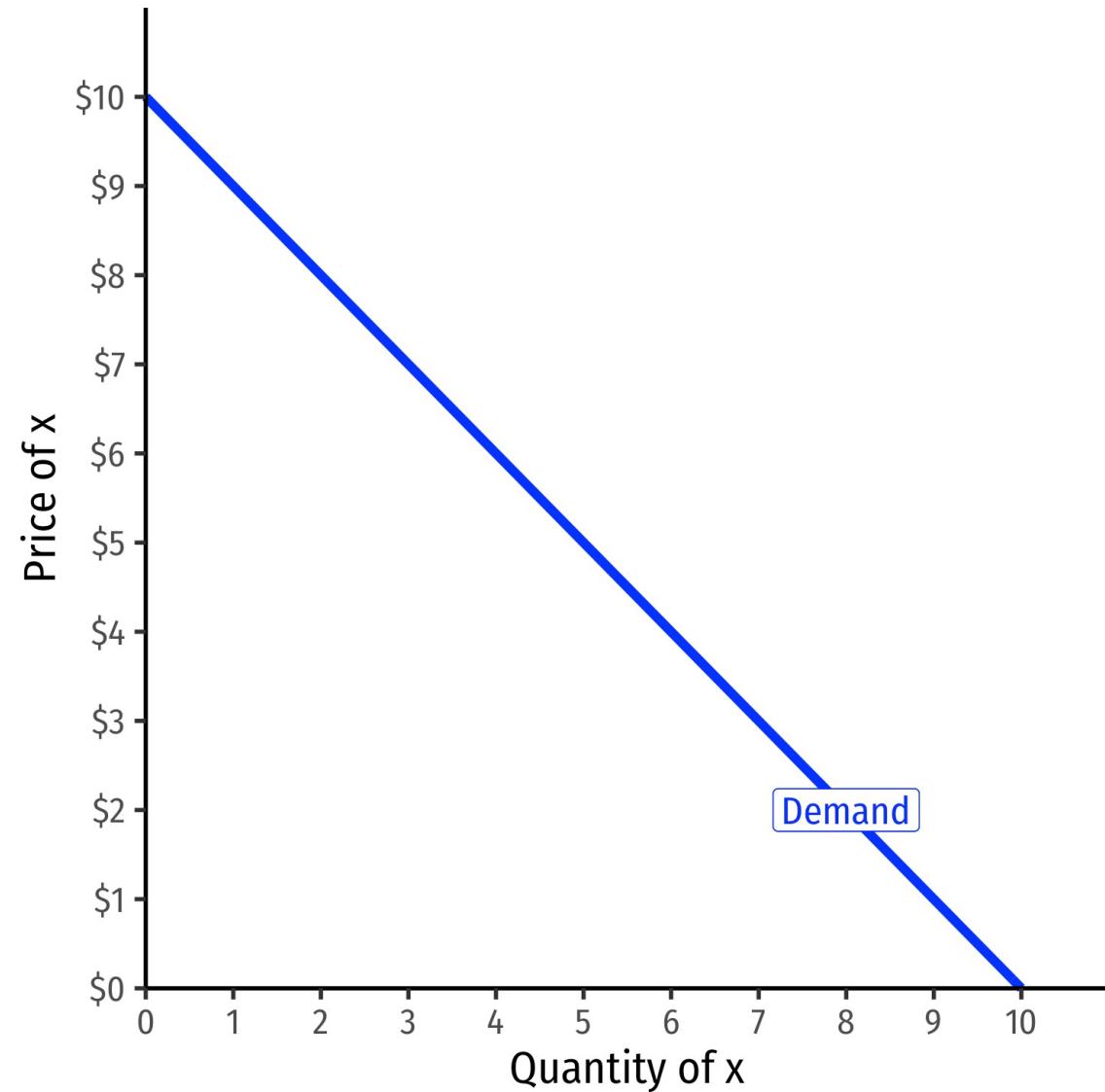


# (Inverse) Demand Function

Read two ways:

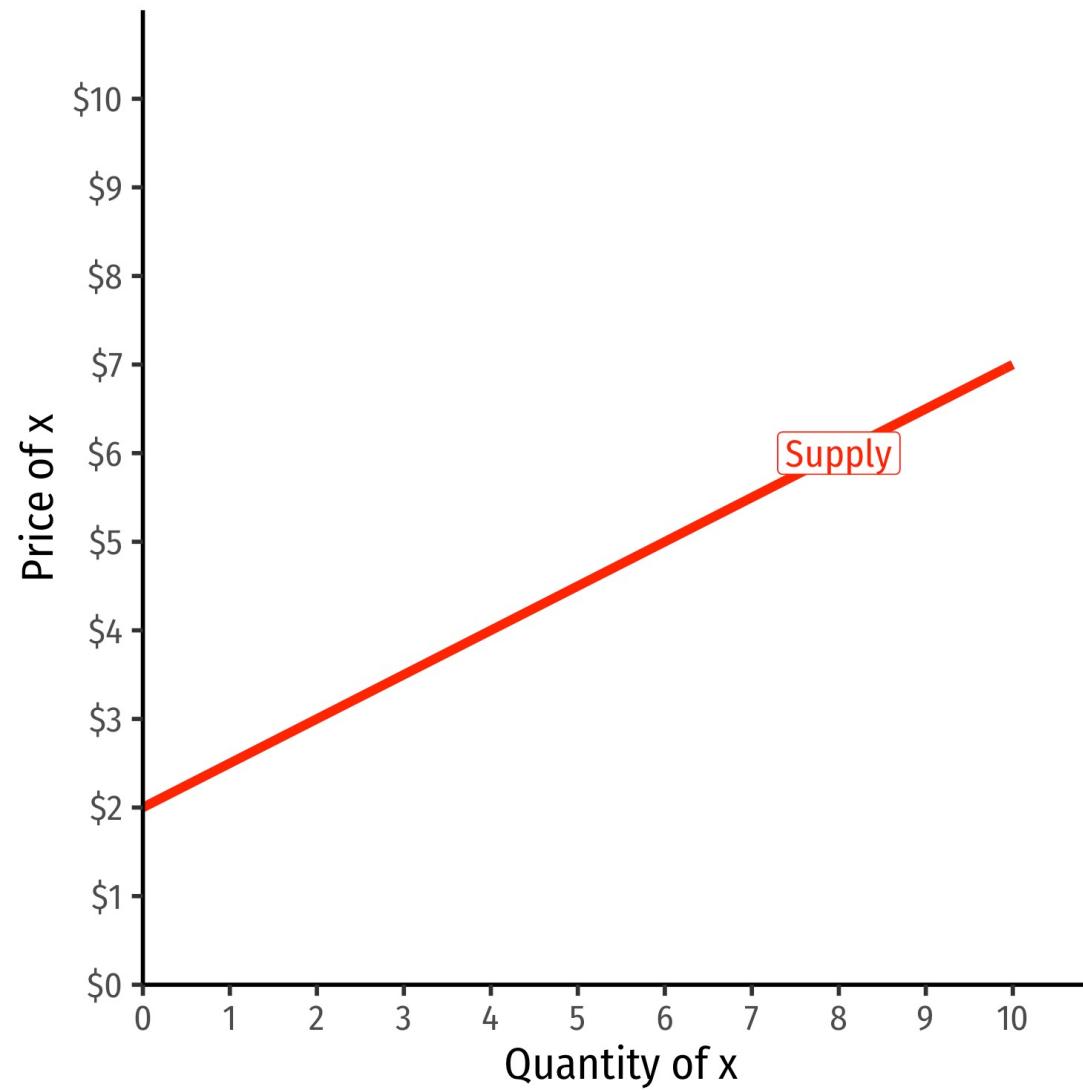
Horizontally: at any given price, how many units person wants to buy

Vertically: at any given quantity, the **maximum willingness to pay (WTP)** for that quantity





# (Inverse) Supply Function



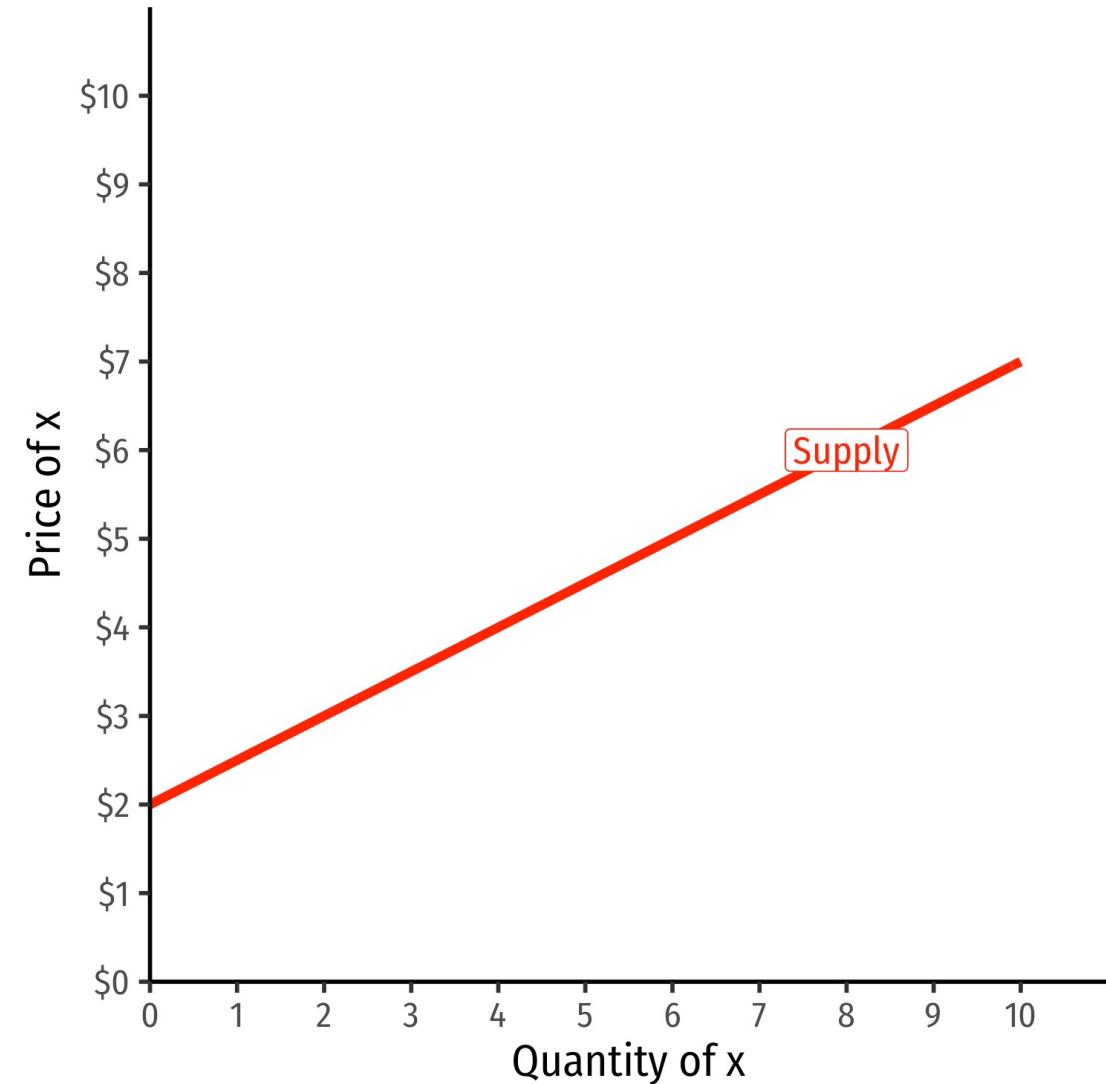


# (Inverse) Supply Function

Read two ways:

Horizontally: at any given price, how many units firm wants to sell

Vertically: at any given quantity, the **minimum willingness to accept (WTA)** for that quantity

