

BINGHAMTON UNIVERSITY
COMPREHENSIVE EXAMINATION IN URBAN ECONOMICS
SPRING 2004

YOU MAY ANSWER ANY FOUR QUESTIONS.

1. Assume a standard urban residential location model in which all residents are employed at the city center, all residential locations are identical except for distance from the center (r), resident utility depends on consumption of a composite good (z) and residential lot size (s), both goods are normal, and the budget constraint for a given resident is $Y = tr + R(r)s + z$, where Y is income, t is commuting cost per mile between home and work, $R(r)$ is residential land rent at distance r , and the price of the composite good is 1.
 - (a) Show that if residents in the urban area differ only in income, those with higher income will live farther from the city center when the urban area is in residential equilibrium. Your argument may be either mathematical or graphical. Also explain in words the reasons why income increases with residential distance.
 - (b) Make two different modifications to the assumptions of the model that could each result in equilibrium resident income increasing with distance from the center. For each case, show and explain why.
 - (c) In some urban areas, income first decreases, then increases with residential distance from the center. For example, Glaeser, Kolko, and Saiz show in "Consumer City" that resident income and distance had the following relationship in the 10 largest U.S. metropolitan areas in 1990.

<u>Distance from Center</u>	<u>Resident Income as a Percent of Average Income in Urban Area</u>
Within One Mile	163%
One to Three Miles	97%
Three to Five Miles	86%
Beyond Five Miles	100%

Make a change in the standard residential model so that it can predict this residential pattern, show that it does, and explain why.

2. In modern cities in the United States, the most common relationship between the income of residents and where they live is for residents of many different incomes to live at all distances in urban areas that were built after the automobile became the dominant method of commuting to work, and for resident income to increase with distance in areas that were settled earlier. Use urban economic analysis to explain this difference. Assume that new and old urban areas do not differ today in the location of jobs or consumption opportunities, residents' tastes, or transportation technologies. Use mathematics, graphs, or words, as you choose, but be sure to explain carefully your assumptions and the reasons they lead to your conclusions.
3. In an economic model of urban residence where all residents and residential sites are identical and all jobs are at the city center, the following three conditions must be satisfied for a long-run residential equilibrium:

$$R(r) = \Psi(r, u) \quad r \leq r_f,$$

$$N = \int_0^{r_f} [L(r)/S(r,u)]dr,$$

$$R_A = \Psi(r_f, u),$$

where $R(r)$ is land rent at distance r , $\Psi(r, u)$ is the (Alonso) residential bid at distance r consistent with utility level u , r_f is the edge of the city, N is the total number of residents, $L(r)$ is the land distribution function that specifies the quantity of land available at distance r , $S(r,u)$ is bid-maximizing demand for land at distance r and utility u , and R_A is agricultural land rent.

- (a) Explain why each of these conditions is necessary for a long-run residential equilibrium.
- (b) What is the difference between an "open city" and "closed city" residential equilibrium? What would identify the set of equilibrium conditions shown above as an "open city" equilibrium? A "closed city" equilibrium?
- (c) Show with diagrams and explain in words how and why the effect of a reduction in the marginal cost of commuting on the urban equilibrium would differ depending on whether the urban area is "open" or "closed."
4. Show that equilibrium residential land rent in a standard urban residential model, like that described in the introduction to Question (1), must decline with distance from the center, and explain why. Then modify the assumptions of the model in two different ways that each can lead to land rent that rises with distance, and explain why. For simplicity, assume all residents to be identical.

5. Consider an economy of identical workers living in different urban areas, each of which is small relative the entire economy and among which workers are costlessly mobile. Worker utility is

$$u = U(z, s),$$

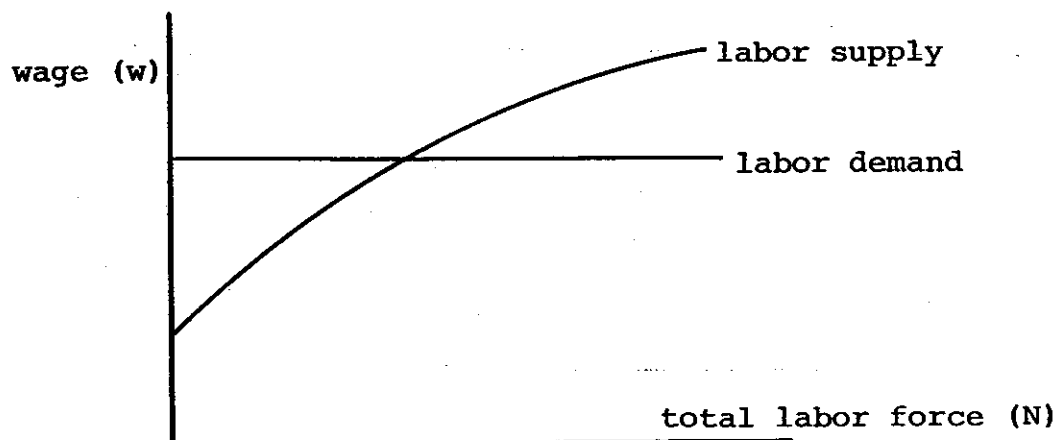
where u is the level of utility, z is a composite good, and s is residential lot size. The budget is

$$w = z + R(r)s + tr,$$

where w is the wage, the price per unit of the composite good is 1, $R(r)$ is rent per unit of residential land at distance r miles from the city center, and t is the commuting cost per mile between home and work.

Employment in each area is provided by identical competitive firms in long-run equilibrium that are all located at the city center, produce an export good that is shipped for sale in national markets, use only labor in production, and produce with constant returns to scale. Assume that after paying shipping to national markets, all firms in the area receive $(p-\tau)$ per unit of output, and that each firm's production function is $x = an$, where p is price per unit of output, τ is transportation cost per unit of output from the urban area to the national market, x is firm output, a is output per worker, and n is total employment in the firm.

The diagram below shows the demand and supply curves for workers in a single urban area.



- Explain as precisely as you can why the slope of the demand curve for workers is flat and the supply curve for workers is upward sloping.
- If the supply and demand for labor shown in the diagrams are in long-run equilibrium, what would be the equilibrium size of the urban area? Explain why.
- If urban areas differed in worker productivity (a), because of differences in natural advantage among areas, or in the cost of transportation to national markets (τ), because of

differences in transportation infrastructure, how would these differences affect the equilibrium size of urban areas? Why?

- (d) In the model defined above, if worker productivity (a) and the cost of transportation to national markets (τ) are identical across urban areas, explain why equilibrium area size would approach 1, so that production and residence are completely dispersed rather than concentrated in particular locations.
- (e) Suppose that all areas are identical in the cost of transportation to national markets (τ), but worker productivity increases with area size, so that $a = A(N)$. How and why would the supply curve of labor, demand curve for labor, and the determination of equilibrium area size differ from those shown in the diagram, if at all?
6. Write an essay that discusses the role of agglomeration economies in recent urban economic analysis. Describe the different causes of agglomeration economies that have been suggested and the different ways they may affect productivity; discuss why their presence or absence has important implications for the future of large urban areas; comment on the existence or lack of consistent empirical support for agglomeration economies of various kinds (a non-technical summary of research findings, not a technical discussion of theoretical or empirical modeling techniques, is all that is needed here).