



# Econ 330: Urban Economics

## Lecture 02

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# Lecture 02: Review & The 5 Axioms of Urban Economics

# Schedule

## Today:

(i). EC-201 review

(ii). The five axioms of urban econ

## Upcoming:

- EC-201 Review Quiz on Canvas
- Letter of Intro on Canvas
- Reading: intro + chapter 1

# Review

Resources for more EC-201 review

- [Khan academy](#)

# Review 010: Utility

## Definitions:

- **Utility:** Satisfaction one receives from consuming a good or a service
  - Ordinal not cardinal; only know order of preference not how much
- **Utility function:**  $U(x)$  A function that describes utility given from  $x$
- **Marginal Utility:** Additional utility received from one additional good
- **The Law of Diminishing Marginal Utility:** Marginal utility decreases as one consumes more and more goods or services

# Review 011: Demand

**Definition:** The relationship between price and quantities (demanded)

## The Law of Demand

- $P \uparrow \longrightarrow Q_d \downarrow$
- When prices increase, quantity demanded decreases

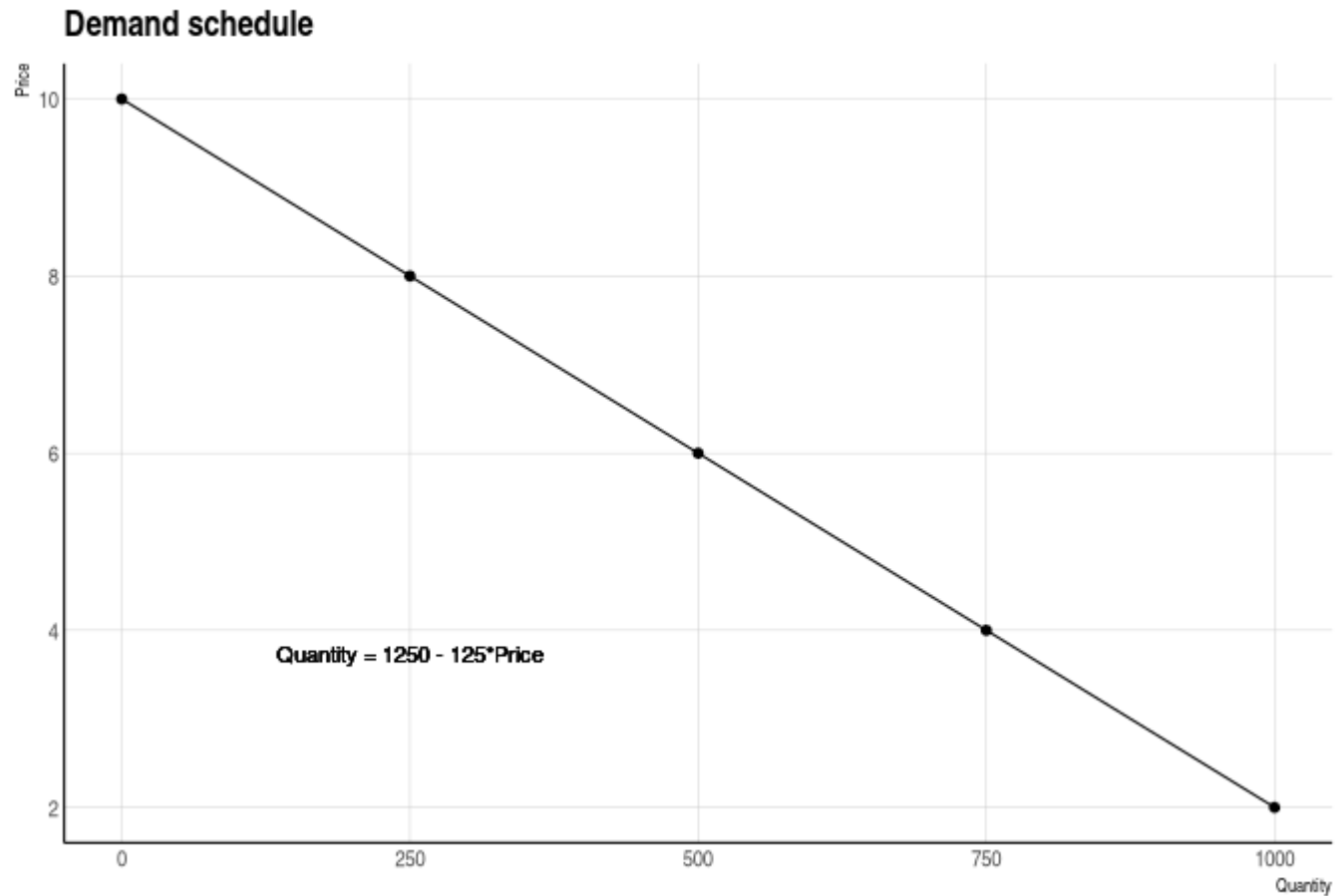
The key players are **consumers**

**Example:** Demand schedule

Price	Quantity
2	1000
4	750
6	500
8	250
10	0

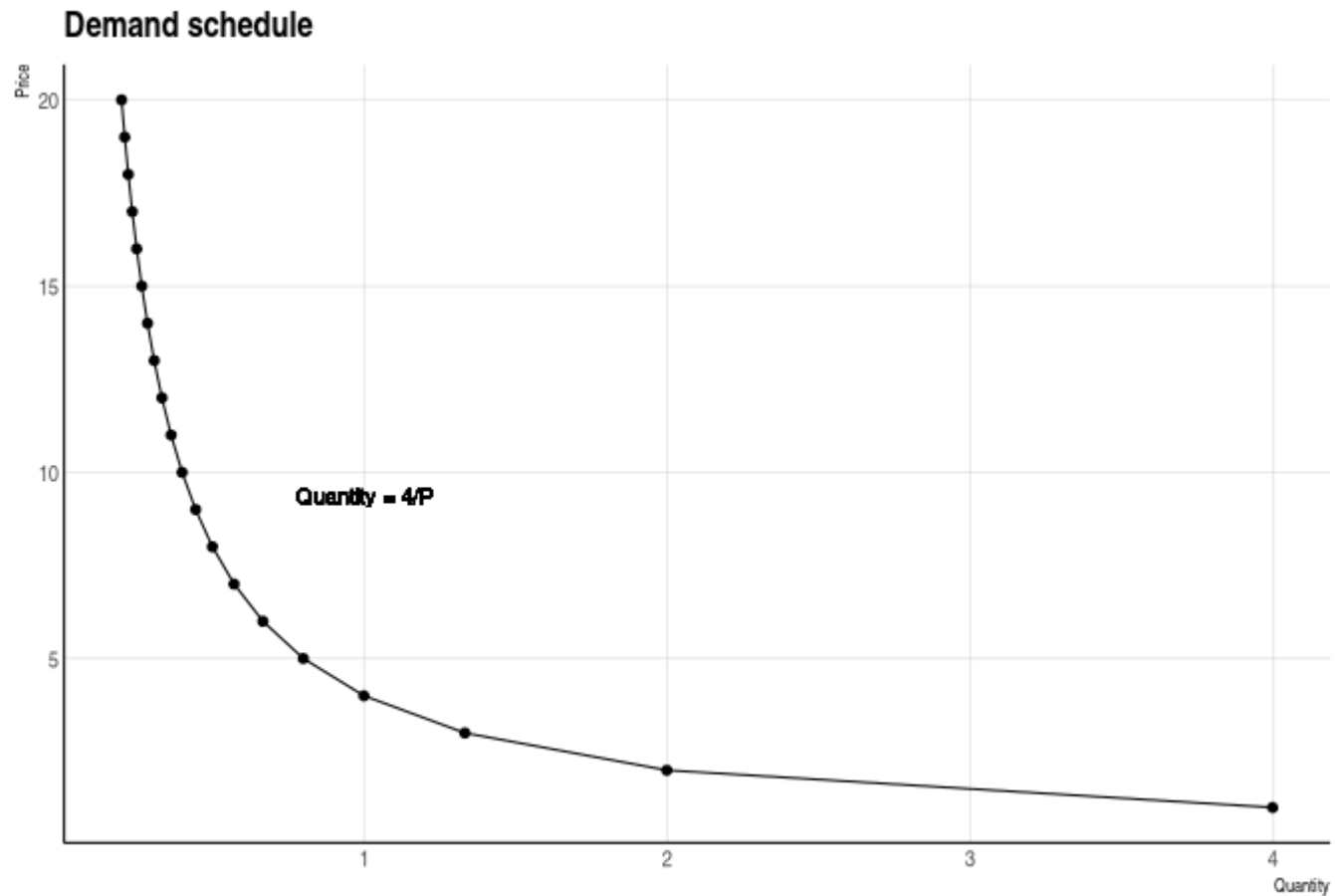
- **Demand curves** are constructed from **consumers** making optimal purchase decisions

