Econ 330: Urban Economics

Lecture 4

John Morehouse
April 7th, 2021

Lecture IV: City Size and Growth

Schedule

Today

1) **Clustering**

2) **City Size**

3) **Intro to Growth**

Upcoming

- **Reading** (Chapter II & III *ToTC*)

- **HW 1** (due on April 11th)

Last Time

We discussed some **fundamentals** that lead to the existence of cities

- **Main takeaway**:
  - Need some reason (**economies of scale**) for cost of cities (high land prices, for example) to be justified

Questions:

- Why do cities grow beyond one factory?
- Why are there differences in size across cities?
- Where do cities emerge?

Clustering

So we explained *why* cities exist. Can we explain their size?

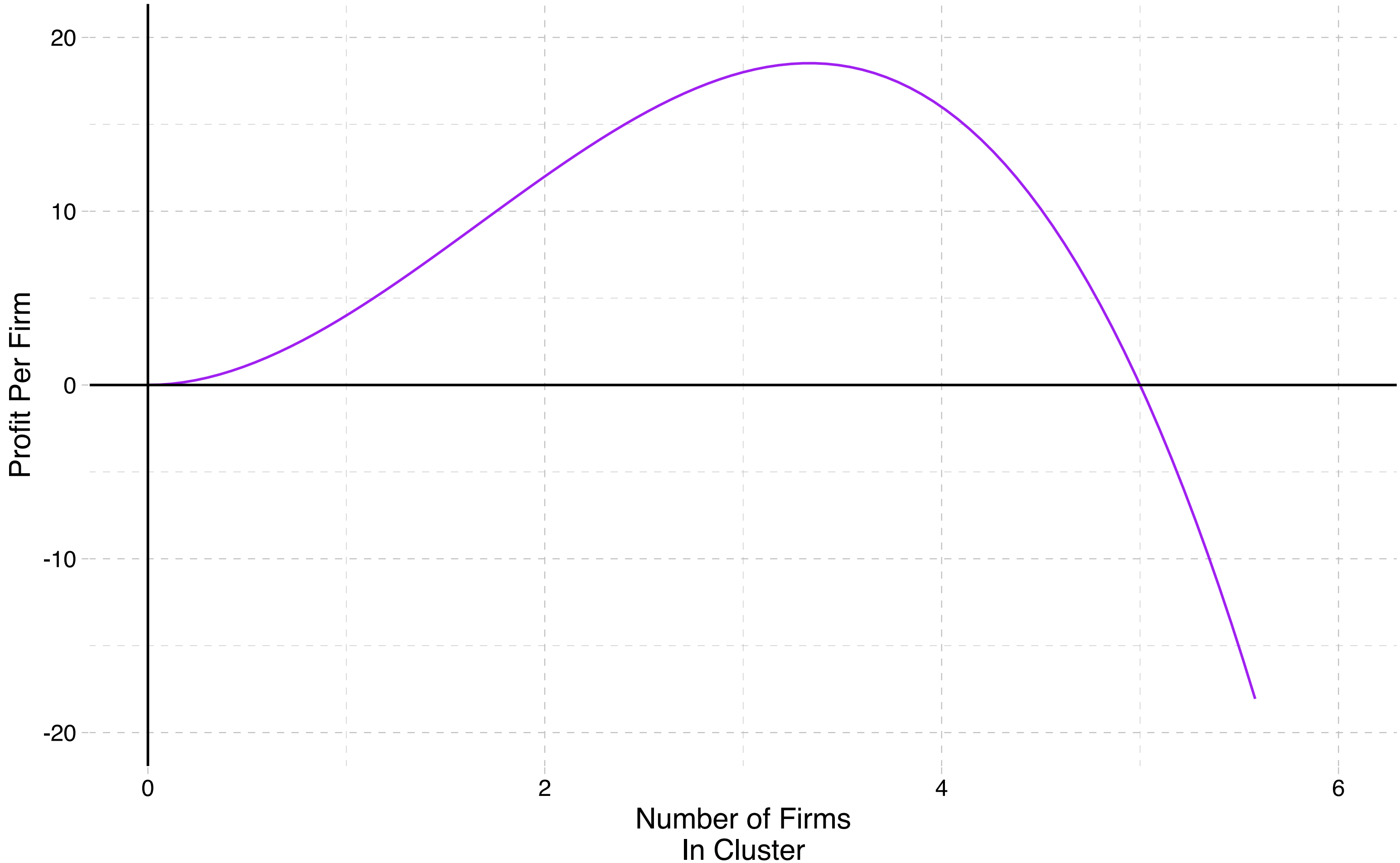
- Let's start by asking why firms cluster. Where to start? **Axiom 5**

Axiom 5: ***Competition generates zero economic profit***

- If a firm is making positive economic profit, more firms enter the market
- What happens to the profit per firm as more firms enter?
- It decreases. Eventually goes to zero

Example

How many firms are in the cluster?



Clustering

Why does **profit increase** as firms cluster? Firms cluster because

1) To share intermediate inputs

2) Labor Matching

3) Knowledge Sharing

4) Share the pool of labor

Let's look at these in some more detail

1: Sharing Inputs

Firms in **similar industries** share inputs to take advantage of scale economies†

Example: High Tech Firms

- Rapidly changing products that require sophisticated intermediate inputs
- Electronic components and testing facilities
- Firms share intermediate input suppliers

† Scale economies: *bigger* → *cheaper per unit*

2: Labor Matching

With **tech firms**

- Clustering attracts more of the kind of workers they want
- Firms and workers are not always perfectly matched
- Mitchmatches require training to eliminate skill gap. **Training is costly**
- Better for firm if they can find a worker to fill role immediately. More likely in a cluster

3: Knowledge Sharing

Defn: **Agglomeration Economies**: benefits that come when firms and people locate near one another together in cities and industrial clusters

> Agglomeration economies are the benefits that come when firms and people locate near one another together in cities and industrial clusters. These benefits all ultimately come from transport costs savings: the only real difference between a nearby firm and one across the continent is that it is easier to connect with a neighbor. Of course, transportation costs must be interpreted broadly, and they include the difficulties in exchanging goods, people, and ideas

Source: Ed. Glaeser

Firm Clustering

Let's refine our language a bit.

