

ANSWERS TO STUDY QUESTIONS

Chapter 4

- 4.1. A factor of production is a necessary input in the production of a good or service. There are four basic types of production factors: land, labor, capital, and raw materials. All of these factors of production must be paid for by, and will therefore derive their value from, the value of the finished product. In dividing up the value of the finished product among the four factors of production, we can see that the defining characteristic of land that differentiates it from the other three factors is that land is fixed in location, even in the long run.
- 4.3. The bid-rent is the maximum rent that a potential user would “bid” or be willing to pay, for a site or location. This bid-rent is essentially the same thing as the residual value.
- 4.5. If transportation costs are negligible, the bid-rent curves would essentially be flat with respect to location. In such a case, the value of land at any given location would be determined by the use with the highest productivity at that location.
- 4.7. Equilibrium is characterized by the condition that no land user would rather be located at a different place, given the cost or rent they would have to pay for another location. Otherwise, they would simply move to that other place and pay the rent charged there. The equilibrium thus described results in each location being used at its high and best use.
- 4.9. Other things being equal, denser land uses will have a higher land bid-rent at a central location because they make more intensive use of the land. If the residual value is \$100 per year per widget made, then a site that makes 2,000 widgets per acre can pay \$200,000 in land rent, while a site that makes only 1,000 widgets per acre can pay only \$100,000 land rent. More intensive land use will also cause higher-density uses to have a steeper bid-rent function, as the bid-rent gradient for a given land use is directly proportional to the transport costs per acre of land, and more intensive uses tend to have greater transport costs per acre of land. Thus, lower-density uses will not be able to compete against the higher bid-rents offered by higher-density uses near central points, while more intensive land uses will not be profitable at locations farther from central points, where transport costs would be higher.
- 4.11. The classic monocentric model assumes the structure of a city adjusts instantaneously to a new spatial equilibrium in response to changes in key variables (income, population, and commuting costs). It essentially assumes the city is torn down and rebuilt to its new equilibrium configuration, and it has little to say about the short-run adjustment over time to the new equilibrium configuration. In addition, neither time nor depreciation of urban capital is incorporated into the model.
- 4.13. Declining transport costs, holding population and income constant, will always reduce the value of location rent in the center of the city; the effect on the location rent near the periphery is generally ambiguous, depending on changes in density, but the overall result is certainly a flattening of rent gradients. If some of the transport cost savings were spent on purchasing more urban land, then that could have the effect of increasing land rents near the periphery. This is more likely to happen than the keeping the same level of residential density.
- 4.15. If there are no constraints on expanding the area of the city, then property rent growth will be relatively greater closer to the periphery.
- 4.17. Geographic constraints on the arc of growth, which add to the radius of the city, will be associated with higher land rents.

- 4.19. The land rent would be \$50,000 per year, the residual after all the other factors have been paid: $\$600,000 - \$450,000 - \$100,000 = \$50,000$.
- 4.21. The location premium at the center equals the transport costs at the periphery. So, the annual transport cost at the periphery is \$6,000/acre or \$2,000 per capita (given the density of three persons per acre). If the annual commuting cost per mile of distance from the CBD is \$200 per person, then the radius of the city is 10 miles (computed as \$2,000 total cost divided by \$200 cost per mile).