# Review 011: Demand



Movement vs shift in demand

# Review 011: Demand





# Review 012: Supply

**Definition:** The relationship between prices and quantities (supplied)

## The Law of Supply:

- When prices increase, the quantity supplied increases
- $P \uparrow \longrightarrow Q_s \uparrow$

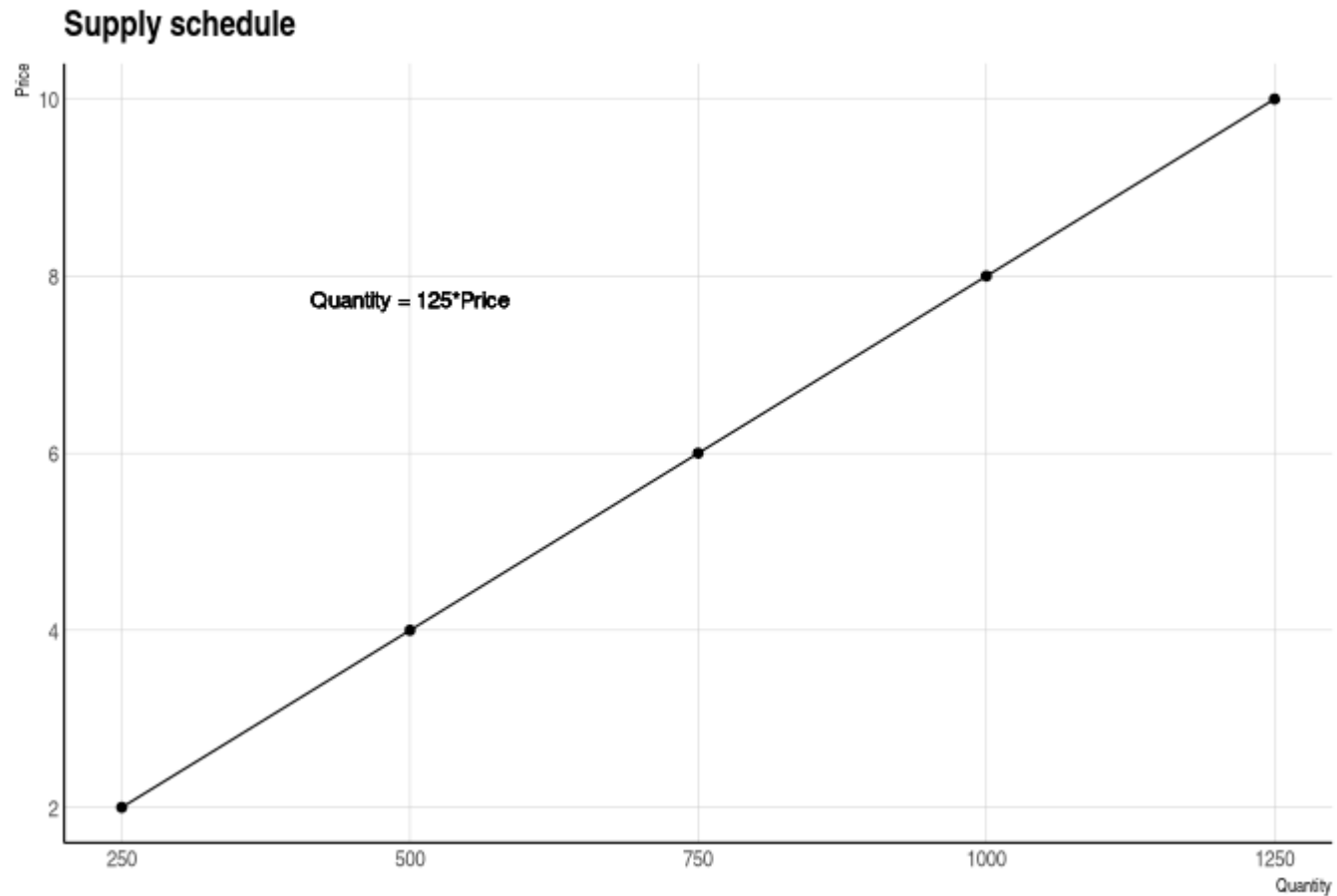
## Example: Supply schedule

Price	Quantity
2	250
4	500
6	750
8	1000
10	1250

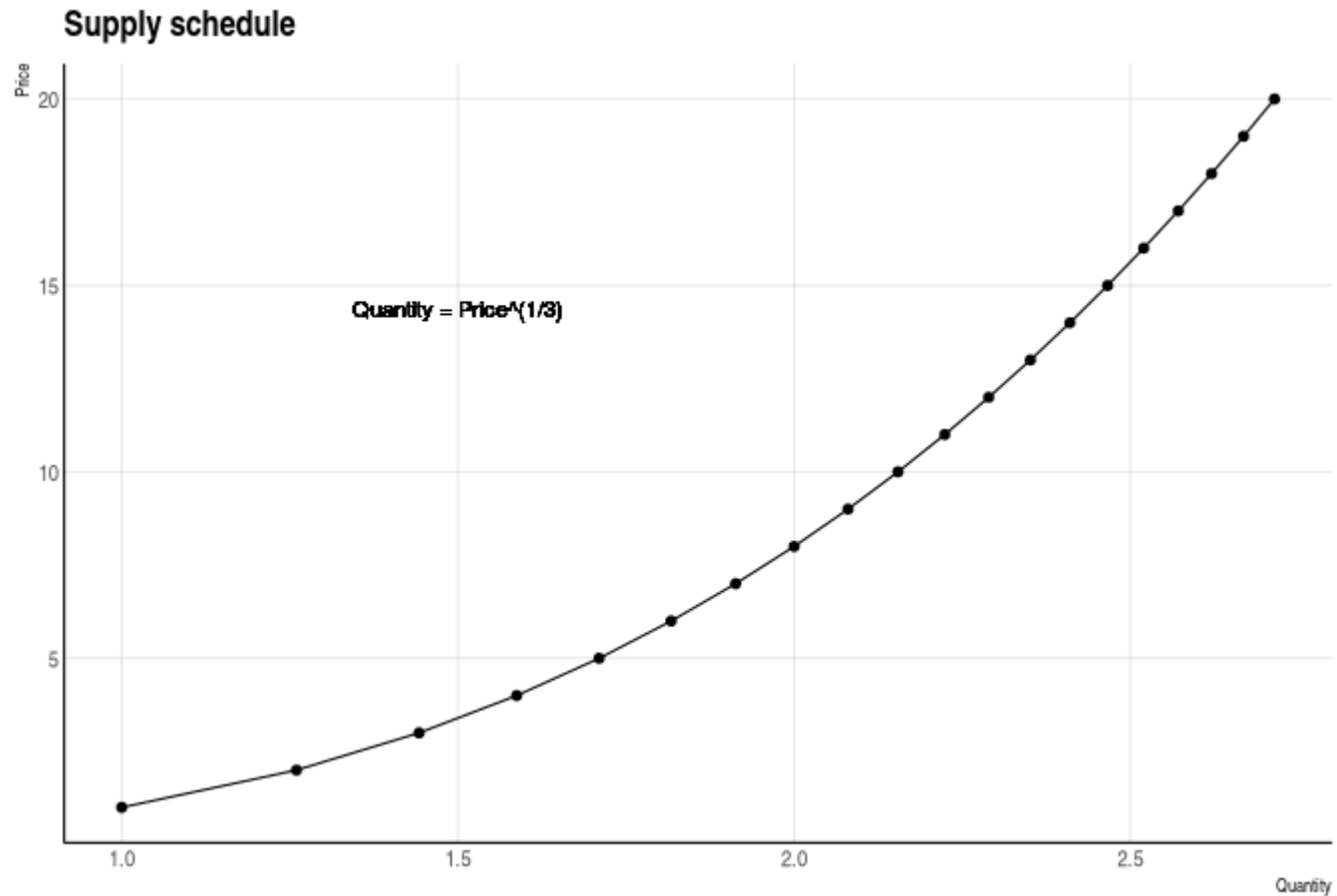
The key players are **firms**

