Quick Review

- Housing durability and housing supply curve
- The compounding challenges that shrinking cities face:
  1. City budget issue
  2. Labor market decline
  3. Vacant and abandoned home

A Monocentric City Model (Alonso-Mills-Muth Model)

RE420: URBAN AND REGIONAL ECONOMICS

Introduction

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- How does the skyline of the city look like?

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Manhattan, New York City

Paris, France

Introduction

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2. How about the sizes of individual dwellings? (apartments/houses)
3. How about the housing prices?

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Introduction

1. How does the skyline of the city look like?
   - The urban center has a concentration of tall buildings
   - Building heights gradually falling with distance from the center
   - The heights of the residential buildings drop to 2-3 stories
   - Single-story houses become common in the distant suburbs
2. How about the sizes of individual dwellings? (apartments/houses)
3. How about the housing prices?

- The monocentric city model (a.k.a. Alonso-Muth-Mills model) attempt to capture these regularities of urban spatial structure

Introduction

1. How does the skyline of the city look like?
2. How about the sizes of individual dwellings? (apartments/houses)
   - The dwellings in the tall residential buildings near the city center are relatively small
   - Suburban houses are much more spacious
3. How about the housing prices?

- The monocentric city model (a.k.a. Alonso-Muth-Mills model) attempt to capture these regularities of urban spatial structure

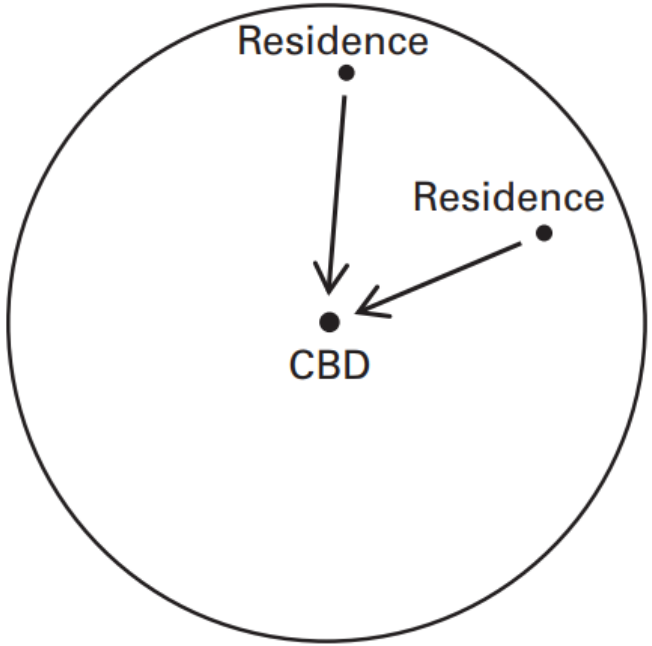
Introduction

1. How does the skyline of the city look like?
2. How about the sizes of individual dwellings? (apartments/houses)
3. How about the housing prices?
   - Rental/purchase price per sqft is much higher near the city center than in the suburbs

- The monocentric city model (a.k.a. Alonso-Muth-Mills model) attempt to capture these regularities of urban spatial structure

Basic Assumptions

- Basic assumptions facilitate a simplified analysis while capturing essential features of cities:
  1. There is a single city in the world with fixed number of population
  2. All the city's jobs are in the center, in an area called the "central business district" (CBD)
  3. The city has a dense network of radial roads
  4. The city's residents consume only two goods: a composite good ("bread") and housing



Commuting Cost and Disposable Income

- Let x denote radial distance from a consumer's residence to the workplace
- The larger is the commuting distance x, the cost of commuting is higher
  - *Money cost* such as the transit fare
  - Opportunity cost of the time spent commuting
- Let's say t represents the per-mile cost of commuting
  - Total cost of commuting is $t \times x$
- Each household earns income amount y
  - Total disposable income is: $y - tx$

Consumer Spending and Budget Constraint

- Each household decides how much bread and housing to consume
  - Denote the amounts of bread and housing consumptions as c and q, respectively.
- The price of bread is normalized to \$1 and the price of housing \$p
  - How can we arbitrarily normalize the price of bread?
- Total expenditure of bread and housing is: $c + pq$
- Due to the budget constraint, the consumer expenditures on bread and housing will be equal to the disposable income:

$$\boldsymbol{y - tx = c + pq}$$

What are the Choice Variables Here?