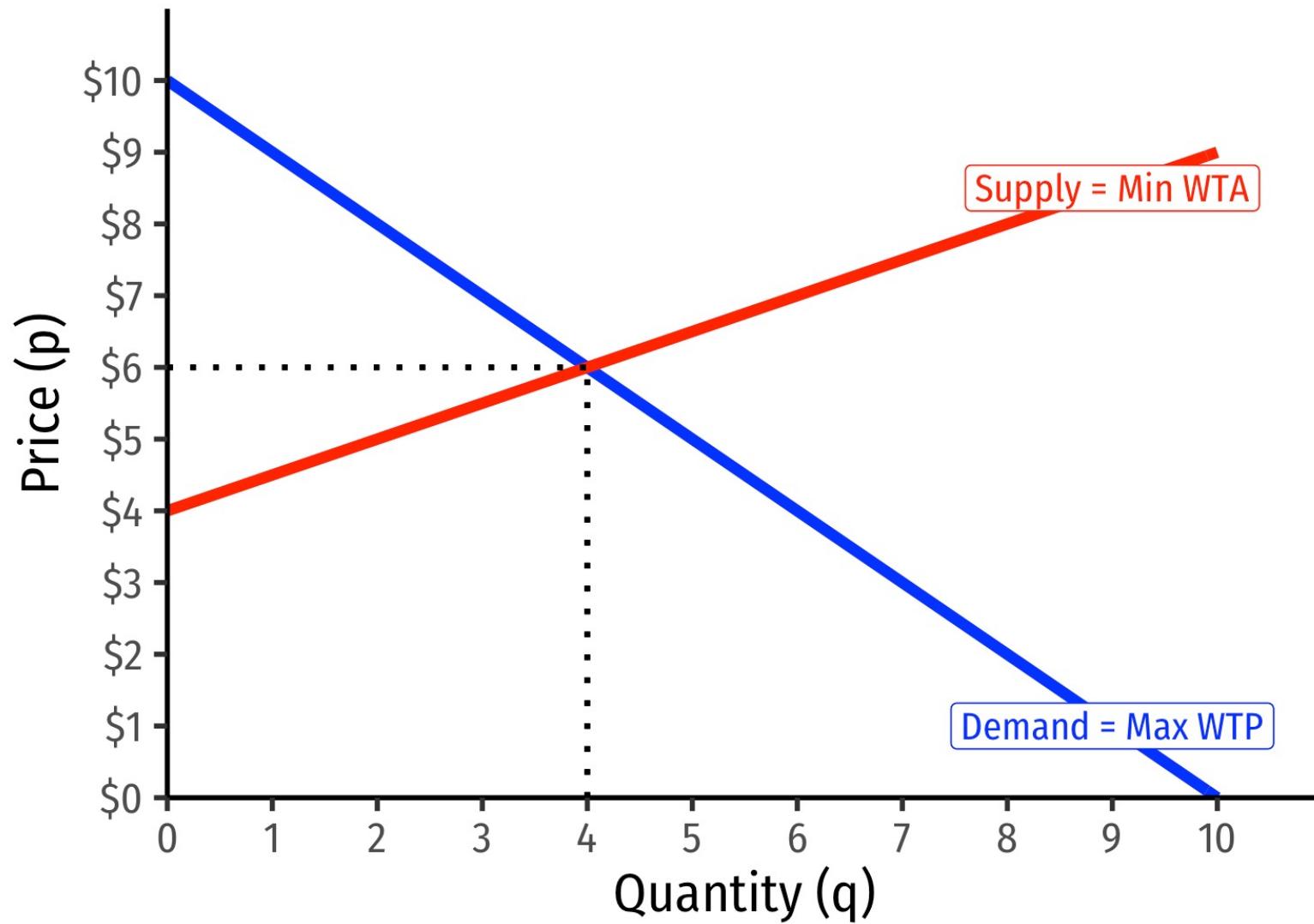




# Equilibrium

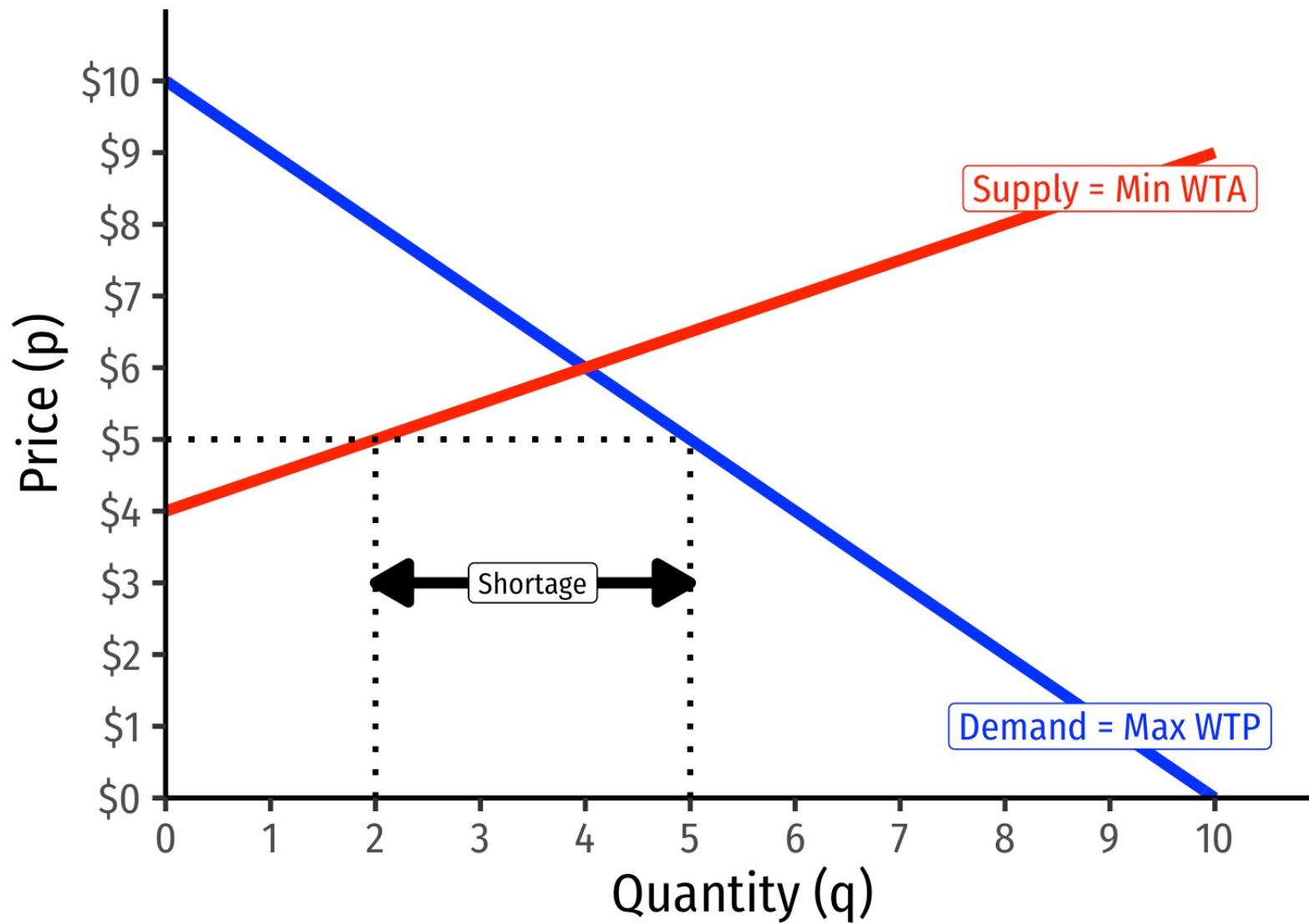


# Equilibrating



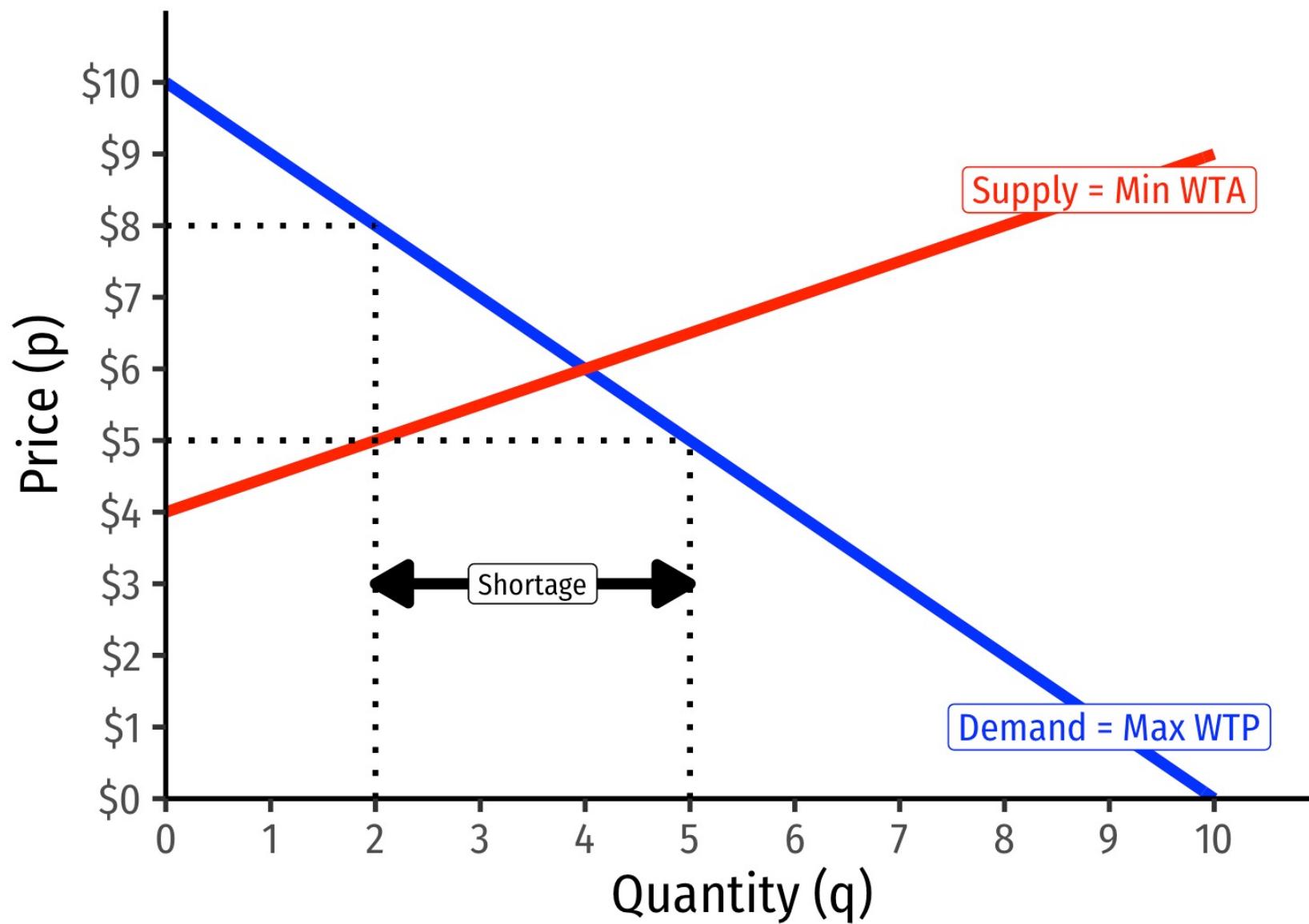


# Equilibrating



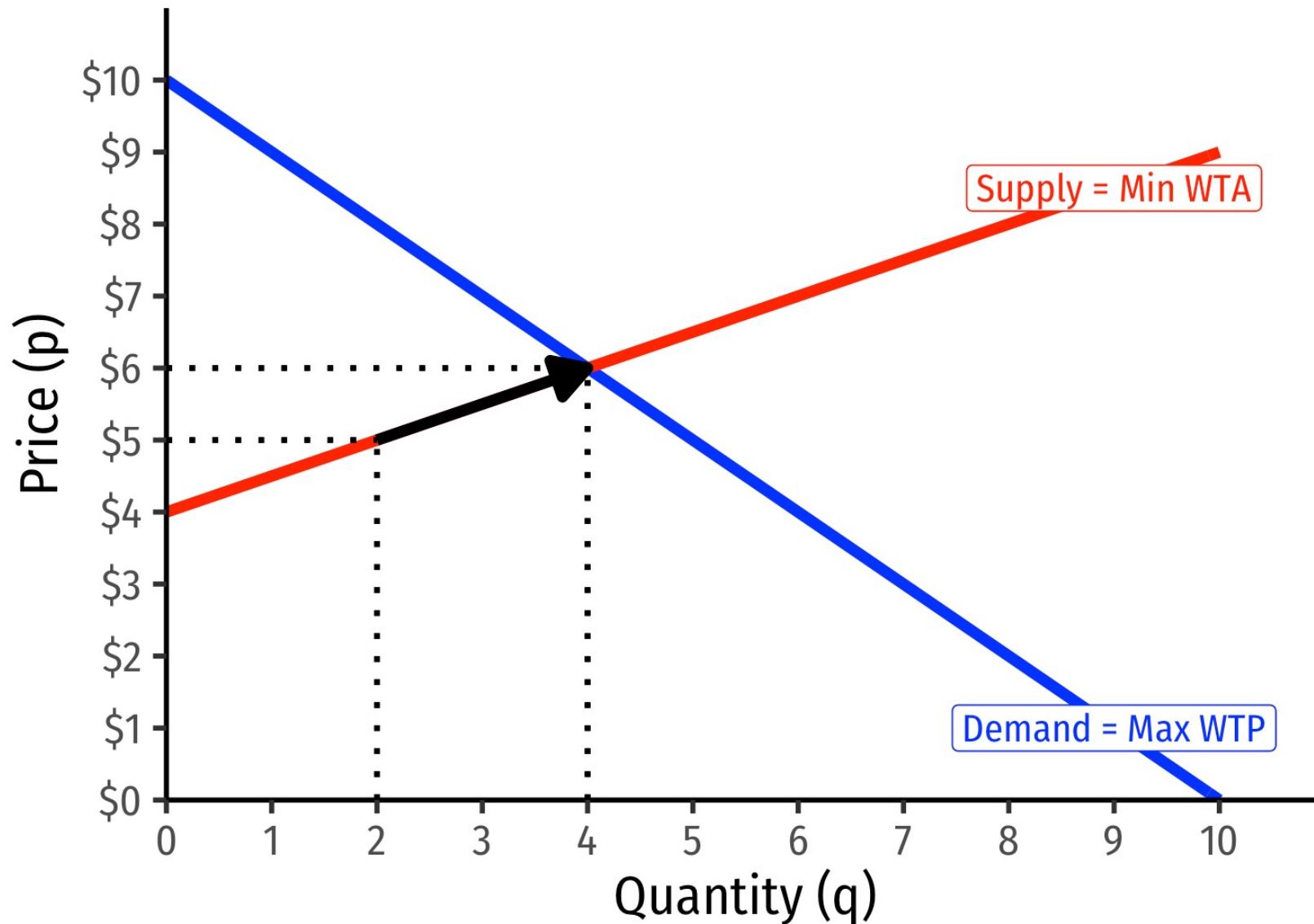


# Equilibrating



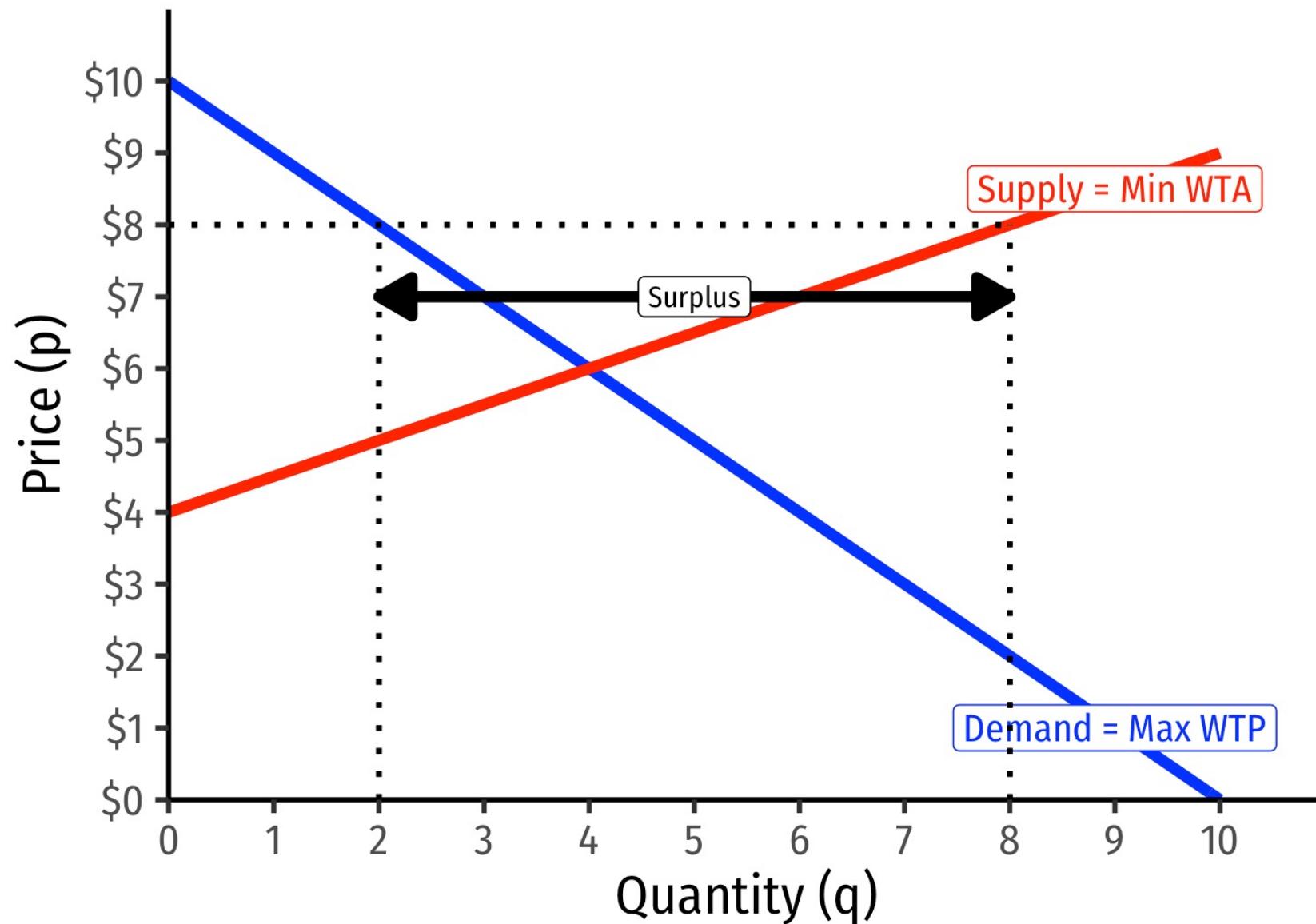


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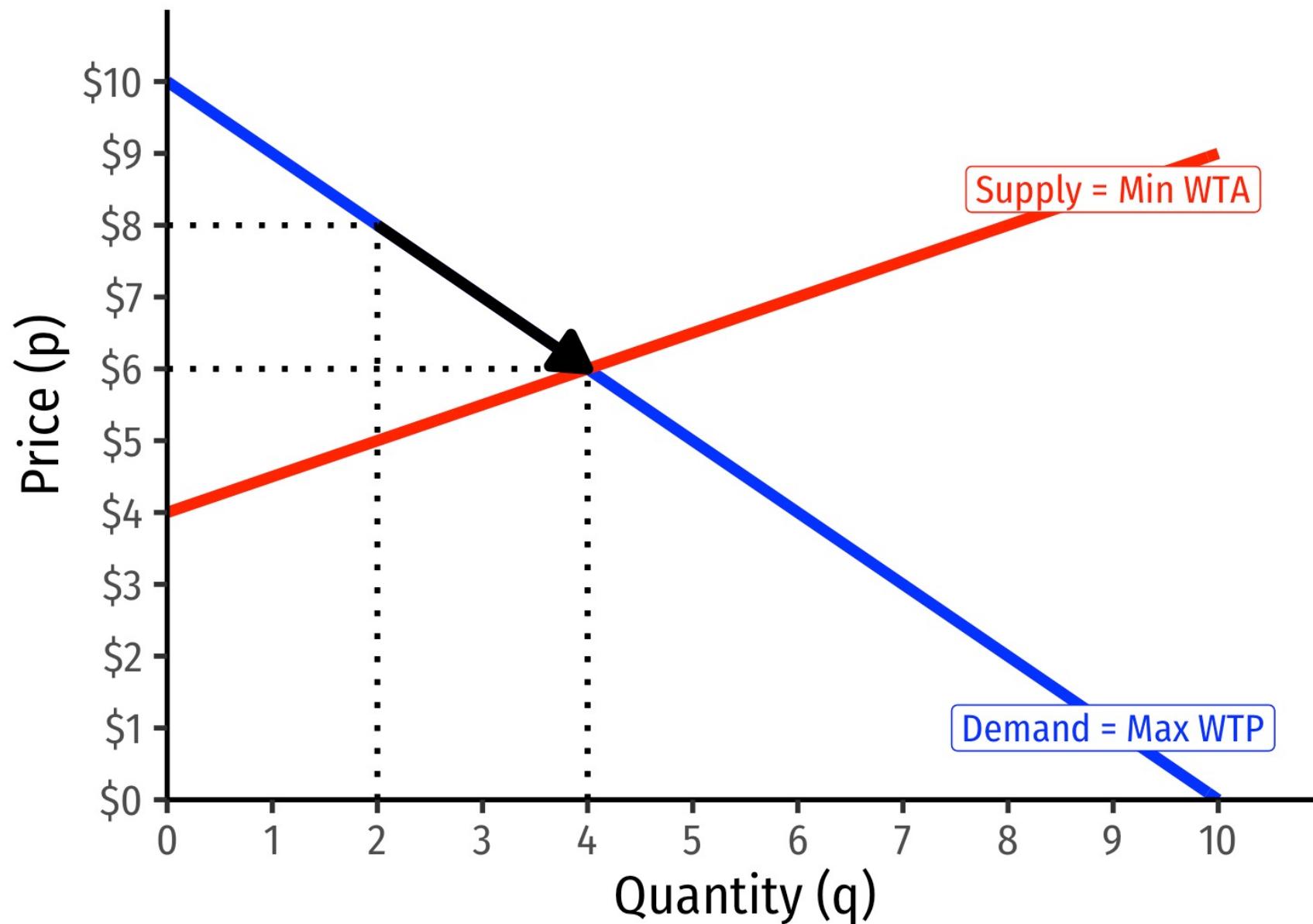


# Equilibrating





# Equilibrating



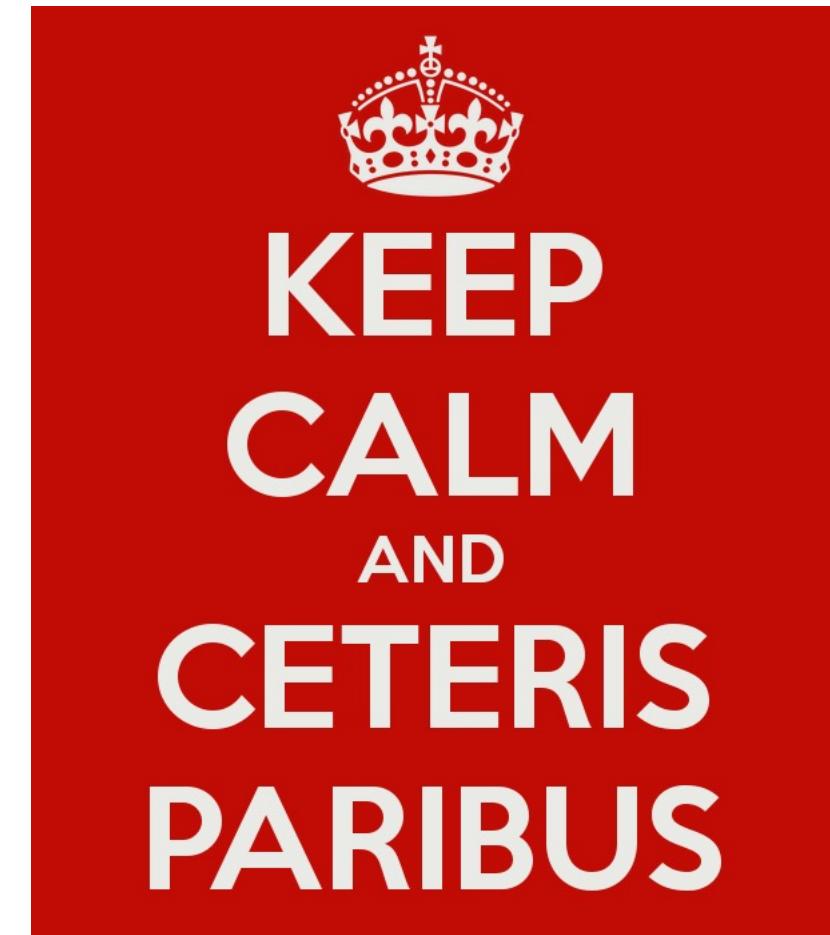


# Comparative Statics



## Ceteris Paribus

- Supply function and demand function **only** relate quantity (supplied or demanded) to price
  - Describes how buyers/sellers respond to changes in **market price**
- Many other factors that influence decisions
  - Incomes, preferences, etc.





## Recall, A Demand Function

- The **consumer's demand for good x**

$$q_x^D = q_x^D(m, p_x, p_y)$$

- How does **demand for x** change?

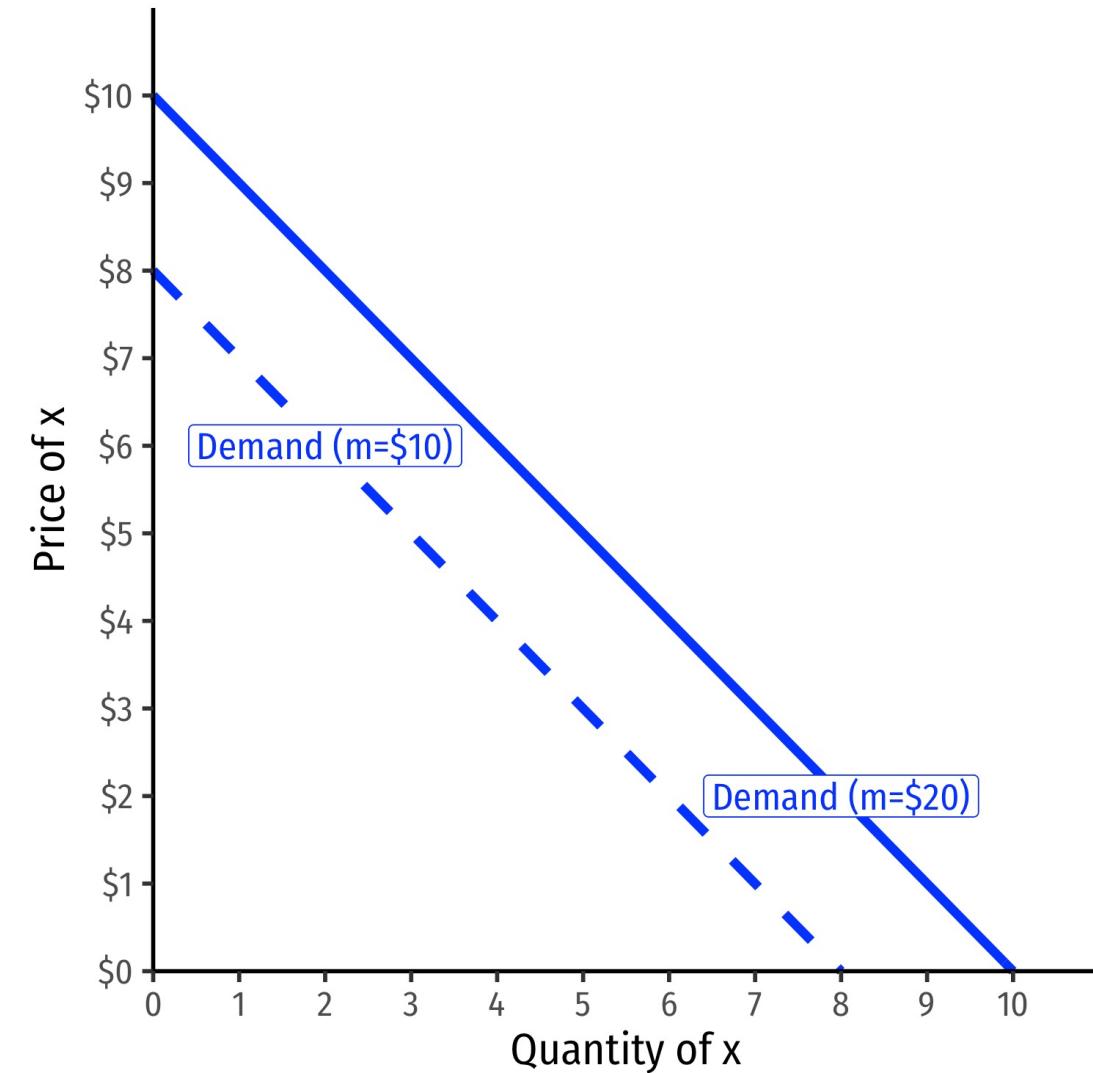
- Income effects =  $\frac{\Delta q_x^D}{\Delta m}$
- Cross-price effects =  $\frac{\Delta q_x^D}{\Delta p_y}$
- Own price effects =  $\frac{\Delta q_x^D}{\Delta p_x}$





## Shifts in Demand

- A change in one of the "determinants of demand" will **shift** demand curve!

