Reflection Questions

Please consider the following questions before class begins:

- How do you assign a dollar value to your time?
- Why does an apartment near a subway stop have higher rent?
- Why do competing stores locate next to one another?

Determinants of Value and Urban Considerations

HADM 4200, Spring 2024

Professor Lauri Kytömaa

Readings

- *Chapters 1 & 2* of Lectures on Urban Economics, Brueckner
- *Chapters 5 & 6* of Real Estate Principles: A Value Approach, Ling and Archer
- *Pages 341- 352* of Real Estate Finance and Investments, Brueggeman and Fisher

Upcoming Assignments

- PS1 is now live and due February 1st @ 6:00PM
- Reminder of policies:
  - Each worth 5% for a total of 20% of your final grade
  - Unique submission for each student
  - Submit through Gradescope

Gradescope Basics

- Navigating there
- Making PDFs
- Selecting questions

Why use Gradescope

TOTAL POINTS

22 / 30

QUESTION 1

20 pts

1.1 a **3 / 4**

+ 4 pts $$Q_A = 36.5, Q_B = 31.5, Q_{MDD} = 26.5; Q = 94.5, P = 46.5$$

✓ **+ 3.5 pts** **Generally correct solution with math mistake**

✓ **- 0.5 pts** **Solution only has two quantities when there should be 3.**

There should be 3 possible q's in this part!

1.2 b **4 / 4**

✓ **+ 4 pts** **$$Q_A = 44, Q_B = 43 (Merged), Q = 87, P= 54$$**

used. If pre-merger shares are used, one might also get $$HHI_{post} = 5259$$.

+ 1.5 pts Some commentary on implications

✓ **+ 2 pts** **Calculation of incorrect HHIs but using reasonable definition of HHI.**

+ 0 pts Missing part (d)

Markets are not split evenly in equilibrium because firms have different marginal costs.

1.5 e **4 / 4**

✓ **+ 4 pts** **Just need to use $$(P_{Collusion} - P_{Cournot})*Q_{Collusion} = (54 - 46.5)(43) = 322.5$$. I did my best to use student prices if they made a mistake in an earlier section.**

Today's class

Why do we have **cities and towns in the form that we do?**

- *Scale economies*
- *Agglomeration economies*
- *Retail agglomeration*
- *Transportation costs*
- *Bid-rent model*
- *Urban form*

Today's class

Why do we have **cities and towns in the form that we do?**

- *Scale economies* - ***HW1 topic***
- *Agglomeration economies*
- *Retail agglomeration* - ***HW1 topic***
- *Transportation costs*
- *Bid-rent model* - ***HW1 topic***
- *Urban form*

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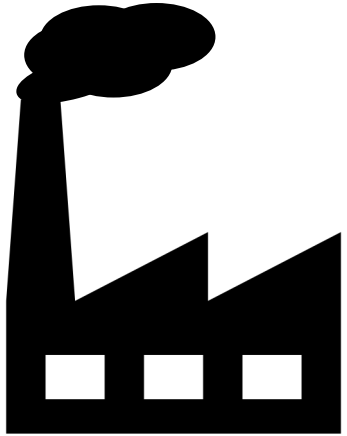
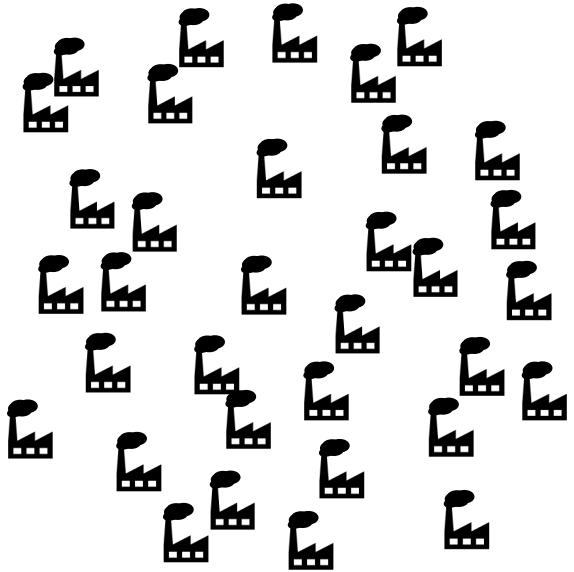
Scale economies

Which is more efficient?

