Existence of Cities

EC330, Set 03

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Fall 2022

Contents

Housekeeping

PS01 will be posted later today

- Due on **Wednesday, October 12th** on canvas by **11:59p**
- Should be straight forward
- Though after today you won't be able to start question 5
- Must be submitted as a pdf

Note:

- Use the space provided on the pdfs
- If you need more space, use scratch paper
- Points will be deducted for messy work

Historical data

Historical data

More than **4 billion** people living in urban area globally †

Urban populations are now greater than rural populations

- Since **2007**
- Only **10%** of humans lived in urban areas in **1800**
- Only **1%** of land is categorize as urban area

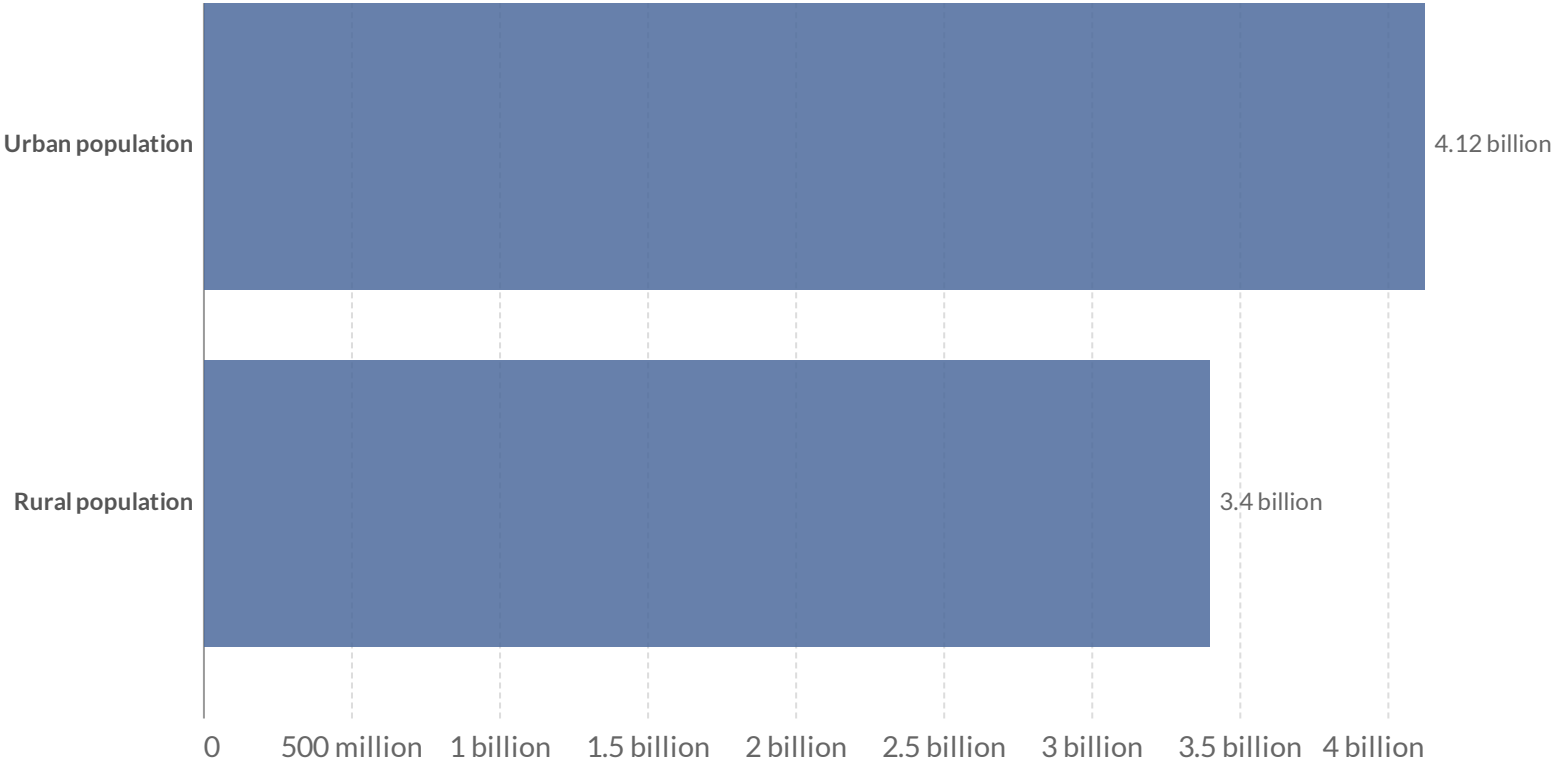
By **2050**, **66%** of global populations will live in urban areas

† Although the definition of an "urban area" is not exactly well defined

Number of people living in urban and rural areas, World, 2017

Our World in Data

Change country



Source: World Bank based on data from the UN Population Division
Note: Urban populations are defined based on the definition of urban areas by national statistical offices.