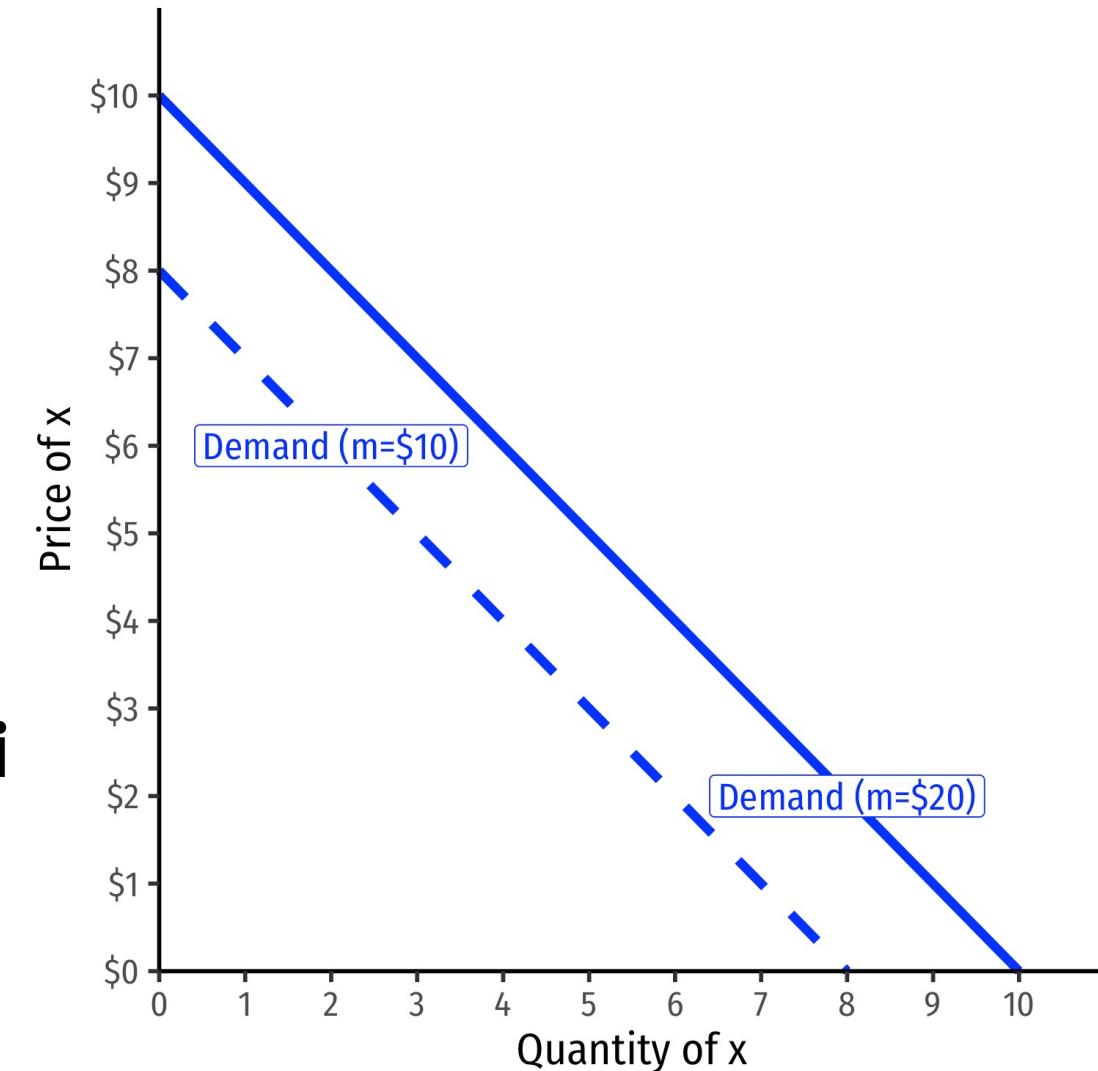




## Shifts in Demand

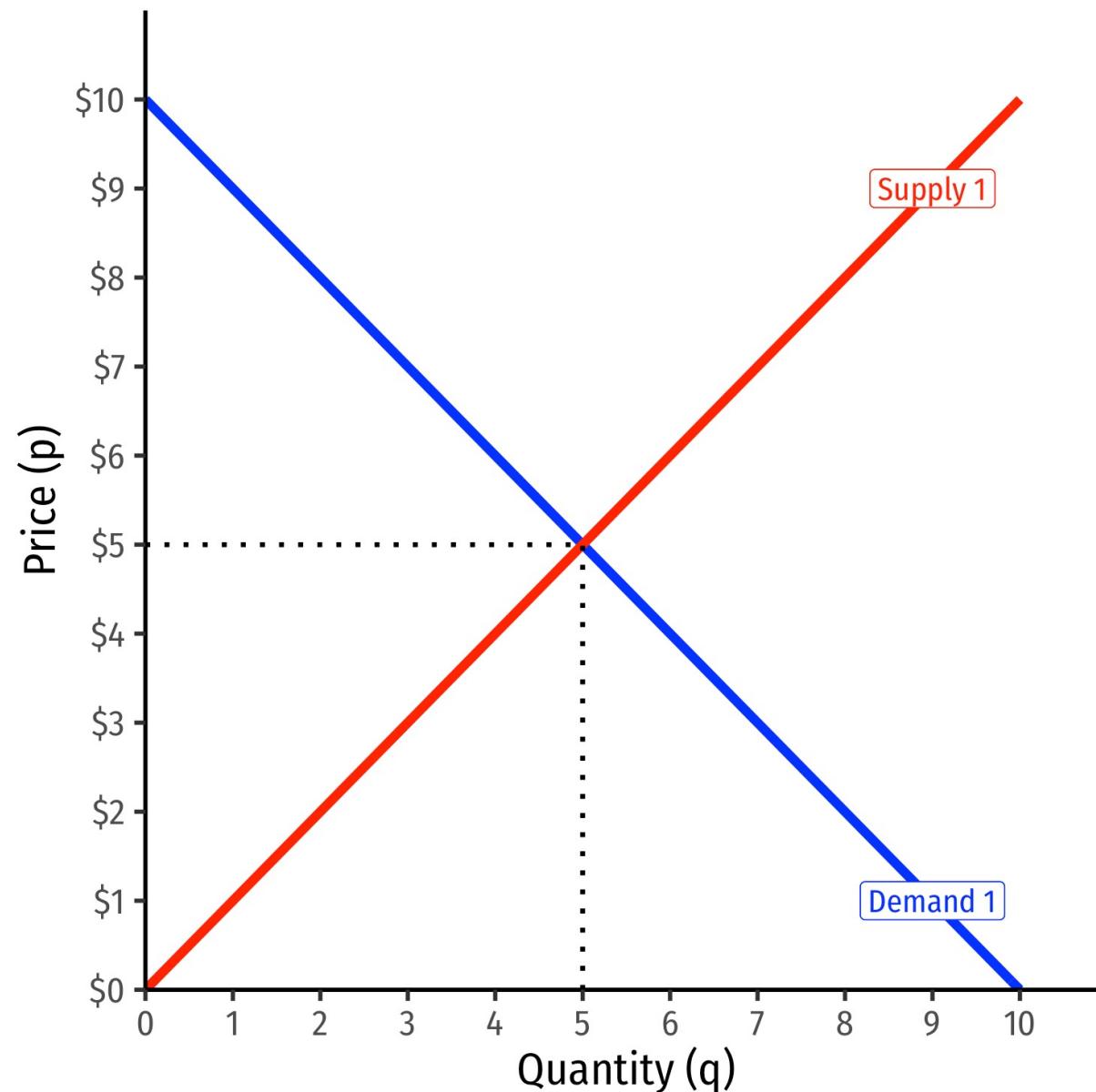
- A change in a "**determinant of demand**" will **shift** demand curve!

- 1) Change in **income**  $m$
- 2) Change in **price of other goods**  $p_y$  (substitutes or complements)
- 3) Change **preferences** or **expectations** for good  $x$
- 4) Change in **number of buyers**