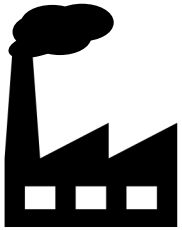


1 factory with 100 workers



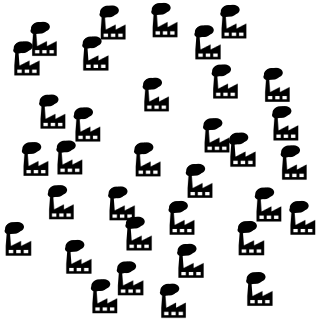
100 factories with 1 worker

Scale economies



1 factory with 100 workers

Factory costs fixed cost F to build
Hiring 100 workers at a wage w each
Workers can work together and specialize



100 factories with 1 worker

Smaller factors cost $100 \times f > F$
Hiring 100 workers at a wage w each
Each worker has to do everything at assigned factory

Scale economies – Moving to numerical

Revenue from operation

$$(Output\ per\ factory) \times (Total\ factories) \times (Price\ of\ output)$$

Scale could improve output per factory!

Cost of operations

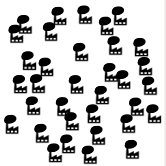
$$(Fixed\ cost\ of\ factory) \times (Total\ factories) + (Variable\ costs) \times (Total\ output)$$

Scale could also reduce fixed costs!

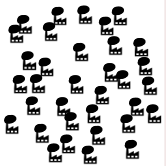
Profit of operations

$$Revenue\ from\ operations\ - Cost\ of\ operation$$

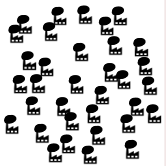
Scale economies - numerical

(a) Factories	(b) Worker/ factory	(c) Output/ Worker	(d) Factory cost	(e) Car price
 1	100	100 cars	$100m	$15k
 100	1	15 cars	$1.1m	

Scale economies - numerical

	(a) Factories	(b) Worker/ factory	(c) Output/ Worker	(d) Factory cost	(e) Car price	(b) x (c) Output per factory	(a)x(b)x(c) Total output
	1	100	100 cars	$100m	$15k	10,000 cars	10,000 cars
	100	1	15 cars	$1.1m		15 cars	1,500 cars

Scale economies - numerical

	(a) Factories	(b) Worker/ factory	(c) Output/ Worker	(d) Factory cost	(e) Car price	(b) x (c) Output per factory	(a)x(b)x(c) Total output	(a)x(b) x(c)x(e) Revenue	(a) x (d) + Wages Cost
	1	100	100 cars	$100m	$15k	10,000 cars	10,000 cars	$150m	$100m + Wages
	100	1	15 cars	$1.1m		15 cars	1,500 cars	$22.5m	$110m + Wages

For simplicity I have no variable costs here, fixed labor!

Scale economies – How does this relate to towns/cities?

- Large employers will draw workers to live nearby, forming more populated areas
- Concentration of employment will create new business - like grocery stores, gas stations, doctor's offices

Scale economies may not be enough to explain large cities!

Cornell is a major driver of employment in Ithaca, NY

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- *Urban form*

Agglomeration economies

- *Pecuniary agglomeration* – Reduction in the cost of a firm's inputs without affecting the productivity of the inputs.

Input costs reduced by pecuniary agglomeration

Agglomeration economies

- *Pecuniary agglomeration* – Reduction in the cost of a firm's inputs without affecting the productivity of the inputs.

- *Technological agglomeration* – Raises the productivity of inputs without lower (changing) the cost.

Output productivity is influenced by technological agglomeration

We'll talk about 'retail agglomeration' later

Pecuniary agglomeration: Hiring an experienced robotics engineer

Palo Alto, California

Large talent pool

- Travel costs – Uber/Taxi
- Limited relocation costs
- Attractive professional setting

Ithaca, New York

Limited talent pool

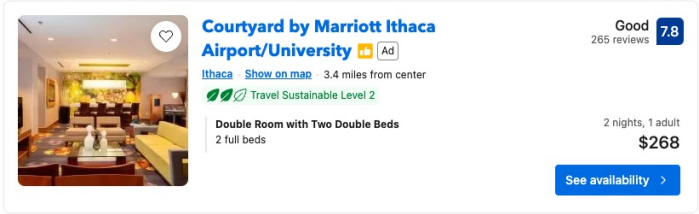
- Travel costs - flights
- Relocation fees
- Less appealing community, may need to reimburse more

Pecuniary agglomeration: Hiring an experienced robotics engineer

Interview

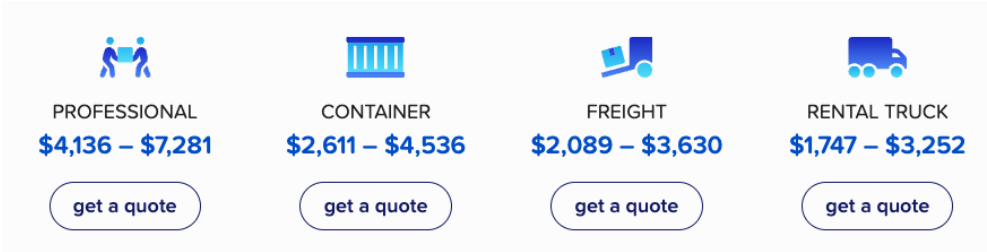
Flights: SFO to Ithaca

Hotels: Two nights



Remember these costs will be for every candidate we interview!