**Supply curves** are constructed from **producers** making optimal production decisions

# Review 012: Supply



# Review 012: Supply

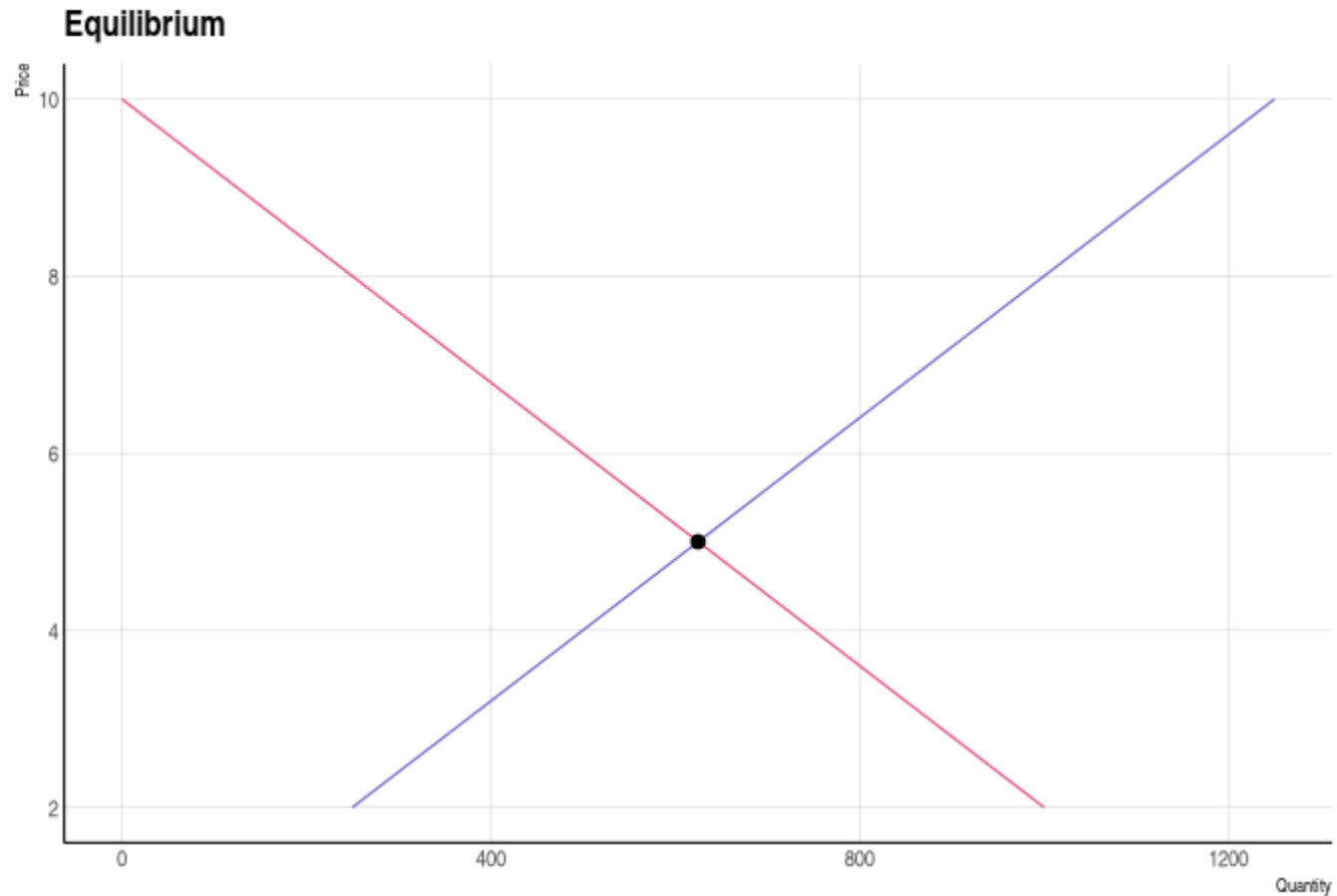


# Review 013: Equilibrium + surplus

## Definitions:

- **Equilibrium:** A pair of points  $(Q^*, P^*)$  such that there is no excess supply or demand
  - Supply = Demand
  - Fundamental Assumptions: Marginal value (utility) is decreasing and marginal cost is increasing
- **Consumer Surplus:** The difference between a consumers **maximum** willingness to pay (WTP) and the market price
- **Producer Surplus:** The difference between the price producers **minimum** willingness to sell and the market price

# Review 013: Market equilibrium



# Review 013: Market equilibrium shifts

# Example: Consumer surplus



**Max Auffhammer**  
@auffhammer



A California Household spends roughly \$2.75 per day on electricity (equal to a [@starbucks](#) latte). The massive whining about a possible two day power outage indicates that marginal willingness to pay is way higher than that. Yes. That pain you are feeling we call consumer surplus.