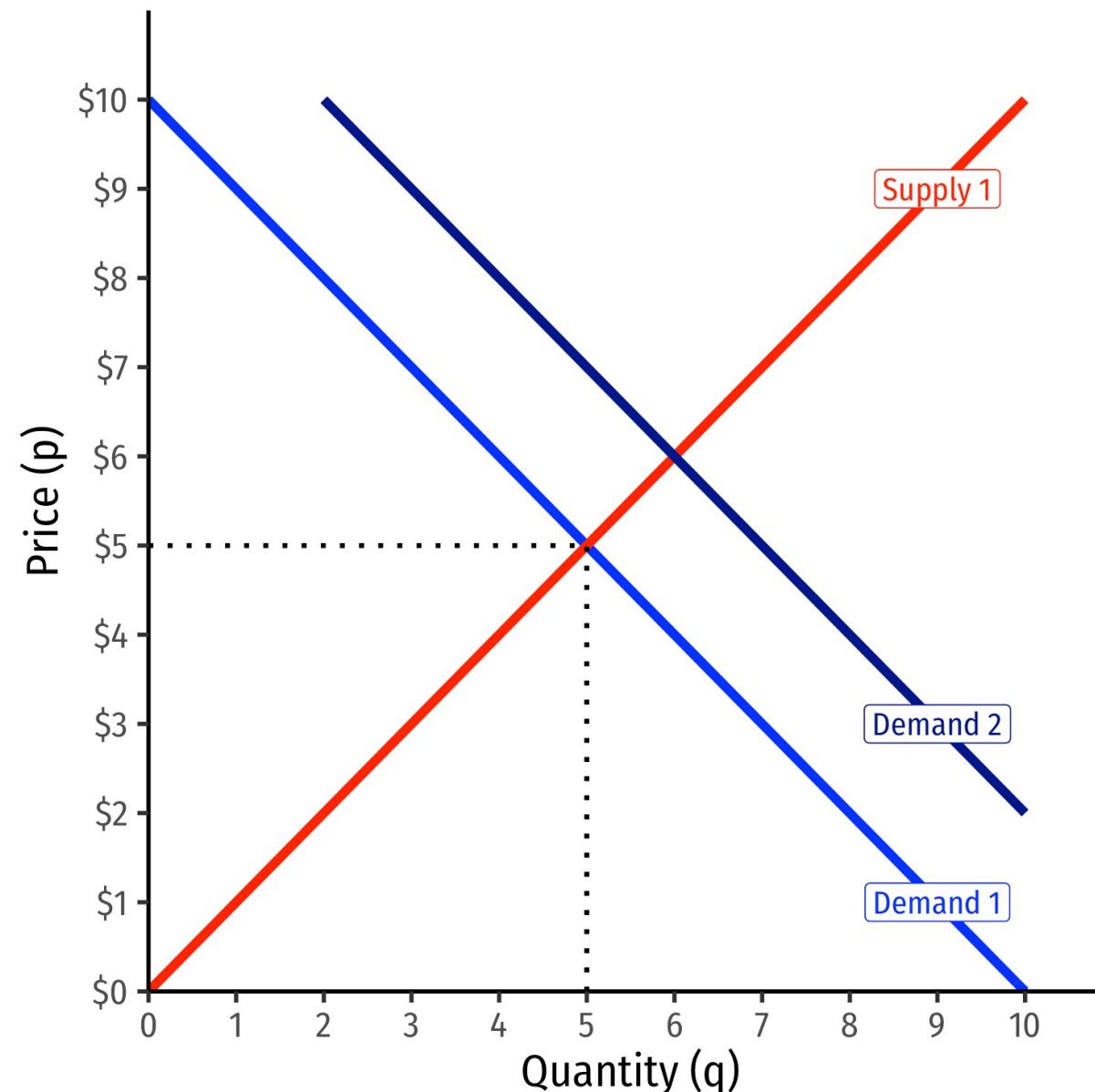


# Increase in Demand



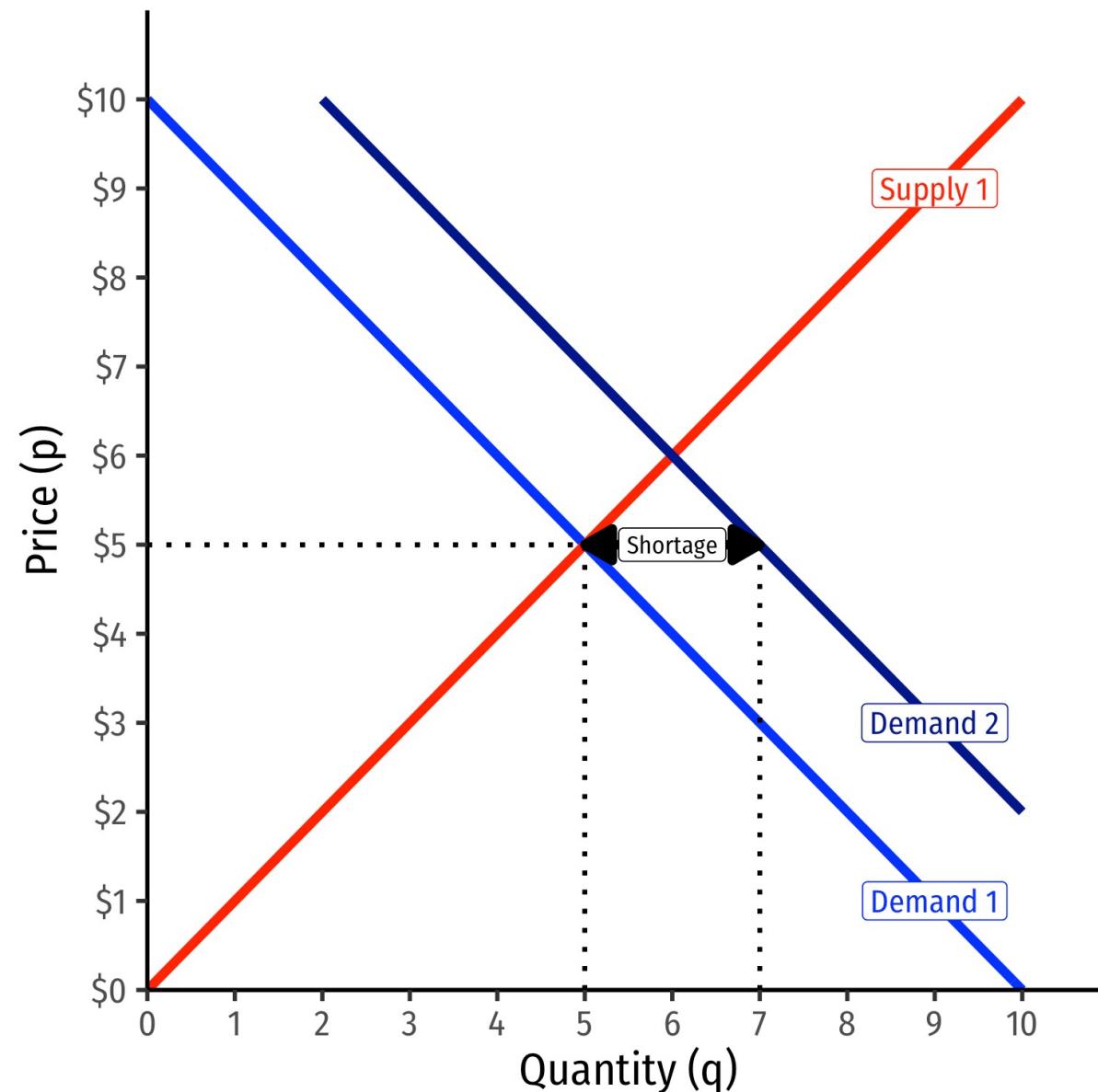


# Increase in Demand



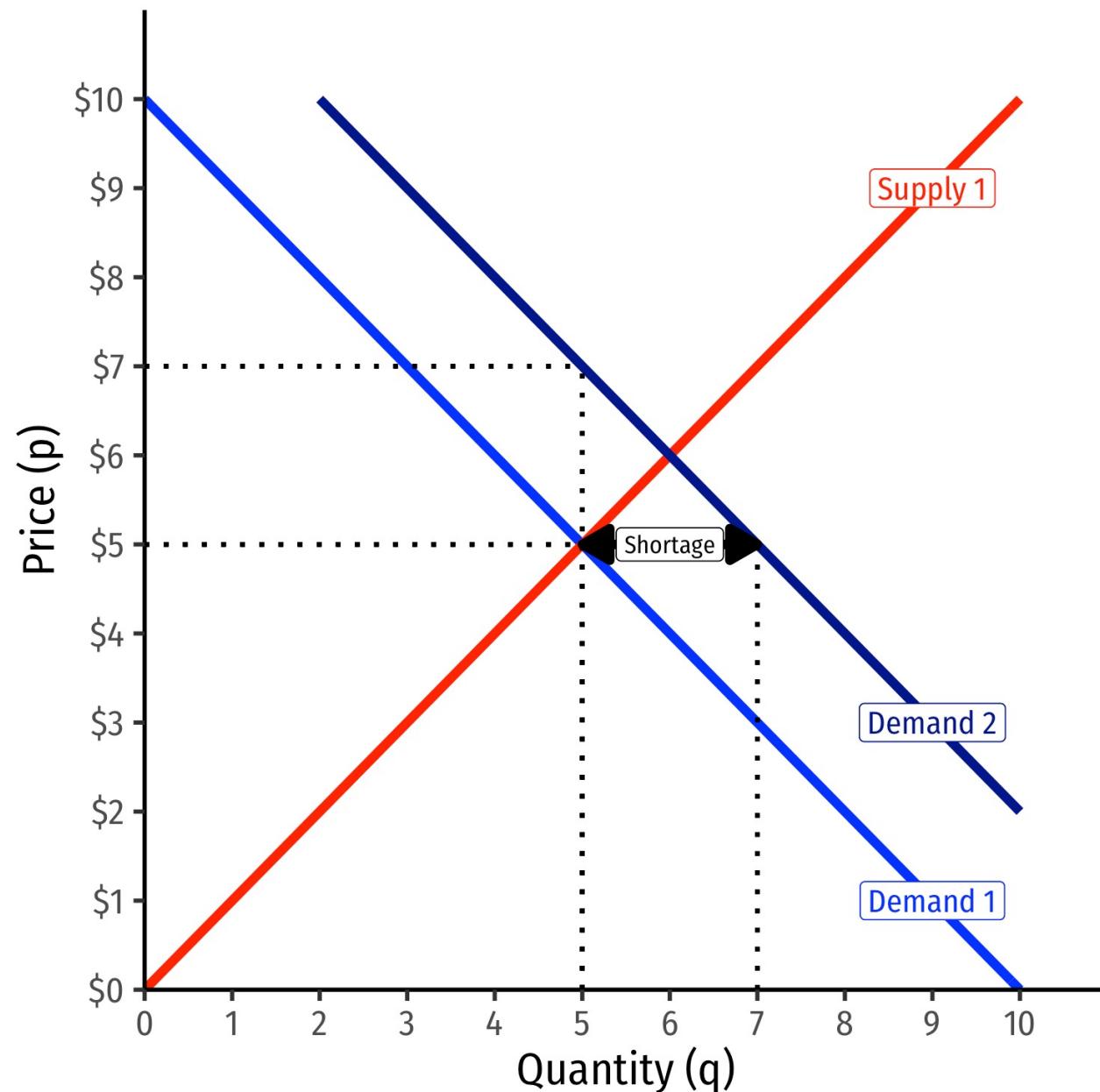


# Increase in Demand



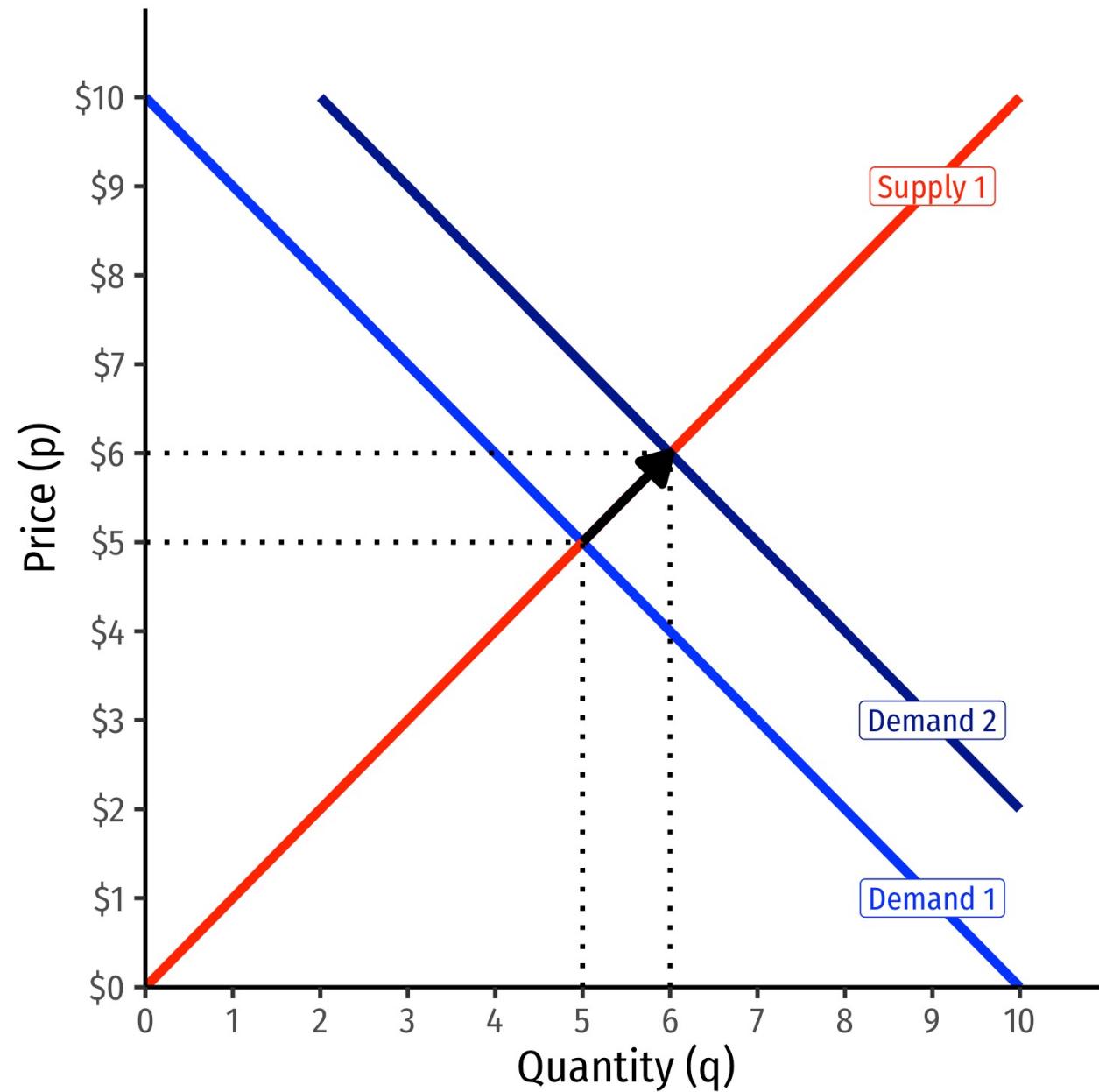


# Increase in Demand



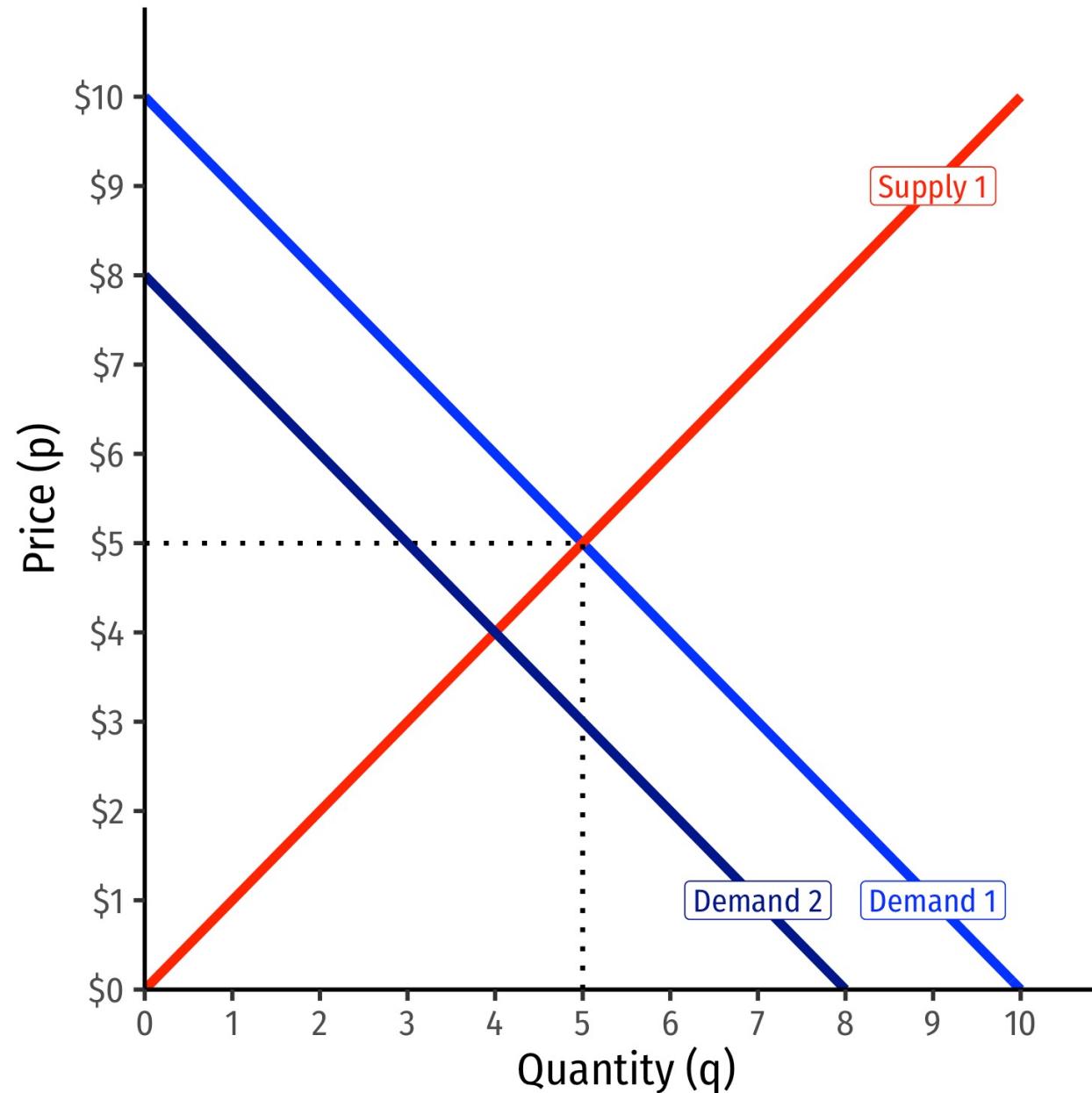


# Increase in Demand



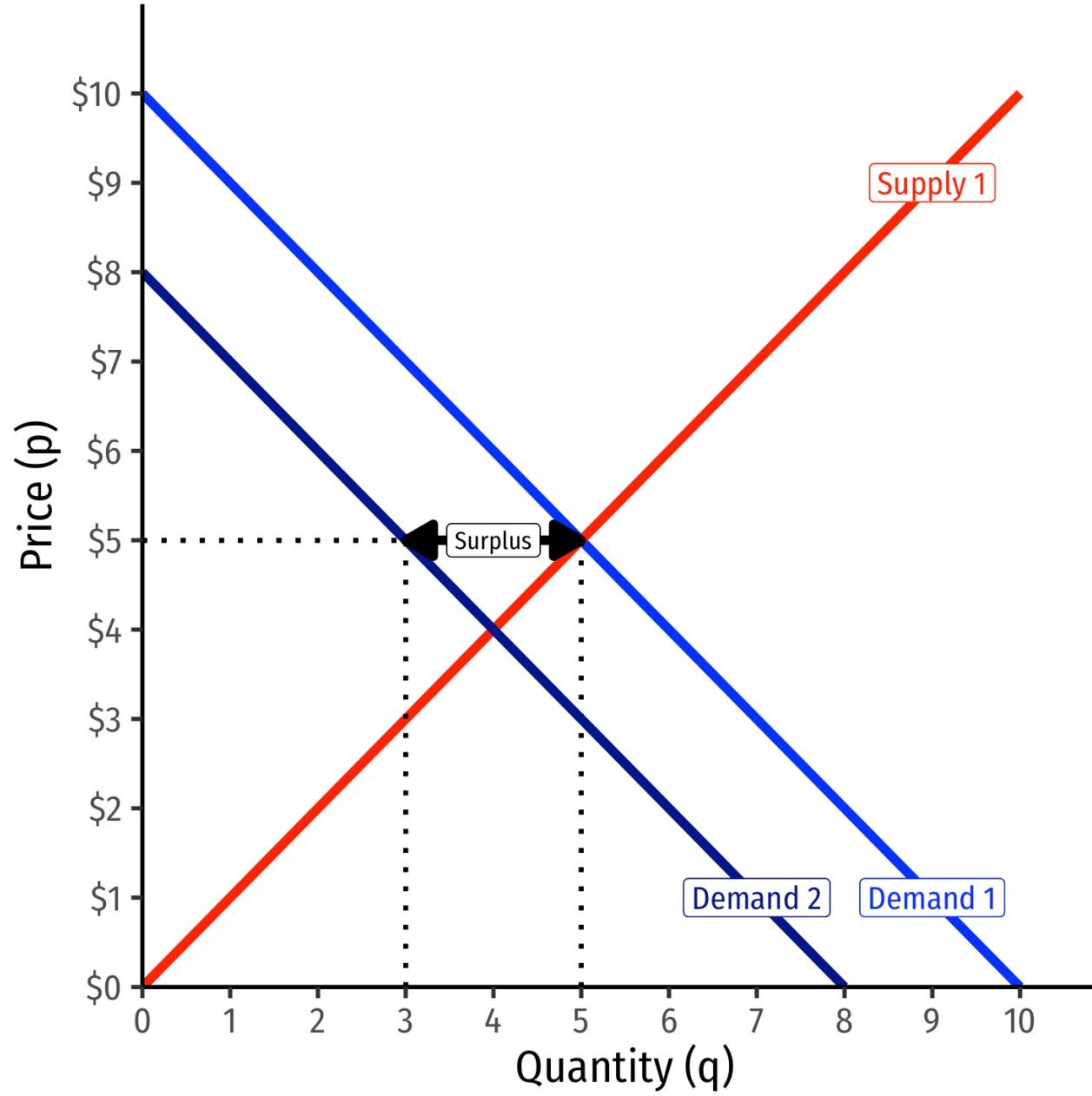


# Decrease in Demand



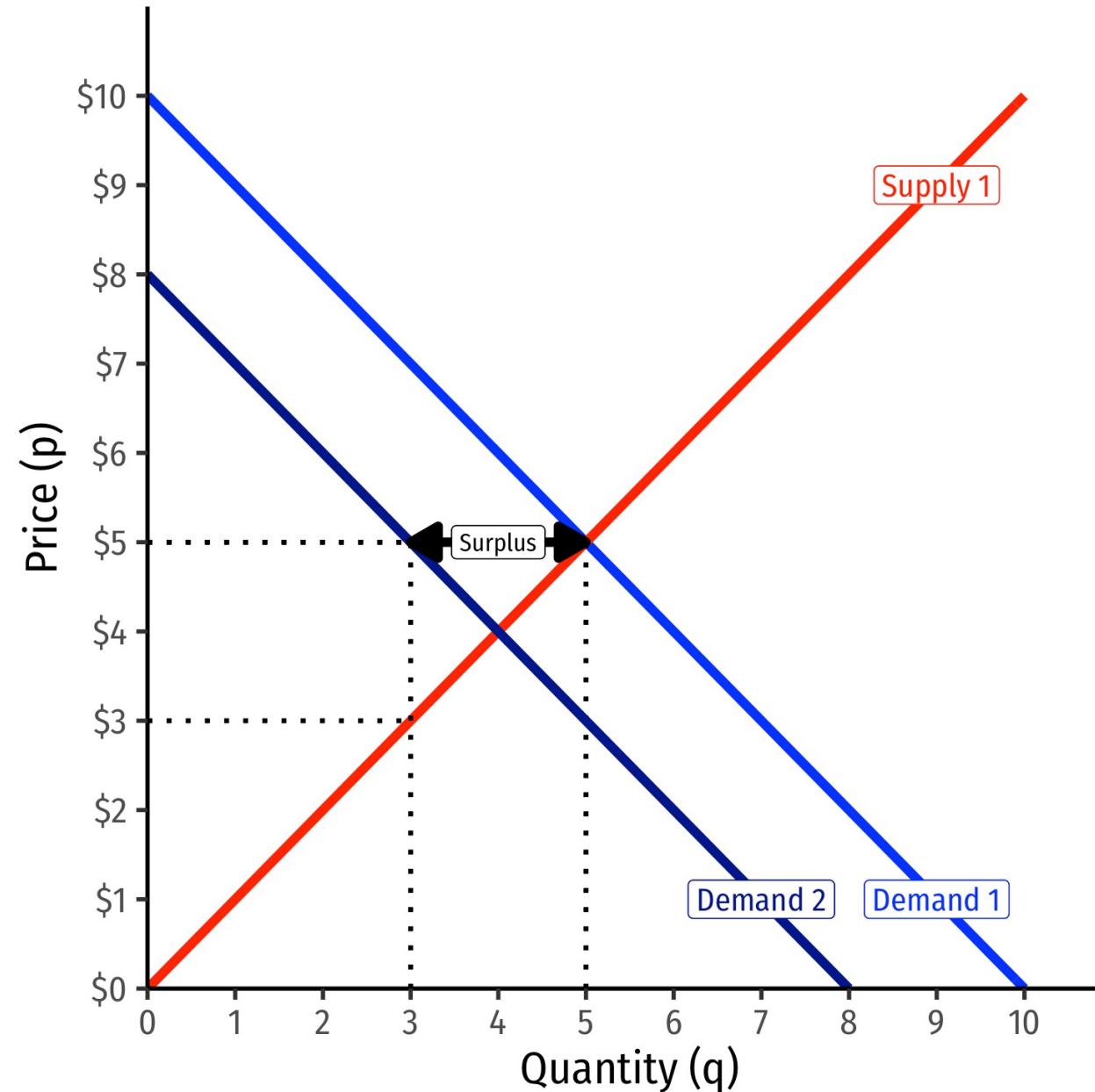


# Decrease in Demand



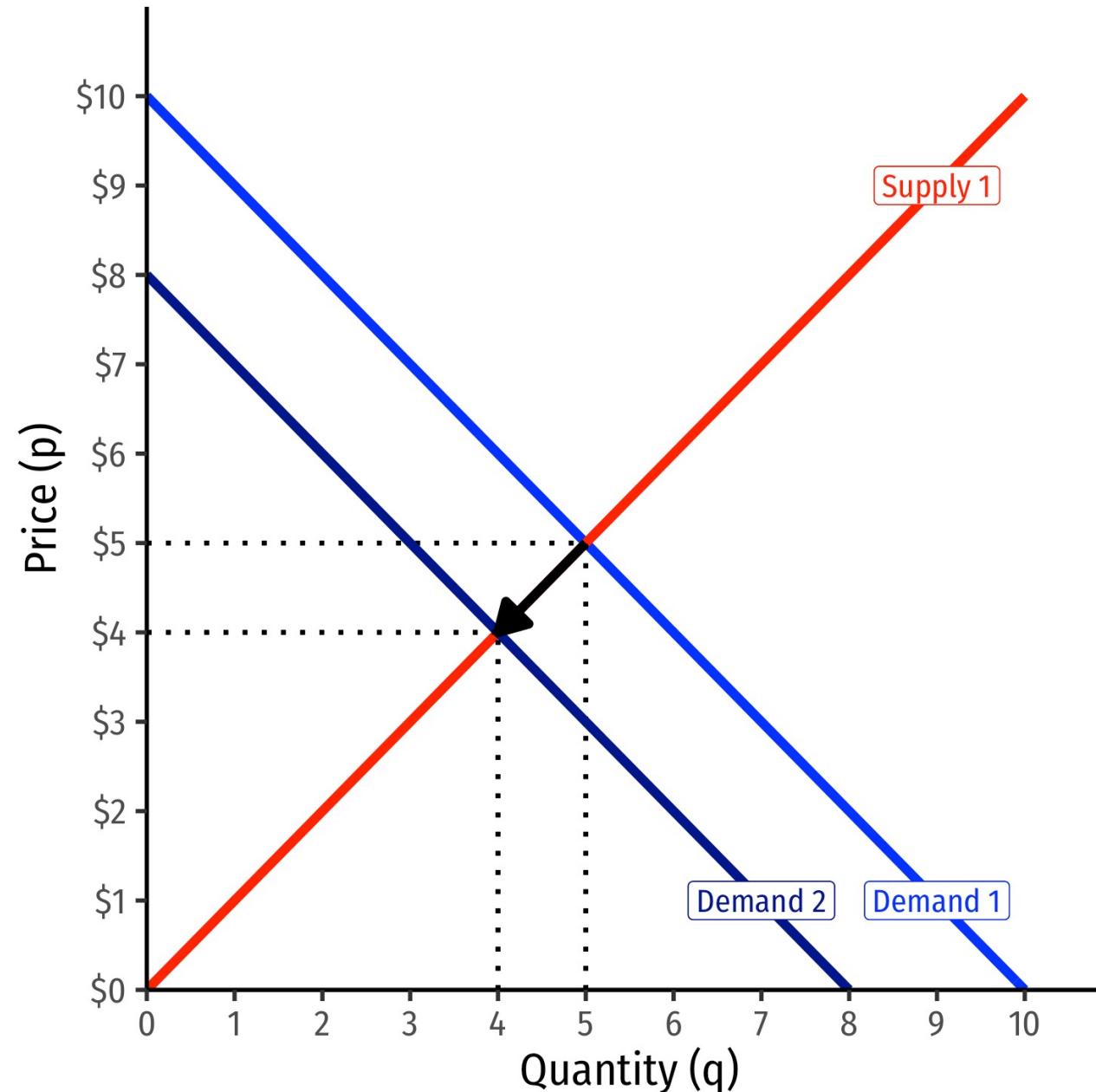


# Decrease in Demand





# Decrease in Demand





# Supply Function

- The **producer's supply for good x**

- Goal is to maximize profit

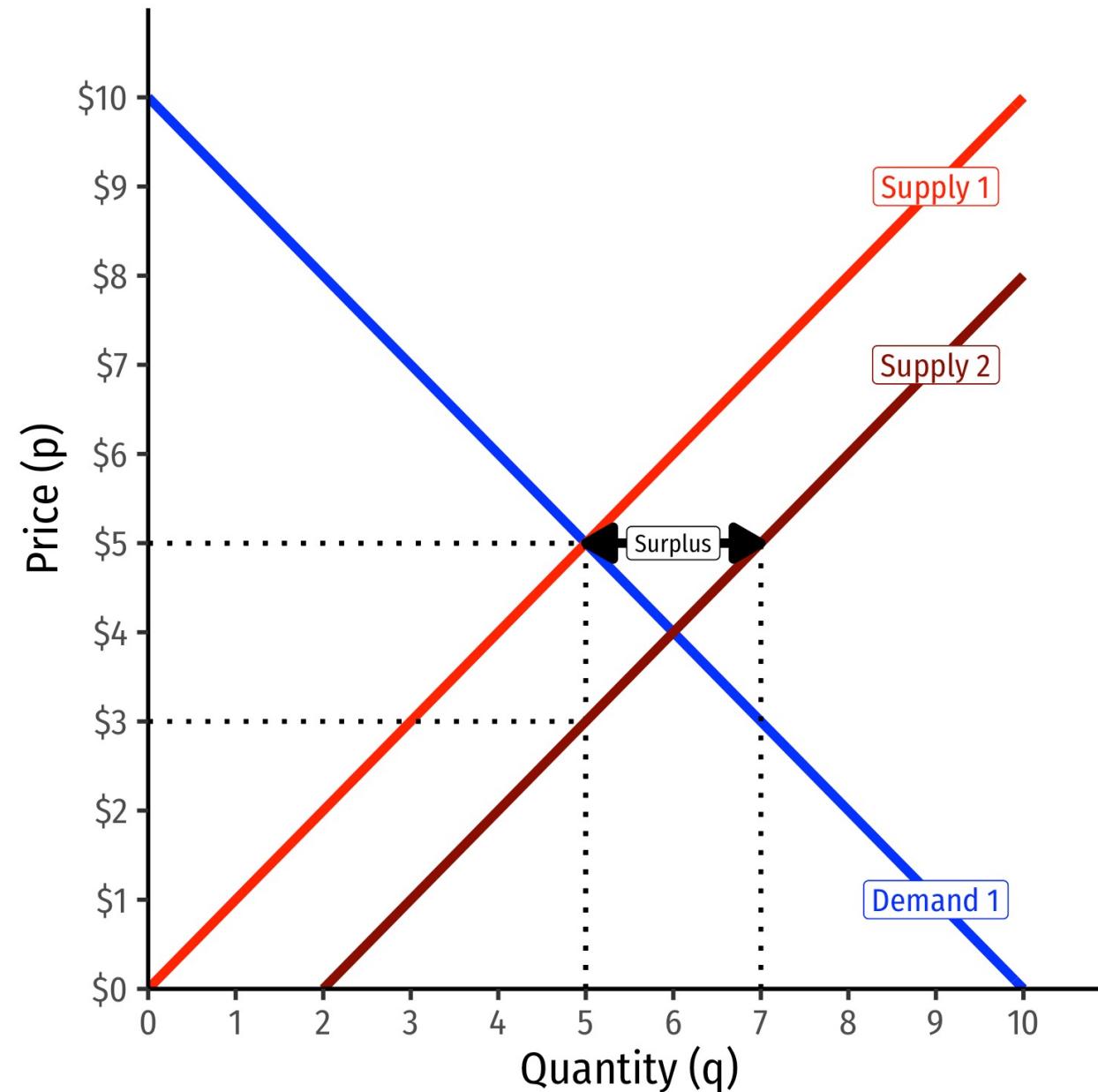
Shift factors

- Number of producers
- Input prices
- Technology
- Opportunity cost for other goods