Relocation



Main point: locating robotics company in Ithaca will drive up costs of recruitment

Technological agglomeration: Knowledge spillovers

- *Contact with workers across firms in one location may have beneficial effects on productivity*
  - Example: Hearing about alternative manufacturing techniques
- *Engagements across industries may also drive further benefits*
  - Example: Interaction between a medical equipment supplier and a software producer

Technological agglomeration: Other factors

- *Easier to replace low-productivity workers with many potential employees around*
  - Large labor pool makes replacement easier

- *Greater competition for jobs may drive workers to gain additional education and training*
  - Harder to secure the first job in the industry

Research testing for agglomeration economies

Examples:

- Start-ups more likely to occur in areas offering agglomeration economies (Rosenthal and Strange 2003)
- Patent citations tend to be from the same city as patent application (Jaffe, Trajtenberg, & Henderson 1993)
- Patent creation is positively related to employment density (Carlino, Chatterjee, & Hunt 2007)

Agglomeration economies – How does this relate to towns/cities?

- Companies in cities may experience both cost (pecuniary) and productivity (technological) benefits from establishing in high-density areas.
- Academic literature provides strong evidence for technological agglomerations arising from urban areas.

Chicago features high urban density

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Retail agglomeration

Cities typically have shopping districts in which many stores are concentrated next to one another.

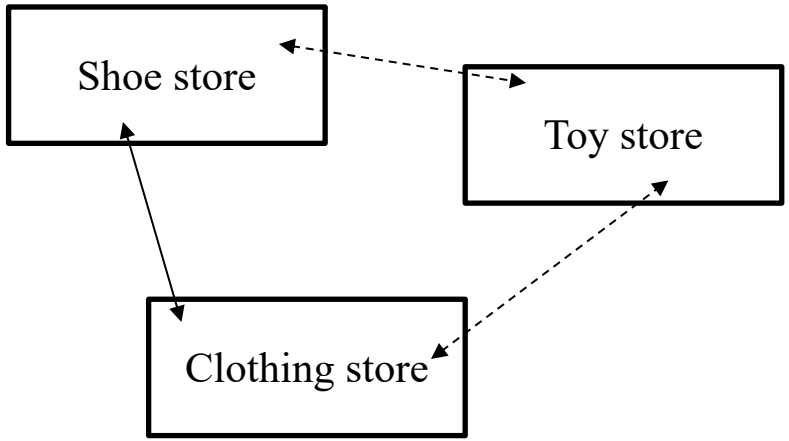
Why do competing stores locate next to one another?

City street in Japan
Source: Andre Benz via Unsplash

Retail agglomeration

- **Limit costs of shopping trips**
  - Consumer prefer to visit multiple stores in a single trip.
- **Benefit of comparison shopping**
  - Costly with highly dispersed stores.
    Could drive fiercer price competition
- **Inter-store externalities**
  - Certain stores may have complementarities, driving new visits.

We can't forget the importance of online-shopping, but higher-end retail locations continue to matter.



Inter-store externalities
Source: Brueckner, Figure 1.8

Retail agglomeration – running a mall

	Profit in isolation	Required sq ft
Clothing	$80,000	6,000
Toy	$7,000	500
Shoe	$5,000	250

Assume:

$$Developer\ profit = (Gross\ profit\ of\ stores) - \left(\frac{Price}{Sq\ ft}\right) \times (Sq\ ft)$$

Say price/sq ft = $12

Clothing only profit:

$$\$80{,}000 - \$12 * 6{,}000 = \$8{,}000$$

Toy only profit:

$$\$7{,}000 - \$12 * 500 = \$1{,}000$$

Shoe only profit:

$$\$5{,}000 - \$12 * 250 = \$2{,}000$$

Retail agglomeration – running a mall

Added store

Affected store	Clothing	Toy	Shoe
Clothing	-	+$1,000	+2,000
Toy	+$1,000	-	+700
Shoe	+$1,000	+$500	-

Now assume some benefit from other store presence

Clothing only profit:

$$\$80{,}000 - \$12 * 6{,}000 = \$8{,}000$$

Clothing & toy store:

$(\$87{,}000)$ *Combine profit*

$-\$12 * (6{,}500)$ *Combine cost*

$+\$2{,}000$ *Externality* $= \$11{,}000$

Clothing & shoe store:

$(\$85{,}000)$ *Combine profit*

$-\$12 * (6{,}250)$ *Combine cost*

$+\$3{,}000$ *Externality* $= \$13{,}000$

Optimal mix of stores left as an exercise – see HW1

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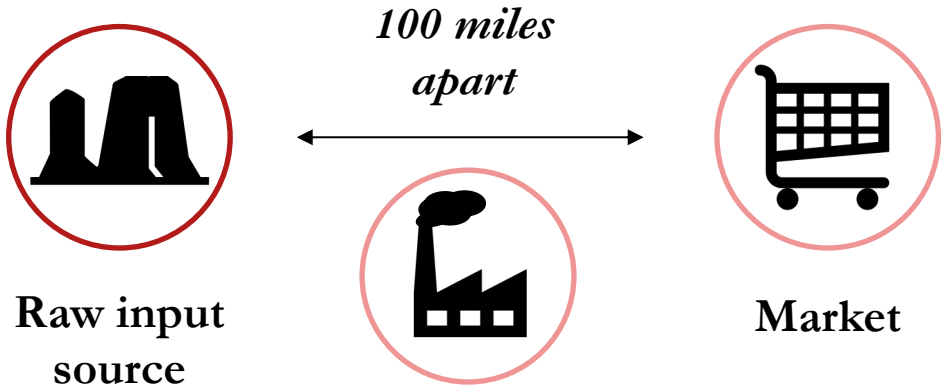
Transportation costs

- *Transportation cost-savings:* a special pecuniary agglomeration effect that may bring business into a city if suppliers and customers are both in the urban center.

- However! If suppliers and customers are far away from each other, then the **firm's location decision is not always clear**.

Transportation costs



What factors effect where should we put our factory?

Transportation costs

Input source

Bakery

Town

Where do we want to put a bakery?

Transportation costs

Cost factor	Price
Cost of shipping raw good	\$12 / mile
Cost of shipping final good	\$10 / mile
Terminal cost	\$1,000

$$Total\ transport\ cost = \left(Miles \times \frac{Cost}{mile}\right) + Terminal\ cost$$

$$Cost\ per\ mile = \frac{Total\ transport\ cost}{Miles}$$

Notice that fixed terminal cost means that we benefit from economies of distance:

- **Shipping raw good 10 miles costs \$112/mile**
  (10\$12 + \$1,000)/10*
  = \$1,120/10 = \$112
- **Shipping raw good 100 miles costs \$22/mile**
  (100\$12 + \$1,000)/100*
  = \$2,200/100 = \$22

This is because the terminal cost is unaffected by how far we ship!

Transportation costs

Cost factor	Price
Cost of shipping raw good	$12 / mile
Cost of shipping final good	$10 / mile
Terminal cost	$1,000

With higher costs of raw shipping, we want to place our factory at the raw good and ship to the market.

So where should the factory go?
Economies of distance mean the extremes are best (either at the raw good or at the final good)

Shipping cost with factory at raw good (only final ship)
$1,000 + 100*$10 = $2,000

Shopping cost with factory at final good (only raw ship)
$1,000 + 100*$12 = $2,200

Transportation costs

Weight-gaining production

- Beverage bottling
- Bakery products
- Furniture manufacturing

Located near customers

Weight-losing production

- Lumber milling
- Metal ore refining
- Oil refining

Locate near supply/input

Think about where these production centers are located!

Transportation costs – How does this relate to towns/cities?

- Relative transportation costs will influence the presence of certain types of properties in urban centers.

- Big cities will tend to attract weight-gaining production processes. Big-city markets may also create employment concentration in faraway locations due to the relative transport cost effects.