1. ***Localization economies***
    - Explains **within the same** industry clustering
2. ***Urbanization economies***
    - Explains **across** industry clustering

Localization Economies

A ***localization economy*** occurs when an increase in the size of an industry leads to an increase in productivity of production

Why?

- Evidence of higher **labor productivity**
    - Higher output → more productive workers (Henderson, 1986)
    - Tech workers benefit more from knowledge spillovers than manufacturing (Mun & Huchinson, 1995)
- Evidence of higher **rates of entry**
    - More firms are born where output is higher; that is, where the industry is clustered (Carlton, 1986)

Urbanization Economies

Urbanization Economies are when the size of a city leads to an increase in productivity

Why?

- **Sharing intermediate goods**: (banks, accountants, hotels, transport services)
- **Pooling**: workers move from industries with low demand to high demand (across sector)
- **Matching**: common skills across sectors (excel, for example)

Urbanization Economies result in **large, diverse cities**

Examples

Two major examples of **localization** & **urbanization** economies:

1) **Silicon Valley**

- **Localization**: firms locate close to each other to share high-skilled labor pool despite very high rents

2) **Los Angeles**

- **Urbanization**: Not really any super dominant industries, yet it continues to grow

Checklist

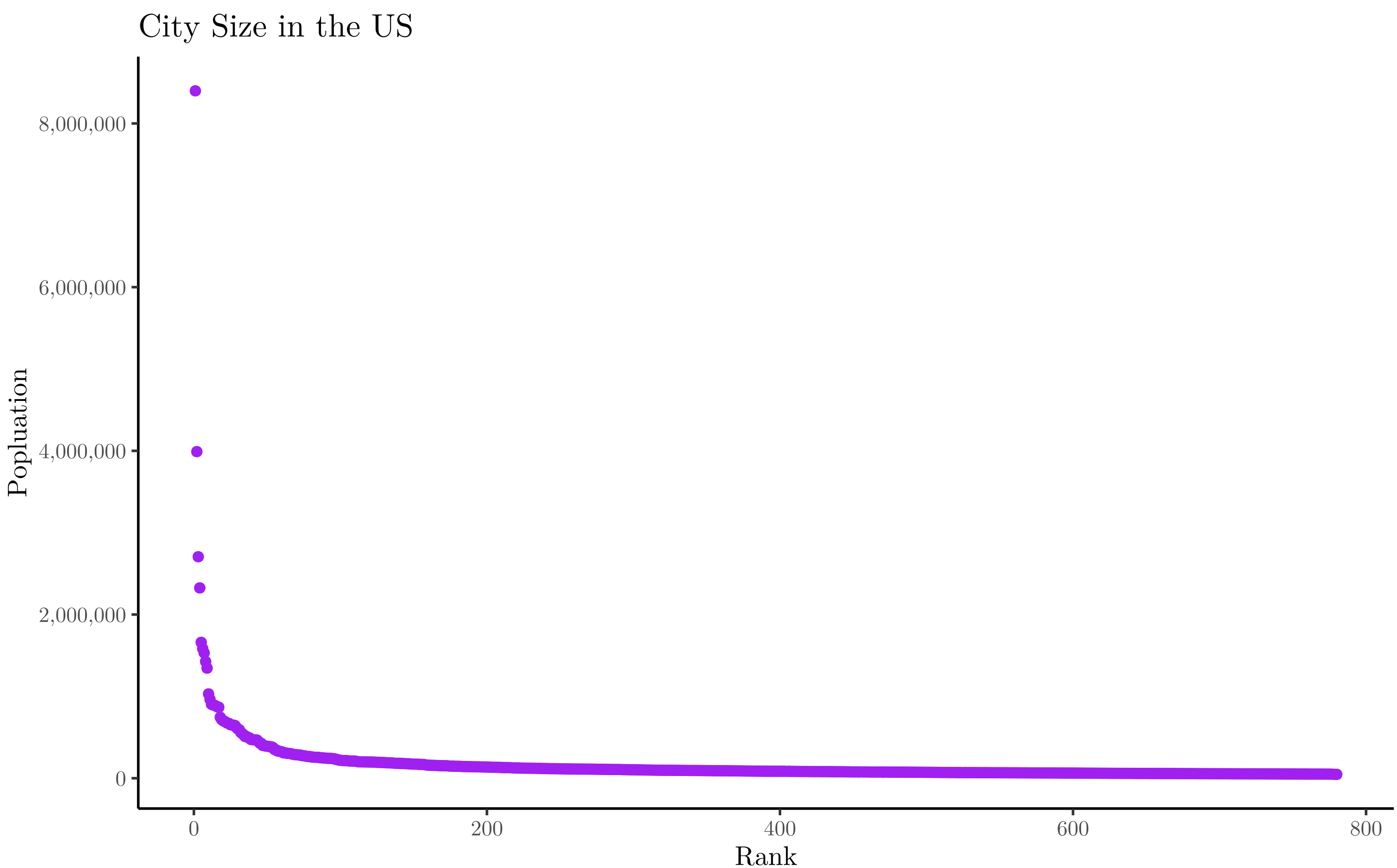
1) **Clustering** ✅

- Reasons for firm clustering
- Urbanization vs Localization Economies

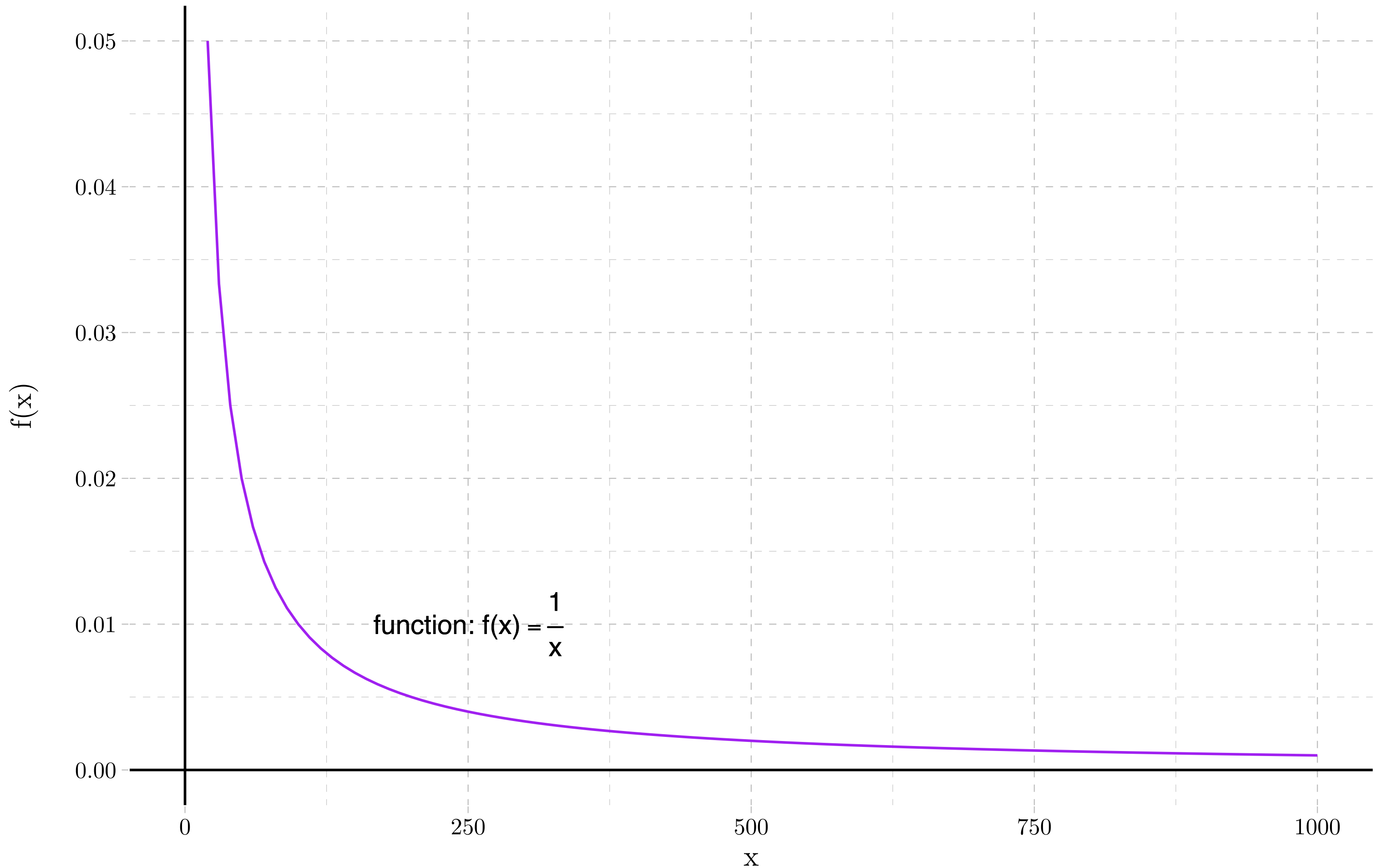
2) **City Size**

3) **Intro to Growth**

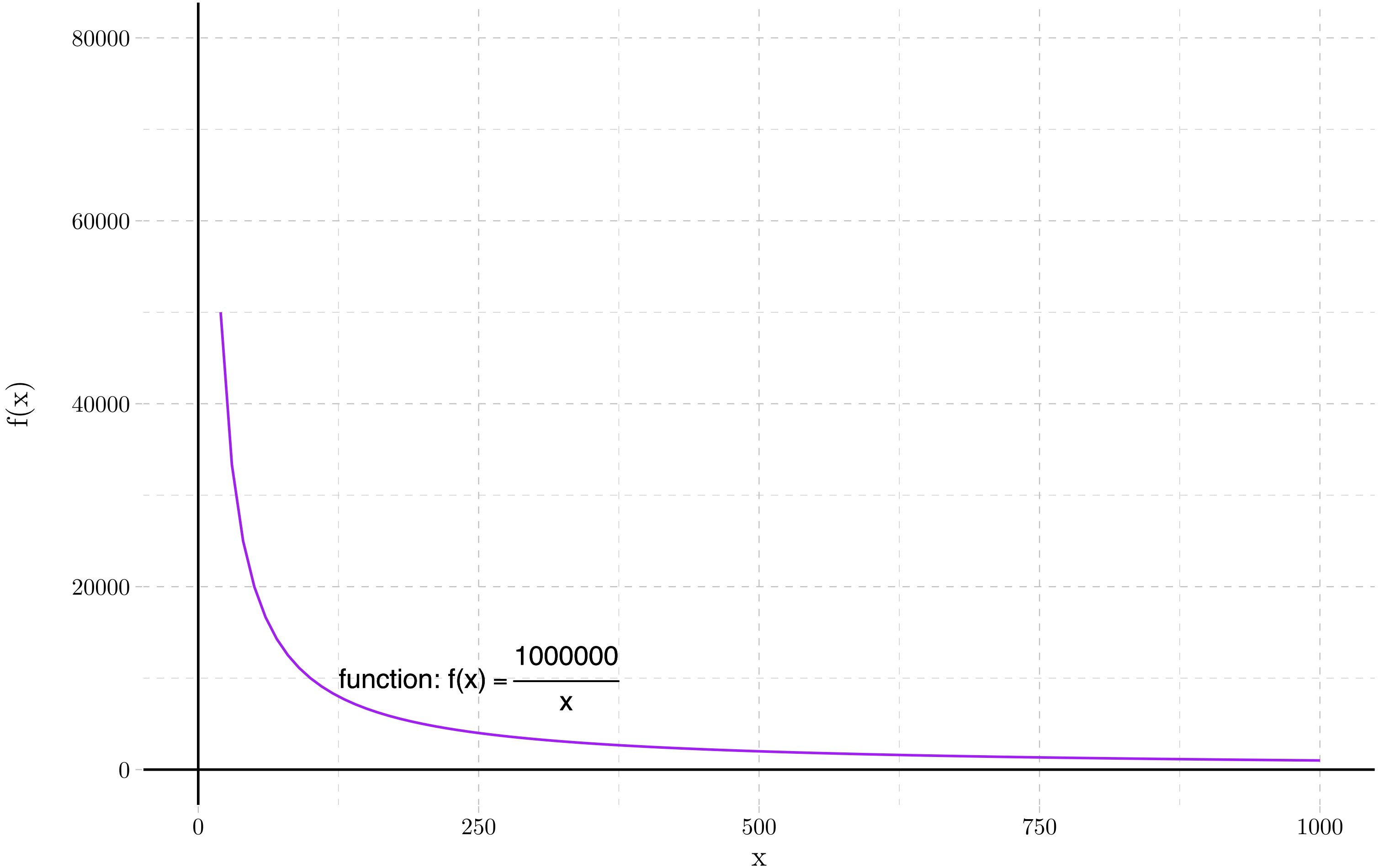
City Size