5:21 PM · Oct 8, 2019 · [Twitter Web App](#)

**19** Retweets   **130** Likes



# Example: Solve for the equilibrium

## Example

Suppose we are given the following:

- Supply:  $P(Q_s) = 10 + Q_s$
- Demand:  $P(Q_d) = 20 - 4 * Q_d$

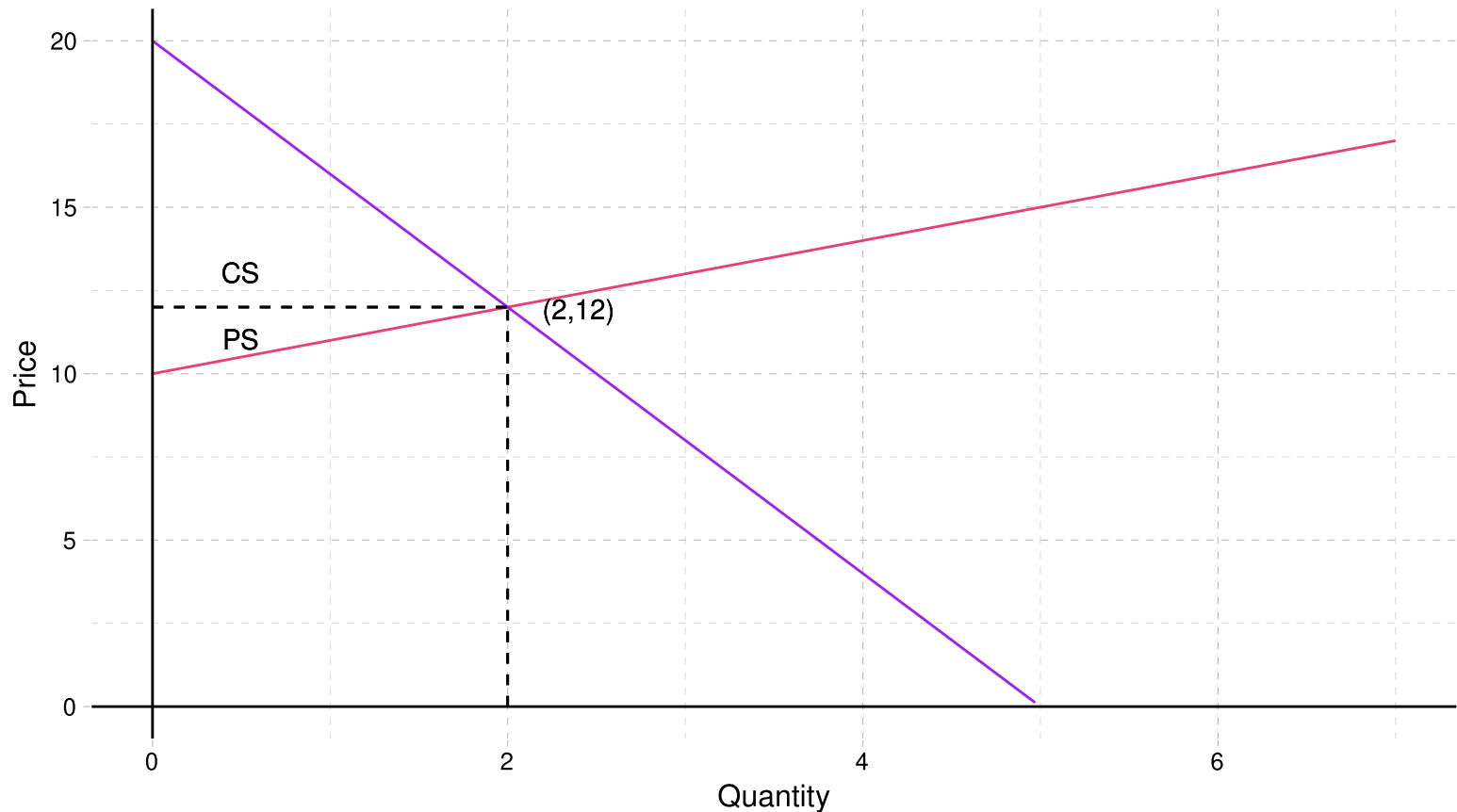
## Task:

- (i). Carefully graph and label both curves
- (ii). Compute the Equilibrium
- (iii). Compute Consumer and Producer Surplus



# Example: Solve for the equilibrium

- Supply:  $P(Q_s) = 10 + Q_s$
- Demand:  $P(Q_d) = 20 - 4 * Q_d$



# Example: Solve for the equilibrium

- **Equilibrium:**

$$10 + Q^* = 20 - 4 * Q^*$$

$$5Q^* = 10$$

$$Q^* = 2$$

Plug this into either supply or demand equation to get:

$$P^* = 10 + 2 = 12$$

- **Consumer Surplus:**

- $CS = \frac{1}{2} * (20 - 12) * (2 - 0) = 8$

- **Producer Surplus:**

- $PS = \frac{1}{2} * (12 - 10)(2 - 0) = 2$

# Quiz 01:

Using the follow supply + demand functions

**Supply:**  $Q(p_s) = 15 + \frac{1}{2} * p_s$

**Demand:**  $Q(p_d) = 40 - \frac{2}{3} * p_d$

Determine:

- (i) Graph each curve and label carefully
- (ii). Equilibrium prices (  $p^*$  ) and quantities (  $q^*$  )
- (iii). Consumer surplus
- (iv). Producer surplus

# Review 014: Elasticities

**Elasticity:** A measure of responsiveness of one variable to another

- **in percentage terms**

## Common elasticities:

- **Own price elasticity (good x):** Measures how much quantity demanded for **x** will respond to a one percent change in the price of good **x**

- Formula:  $\epsilon_{x,P_x} = \frac{\% \Delta Q_x}{\% \Delta P_x}$

- **Cross price elasticity (goods x,y):** Measures how much quantity demanded for **x** will respond to a one percent change in the price of **y**

- Formula:  $\epsilon_{x,P_y} = \frac{\% \Delta Q_x}{\% \Delta P_y}$

# Review 014: Elasticities (examples)

Own price elasticity:

Cross price elasticity:

# Review 014: Elasticities

Suppose  $\varepsilon_{x,P_x} = -0.5$ . What does this mean in words?

A 1% change in the **price of good x** will lead to a .5% change in the *opposite* direction in the **quantity demanded for good x**

The equation can be helpful. If  $\varepsilon_{x,P_x} = -0.5$ , then:

$$\frac{\% \Delta Q_x}{\% \Delta P_x} = -0.5$$
$$\% \Delta Q_x = -0.5 * \% \Delta P_x$$

# Review 014: Elasticities (questions)

## Review Questions:

- If  $\varepsilon_{x,y} > 0$ , are these goods complements or substitutes?
  - Substitutes, because an increase in the price of  $y$  **increases** demand for  $x$
  - Lame example: cheerios and other cereal
- If  $\varepsilon_{x,y} < 0$ , are these goods complements or substitutes?
  - Complements, because an increase in the price of  $y$  **decreases** demand for  $x$
  - Lame example: Left and right shoes; pb and bananas

# Review 015: Cost functions

## Definitions:

- **Total Revenue (TR):** Total money firm brings in from selling  $Q$  units.

- $TR = P * Q$

- **Total Cost (TC):** The cost of producing  $Q$  units units

- **Average Cost (AC)** =  $\frac{TC}{Q}$

- **Profit** (denoted as  $\Pi$ ):

$$\Pi = TR - TC$$



# Review 015: Cost functions

Suppose the price of the output good is **3** dollars per unit. Suppose a firm's cost function is  $TC(Q) = 1 + Q$ . If the firm produces 8 units of the good, calculate:

- $TR$
- $TC$
- $AC$
- Profit

# Review 015: Cost functions

Suppose the price of the output good is 3 dollars per unit. Suppose a firm's cost function is  $TC(Q) = 1 + Q$ . If the firm produces 8 units of the good, calculate:

- $TR = 3 * 8 = 24$
- $TC = 1 + 8 = 9$
- $AC = \frac{9}{8}$
- Profit =  $24 - 9 = 15$