- Choice variable: a decision that an economic agent can actively make, like the quantity of a good to produce

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- Choice variable: a decision that an economic agent can actively make, like the quantity of a good to produce
  1. Where to live: This choice determines the commuting distance x.
  2. Housing space consumption: This decision determines q.
  3. Bread consumption: This choice determines c.

- As a result of the individual's choices, the price of housing, p, at each location will be determined.

Simplified Version

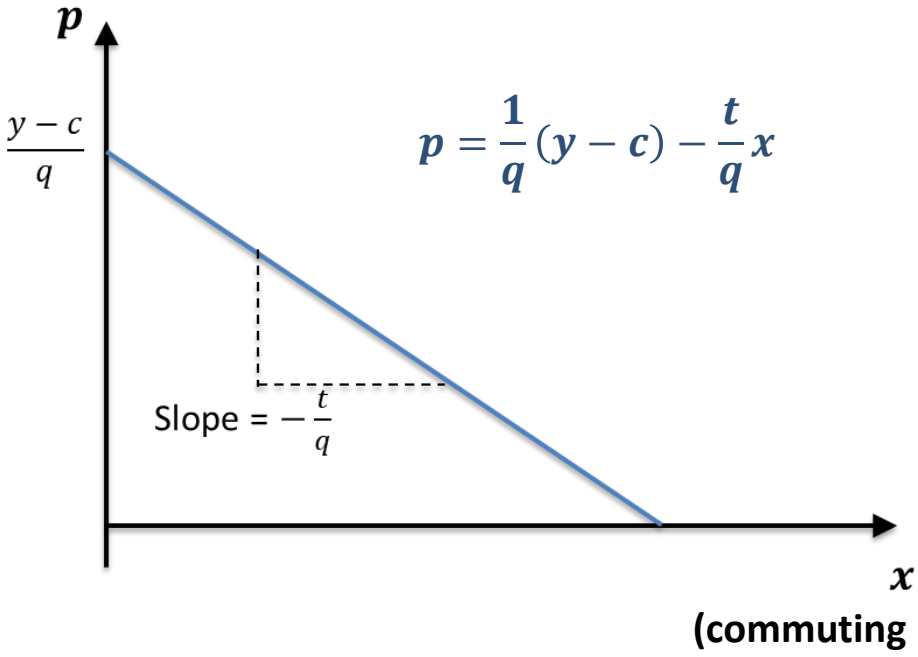
- The most simplified way to understand the model is to assume the consumption amounts, c and q, do not change.
- Then, the only variable that individuals choose vary is the commuting distance, x.
- Arrange the terms to see the relationship between x and p:

$$y - tx = c + pq$$

$$\Longrightarrow pq = (y - c) - tx$$

$$\Longrightarrow p = \frac{1}{q}(y - c) - \frac{t}{q}x$$

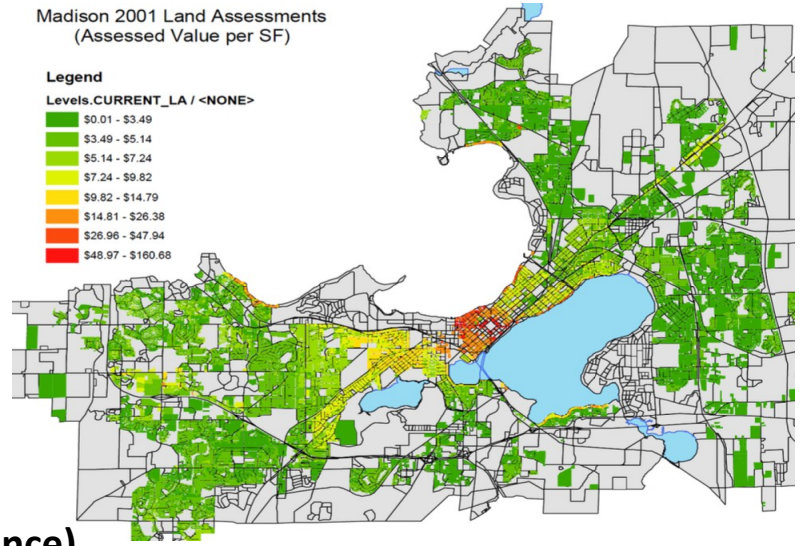
Simplified Version



$$p = \frac{1}{q}(y - c) - \frac{t}{q}x$$

(commuting distance)