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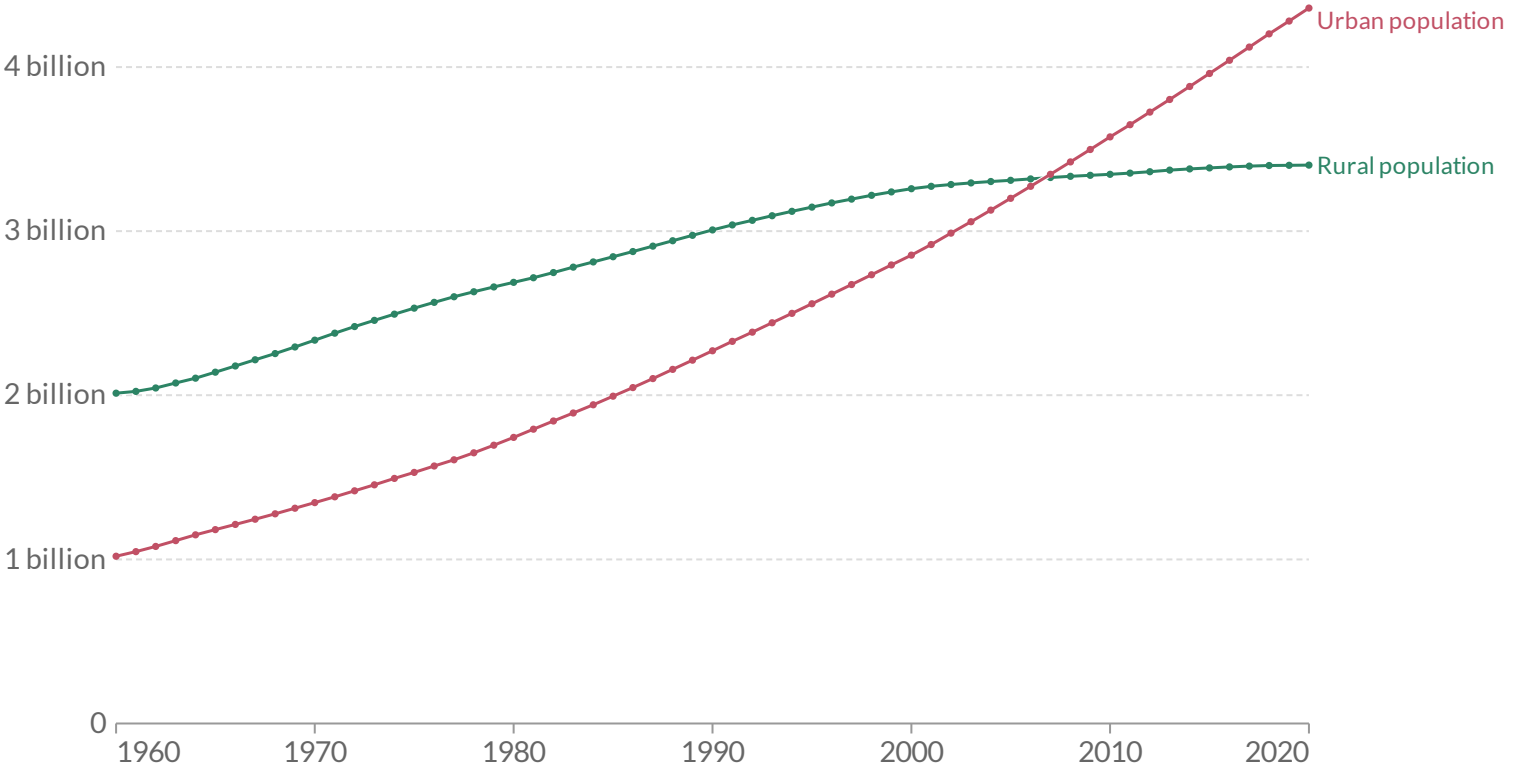
1960 2020

