



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

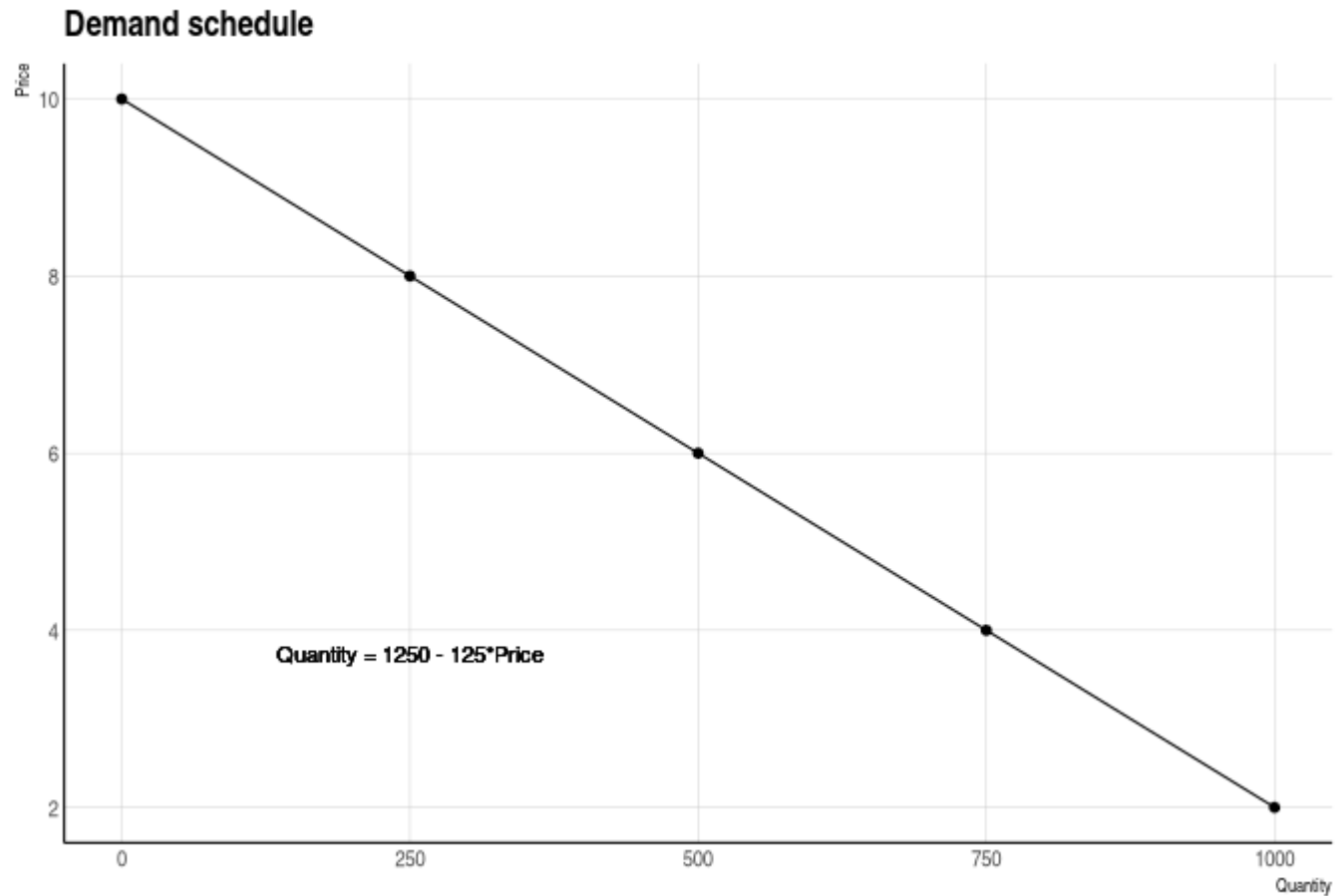
The key players are **consumers**

Example: Demand schedule

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