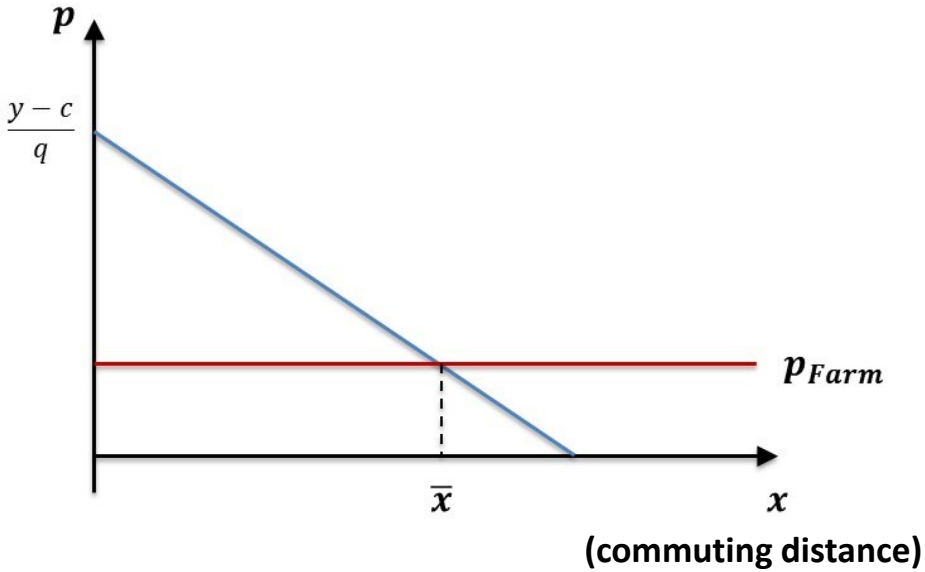
- As commuting distance gets longer, the price goes down



< Land values in Madison >

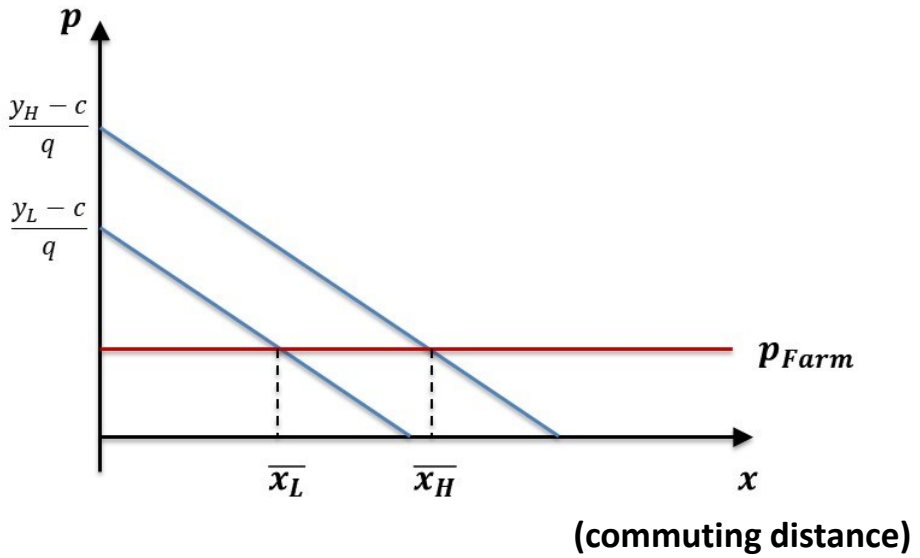
Simplified Version: Determination of City's Edge

- From urban developers' perspective, selling price per unit goes down as the unit further away from CBD
- However, from farmers' perspective, land price per unit should be equal ($= p_{Farm}$) regardless of distance from CBD.
  - The same size of land yields the same amount of corn, regardless of its proximity to CBD.
- Therefore, the city is developed up to the point where developers' selling price per unit is greater than p_{Farm}



Simplified Version: Determination of City's Edge

- Consider two cities: one with a high wage (city *H*) and another with a low wage (city *L*)
- How do the different wages affect the size of two cities?
- What happens to the size of cities in a developing country, if the country has relatively cheaper farmland while urban wages are relatively high?
  - Can this explain any of the stylized facts of cities?



A Little More Complicated Version

- Now allow consumers can choose their own consumption amounts c and q.

