COMPETITION FOR URBAN LAND

What decides who goes where in a metropolitan area? Here's an overly simplistic model that assumes:

- There's one spot of maximum accessibility in a metro area, where most of the transport routes (highways, busses, trains) converge.
- There's a competitive market for urban land, based on the rents that different uses are able to pay.
  - Everyone wants to be at the point of maximum accessibility, because they save on transport costs.
  - Activities that bring together more people have more to save by being in an accessible spot, and will pay more for the benefit. Those activities win out.
  - Those are the dense and usually the profit-generating activities like high-rise commercial buildings and high-rise residential buildings.
  - Less dense users of space get less benefit per square foot from being at the most accessible spot (fewer people are bearing the transport costs to get there and back), so they locate further away from the point of maximum accessibility.
  - As a consequence of this competition, what a land user doesn't pay in transportation costs, it pays in land rent.

The equation below says this: land rent at a particular location equals the maximum rent that a particular land use can pay per acre, minus the total transportation costs incurred at that location.

$$R_i = D\,(r - c) - Dtd_{ic}$$

where

R_i = maximum rent or price that a particular use can pay for urban land at a particular point i, in dollars/acre

D = land-use density, in rentable sq.ft./acre (varies across types of activity and according to the zoning regulation in force)

r = revenues generated per sq.ft. of the activity (varies across types of activity)

c = costs of generating that revenue, in dollars/sq.ft. (varies across types of activity)

t = transport cost, in dollars/sq.ft.-mile: think of this as the people who work, live, school, or shop there per sq.ft. of space, times the transit cost per person-mile = people/sq.ft. X $/person-mile = $/sq.ft.-mile; this varies according to the "person-intensity" of the activity and the opportunity cost of those people's transport time.

d_{ic} = distance from the point in question to the point of maximum accessibility, in miles.

What is this equation saying?

(r - c) is the profit to be made per sq.ft. of rented space: higher for high-volume department stores and for exclusive office space for corporate headquarters, lower for inexpensive housing or land-hungry manufacturing.

D (r - c) is the profit to be made per acre of land: this gets pretty high even for inexpensive housing, if the density is great enough.

Dtd_{ic} is the cost to transport the people (and goods) that have to get to and from the site every day: the denser the land use and the more people who use it per square foot of space, the more costly it is to be far from the point of maximum accessibility to everyone's home and workplace.

The equation is saying that LOCATION RENT -- the portion of the economic return from an urban activity which can be attributed to the *location* of the activity -- equals the difference between (a) the profit to be made per acre of land, before transport costs and (b) the costs associated with moving goods and people to and from the location.

We can relate this equation to linear rent gradients in the form $Y = a - bX$: ***D (r - c)*** **is the y-intercept** (the rent at the point of maximum accessibility) and ***Dt*** **is the slope**. See Figure 1.

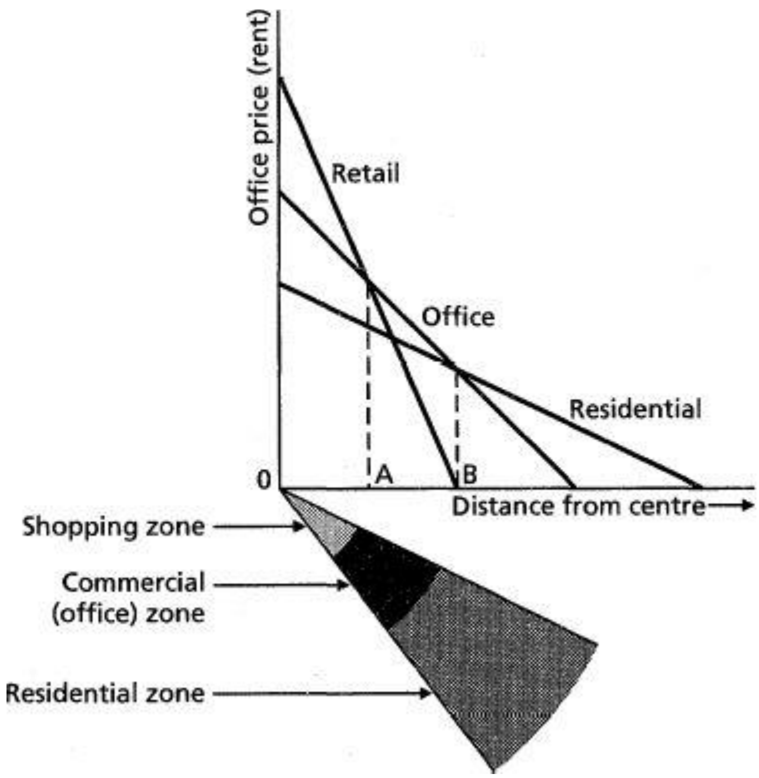

Figure 1: A set of bid-rent curves, each in the form R = D(r-c) –Dtd
(Source: http://www.answers.com/topic/bid-rent-theory)

A **bid-rent curve** is a graph of the variations in land rents payable by different users with distance from some point in the market, usually the CBD.

- Since transport costs rise with distance from the market, rents generally tend to fall correspondingly, but different forms of land use (retail, service, industrial, housing, or agricultural) generate different bid-rent curves.
- What each land use doesn't pay in C_T, it pays in **location rent**.
- For example, retailers will be willing to pay high rents for sites near the CBD where accessibility is of prime importance, but will be unwilling to pay much for sites more than about 500 m from the peak land-value intersection, because the distance shoppers are willing to walk is surprisingly short.
- The curve for industry starts lower—manufacturers cannot afford the high rents that retailers can—but drops away less sharply because pedestrian access is not such a key point.
- Bid-rent theory shows that each land-user will outbid the others at certain points (as the curve for each stands above all the others on the graph). At that point, the successful, highest competing land use will predominate, and the theory posits a series of land-use rings around the CBD. As with most locational models in human geography, the usual caveats apply: the theory takes no account of relief variations, lines of communication, planning constraints, and so on.
- The **bid-rent curve** is the shape made by the uppermost segments in Figure 1, above: retail, then office, then residential. (The actual order of land uses may vary.)

If we assume that different urban land uses have different densities, we can understand a pattern of concentric zones around the point or points of maximum accessibility: dense commercial, then dense residential, then mixed uses including industrial, then moderately dense residential and commercial, then low-density residential.

We can also model a more complicated pattern when there are several points of great accessibility, as where a circumferential highway (the Beltway around Washington, D.C., or Route 128 and Route 495 around Boston) intersects the radial highways leading into the center of town.

Citation:
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