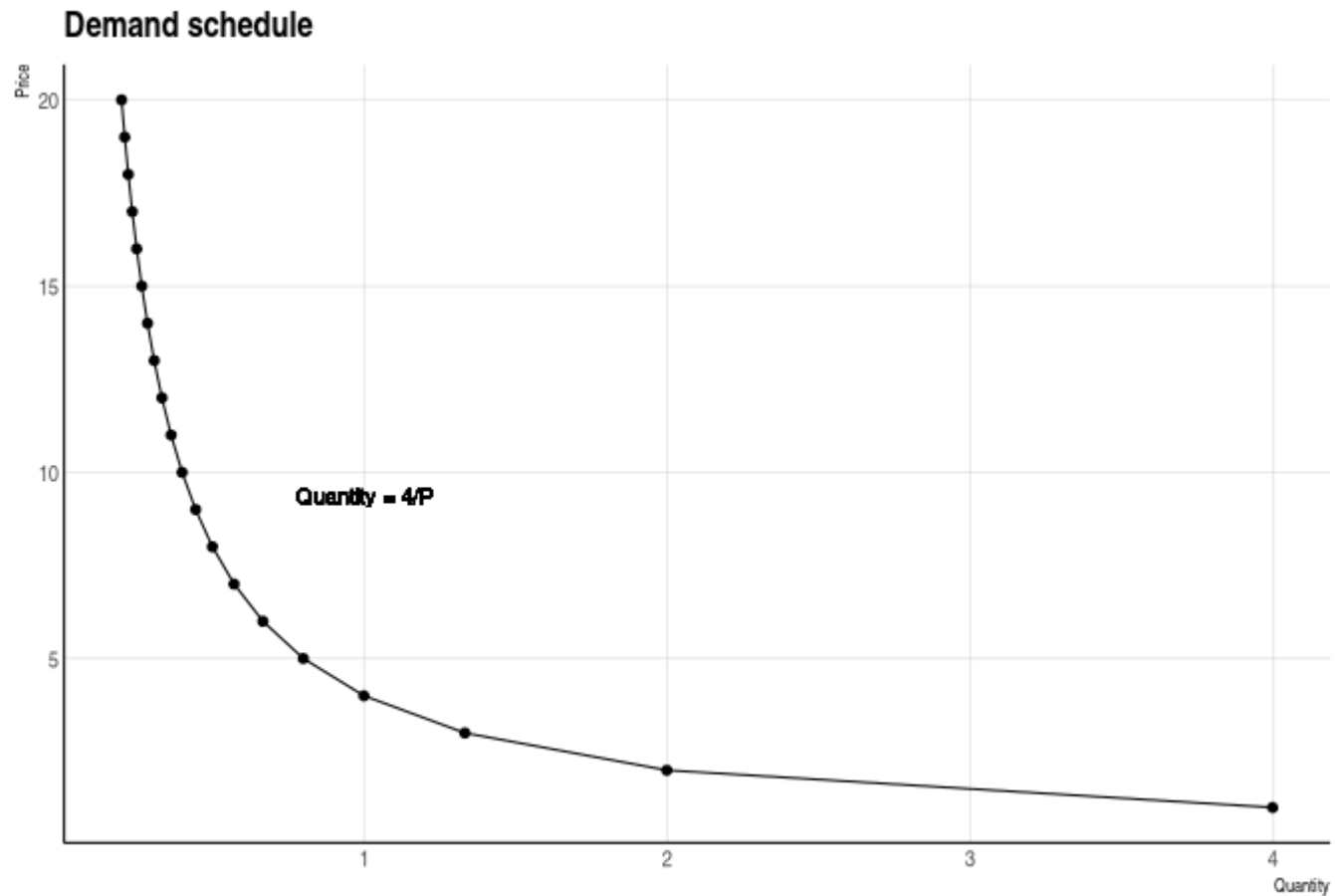
- **Demand curves** are constructed from **consumers** making optimal purchase decisions

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
- $P \uparrow \longrightarrow Q_s \uparrow$