City Size in the US
8,000,000
6,000,000
4,000,000
2,000,000
0
Popluation
0
200
400
600
800
Rank

What Function?



What Function?



Size: Zipf's Law

Zipf's Law of city size can be expressed as:

$$rank = \frac{C}{N}$$

- C represents a constant for a country/region
- N represents the population level

Zipf's Law: Example

Assume the *third largest* city in a region has 200,000 people.

- Use Zipf's law to figure out how many people are in the *fifth-largest* city

2 Steps

1) Calculate the constant C:

$$3 = \frac{C}{200,000}$$
$$C = 600,000$$

2) Use that info to calculate the population of the 5th largest city:

$$5 = \frac{600,000}{Pop_5}$$

Zipf's Law: Example

Assume the *third largest* city in a region has 200,000 people.

- Use Zipf's law to figure out how many people are in the *fifth-largest* city

2 Steps

1) Calculate the constant C:

$$3 = \frac{C}{200,000}$$
$$C = 600,000$$

2) Use that info to calculate the population of the 5th largest city:

$$5 = \frac{600,000}{Pop_5} \implies Pop_5 = 120,000$$

Zipf's Law: Intuition

Q1: In words, what does **Zipf's law** tell us about the relationship between **rank** and **city size**?

A1: In words, this equation says:

- A few cities will be pretty big
- There is a **big drop** in population as rank increases
- Most low rank (high number) cities are **pretty similar** in size

Primate Cities

Definition: A **primate city** is

> A major city that works as the **financial, political, and population center of a country** and is not rivaled in any of these aspects by any other city in that country. Normally, a primate city must be at least twice as populous as the second largest city in the country.

Examples:

City	Percent of Total Population
Seoul, South Korea	45.8%
Santiago, Chile	35.5%
Buenos Aires, Argentina	33.7%
Lima, Peru	31.7%

Why Primate Cities?

What might generate primate cities?

- Large **economies of scale** in exchange
- Inadequate transportation infastructure elsewhere
- **Political factors**?
    - Easier for dictators to bribe, surveil populations of a primary city (?)
    - Capital cities with dictatorships are *45%* larger than capital cities of other countries
    - Is this relationship **causal**? †

† I don't know. Maybe somebody does. But you definitely can't say from the 45% number. Much of modern econ is about figuring out when relationships *are* causal. For a completely unrelated, but informative and entertaining example, see this video.

Why Zipf's Law?

Q2: *Why does Zipf's Law* do pretty well in general at describing city size?

A2: **Axiom 2**: ***Self-reinforcing effects*** *generate extreme outcomes*

- "Winner take all" situations from policies, agglomeration, knowledge spillovers, etc.

- Wages grow, workers in, firms enter, $\rightarrow$ labor demand $\uparrow$ $\rightarrow$ wages grow . 🔁

Q3: What slows this process down? **Discuss**

Increases in Cost

Size

Why do costs increase as workers move in?

1) **Commute costs increase**

- More people $\implies$ more congestion (all else equal)

2) **Pollution** increases

- More workers $\implies$ more production $\implies$ more **pollution**?

3) **Disease**

- Early 1900's (US), living in a city $\rightarrow$ life expectancy $\downarrow$ 5 years
- Now, the US's largest cities life expectancy exceeds the national average
- In many developing countries, life expectancy in cities is lower than rural areas (why?)