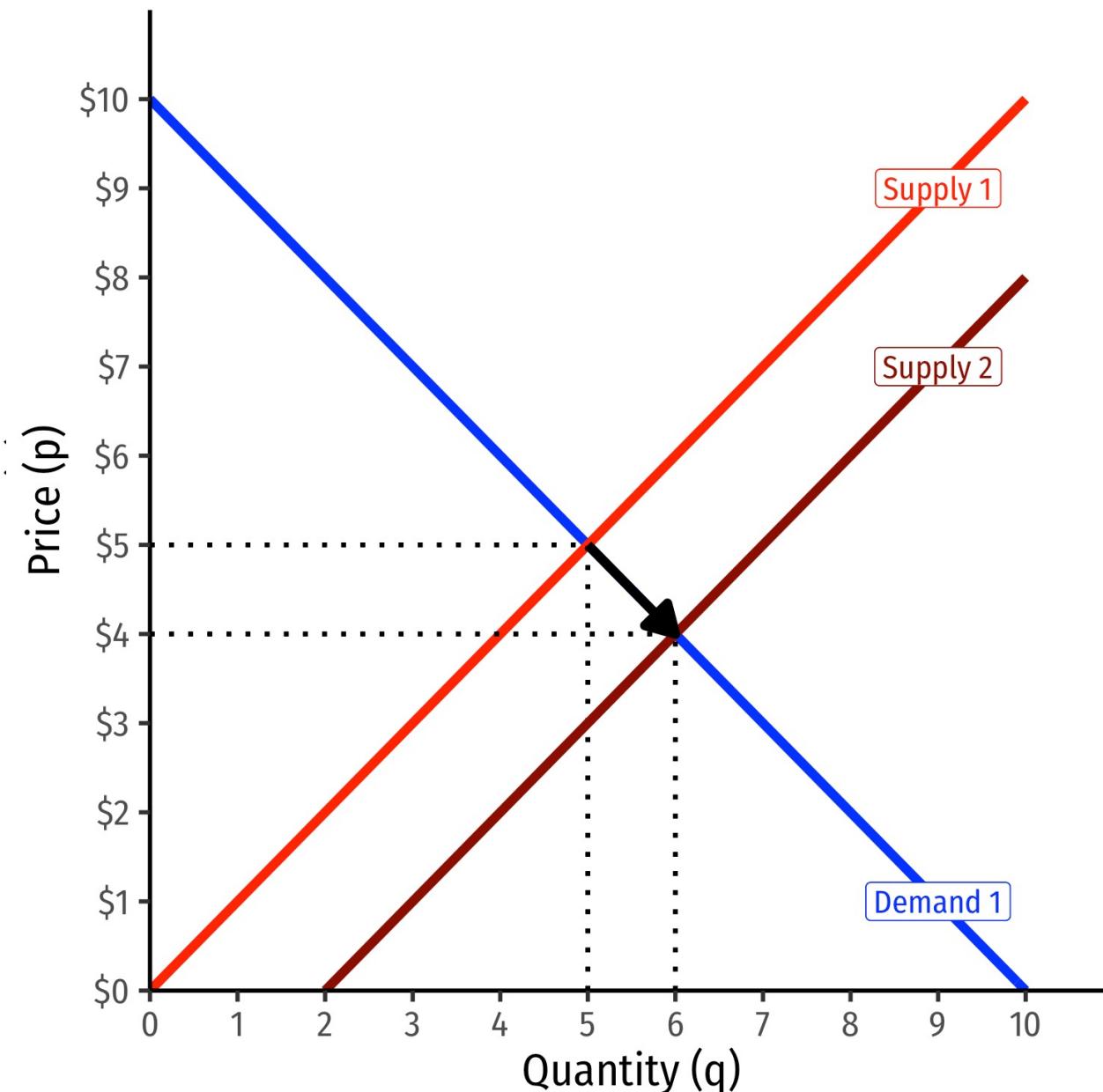


# Increase in Supply



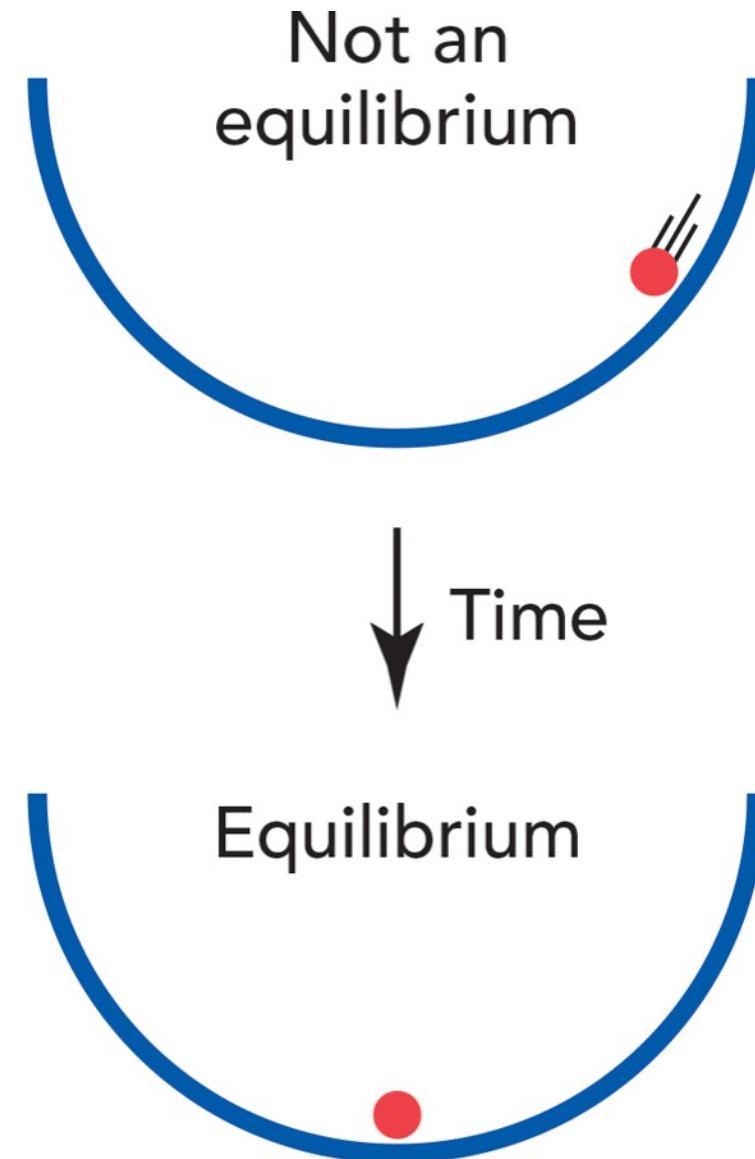


# Increase in Supply





# Equilibrium



- Equilibrium is a *tendency* we can *predict* with our models
  - Buyers and sellers raise and lower their bids and asks to adjust to competition from other buyers and sellers, moving the market price
  - *Ceterus paribus*, market prices will settle on an equilibrium given existing conditions
  - But conditions are always changing (and so are prices)!



# Elasticity



# Elasticities

- Tell us something about . . .
  - 1) The shape of supply and demand curves
  - 3) The magnitude of adjustment in comparative statics



# Elasticities

Measure of responsiveness of one variable to a change in another variable

$$E_{G,S} = \frac{\% \Delta G}{\% \Delta S}$$





# Elasticities

Important aspects of an elasticity:

- 1) Sign: (+) or (-)
- 2) The absolute value of the elasticity relative to 1

$|E_{G,S}| > 1$  Highly responsive to a change in S

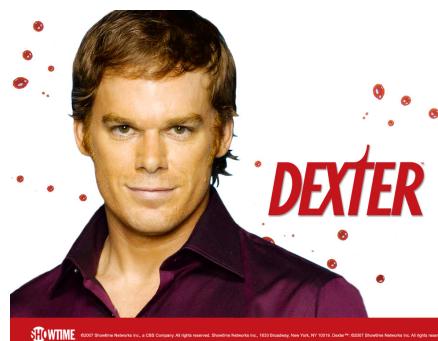
$|E_{G,S}| < 1$  Slightly responsive to a change in S





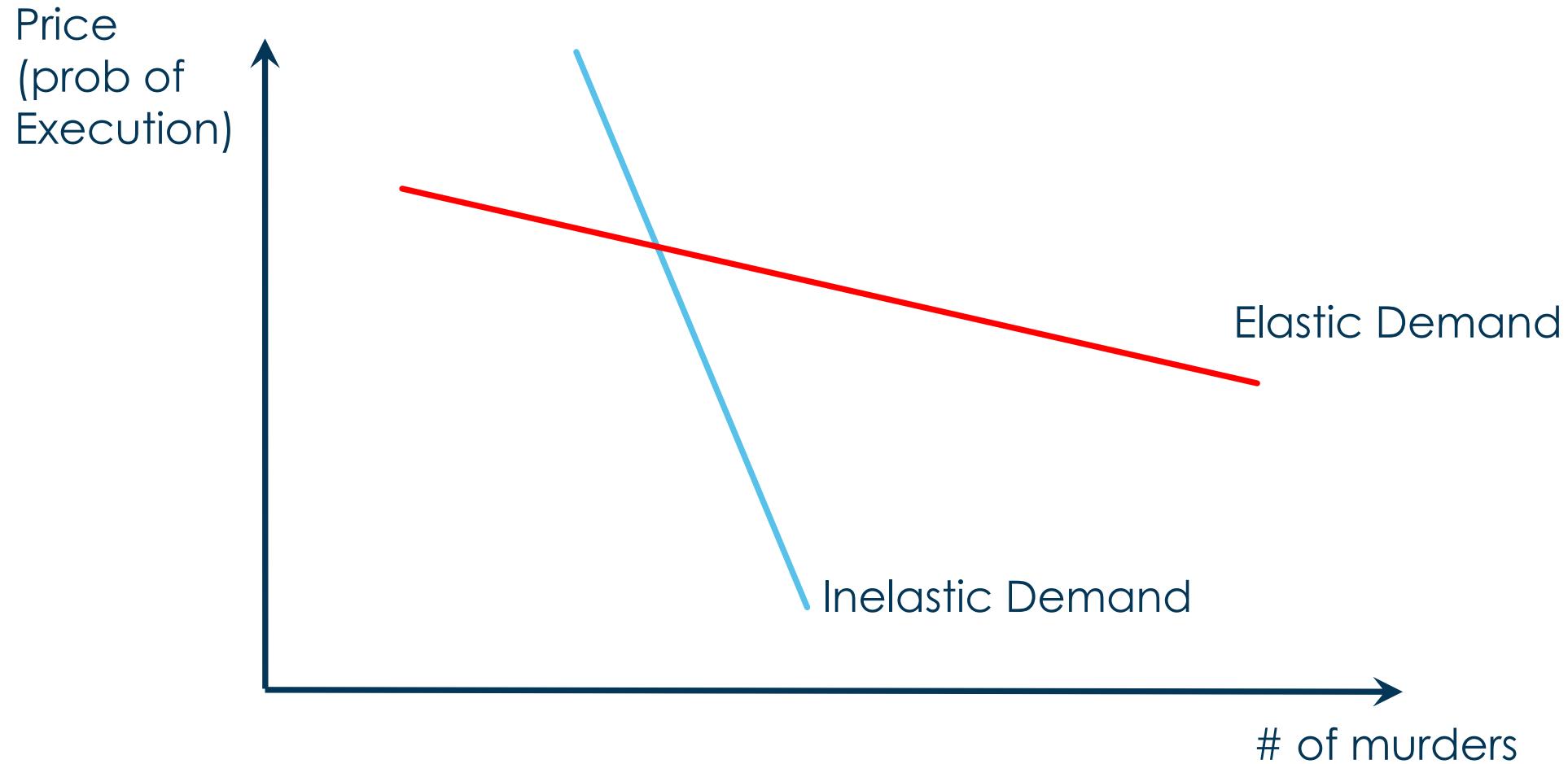
# Elasticities

- Measuring how responsive quantity demanded is to a change in the price
  - If the price rises does the quantity fall a little or a lot?
- E.g. The Dexter Model and the demand for murder





# Elasticities





## Own Price Elasticity

$$E_{Q^d, P} = \frac{\% \Delta Q^d}{\% \Delta P}$$

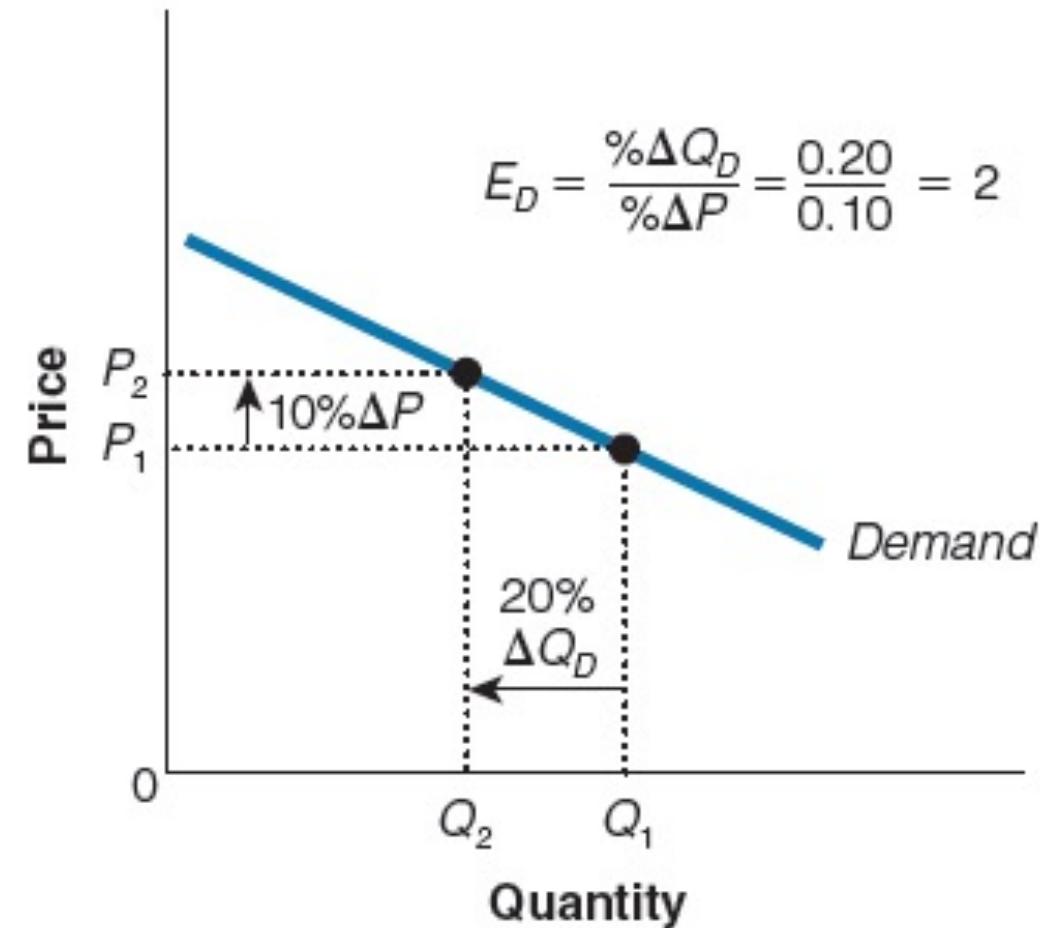
Elasticity over an interval  
(2 points on a demand curve)

Read as a 1% change in price leads to a percent change in the quantity demanded

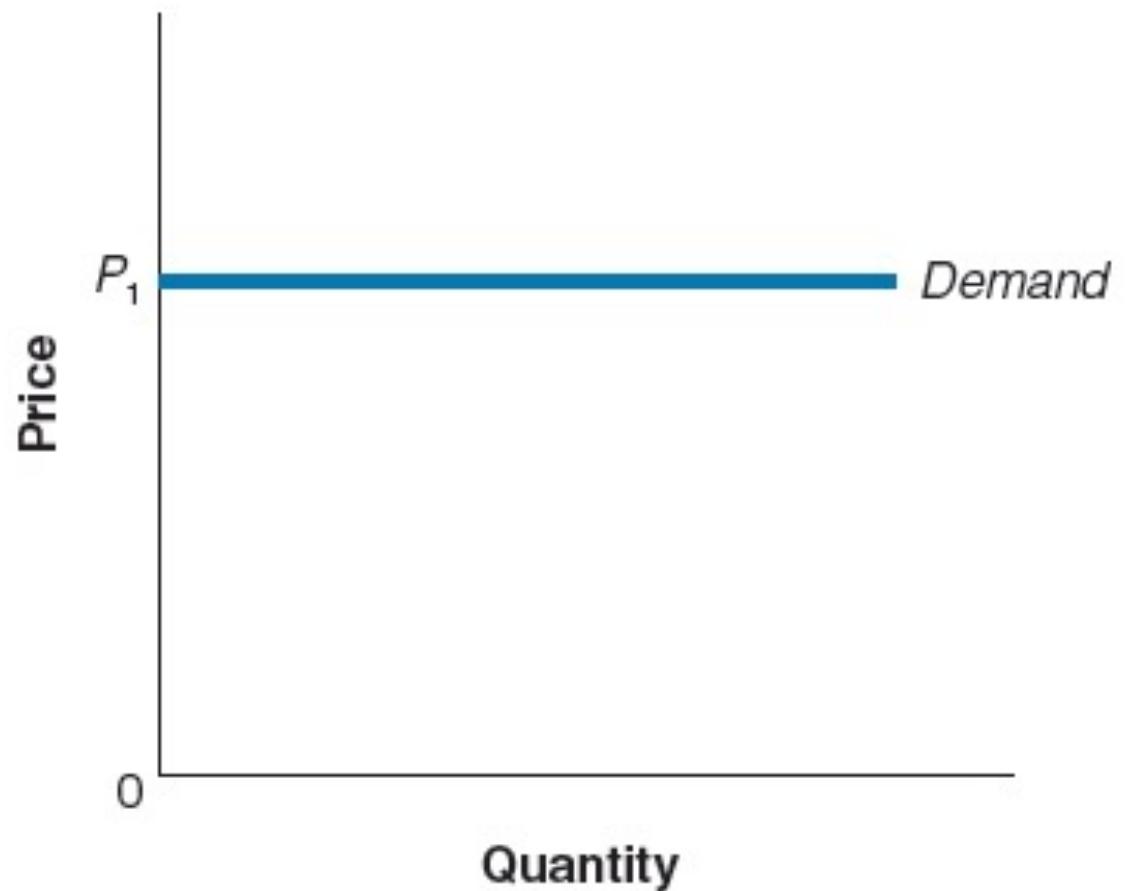


# Own Price Elasticity

a. Elastic Demand ( $E_D > 1$ )



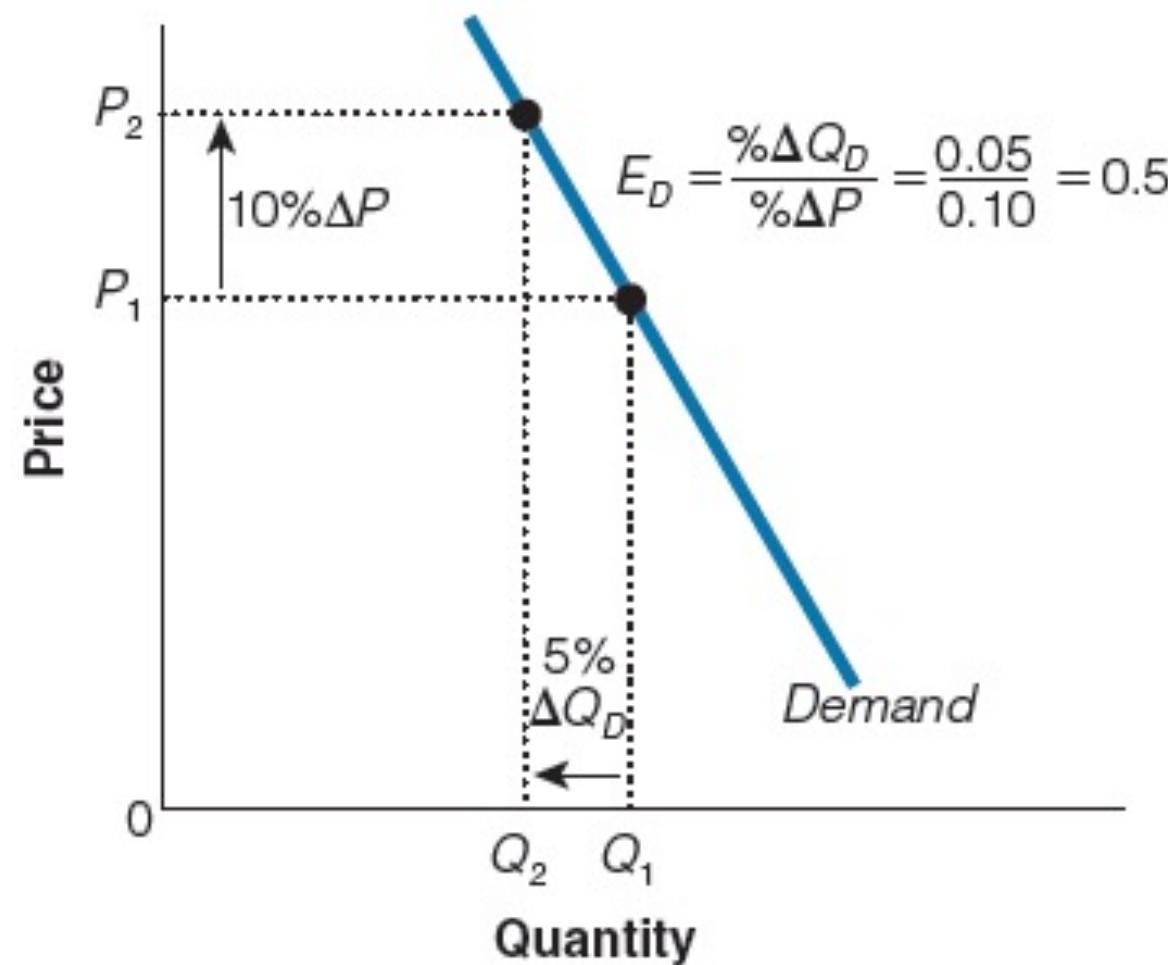
b. Perfectly Elastic Demand ( $E_D = \infty$ )