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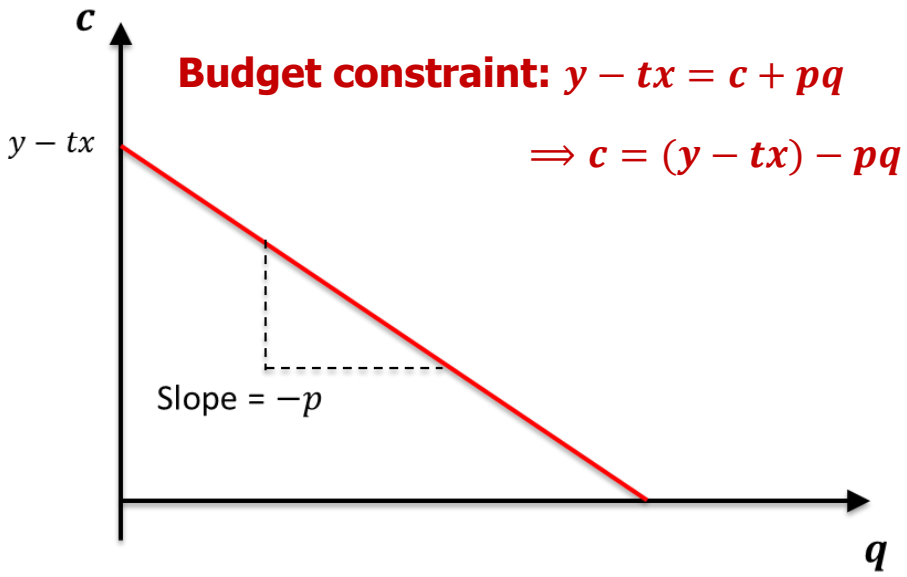
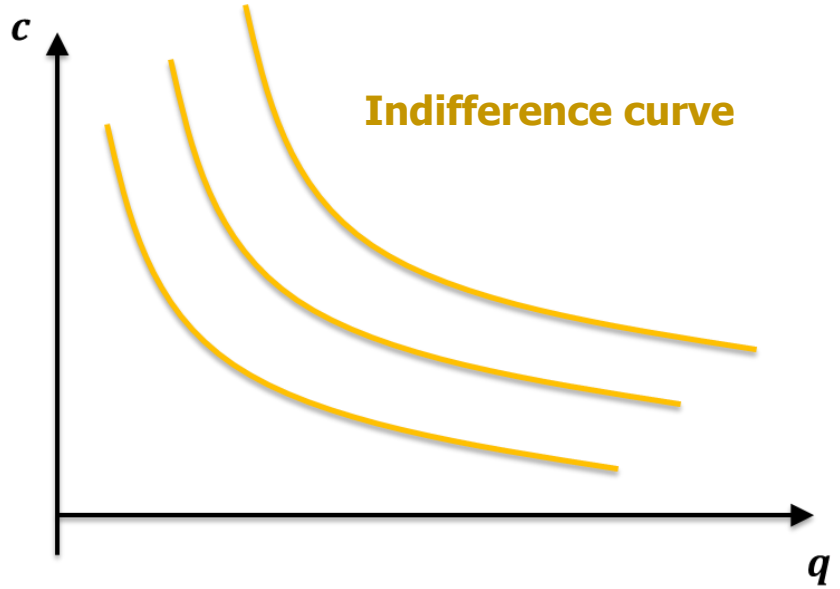
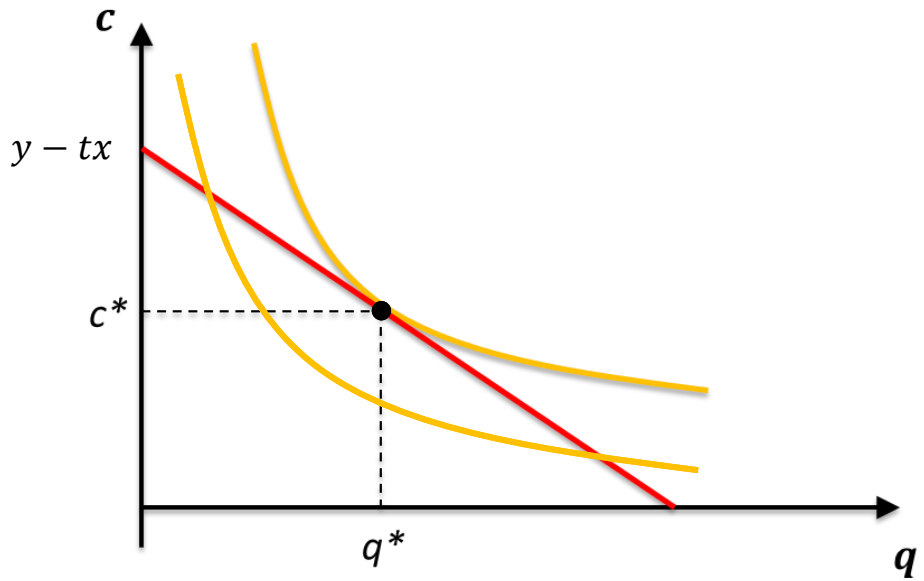