Utility

What can we use to model the value individuals place on different attributes of cities? **Utility**

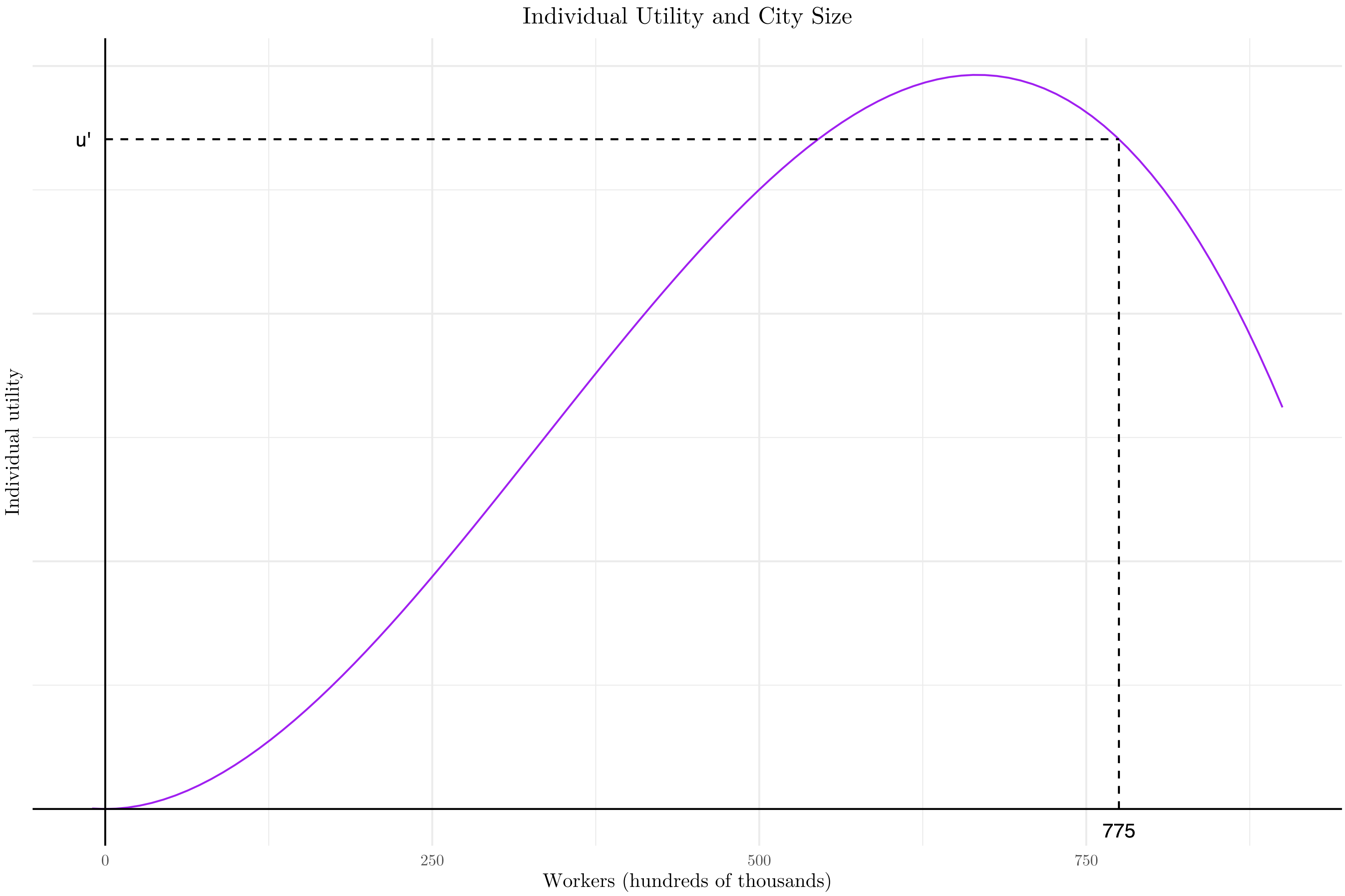
Utility is an abstract notion of peoples preferences. A few assumptions

1) Higher levels of utility are preferred to lower levels. And more consumption is better than less

