

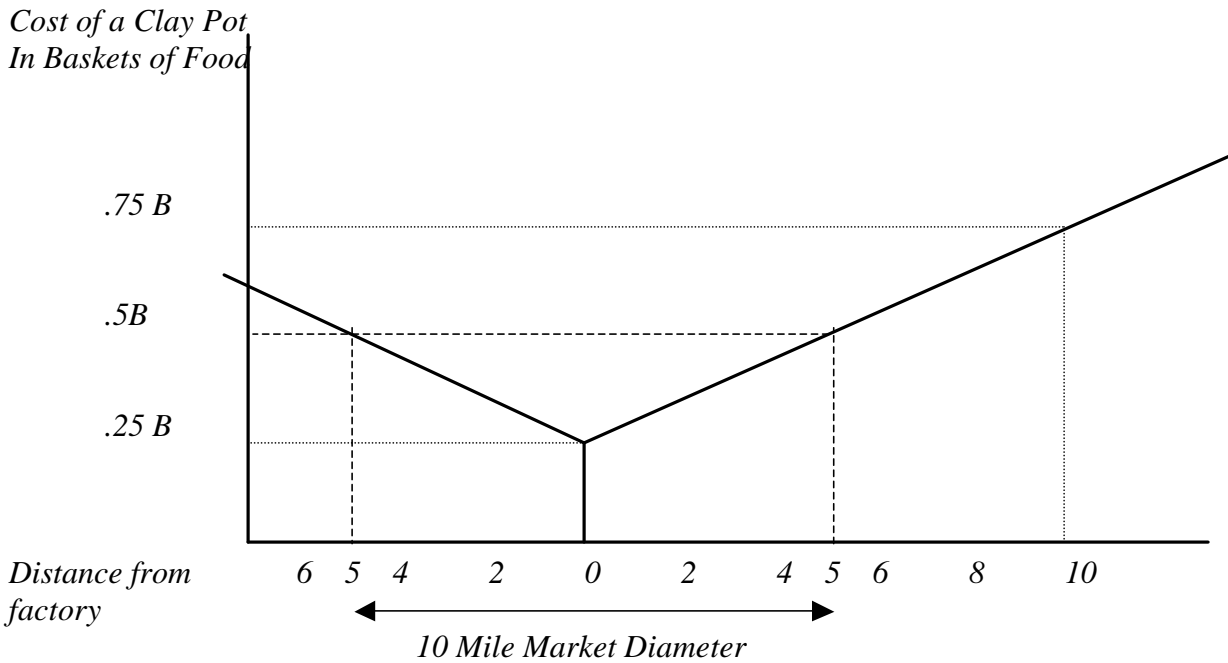
1. At home, households can produce 1 basket of food (B) or 2 clay pots (C) per hour. An entrepreneur determines that workers in a factory can produce 4 clay pots per hour.

Assume the entrepreneur pays needs to pay her workers 1 baskets of food per hour to work at the factory (making them indifferent between working at home or at the factory) and earns a zero economic profit.

a. (2) What price do clay pots sell for?

.25 baskets of food. At zero economic profit, workers earn 1 basket of food per hour and can produce 4 pots. The entrepreneur therefore sells them for .25 baskets of food per clay pot.

b. (10) Assuming people can only buy one clay pot from the factory per trip and people can travel 20 miles per hour, graph the cost of a factory-made pot at each distance from the factory.



By traveling 40 mph, living 10 miles away means taking 1/2 hour to make the trip. In 1/2 hour at home, the person can produce 1/2 B. So, living 10 miles from the factory means a Clay Pot would cost .75 B (.25 at the store + .5 in lost time). The most time they are willing to give up to travel is 15 minutes. In 15 minutes at home, they can produce 1/4 of a basket of food. At 40 mph, they can travel 10 miles. This is equal to 5 miles to the factory and 5 miles home (10 miles round trip).