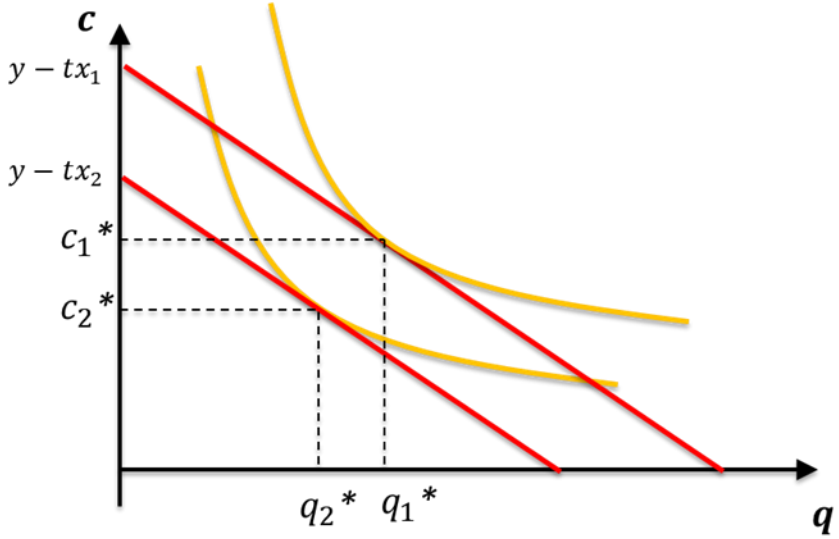
A Little More Complicated Version

- Household consumption amount will be determined at the tangent point of indifference curve and budget constraint line.



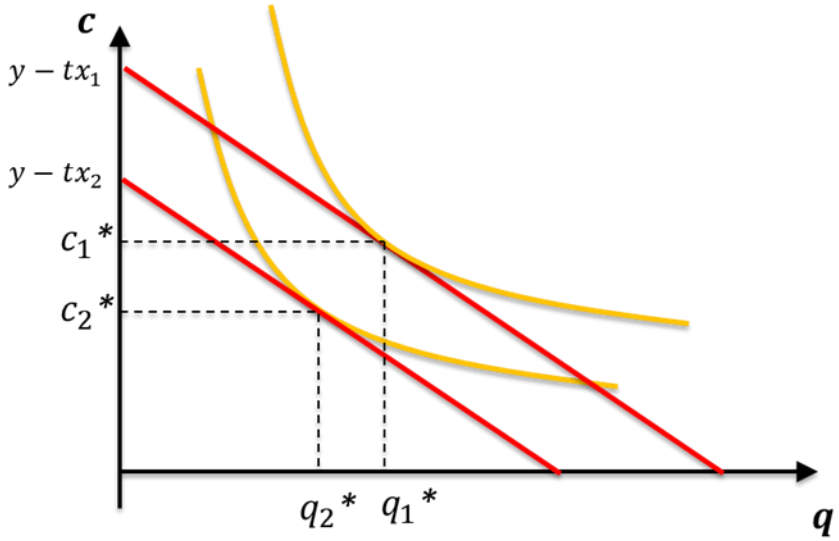
A Little More Complicated Version

- Two locations: one closer to CBD (x_1) and another farther away from CBD (x_2)
- If housing prices in the two locations are equal, the household living closer will consume more for both bread and housing than the household living farther ($c_1^* > c_2^*$, $q_1^* > q_2^*$)
  - The household living closer will attain a greater utility