Baking
Weight-gaining production

Forestry
Weight-losing production

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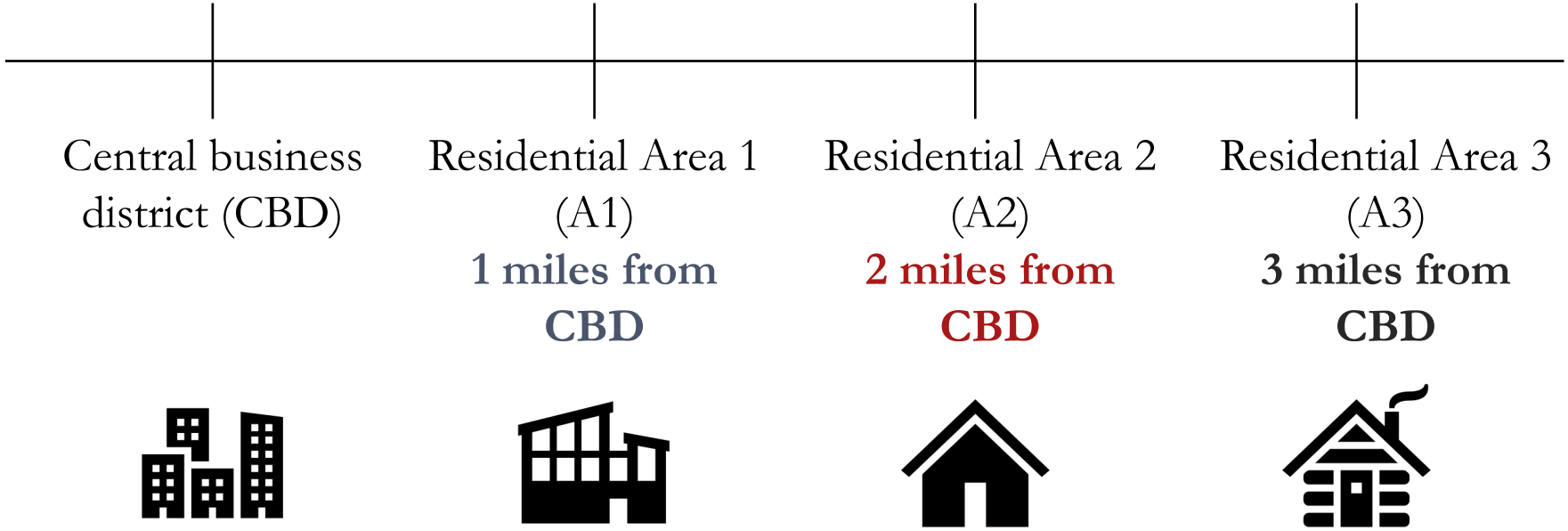
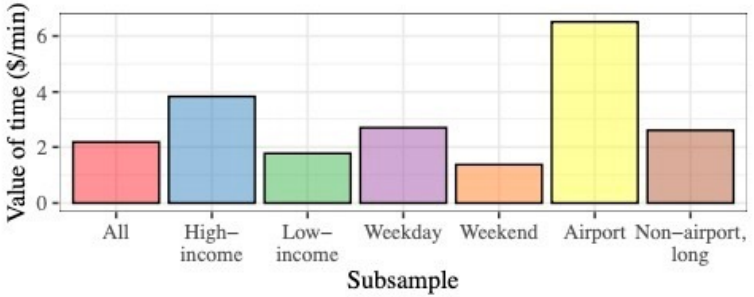
Individual travel cost and bid-rent model



If home quality and amenities are identical – which areas will be more expensive?

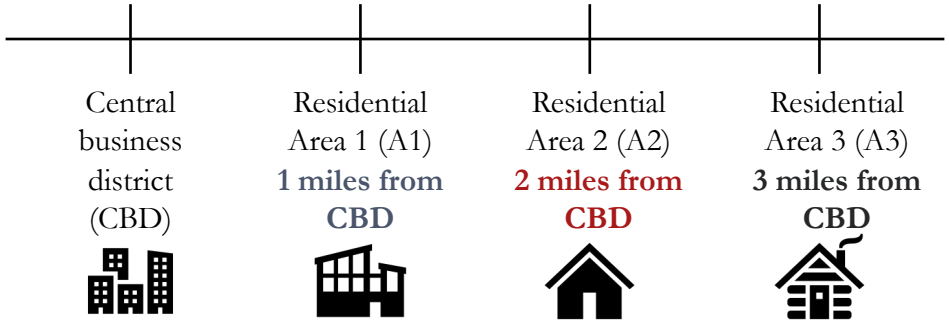
Aside – valuing your time

- Simple way to assign a dollar value to your time is to use your hourly wage
  - H*ow many hours could I have worked instead of traveling?*
- Work doesn't need to be the benchmark for opportunity cost
  - *Time with family*
  - *Time spent kayaking*



Average value of time for subsamples of data
Source: Castillo (2023), Who Benefits from Surge Pricing?

Individual travel cost and bid-rent model



Basic bid-rent Assumptions:

1. All employment at CBD
2. One road to CBD, residences are increasingly far away
3. All houses travel to city center at same speed, s mph
4. All workers face an hourly wage of $w
5. One worker per household
6. Workers make T round-trips per month
7. Fixed supply of houses

Individual travel cost and bid-rent model

Time cost of travel?

If moving s mph with wage of $w per hour then:

$$\frac{w \text{ per hour}}{s \text{ miles per hour}} = \$\frac{w}{s} \text{ per mile}$$

Example:

With s = 25 mph and w = $30/hour then:

Time cost of travel = 30/25 = $1.20 per mile

Time cost per month saved by living 1 mile closer?