So, they spend 15 minutes at home making .25B, then they take 7.5 minutes to make the trip (costing another .25B in lost time). Then they buy a clay pot with the .25B they made and go home (taking another 7.5 minutes). So, in 30 minutes of time, they were able to make a basket of food and trade for a clay pot. OR, they could have stayed home and spent 30 minutes making a clay pot. So at 5 miles away from the factory, they are indifferent between home production of C and trading for C. Living any closer to the factory makes trading at the factory a better deal.

c. (2) What will be the size (diameter) of the firm's market area? (*see answer to b above*)

d. (2) How will the size of the city be determined?

By the number of workers needed to produce the quantity demanded of clay pots by those that live within 5 miles (radius) of the factory.

e. (2) True/False: people who live closer to the factory will be better off than those that live further from the factory? Explain your answer.

False, any travel time savings from living closer to the factory will be offset with higher rents.

2. Big Tex runs the largest traveling Gun and Ammunition market in the Southwest. Tex hires local workers (people experienced in the operation and maintenance of guns) in each town where he sets up his exposition. In any city he always pays the going wage for that type of labor.

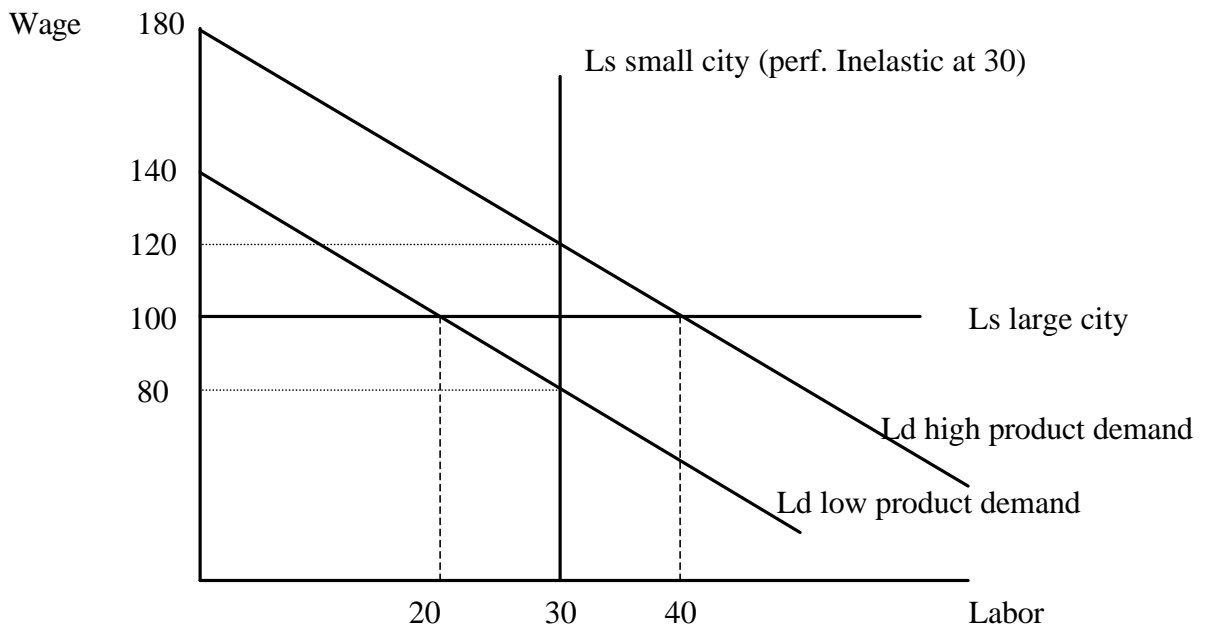
In large cities, he always ends up paying \$100 per day and 1/2 the time hires 20 workers and 1/2 the time hires 40 workers.

In small cities, he always hires 30 workers but 1/2 the time pays \$80 per day and 1/2 the time pays \$120 per day.

Which type of city has a higher expected profit?