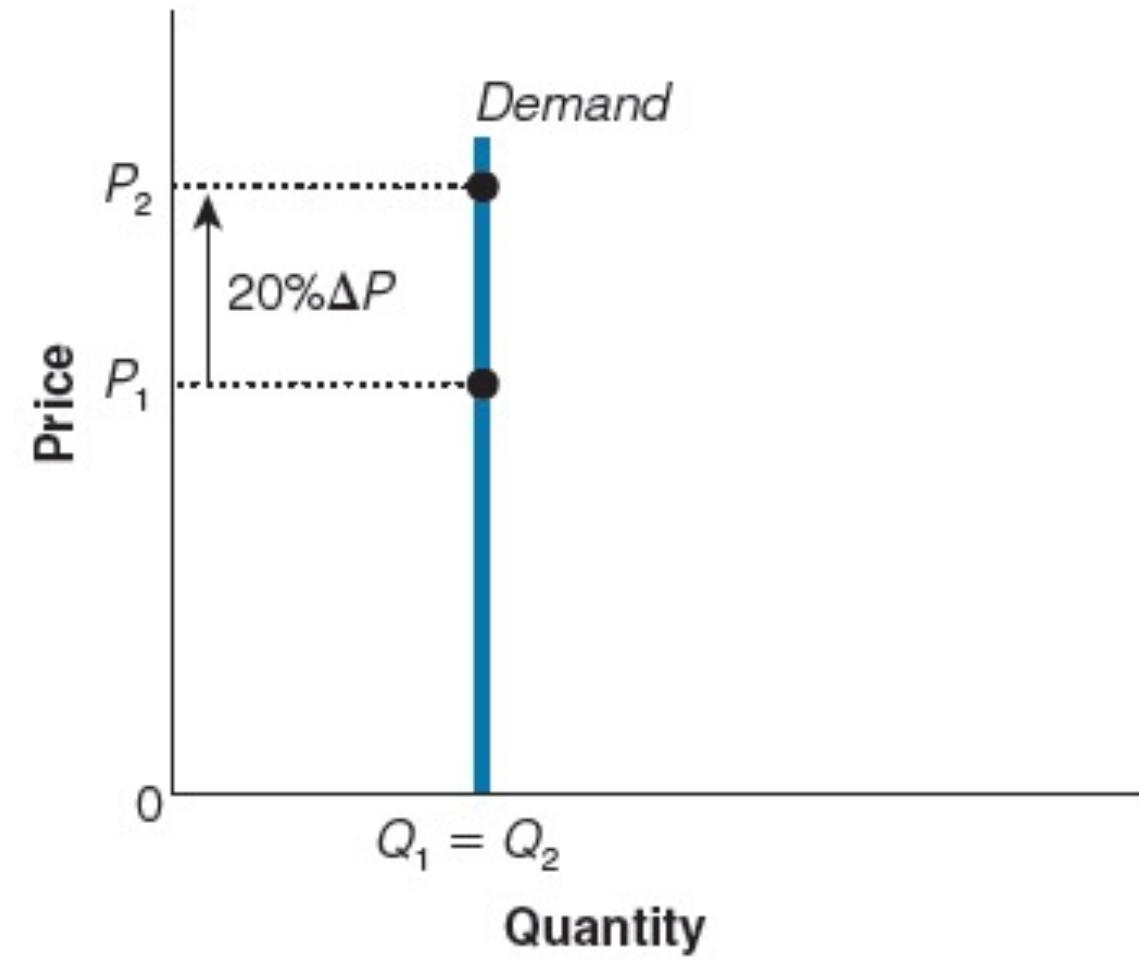


# Own Price Elasticity

a. Inelastic Demand ( $E_D < 1$ )

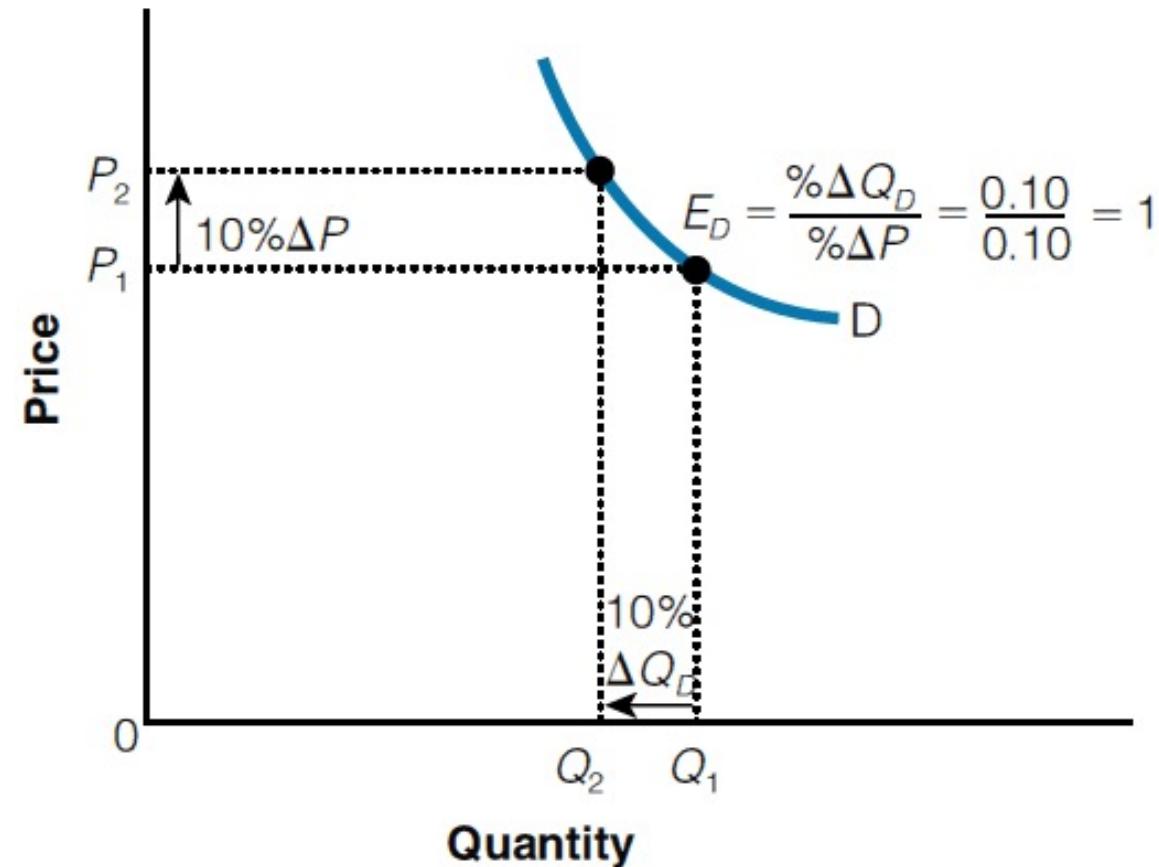


b. Perfectly Inelastic Demand ( $E_D = 0$ )



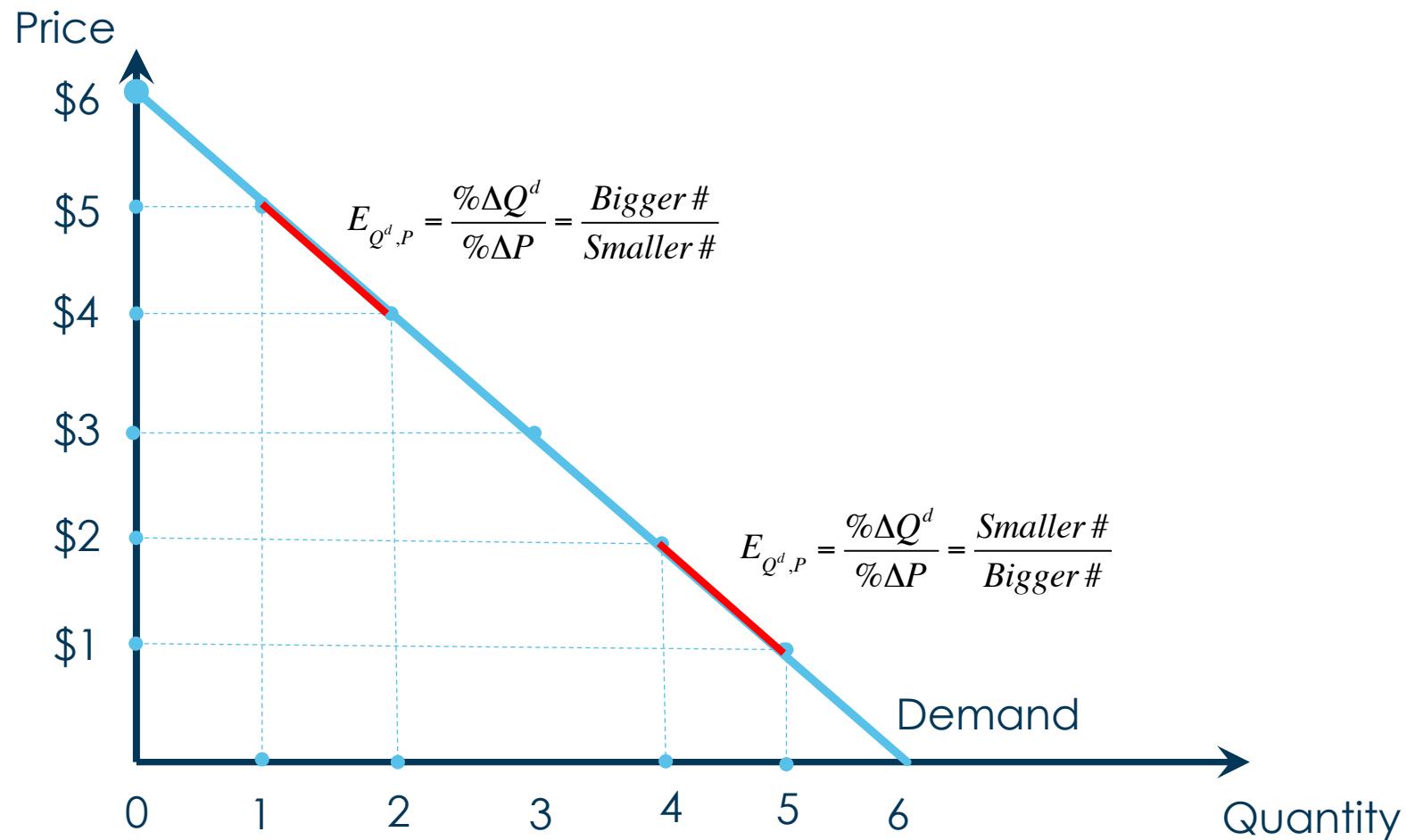


# Own Price Elasticity





# Own Price Elasticity





# Determinants of elasticity

## Demand

- Availability of substitutes
- Time horizon / duration
- Share of budget

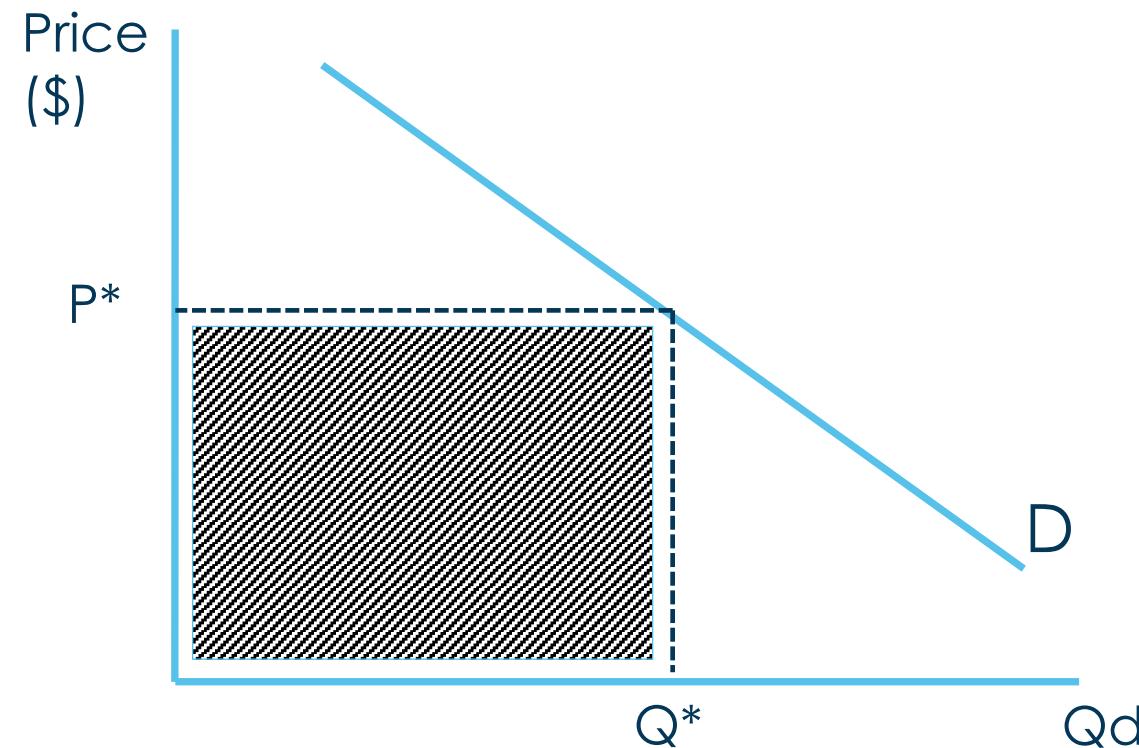
## Supply

- Number of producers
- Time horizon / duration
- Excess capacity



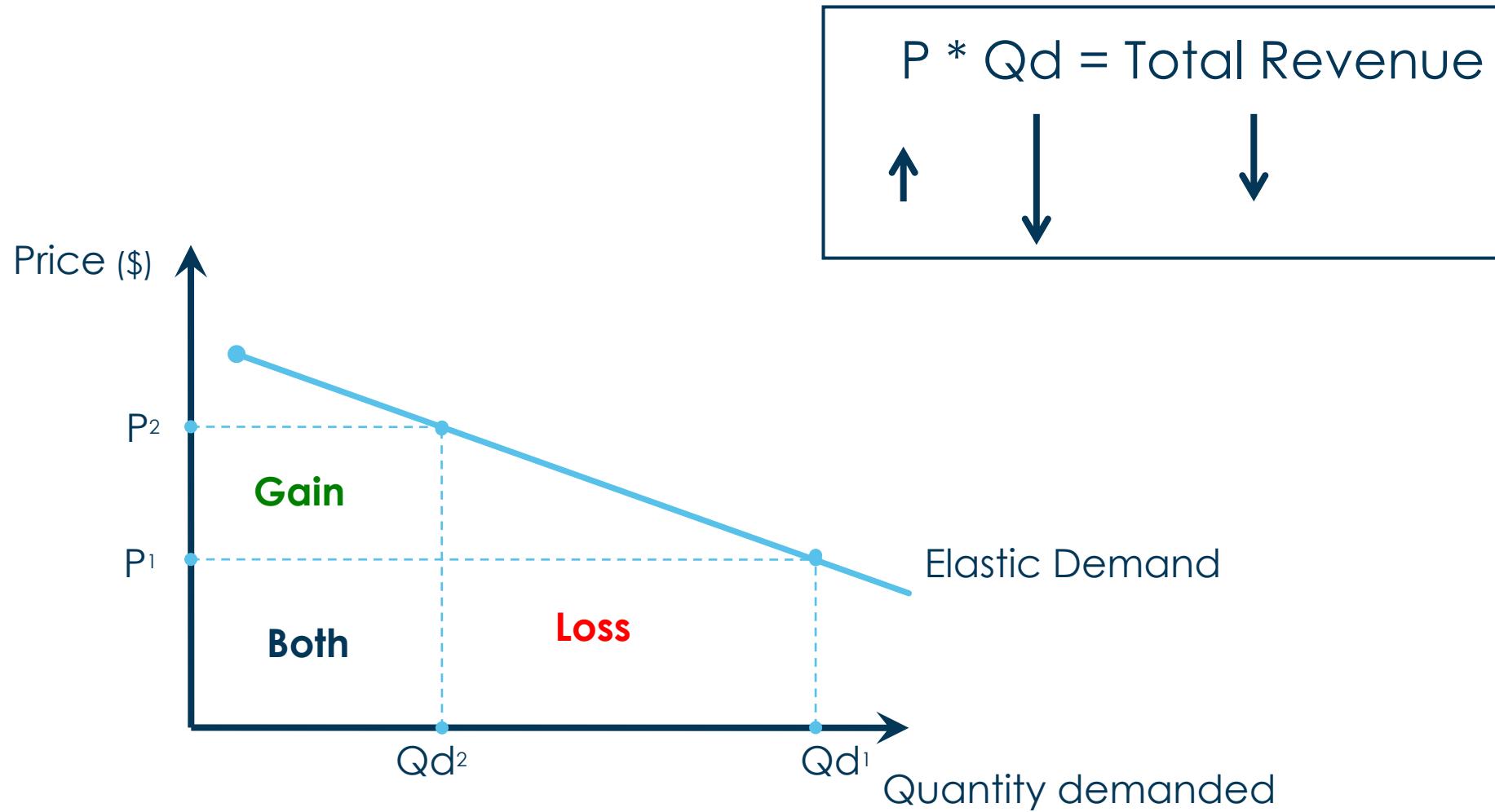
# Total Revenue and Price Elasticity of Demand

- **Total revenue (TR)** is simply the price of the good ( $P$ ) times the quantity of the good sold ( $Q$ ):



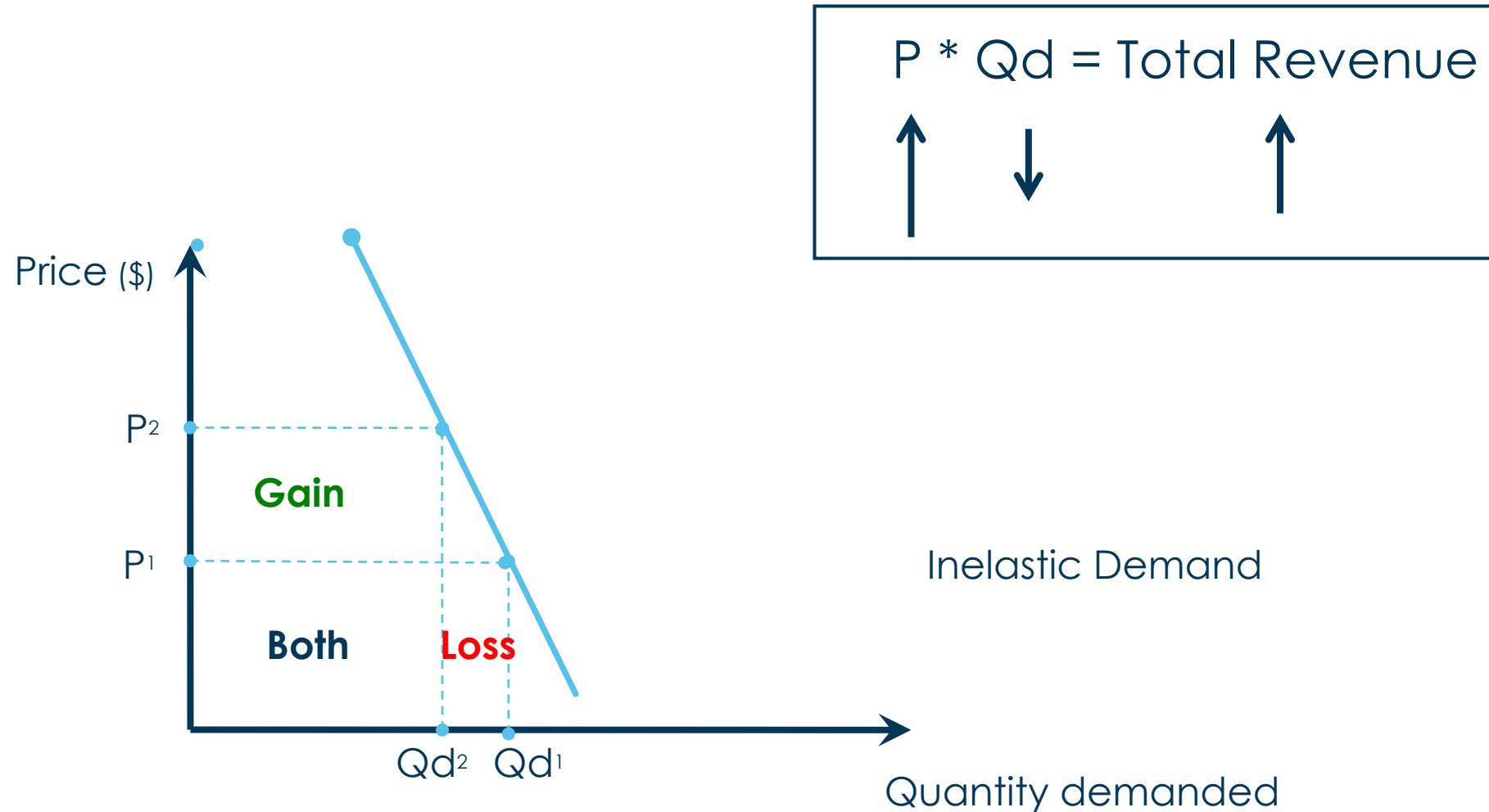


# Total Revenue and Price Elasticity of Demand





# Total Revenue and Price Elasticity of Demand





# Total Revenue and Price Elasticity of Demand

- Netflix price increase
  - Price increased from \$10 to \$16
  - Quantity demanded decrease 25 to 24 mill
  - Headlines: Netflix loses 1 million customers!