# The Five Axioms of Urban Economics

# The Five Axioms of Urban Economics

As discussed in **lecture 01**, we are after some big questions in this course

- Agree upon a few basics before moving onto more complex problems

## **Definition: Axiom**

- A statement which is regarded as being established or evidently true
- Long agreed upon assumptions

Axioms are the building blocks upon which theory is built

The 5 axioms of urban econ are 5 assumptions that we will take *as given* throughout the class

- Almost everything moving forward will be tied to one of these assumptions

# The Five Axioms of Urban Economics

Some lectures will focus on refining our understanding of these axioms

Almost everything we learn ties back to one of the 5 axioms

**(A1).** Prices adjust to achieve locational equilibrium

**(A2).** Self-reinforcing effects generate extreme outcomes

**(A3).** Externalities are inefficient

**(A4).** Production is subject to economies of scale

**(A5).** Competition generates zero economic profit

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# Axiom 1

**A1:** Prices adjust to achieve **locational equilibrium** <sup>†</sup>

- **Locational EQ:** The balance that exists when there is no incentive for firms or households to move

## Examples:

- Rents **near** downtown > rents **far** from downtown
- Home prices **near** good schools > home prices **near** bad schools
- Wages + amenities in **high-cost** cities > wages + amenities in **low-cost** cities

<sup>†</sup>: We will refine this definition later in the term

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# Axiom 2

**A2:** *hi[Self-reinforcing effects] generate extreme outcomes*

**Self-reinforcing effect:** Pattern that leads to changes in the same direction

- *AKA positive feedback loop*

## Examples

- Tech firms in the Silicon Valley
- Artists in Santa Fe, NM
- Hippies in Eugene, OR

Explains common pattern of clustering of similar people and firms

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# Axiom 3

**A3: Externalities** *are inefficient*

**Externality:** A **cost** or **benefit** of a transaction experienced by somebody who is not involved in the transaction

## **Negative Externalities** (costs)

- Pollution
- Car noise
- Dilapidated housing
- Second-hand smoke

## **Positive Externalities** (benefits)

- Vaccines
- Public schools
- Remodeling housing
- Beekeepers

# Axiom 3: Externalities

What do these have to do with **efficiency**?<sup>†</sup>

- Private incentives are not aligned with social costs or benefits
- **Example:** In absence of quotas, do people fish too much or too little?
  - Too much. This harms future fisheries

Negative externalities are **overprovided**

Positive externalities are **underprovided**

- So a market with an externality is **inefficient**

<sup>†</sup>: Highest total surplus

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**(A5).** Competition generates zero economic profit

# Axiom 4

**14:** *Production is subject to **economies of scale***

- **Economies of Scale:** Average cost of production decreases as quantity produced increases

## **Examples:**

- **Transportation** of good & people
  - Trains shipping to small towns **vs** big cities
  - Amazon ships wayyy faster in San Diego compared to Eugene
- **Education**
  - 20 person class **vs** 80 person class

# The Five Axioms of Urban Economics

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**(A4).** Production is subject to economies of scale

**(A5).** **Competition generates zero economic profit**

# Axiom 5

**A5:** *Competition generates zero **economic profit***

- Degree of competition dictates **number of firms** in the market
- Firms enter (drives price down) until **economic profit** → zero
  - Enough firms earn enough to stay in business but no more

**Economic profit:** Includes **opportunity cost**

- Different from accounting profit; hear on the news/balance sheets



# List of the 5 Axioms

**(A1).** Prices adjust to achieve locational equilibrium

**(A2).** Self-reinforcing effects generate extreme outcomes

**(A3).** Externalities are inefficient

**(A4).** Production is subject to economies of scale

**(A5).** Competition generates zero economic profit

# Schedule

## Next Class:

- Determinants of city size

## Upcoming:

- **Reading:** intro + chapter 1

# Table of Contents

## Econ 201 Review

1. Supply & Demand
2. Elasticities
3. Profit, Revenue, & Cost

## 5 Axioms of Urban Economics

1. Axiom 1: Prices adjust to achieve locational equilibrium
2. Axiom 2: Self-reinforcing effects generate extreme outcomes
3. Axiom 3: Externalities are Inefficient
4. Axiom 4: Production is subject to economies of scale
5. Axiom 5: Competition generates zero economic profit