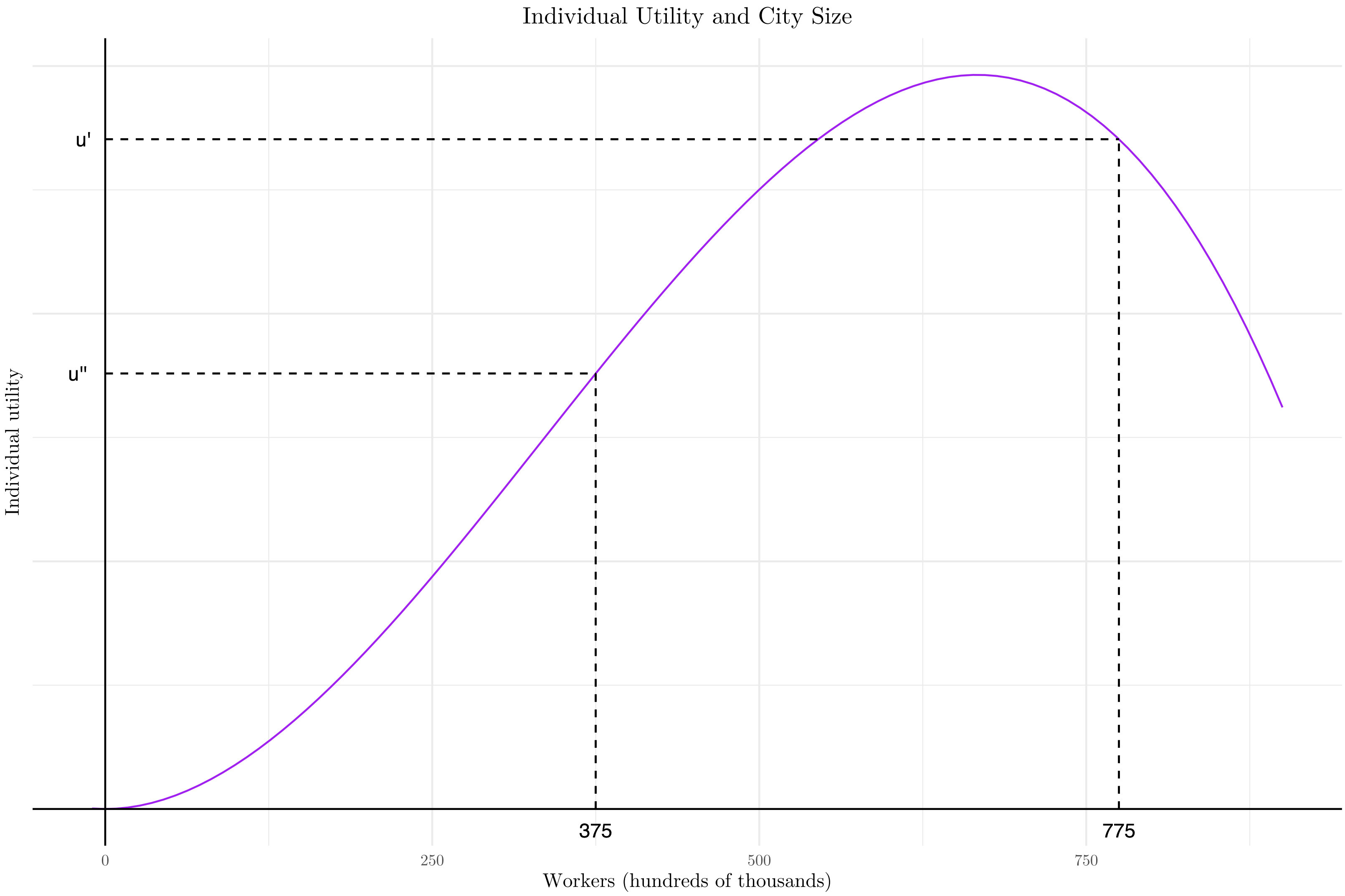
2) Utility is *ordinal, not cardinal* meaning only the **rank** of the number matters, **not the level**

3) Marginal utility is diminishing (marginal value is diminishing)