The screenshot shows the homepage of The Atlantic. At the top left is a banner for "The Atlantic SHOP" featuring a portrait of a historical figure and the text "WEAR 157 YEARS OF HISTORY". Below the banner is a navigation bar with categories: POLITICS, BUSINESS, TECH, ENTERTAINMENT, HEALTH, EDUCATION, and SEXES. A "JUST IN" section headline reads "Your Next Shot Might Be Inspired by a Spider". The main content area features several article thumbnails with titles like "Trucks Are Saving the American Economy" (By Derek Thompson), "How to Freeze People and Bring Them Back to Life" (By Olga Khazan), and "The P... Land About Palest..." (By Emr...). The "The Atlantic" logo is prominently displayed in the center.

## Netflix to Lose a Million Subscribers: It's Worse Than It Looks

DANIEL INDIVIGLIO | SEP 15 2011, 1:33 PM ET

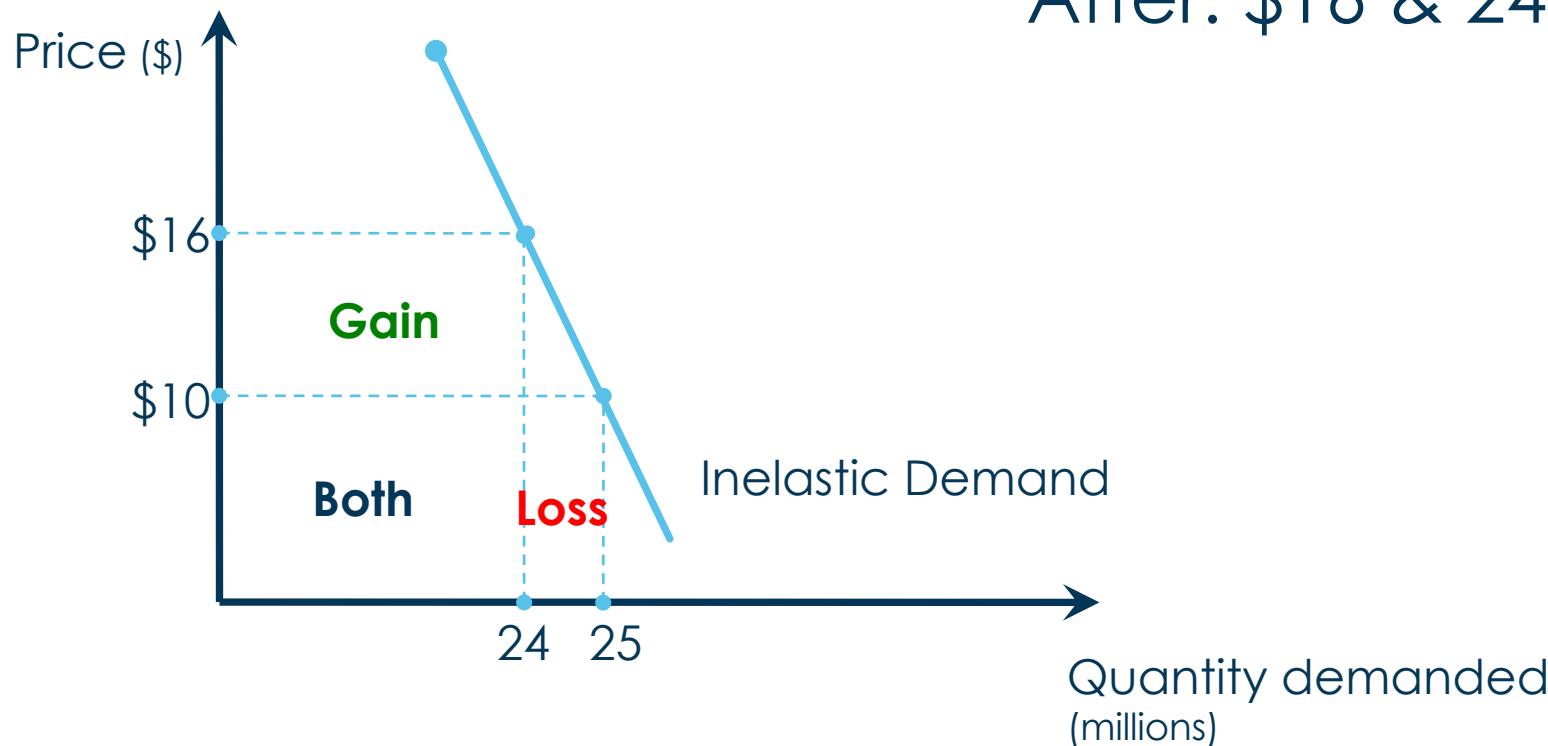


# Total Revenue and Price Elasticity of Demand

- Netflix thought demand was inelastic

## Total Revenues

Before:  $\$10 * 25 \text{ mill} = \$250 \text{ mill}$   
After:  $\$16 * 24 \text{ mill} = \$384 \text{ mill}$





# Competition



# Competition



- Markets allocate resources based on individuals' **reservation prices**:
  - **maximum willingness to pay** (as a buyer)
  - **minimum willingness to accept** (as a seller)
- **Goods flow to those who value them the highest and away from those who value them the lowest**



# Competition



- In markets: **buyers compete with other buyers** and **sellers compete with other sellers**
- **Buyers compete and want the lowest price then can get**
- **Sellers compete and want the highest price possible**



## Example



Imagine a small public horse market

3 people, A, B, and C each own  
1 horse

3 people, D, E, and F each are  
potentially interested in buying a  
horse

This example is based on Eugen von Böhm-Bawerk's famous example in *Capital and Interest* (1884)



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

Suppose Buyer F announces she will pay \$400 for a horse

Only Seller A is willing to sell at \$400

Buyers D, E, and F are willing to buy at \$400

- D and E are willing to pay more than F to obtain the 1 horse
- They raise their bids above \$400 to attract sellers



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

Suppose Seller C announces he will sell his horse for \$600

Only Buyer D is willing to buy at \$600  
Sellers A, B, and C are willing to sell at \$600

- A and B are willing to accept less than C to sell their horses
- They lower their asks below \$600 to attract buyers



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

If the market price reaches \$500 (through bids and asks changing)

Sellers A and B sell their horses for \$500 each

- Buyers D and E buy them at \$500 each



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

At \$500, **B** and **E** are the "**marginal**" buyer and seller, the "last" ones that *just* got off the fence to exchange in the market

- **B** has WTA *just* low enough to sell
- **E** has WTP *just* high enough to buy

The marginal pair actually are the ones that "set" the market price!



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

Notice the most possible exchanges take place at a market price of \$500

- 2 horses get exchanged
- Any price above or below \$500, only 1 horse would get exchanged
- Also, at least one other buyer or seller would raise/lower their bid/ask



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

At \$500, C and F are the "**excluded**" buyers and sellers

- C has WTA *too high* to sell
- F has WTP *too low* to buy



## Example

Person	Reservation Price
Seller A	Minimum WTA: \$400
Seller B	Minimum WTA: \$500
Seller C	Minimum WTA: \$600
Buyer D	Maximum WTP: \$600
Buyer E	Maximum WTP: \$500
Buyer F	Maximum WTP: \$400

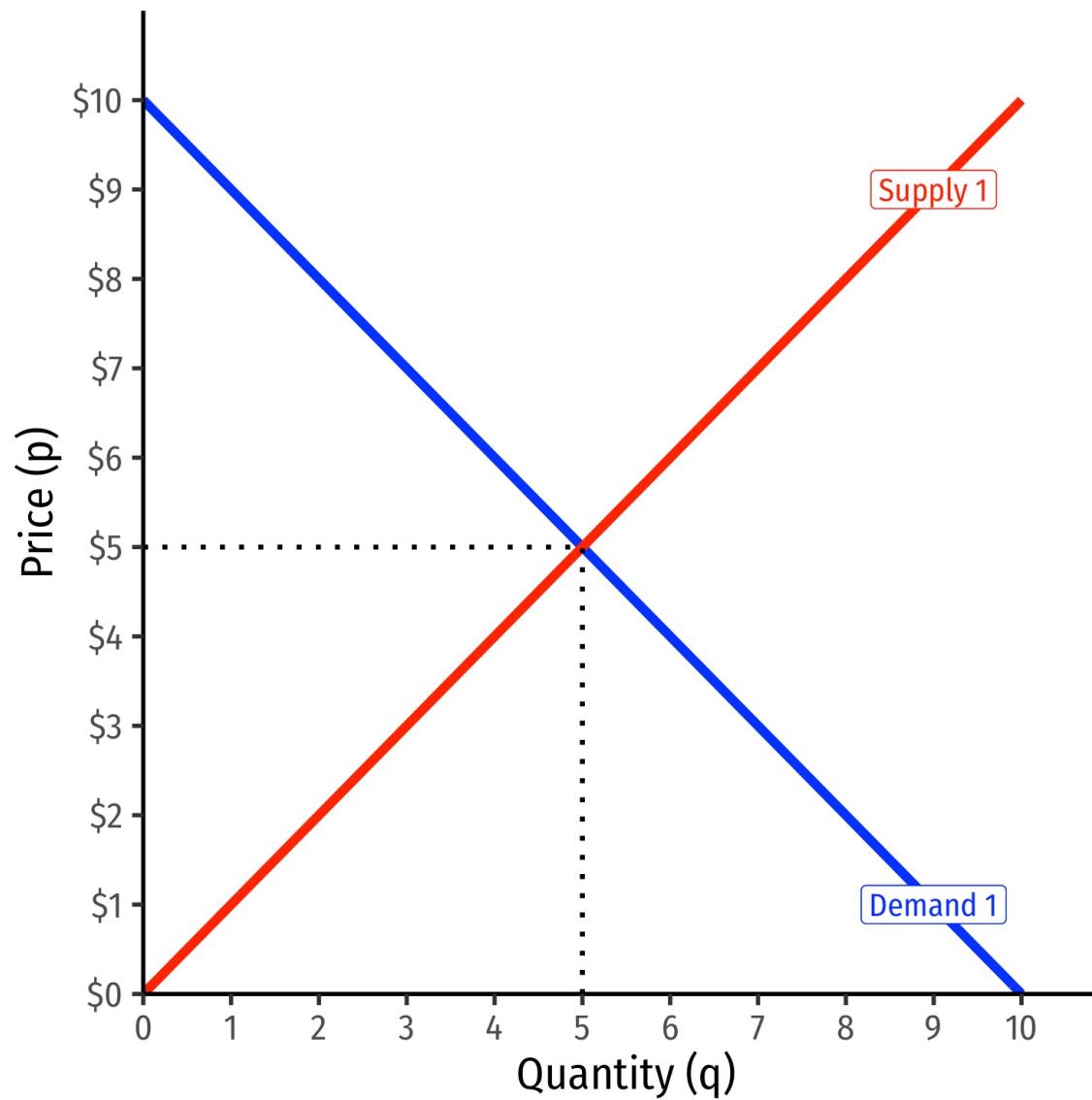
- At \$500, A and D are the "**inframarginal**" buyers and sellers
  - A has WTA lower than market price, earns extra \$100 surplus from exchange
  - D has WTP higher than market price, earns extra \$100 surplus from exchange
- These buyers and sellers benefit *the most* from exchange



# Welfare



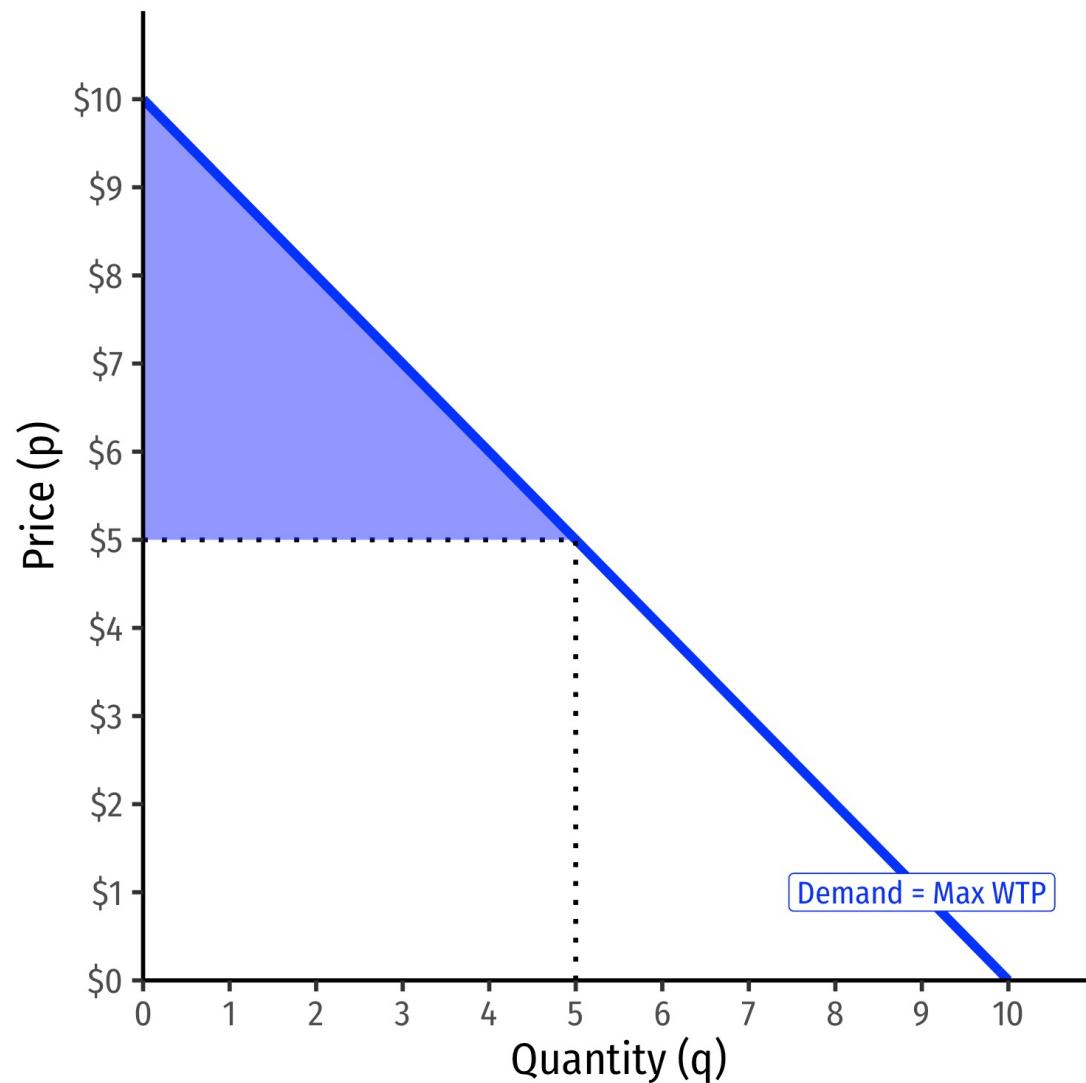
# Markets, Supply and Demand



Supply and demand set the market-clearing price for all units exchanged (bought and sold)



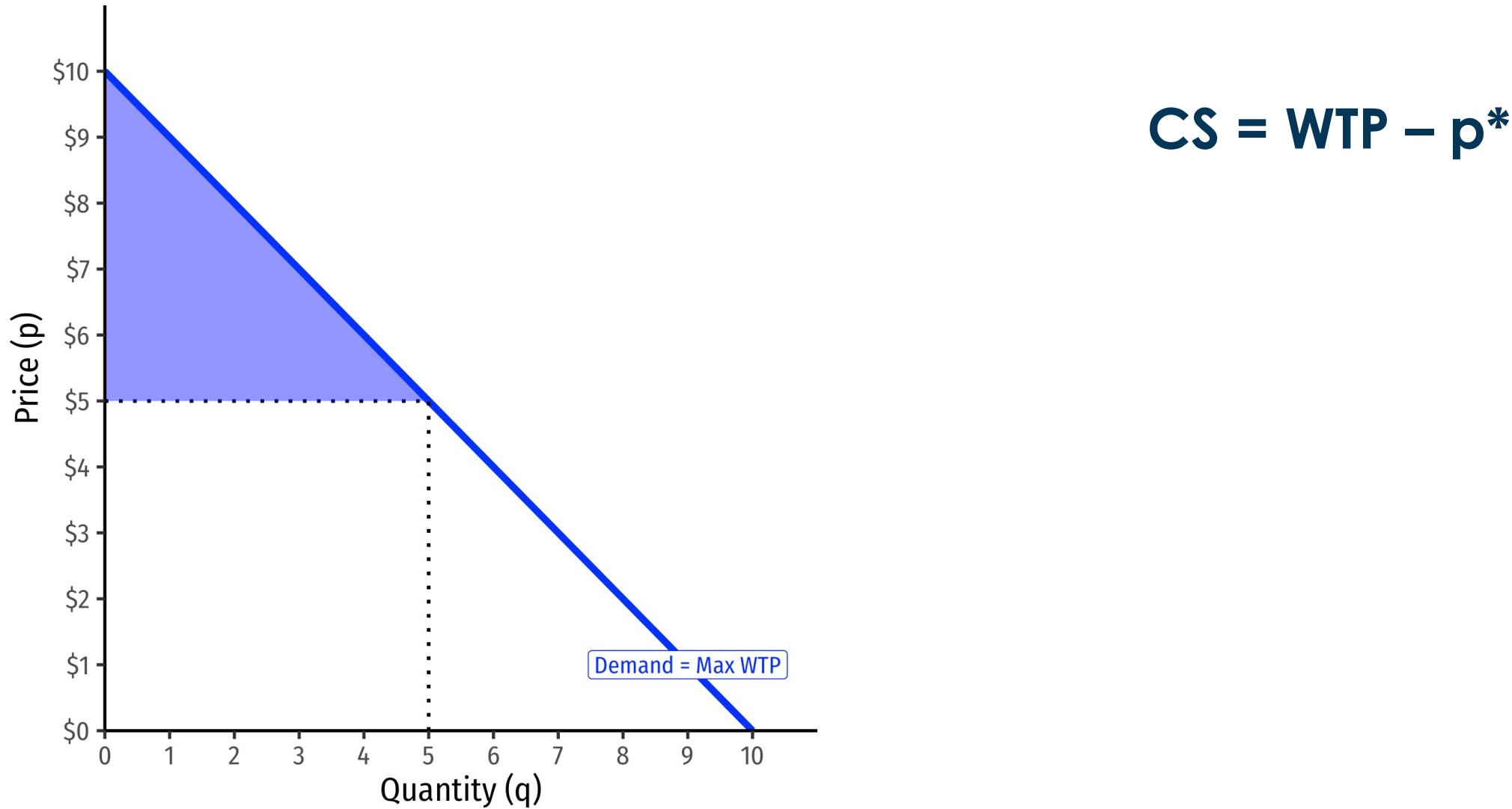
# Consumer Surplus



- Demand function measures how much you would *hypothetically* be willing to pay for various quantities
  - "reservation price"
- You often *actually* pay (the market-clearing price,  $p^*$ ) a lot less than your reservation price
- The difference is **consumer surplus**