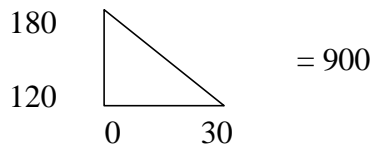
Illustrate with a completely labeled graph, assuming that the demand curves for labor are linear and parallel with vertical intercepts of \$180 when gun demand is high (1/2 the time) and \$140 when gun demand is low (1/2 the time).

a. (10) Which type of city has a higher expected profit? Explain why. Illustrate your answer with a completely labeled graph.

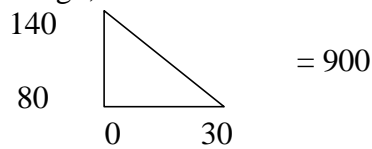


Assuming fixed cost = 0 (purely a simplifying assumption):

π in small city is



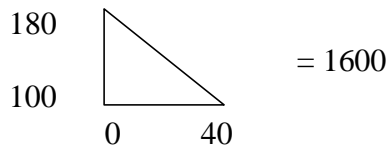
when demand is high, and



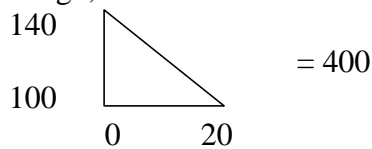
when demand is high.

In small city, profit is always 900.

π in large city is



when demand is high, and



when demand is high.
50% and low 50%.

In large city, profit is 1000 on average (demand is high 50% and low 50%).

Ls in the large city is perf. elastic b/c so many workers have necessary skills.

b. (5) Explain the economic theory about cities that this model illustrates.

This model illustrates that for industries where demand for each firm's output may vary from year to year (or season to season), being in a location where wages do not fluctuate with your firm's labor demand can increase profitability.

3. Assume household utility is determined by the following equation:

$$U = \text{Income} - \text{Commuting Cost}$$

Also assume that Income and Commuting cost vary by city size according to the following table:

Population	Income	Commute Cost	Utility	
500,000	20,000	4,000	16,000	
1,000,000	30,000	5,000	25,000	
1,500,000	37,000	7,000	30,000	
2,000,000	43,000	10,000	33,000	
2,500,000	46,000	14,000	32,000	
3,000,000	48,000	20,000	28,000	

a. (8) Assume a region has two cities, each with a 1,000,000 population. Using the population/utility graph to illustrate your answer, explain whether this is a stable equilibrium or not and why. If not, explain what you expect to see happen to the population of each city?

Starting with 1m each, if the cities experience any sort of shift from one city to the other, the city with the population increase will see utility per capita increase and the now slightly smaller city will see utility decrease. This will cause more people to move from the smaller to the larger city until one gets much larger and the other much smaller. {professor's note: ok, in reality, we might not see this so much as a shift of population from lots of smaller towns to larger cities. Also, population growth in the US might mean one city shrinks a little and the other grows quite rapidly}

b. (8) Assume a region has two cities, one with a population of 2,500,000 and the other with a population of 3,000,000. Using the population/utility graph to illustrate your answer, explain whether this is a stable equilibrium or not and why. If not, explain what you expect to see happen to the population of each city?

This time, the smaller city generates more utility per capita and so people will move from the larger city to the smaller city (utility in the larger city rises and in the smaller city falls). This happens until the cities have the same size.

c. (8) Commuting costs across each city should vary widely. What assumption of the model allows us to claim that utility is the same for each household in a city of any given size?

Rents in all locations change so that utility from better locations is paid for through higher rent paid.

4. (15) In the economics of city growth, it is often assumed that the number of hours worked by each resident is not affected by the wage rate (Irrelevant Professor comment: this assumption is not necessary, but it does simplify things). Still, the city labor supply curve is upward sloping. Explain how the upward slope of the labor supply curve is achieved under this model and explain why different cities may see different labor supply elasticities.

First, the big assumption is that any change in the quantity of labor supplied comes from people moving to or away from the city. We know that an increase in the demand for housing will affect the housing market. If there is plenty of available land for housing near centers of employment, then when demand for housing rises, the short run supply of housing can shift out and the equilibrium price of housing might not change much at all. In this case, not much of an increase in wages will be needed to attract workers to move to the city (increase in quantity supplied of labor). I.e., an increase in the demand for labor will result in a larger % change in Q_s of labor than the % increase in wages. However, if land is relatively scarce in the city, then workers will require a larger wage increase to get them to move to town as housing prices will rise a lot when the quantity supplied of labor increases. In this case, the labor supply curve will be much more inelastic.