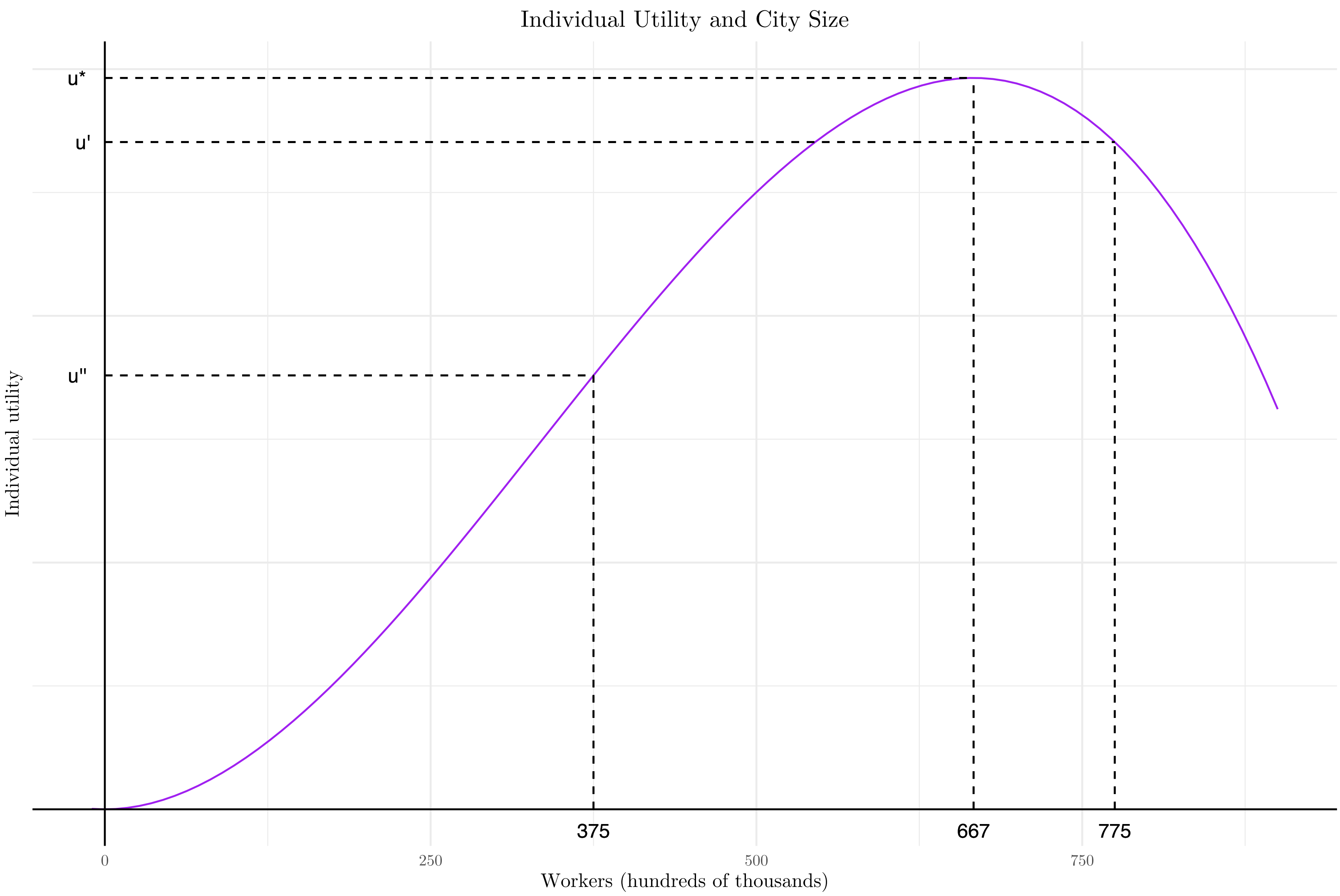
Modeling City Size



Modeling City Size



Modeling City Size

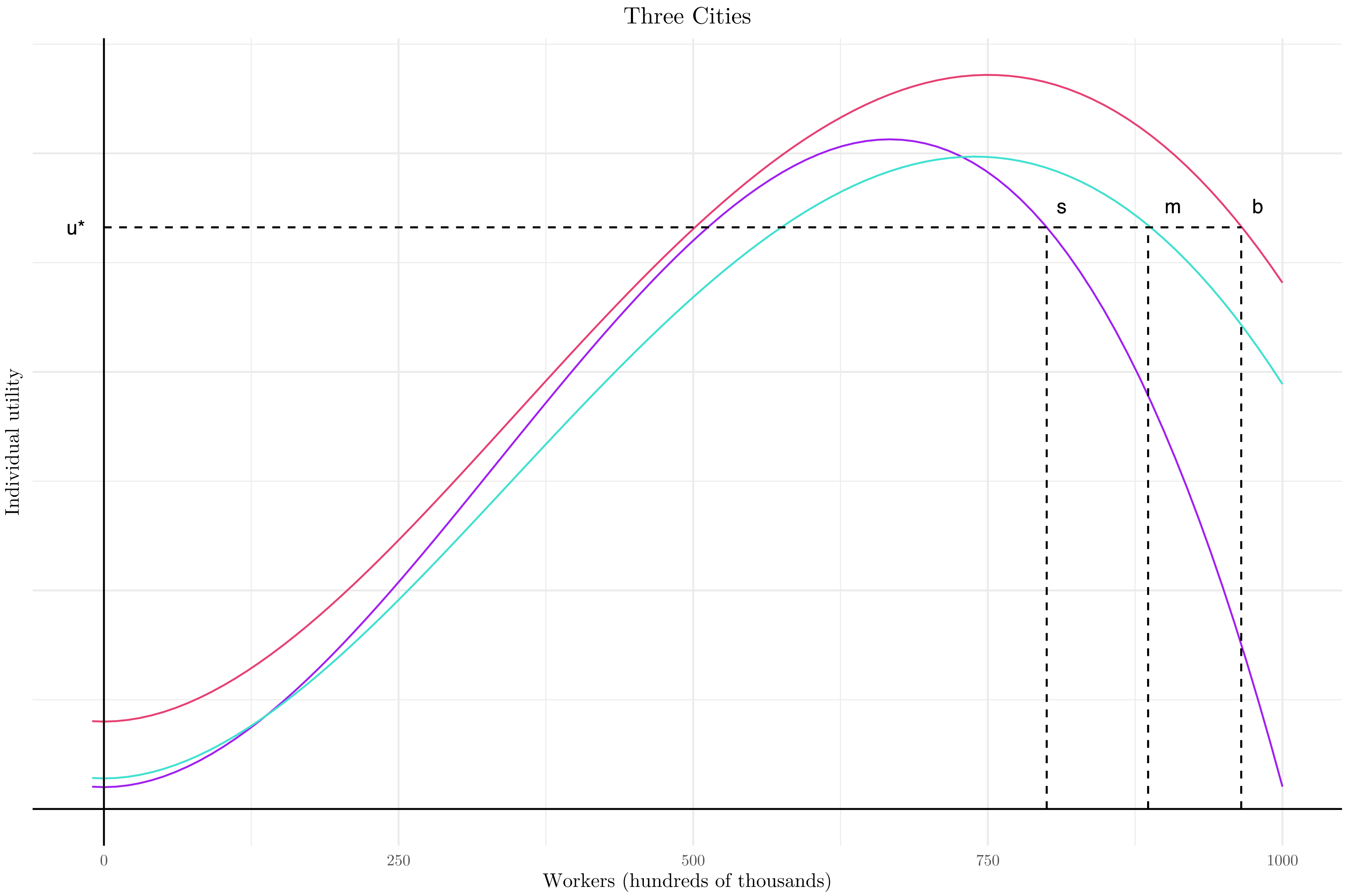


Locational Equilibrium

Locational Equilibrium occurs when utility levels (valuations) across cities are the same for all workers

- In practice, we usually do this by worker type (demographic, income level, education, etc)
- For now, we will just consider the case when all workers are equivalent (*but not cities*)
- This assumption is mostly for accounting purposes

Locational Eq Graph



The Implication?

Back to the **real world**: *why is this framework useful?*

- Put differently, if utility really does look something like the above curve, what does this mean for policy?

*Policies that impact the **spatial distribution** of the population can have far flung effects on individuals it was not designed to impact, **via migration***

- **Example**:
    - Local school quality improvements $\rightarrow$ increased prices. Higher utility from school quality, lower from higher prices. Some people may be displaced? (Gentrification)
    - Net effect could be positive, but there will be winners and losers

More on this later in the term (place-based policies).

Checklist

1) **Clustering** ✅

- Reasons for firm clustering
- Urbanization vs Localization Economies

2) **City Size** ✅

- Zipf's Law
- Utility & City Size
- Locational Eq

3) **Intro to Growth**

Growth

Econ in General: Economic Growth is defined as an increase in per-capita income.