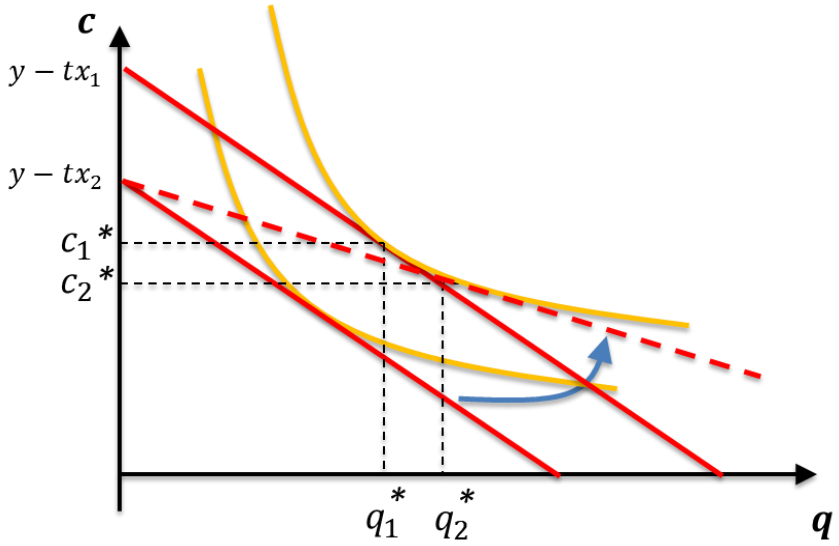
A Little More Complicated Version

- **Spatial Equilibrium:** Consumers must achieve equal levels of utility across different locations. Otherwise, they will migrate to the location that offers a higher utility.
- Therefore, in the world with a spatial equilibrium, it is *impossible* for the household living closer to attain a greater utility



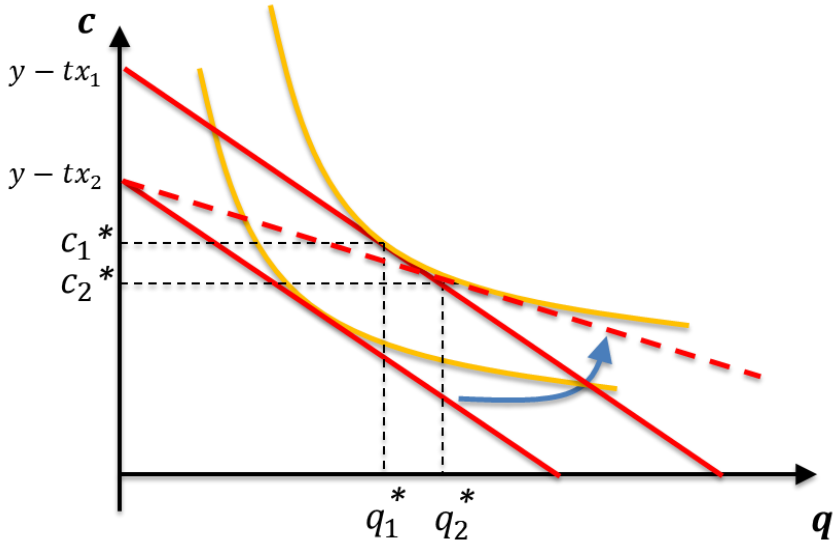
A Little More Complicated Version

- The price will adjust until the equal utility (spatial equilibrium) is attained



A Little More Complicated Version

- The price will adjust until the equal utility (spatial equilibrium) is attained
  1. Housing prices closer to the CBD will be higher
  2. Households further from the CBD will consume more units for housing



A Little More Complicated Version

- The price will adjust until the equal utility (spatial equilibrium) is attained
  1. Housing prices closer to the CBD will be higher
  2. Households further from the CBD will consume more units for housing
  3. Since the same sized lot is more expensive near the city center, developers builds taller structures around the CBD.

- Regularities 1, 2, 3 can be explained by the monocentric model.

- How realistic the model assumptions?
  - Are there really people who commute much longer for cheaper and larger housing?

Video Clip

The Struggle Is Real for Super Commuters (2:30)

Key Takeaways

- Understand the three regularities of urban spatial structure that the monocentric city model can capture.
- Understand the assumptions in the monocentric model.
- Understand the spatial equilibrium concept.
- Optional Readings:
  - Jan K. Brueckner, *Lectures on Urban Economics.* Chapter 2, Chapter 3
  - Alonso, William. 1964. Location and Land Use: Toward a General Theory of Land Rent. Harvard University Press Cambridge, MA.
  - Mills, Edwin S. 1972. Studies in the Structure of the Urban Economy. ERIC.
  - Muth, Richard F. 1975. Urban Economic Problems. HarperCollins Publishers.