5. The Mr. Freeze company makes refrigerators which are exported all over the world. The appliances are shipped to market via the port located in the center of town. Monthly, they produce 1,000 refrigerators and sell them for \$750 each ($TR = 750,000$). Their monthly non-land production cost is \$500,000. Transporting each refrigerator to the port costs \$25 per mile.

They are currently using 10 acres of land for production located 4 miles from the port.

a. (8) What is their current bid rent for the property?
\$15,000 Remember, the transport costs are \$25,000 per mile.

Assume they face the following isoquant options for producing 1000 refrigerators.

Non-land Input Cost	Land in Acres
\$400,000	20
\$500,000	10
\$600,000	5

Land has become available at two locations: At 1 mile from the port land is available for \$29,000 per acre and land at 8 miles is available for \$7,000 per acre.

b. (10) Assuming you are currently paying a rent equal to the bid-rent for the land at 4 miles from the port, do you recommend moving? And if so, where should you move? Explain.
*Bid rent at 1 mile using 5 acres is \$25,000, but the rent is \$29,000.
 Bid rent at 8 miles using 20 acres is \$7500, which is greater than the \$7000 rent (so profit will be $\$500 \times 20 = \$10,000$).*

6. (15) In “Edge City,” Garreau claims that:

“The five Edge City limits are:

- Insurmountability (amount of land to build on and land use restrictions),
- Affordability,
- Mobility (movement around and within an Edge City),
- Accessibility (access to the Edge City),
- Nice.”

Using the language of the class (e.g. agglomeration) and the utility/population model, explain how the automobile allowed for a dramatic increase in the size (geographic and population) of metropolitan areas over, say, the last 50 years. Explain where the “five Edge City limits” fit in the model and its application to the real world.

Before the automobile, cities were organized around transportation nodes such as ports or rail stations. Because travel was so time consuming and expensive, cities were monocentric and compact. Then the automobile and inter and intra-city truck were invented. This opened up tremendous amounts of land for non-agricultural uses. Because the supply of land available for non-agricultural uses increased so rapidly relative to demand, competition for land was greatly reduced and land outside the city center was much less expensive. The firms that had the least to gain from clustering in the old downtown were the first to leave. These were the factory-based firms and horizontally integrated firms that did not need a lot of face-to-face contact to be productive. Households too took advantage of the cheap land to move to new residential areas with larger lots.

As firms moved to the suburbs, the same old agglomeration forces that had made the traditional downtowns so useful, also led to clusters of firms in the suburbs; these are the Edge Cities so well considered by Garreau. Theoretically, any metropolis could grow forever, with new Edge Cities being created further and further away from the old urban center. However, Garreau points to several limits. First, insurmountability is the problem that some land is off-limits either because of geography (mountains or bays) social reasons (historical preservation, environmental issues) may rule out land. Both Boston and San Francisco are faced with this issue. Second, with limits to using land comes the issue that with enough growth, land will become relatively scarce and values will rise. Once this happens, economic activity might switch to some other metro area, limiting growth. Third, a large enough metro area will eventually become congested enough that movement around the metro area will be enough of a factor to limit growth. Similarly, once the size and congestion within a metro area increases past some point, access to the area from other metro areas becomes problematic. This may also limit the size of a metro area. Lastly, even in large metro areas, there are relatively few areas that are considered “nice” by the people making the decision. Dallas is a fine city, but for corporate CEOs, perhaps only Highland Park is considered “nice.” Once Highland Park gets too expensive or Edge Cities get too far from Highland Park, Dallas will no longer have enough “Nice” to attract future economic development. Of course, the downtown boom and the Trinity River Project might create enough new “nice” places that this will not be a problem for Dallas for some time.