CHART | TABLE | SOURCES | DOWNLOAD

Number of people living in urban and rural areas, World

Our World in Data

Change country



Source: World Bank based on data from the UN Population Division
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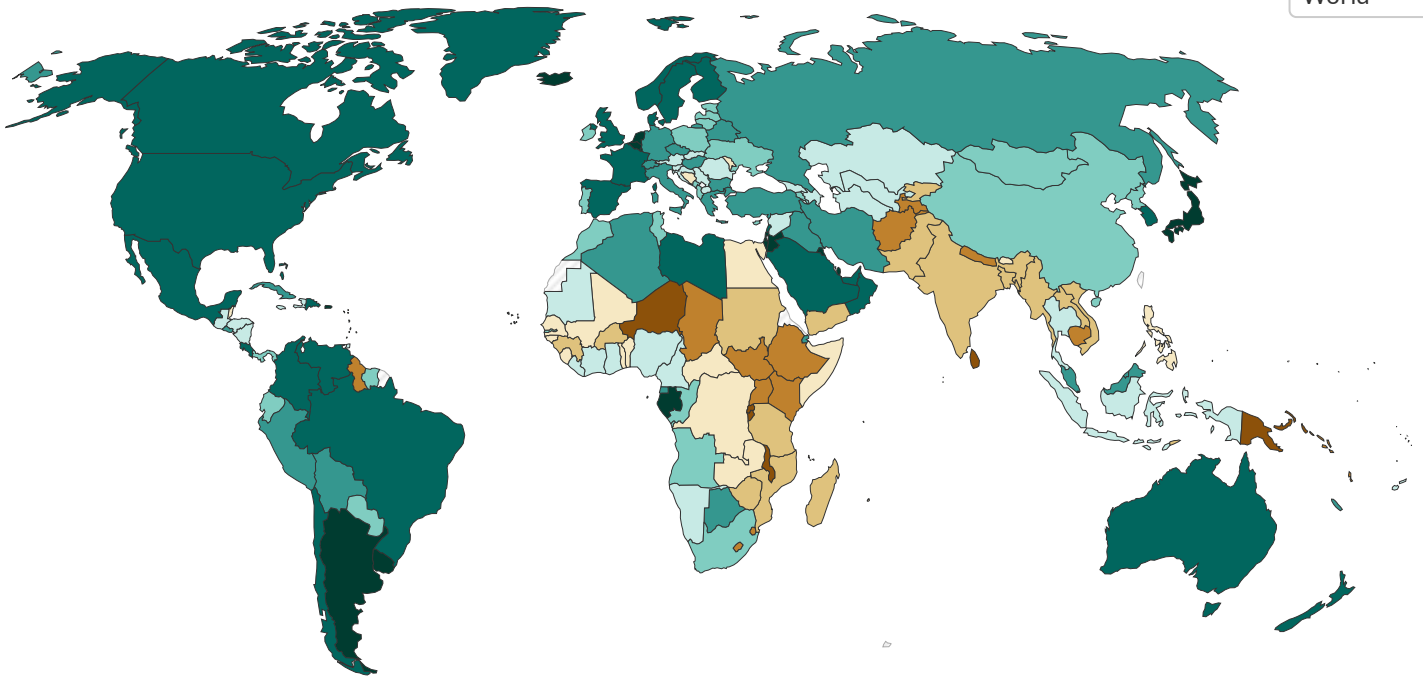
Share of people living in urban areas, 2020

Our World in Data

World



Source: UN Population Division (via World Bank)
Note: Urban populations are defined based on the definition of urban areas by national statistical offices.

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1960 2020

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Technological shifts

Technological shifts

Claim: In the past 200 years the world *has become* **flat**

- **1840s: Rail** becomes ubiquitous
  - Transportation costs ⬇️

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Claim: In the past 200 years the world *has become* **flat**

- 1840s: Rail becomes ubiquitous
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- 1840s: Telegraph is invented
  - Information costs ⬇️
- **1870's: Telephone** is invented
  - Information costs ⬇️

Technological shifts

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- 1840s: Rail becomes ubiquitous
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- 1840s: Telegraph is invented
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- 1870's: Telephone is invented
  - Information costs ⬇️
- **1908: Model T** production starts
  - Transportation costs ⬇️