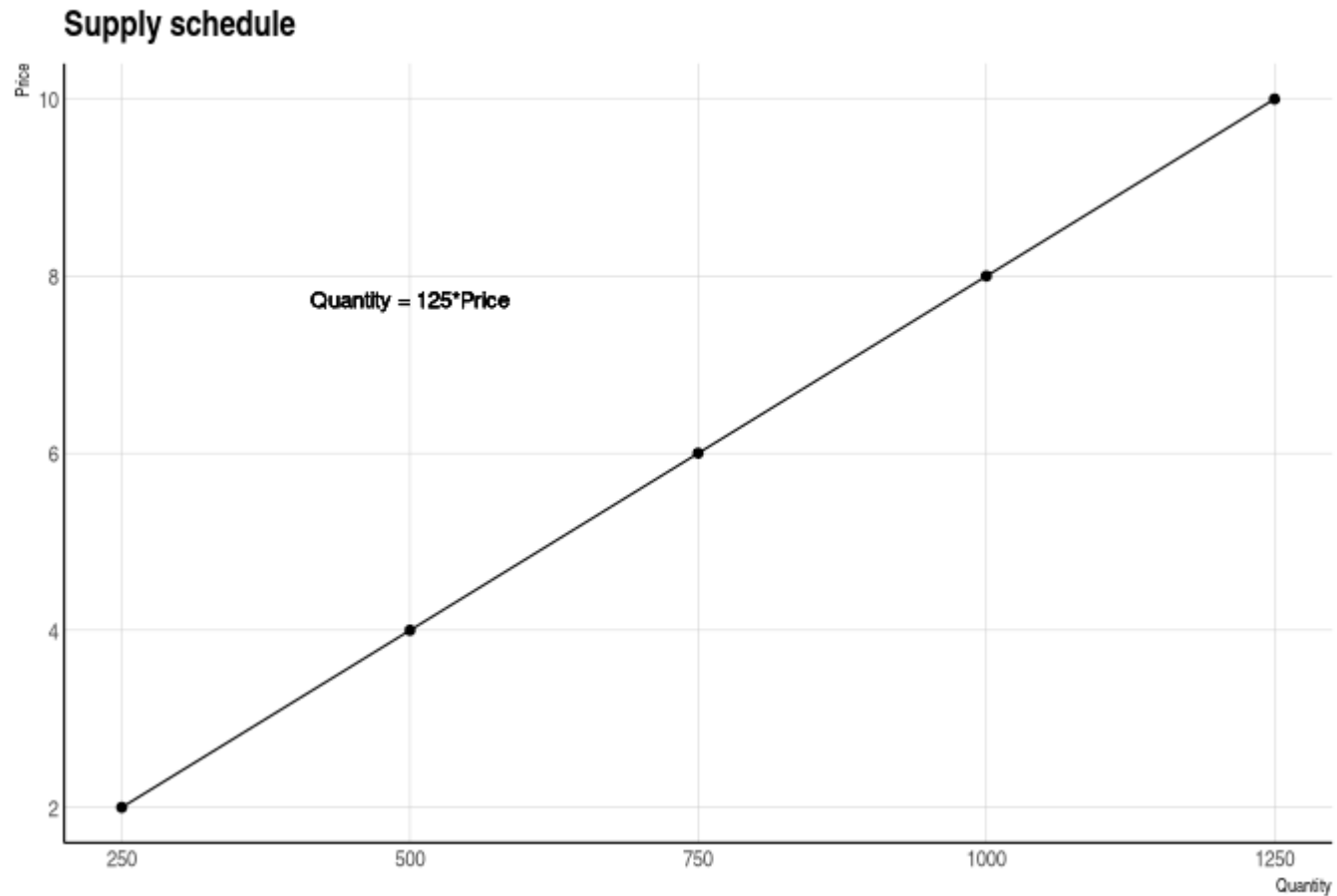
The key players are **firms**

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