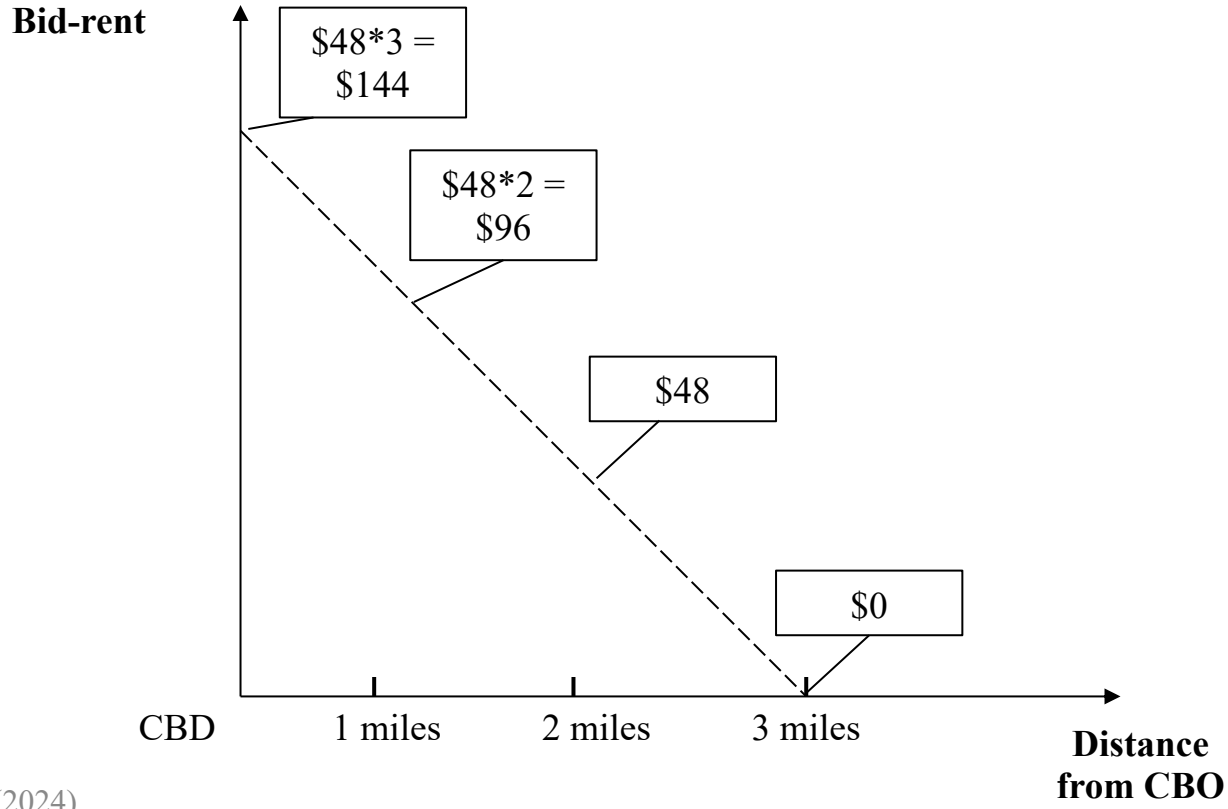
$$(T \text{ round trips per month}) \times (2 \text{ miles per round trip}) \times \left(\frac{w}{s}\right) = (\$ \text{ time value of closer location})$$

Example:

With s = 25 mph, w = $30/hour, and T = 20 trips per month:

Monthly time value saved from living 1 mile closer: 20*2*(30/25) = $48 => Annual this is $576