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- 1840s: Telegraph is invented
  - Information costs ⬇️
- 1870's: Telephone is invented
  - Information costs ⬇️
- 1908: Model T production starts
  - Transportation costs ⬇️
- **1914:** First commercial **airline flight**
  - Transportation costs ⬇️

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- 1914: First commercial airline flight
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- **1980s:** Airline deregulation
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- 1980s: Airline deregulation
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- **1990's:** The internet
  - Information costs ⬇️

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- 1914: First commercial airline flight
  - Transportation costs ⬇️
- 1980s: Airline deregulation
  - Transportation costs ⬇️
- 1990's: The internet
  - Information costs ⬇️
- **2020s:** Post COVID
  - Transportation costs ⬇️
  - Information costs ⬇️
- Among many other technological changes

Why do cities exist?

Paradox: Why do cities exist?

Urban population trends and technological innovations seem **paradoxical**

The world is getting **flatter**, yet urban populations are **booming**

This **paradox** motivates the questions:

Why do cities exist in the first place?

Why have some cities succeeded?

Why have some cities failed?

We will draw insights from economic models to answer these questions

Paradox: Why do cities exist?

What do you think?

There is a pretty simple, one-word answer. **Any guesses?**

Trade.

Cities exist because individuals are not self-sufficient

Suppose there was **no trade**

- *What would we need for this to be true?*
- *Would this lead to no cities?*
- *Even with trade, when is it the case that households just trade amongst themselves?*

EC 201 Review 017: Trade

Definitions:

- **Absolute Advantage** (AA): An economic agent or entity has **AA** in exchange if they can produce more of the good in the same amount of time
- **Comparative Advantage** (CA) : An economic agent or entity has **CA** in exchange if they can produce the good at a lower *oppurtunity cost*
- **Production Possibilities Frontier** (PPF): All possible combinations of goods that an economic agent or entity can produce

EC 201 Review 017: Trade - example

Example: Suppose we have two countries, **A** & **B**, producing guns and oil

Each countries **PPF** is described by:

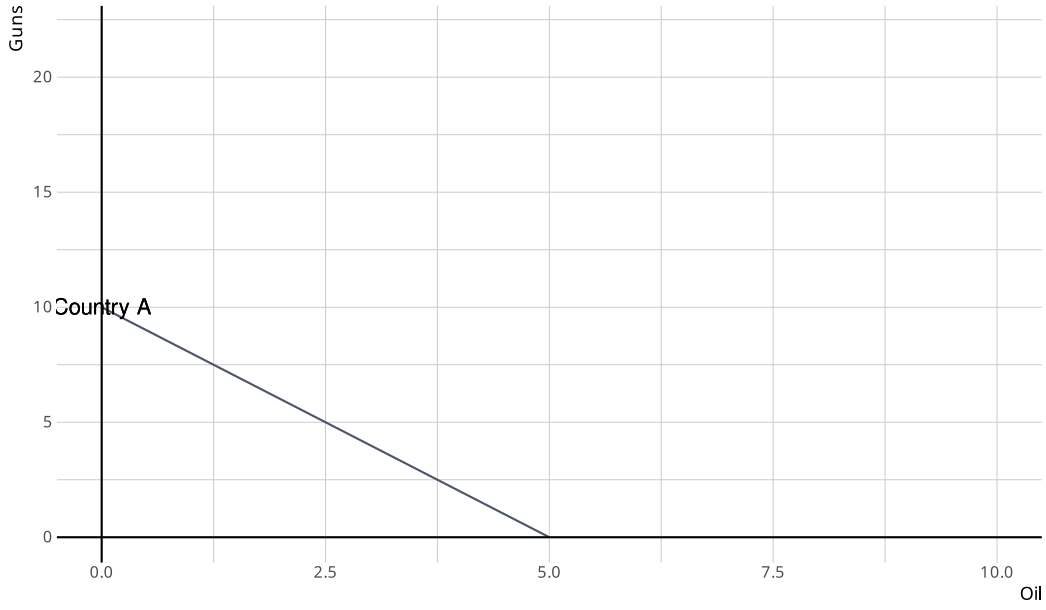
- **A:** $Guns_A = 10 - 2 * Oil_A$
- **B:** $Guns_B = 20 - 5 * Oil_B$