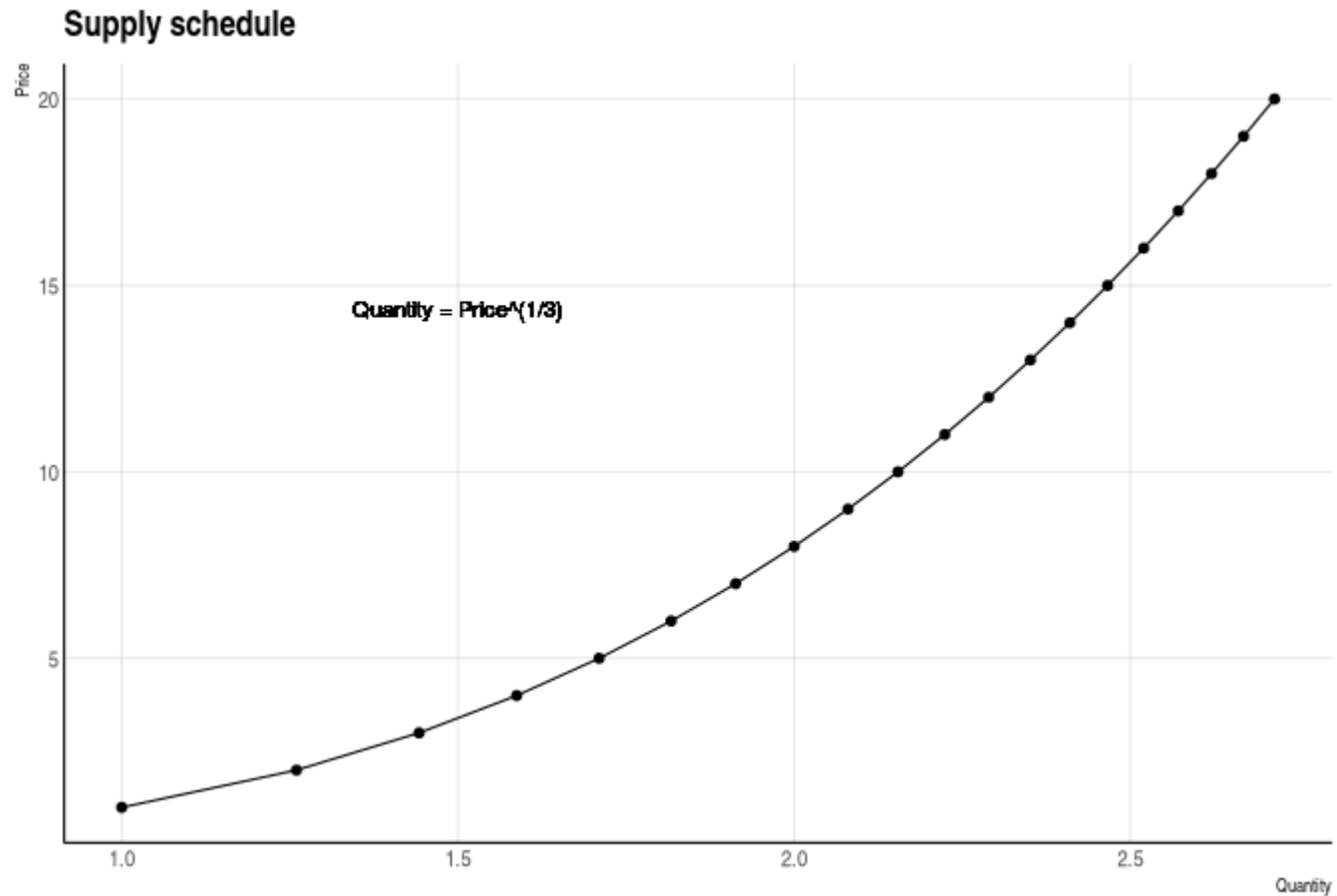
Example: Supply schedule

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

Review 012: Supply



Review 012: Supply