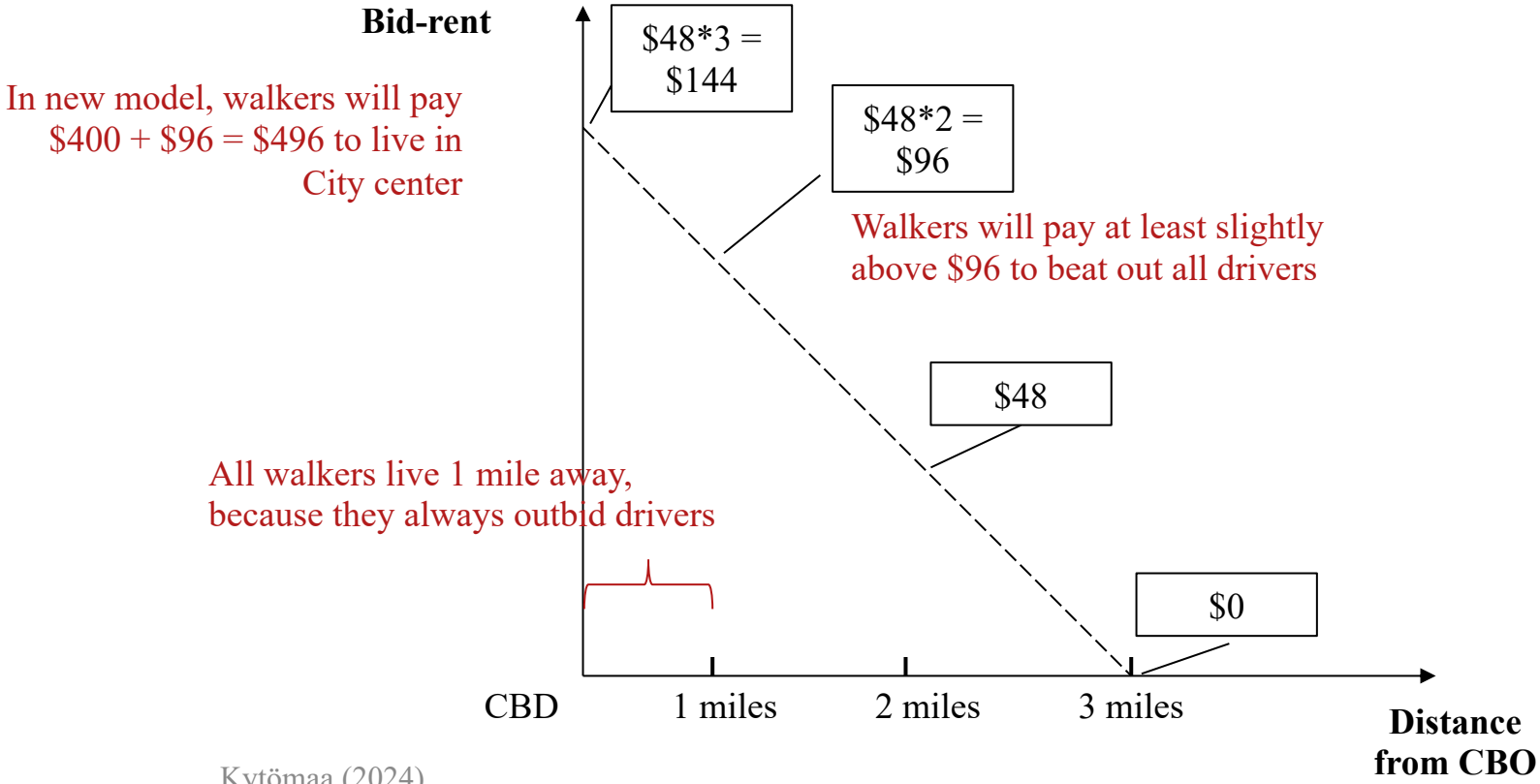
Individual travel cost and bid-rent model



Individual travel cost and bid-rent model

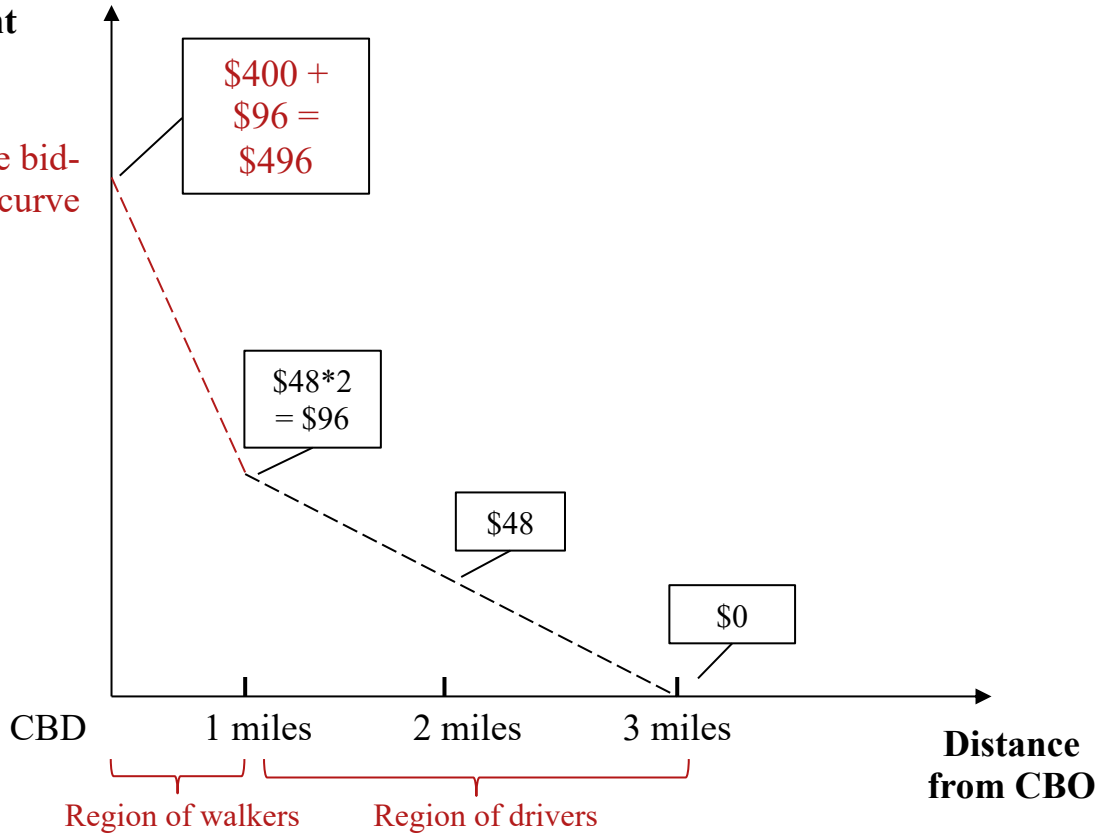
- Simple bid-rent captures the increasing cost of rents approaching the city center but it is still quite crude
- **Introduce a new type of commuter** that always walks with speed 3 mph:
  - Suppose some of our workers are walkers and some still drive at 25 mph
  - Walker's time cost per mile is $30 per hour / 3 mph = $10 per mile
  - Walker will pay ($10 x 2 miles x 20 trips) = $400 per month to be 1 mile closer
  - Walker's outbid drivers for any lot because of their higher willingness to pay