(i) Graph each countries **PPF**

(ii) Determine who has the AA and who has the CA in each good

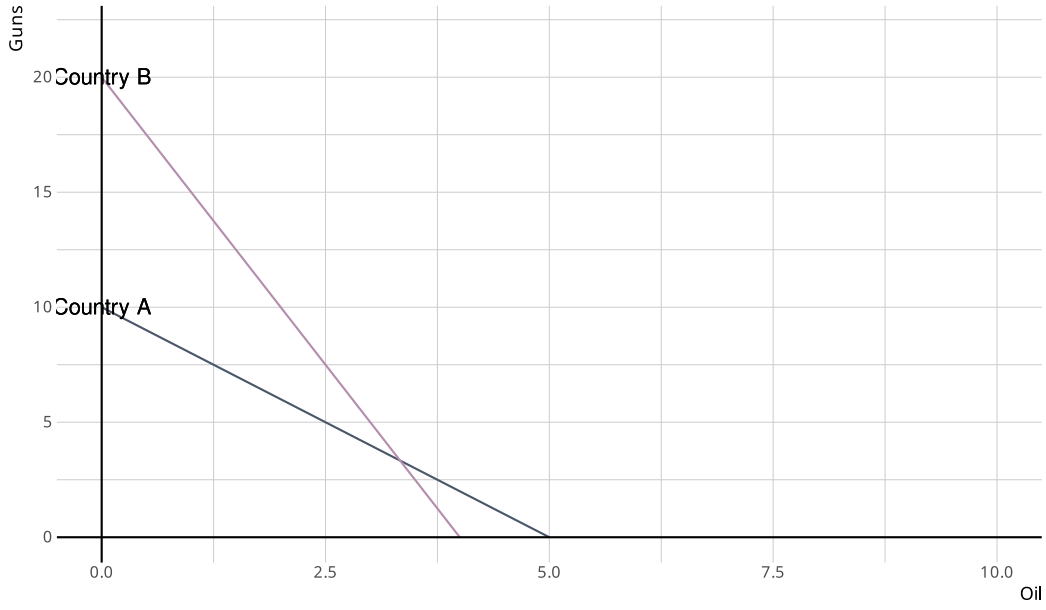
EC 201 Review 017: Trade - example

PPFs:



EC 201 Review 017: Trade - example

PPFs:



PPF Heuristics

When looking at PPFs, to determine:

(i) **AA**: Check intercepts

- Whoever has higher valued **intercept** has the **AA** in production

(ii) **CA**: Check slopes

- A **steeper slope** indicates CA on the vertical axis
- A **shallower slope** indicates CA on the horizontal axis

Why do cities exist?

We need land to produce food and resources; dense cities don't provide

Cities exist because of human **technology** has created systems of production and trade that defy the natural order

Three conditions must be satisfied:

(i). Agricultural surplus: People outside cities must produce enough food to feed themselves and city dwellers

(ii). Urban production: City dwellers must produce goods or services to exchange for food grown by rural workers

(iii). Transportation for exchange: Efficient transportation system to facilitate the exchange of food and urban products must exist

The technology in this case is what we call **trade**

Backyard production model

Backyard production model

A **simple** economic model to understand the economic incentives of cities

Consider a region that produces and consumers two products:

- **Bread**
- **Shirts**

Let's make three assumptions that would eliminate any incentives for households to geographically cluster

Relaxing each assumption will give us **intuition** about the formation of cities

Backyard production model

Model assumptions:

A01: There exist no differences in the productivity of land nor labor

- No comparative advantages

A02: Constant Returns to Scale (CRS) in **exchange** and **transportation**

- Per unit price to **trade** goods *is the same* no matter how much is traded
- No need for middle man firms to help with distribution

A03: CRS in **production**

- The per unit price of production is constant
- No economies of scale $\rightarrow$ households productivity = firm productivity

Backyard production model

These three assumptions would eliminate exchange and ensure each household is self sufficient

A01: Equal productivity

A02: CRS in exchange and transportation

A03: CRS in production

There is no incentive to specialization due to **transaction costs**[†]

Locational equilibrium would be **uniformly distributed** population

[†]transaction cost is the opportunity cost of the time required to exchange products

Backyard production model: Relax A01

Q: Is all land and labor equally productive?