Urban Economics: **Economic Growth** is an increase in the *utility level* of a typical resident

- Urban definition accounts for factors other than wage

1) Increases in natural resources (gold is found under a city)

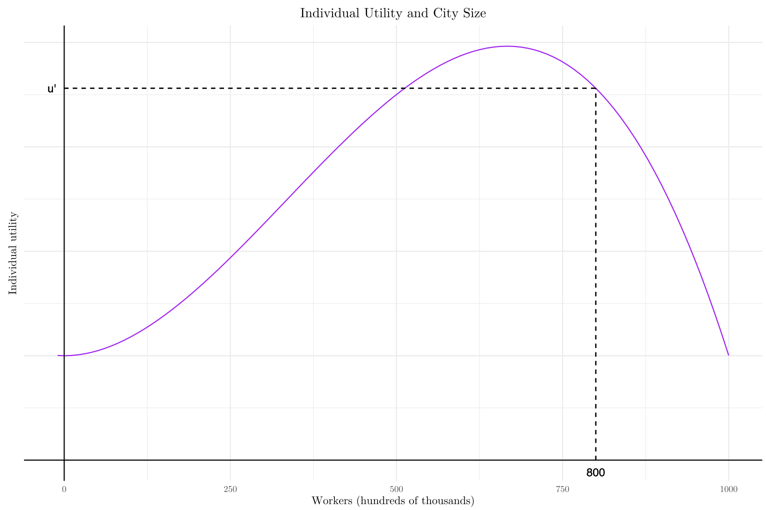
2) Increases in physical capital (computers 💻)

3) Increases in human capital (education 🎓)

4) Technological progress (computers invented)

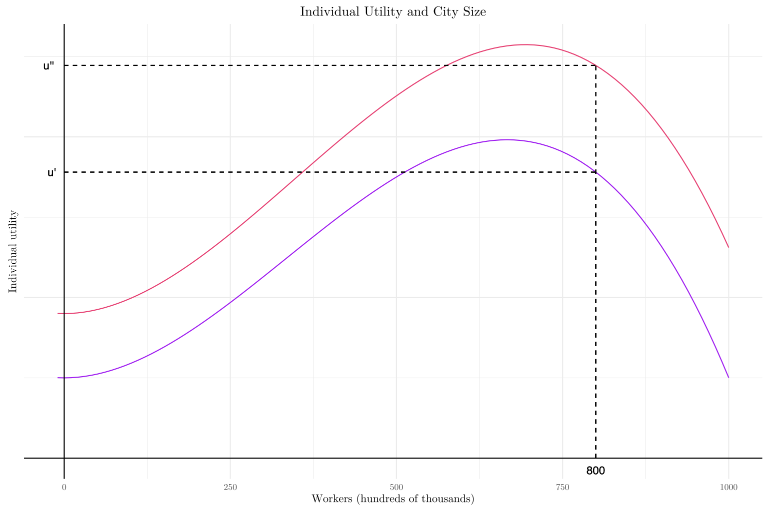
5) Agglomeration Economies 🏙️

Example: Innovation



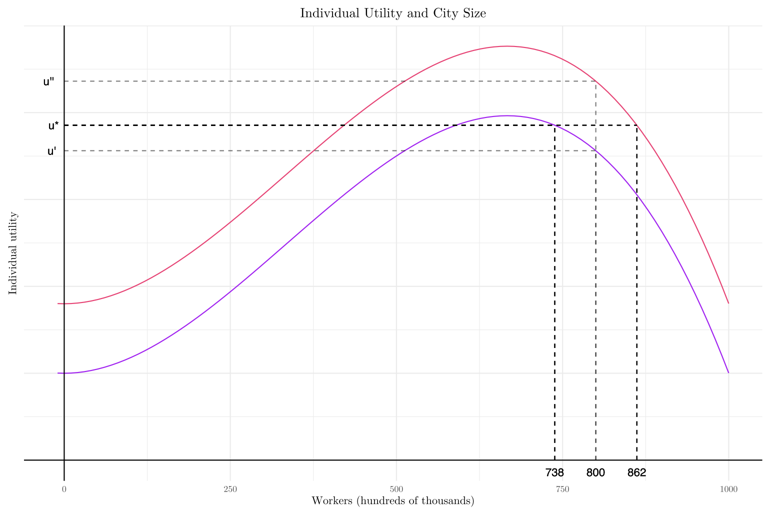
- **Initially**: 2 cities, both with same utility curve
- Population each city: 800k (total pop, 1.6 m)

Example: Innovation



- Productivity shock brings one city's curve up (due to say, higher wages)
- In the absence of migration, utility is now higher in the higher productivity city

Example: Innovation



- Migration induces workers toward the more productive city and away from the less productive city

- **New locational eq** (u^*): utility is equalized (higher than before). populations change

- **Note**: We rested on
  - the implicit assumption that people are perfectly mobile (and they are the same)
  - High skilled workers are generally far more mobile than low skilled (for a variety of reasons). Thoughts?

Example Recap

Consider two cities: each with an equilibrium population of 800k and the same utility per worker curve

- **Innovation** (tech progress) in one city shifts utility per worker curve up
- Workers in the innovative city enjoy a higher level of utility
- Workers migrate to the innovative city from the city that failed to innovate
- Eventually, a new equilibrium is reached where **utility per worker** is the **same across both cities**
    - Innovative city is larger

Economy - Wide Growth

Note: If there is an **innovation for the entire economy**, then:

- **Both cities** experience upward shift of utility curve
- No utility gap at original populations, so no migration
- Increase in utility in both cities
- Still economic growth, but city sizes stay the same

Checklist

1) **Clustering** ✅

- Reasons for firm clustering
- Urbanization vs Localization Economies

2) **City Size** ✅

- Zipf's Law
- Utility & Size of Cities
- Locational Eq.

3) **Intro to Growth** ✅

- Factors that lead to urban growth
- Example with utility curves
- Economy wide vs regional

Table of Contents

Clustering

1. Reasons for Firm Clustering
2. Urbanizations vs Localization

City Size

1. Zipf's Law
2. Utility
3. Locational Eq

Growth

1. Growth factors
2. Example
3. Economy Wide Growth