Old bid-rent curve



New bid-rent curve

This creates a kink in the bid-rent curve



Adjustments to the bid-rent model

- Key factors in the bid-rent model:
  - Number of bidders and types of bidders
  - Wage rate, speed of travel and thus, time cost
  - Frequency of trips
- Limitations:
  - Only dimension of need is the single-person commute
  - Households and firms have more preferences over location
  - Competition for land is more complicated
  - Determinations of land rent and value are more complex

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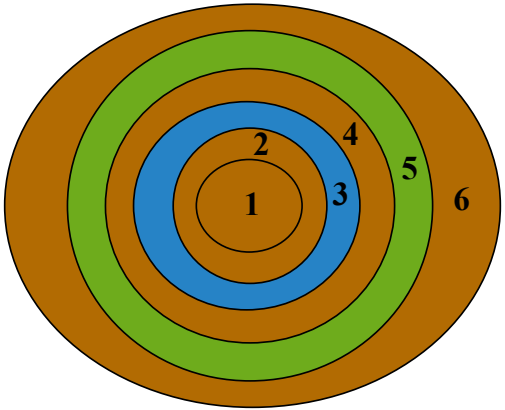
- *Urban form*

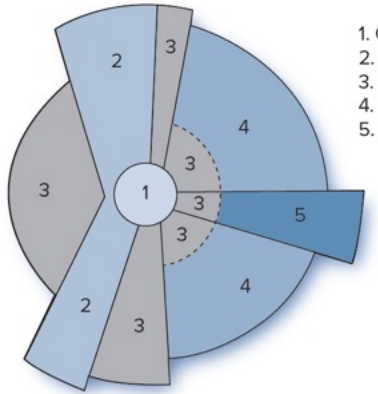
Historical patterns of urban form

Burgess, Concentric Circle Model, 1923



1. Industrial and downtown
2. Warehouse
3. Transition
4. Blue collar
5. White collar clerical
6. Executive

Hoyt – Sector model, 1939



1. CBD
2. Wholesale and light manufacturing
3. Lower-class residence
4. Middle-class residence
5. Upper-class residence

Changing urban form

- Harris and Ullman (1945) observed multinuclei pattern,
  CBD no longer single center of activity

- Technological change has been driver for changing cities since 1920s:
  - U.S. Automotive revolution and expansion of highways
  - Production revolution with birth of assembly line, growth of robotics and automation
  - Decentralization caused by telephone, Internet and smart phones
  - Advances in offices and retailing

- COVID-19 experience and increasing remote-work may continue to push decentralization

Urban form – Takeaways for rest of class

1. Location of a property relative to the rest of the urban property mix matters for value.

2. The value of a location depends on the type of use being considered.
   - As an example, a weak location for a retail store may be a strong location for a warehouse

3. Cities do not grow evenly; some areas of activity may grow faster than others.

4. Urban patterns and transportation networks respond to technological changes and market changes, but this process can be very slow and take many years.

Summing Up

After this lecture (and HW1), you should have:

1. a good sense of how economic forces shape urban settings.

2. an understanding for the bid-rent model and how it can represent rental pricing in a city.

3. a sense of how technology has impacted urban form.