A: Nope. Let's relax that assumption **Ex:**

- Soil may be more productive in certain regions; better climate
- One region specializes in bread while the other in shirts

Relaxing A01 will lead to differences in productivity across cities:

$\Longrightarrow$ **comparative advantages**

$\Longrightarrow$ specialization + trade

However, specialization and trade will not alone lead to urban growth

- Households are just as effective at trading as any firm

Relax A02

In absence of scale economies, households trade directly†

- **CRS in Exchange**: Implies households are just as efficient at executing trades as firms (no cost benefits to scaling)
- No reason to pay a firm to do so (and thus no reason to pay for density)

A trading firm will use productive inputs such as:

- Large truck for transportation
- Specialized workers

† Scale economies: *bigger → cheaper per unit*

Relax A02

To take full advantage advantage of scale economies firms locate s.t. they minimize costs of distribution

ie. Build near river junctions, crossraods, ports

$\Longrightarrow$ higher prices of land $\Longrightarrow$ density

Result: Trading cities

These are represent the cities that **existed before the industrial revolution**

- Most city workers did not produce goods but distributed them
- Trade was risky; insurance, credit, banking and legal services sprouted

Relax A03

Now relax the final assumption **A03**

With economies of scale factories can outproduce households by lowering average costs

- Use indivisible inputs (machines)
- Allow workers to specialize

In order to pay for labor, a factory must pay such that they are indifferent between working in a factory and a rural area (**A1.**)

However, land scarcity **binds** and rents near the factory begin to increase

- Wages increase due to **locational equilibrium**

Factory area

Example:

Consider the shirt making factory:

- **Home** production: 20 p shirt
- **Factory**: 12 p shirt (economies of scale)

The factory locates in a town with 50 miles to east and west of villages

- 50 cents/mile to ship west.
- 20 cents/mile to ship east

Factory Towns

Market area: Area over which factories underprice home production

Under what condition will a consumer purchase the shirt from a factory?

$$\underbrace{p_f}_{\text{factory price}} + \underbrace{t \times d}_{\text{transit cost = cost p mile} \times \text{miles}} \leq \underbrace{p_h}_{\text{Home Price}}$$

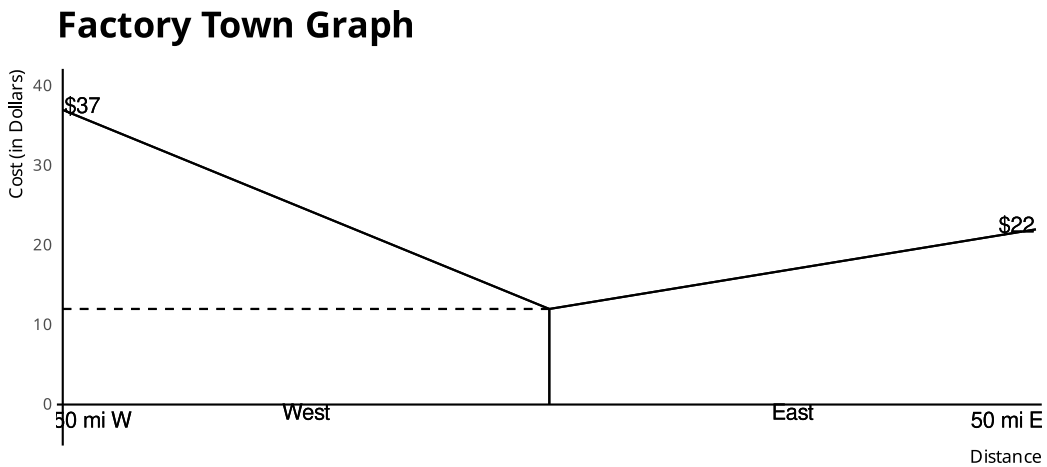
Questions:

1. Graph the cost of shirts throughout the entire region
2. Find the **market area** of the town
    - Find the sum of the **maximum distances** to the east and west that consumers will purchase the shirt from the factory

Regional Costs

Home production: 20 per shirt **Factory production:** 12 per shirt

Transportation costs: 50 cents/mile to ship west; 20 cents/mile east



Market Area Calculation

Market area depends on which side we are looking at. Let m denote miles

West: Consumers buy from factory if

$$12 + .5 * m_{west} \leq 20 \implies m_{west} \leq 16$$

East: Consumers buy from factory if

$$12 + .2 * m_{east} \leq 20 \implies m_{east} \leq 40$$

Market area:

$$40 + 16 = 56$$

Factory Towns

1. Would workers rather live **closer** or **further** from the factory?
    - **Closer!**
2. What happens to land-prices **close** to the factory?
    - They **increase**
3. What happens to **density**?
    - It will **increase**

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