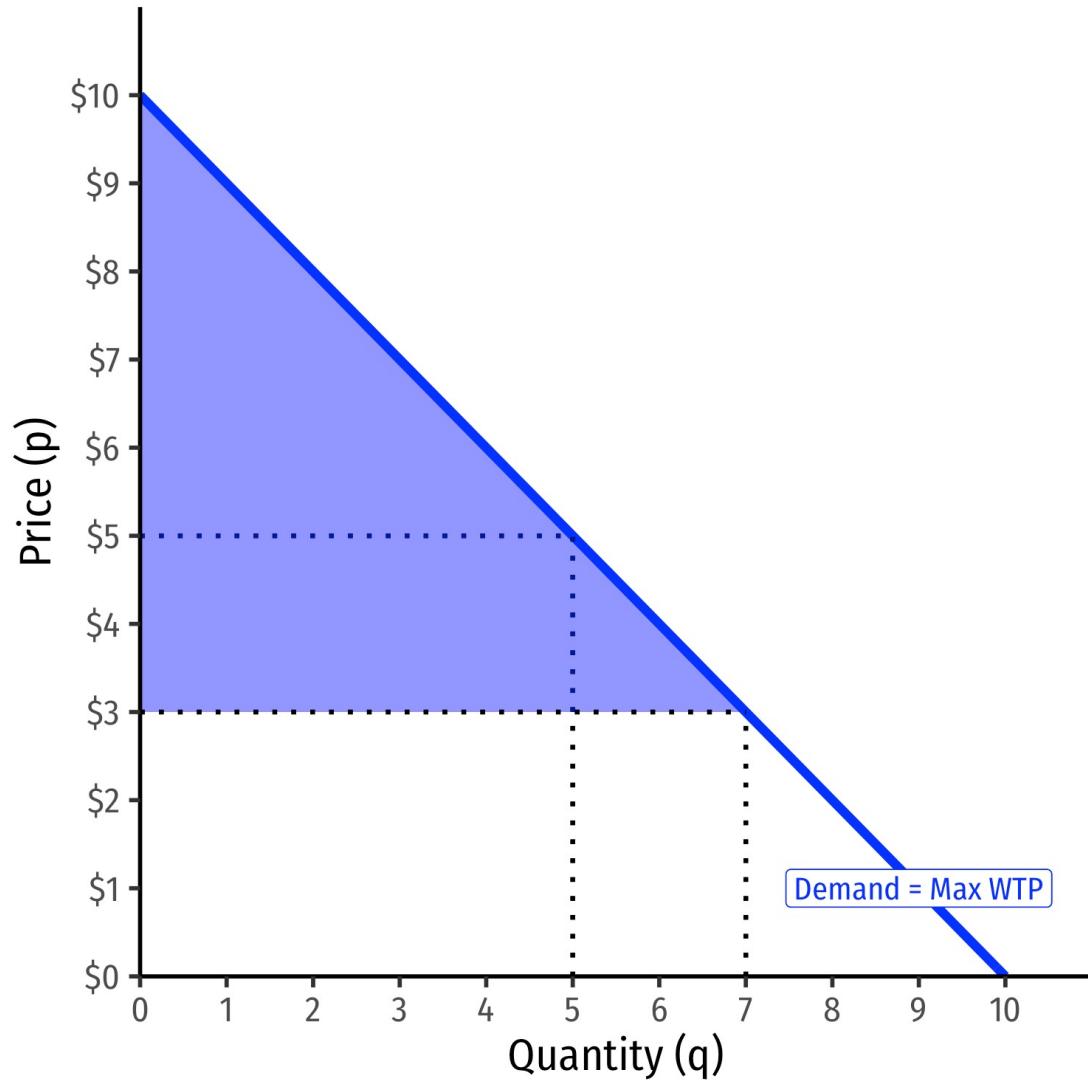


# Consumer Surplus





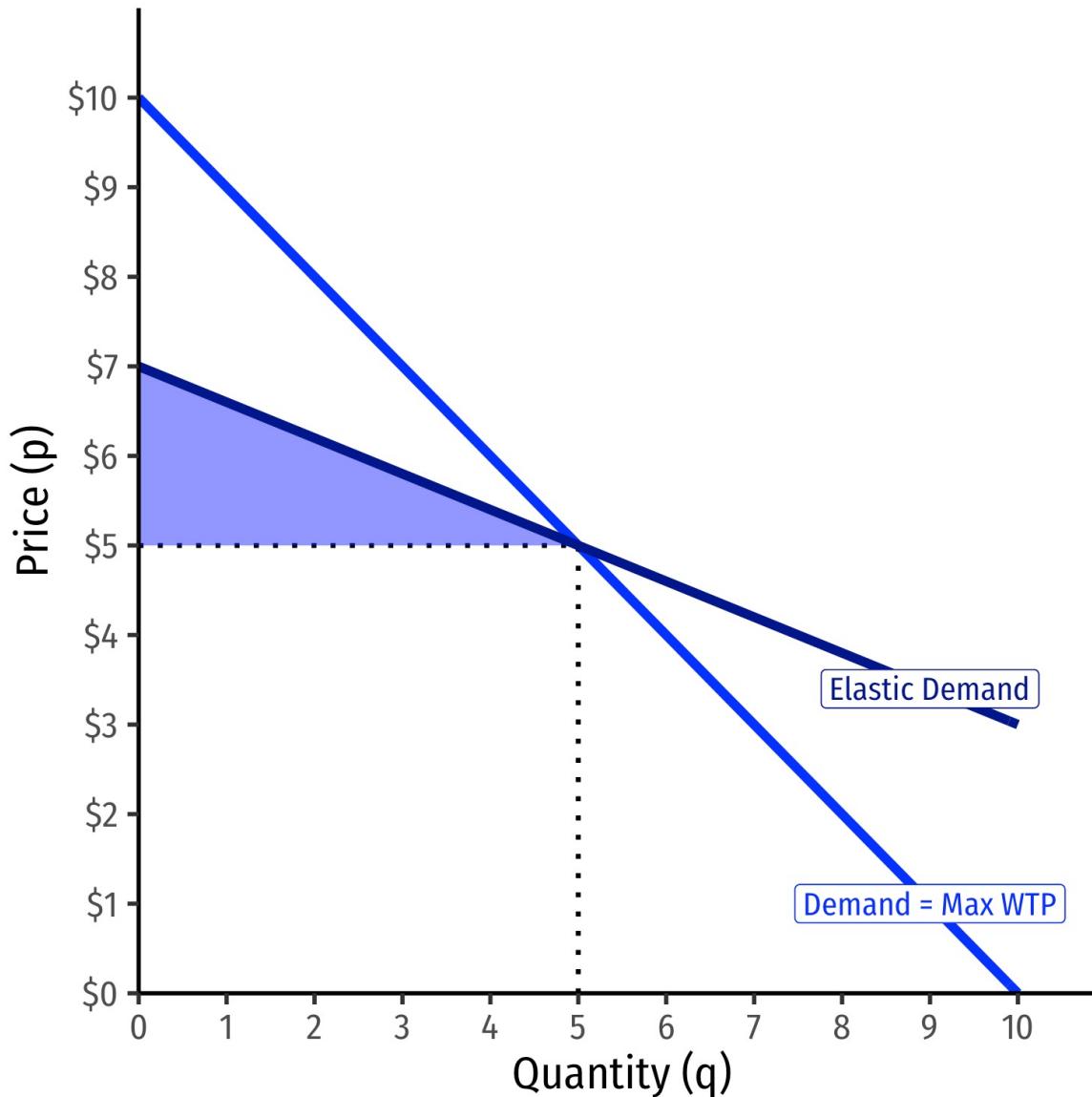
# Consumer Surplus



$$CS = WTP - p^*$$



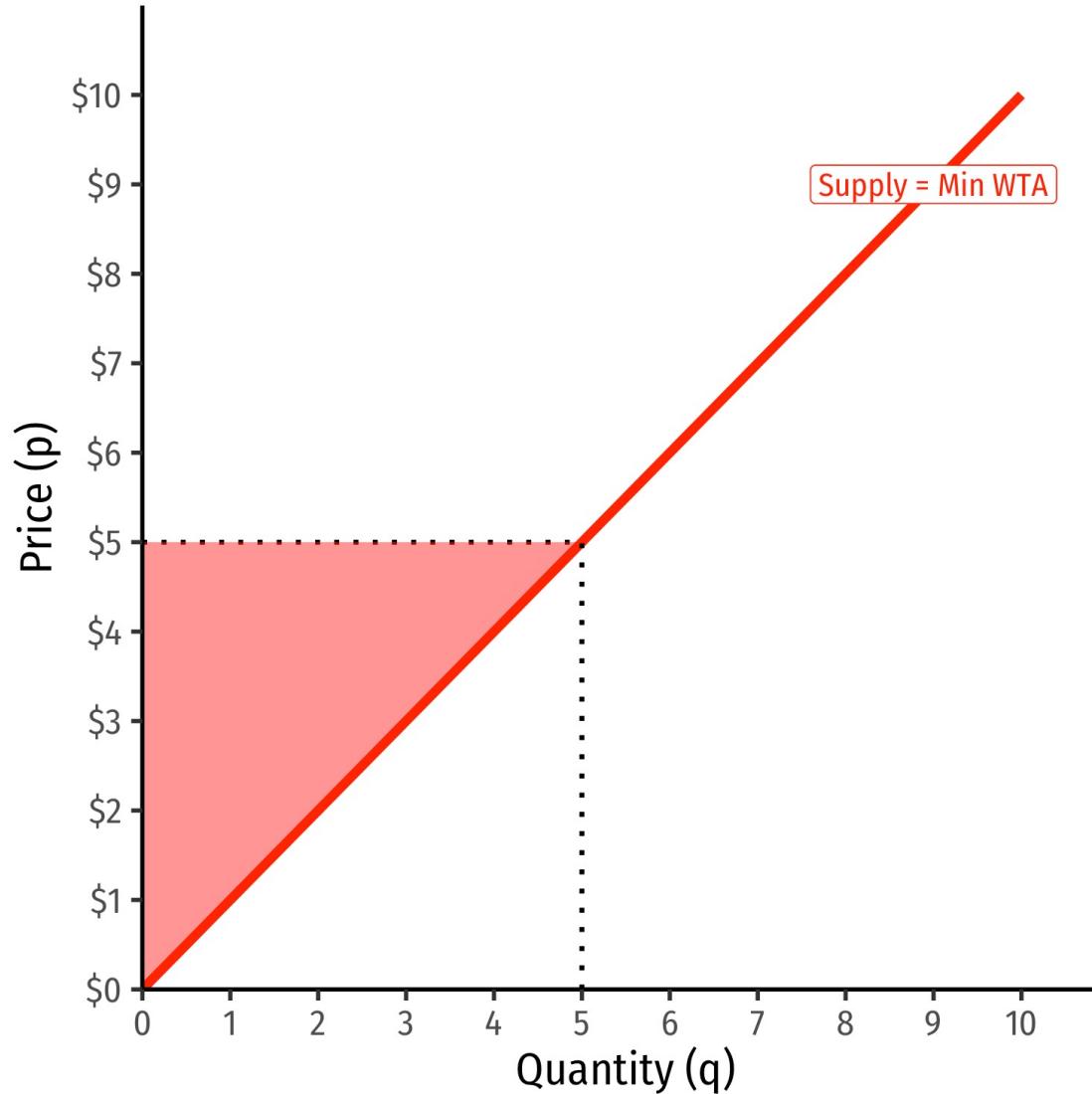
# Consumer Surplus



$$CS = WTP - p^*$$



# Producer Surplus

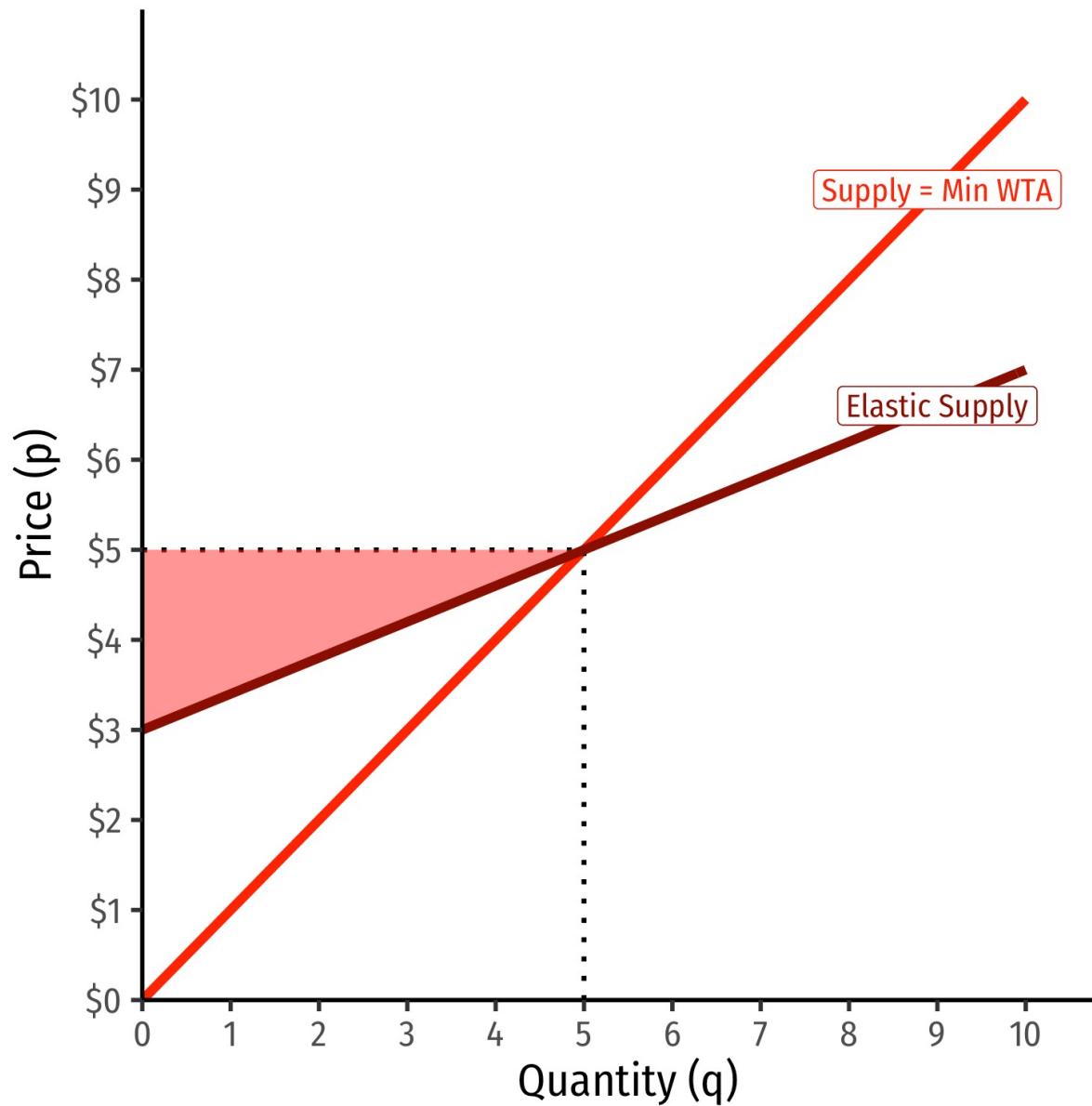


- **Supply curve**
  - Hypothetical willingness to accept
  - "Reservation price"

$$PS = p^* - WTA$$



# Producer Surplus

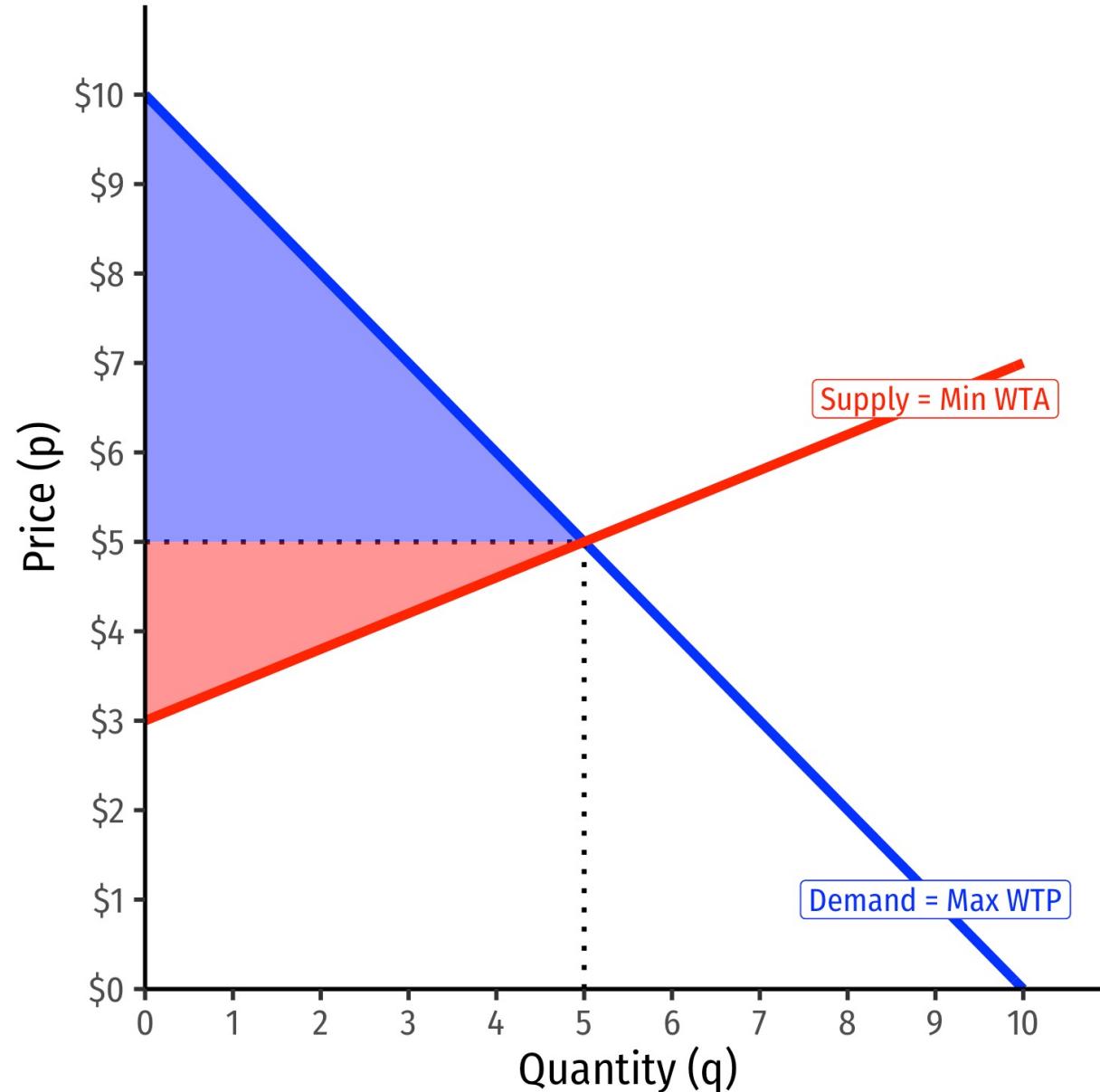


- **Supply curve**
  - Hypothetical willingness to accept
  - "Reservation price"

$$PS = p^* - WTA$$

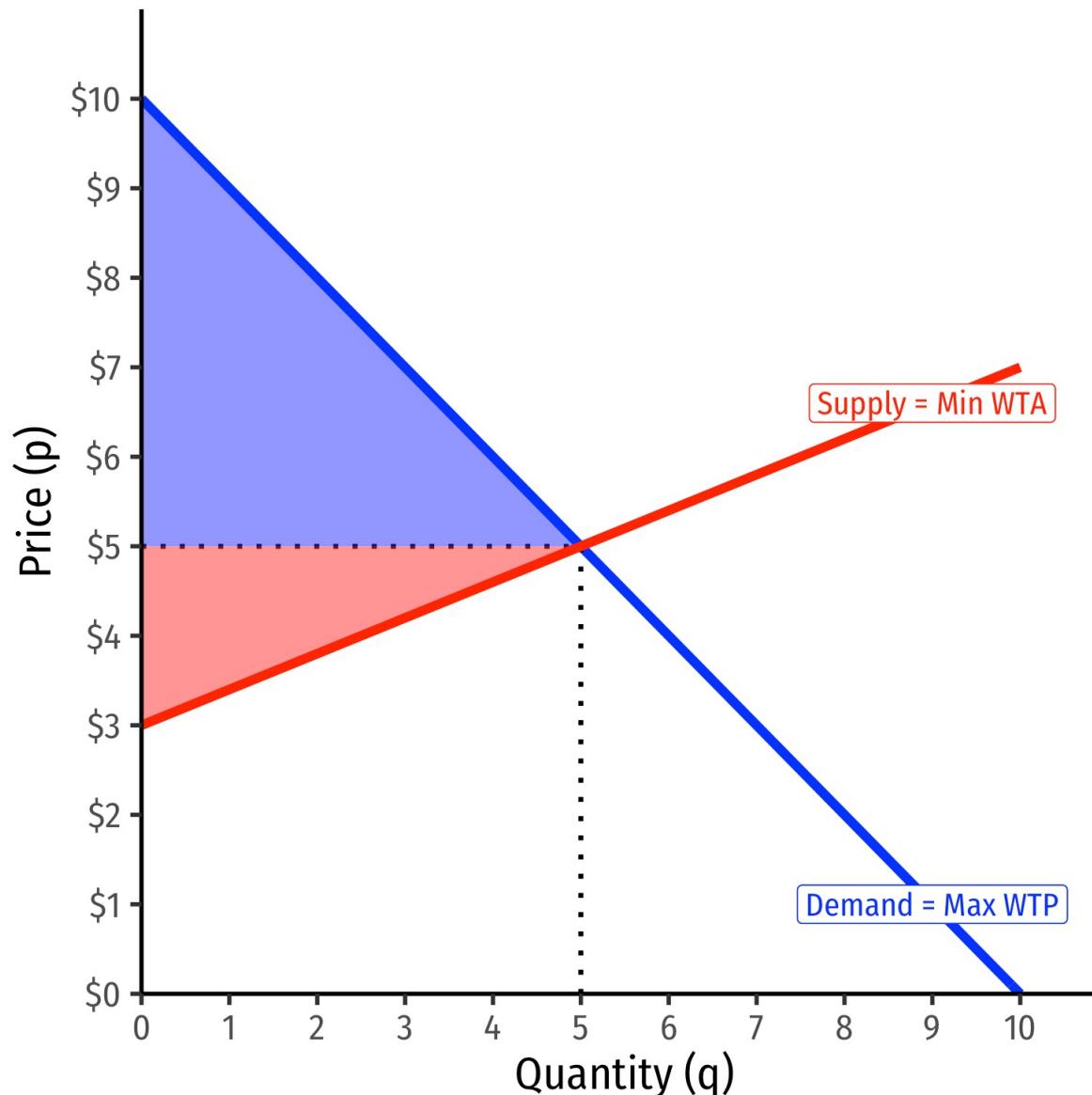


# Elasticities and Welfare





# Elasticities and Welfare



- **More elastic curve**
  - Less surplus
  - More options, easier to change choices, less benefit from any one particular exchange
- **Less elastic curve**
  - More surplus
  - Fewer options, harder to change choices, more benefit from any one particular exchange