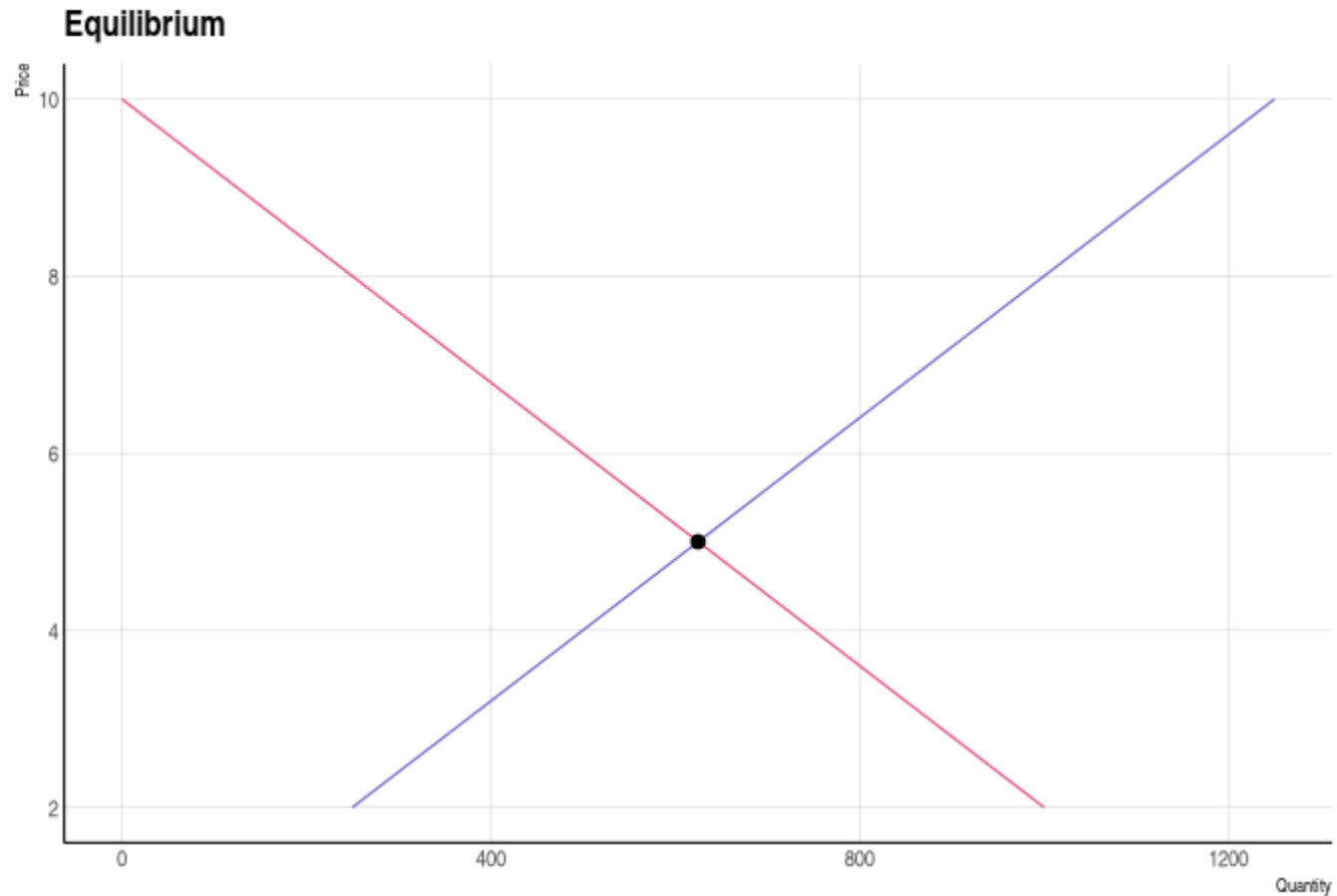


Review 013: Equilibrium + surplus

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:

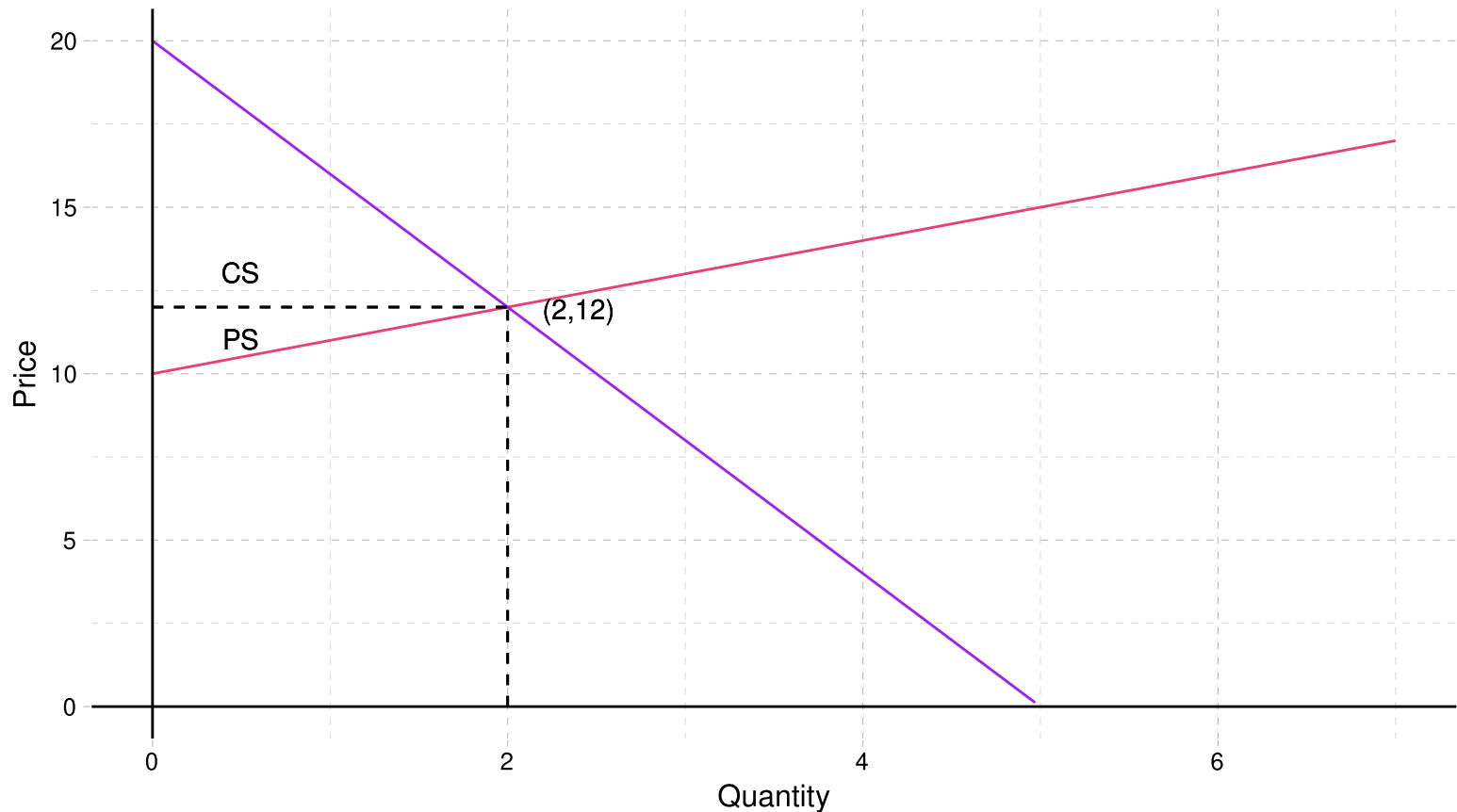
- Supply: $P(Q_s) = 10 + Q_s$
- Demand: $P(Q_d) = 20 - 4 * Q_d$

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 Π):

$$\Pi = TR - TC$$

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** [†]

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

Prices must adjust s.t. there is indifference between locations

⇒ No incentive exists

Examples:

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

[†]: We will refine this definition later in the term

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Axiom 2

A2: 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**?[†]

- 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**

[†]: Highest total surplus

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(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

Axiom 4

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

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

- **"Lumpy" inputs:** Capital inputs may be indivisible; cannot scale down
- **Factor specialization:** Larger operations have more employees who then can specialize

Examples:

- Transportation of goods
- Pizza ovens
- Education
- Building CPU

The Five Axioms of Urban Economics

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(A1). Prices adjust to achieve locational equilibrium

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(A3). Externalities are inefficient

(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

Eugene example: Marijuana dispensaries

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