Geography 350
Formulas for retail location analysis

"BREAK POINT" BETWEEN COMPETING RETAILERS (or market centers)

We can recognize the relative attractiveness or pull of nearby competitors. Assume that

- there are competing retail outlets, and
- that the likelihood that a consumer in zone *i* will shop at a store in zone *j* depends on the distance *ij* relative to the distance from *i* to other zones where there are similar stores.

Also note that

- larger stores (or shopping centers) are more attractive to consumers than smaller stores (or shopping centers) — for reasons of variety and, usually, lower prices.

From these two recognitions — competition among stores (or shopping centers) for customers based on distance; and the additional attraction of the size of the stores (or shopping centers) — we can derive a simplistic but useful model:

$$B_C = \frac{d_{AC}}{1 + \sqrt{(S_A / S_C)}}$$

where
B_C = "break point" between the primary market areas of centers A and C, expressed as distance from C
d_{AC} = distance between centers A and C
S_A = population of city A ***or*** square footage of shopping center A
S_C = population of city C ***or*** square footage of shopping center C

REILLY'S LAW OF RETAIL GRAVITATION

This results from "**Reilly's law of retail gravitation**," which suggests that *R*, the retail attractiveness of a central place (or shopping center) *j* to a potential customer at *i* increases proportionately with the population *P* (or size in square feet) of *j*, and increases inversely with the square of the distance *ij:*

$$R_j = k\,P_j / d_{ij}^{\,2}$$

Note the direct analogy to physical gravity. Also note that whether we're using population or square footage, the implication is that the greater possibility of finding more of the goods/services needed, with only one trip, is a powerful attraction of a consumer to a particular place.

SATURATION INDEX

How much competition exists already within a market area? Here's an approach to estimating the **saturation index** (SI) for market area *i*.

$$SI_i = \frac{R_i / (P_i E_i)}{max\ [R / (P E)]}$$

where
P is a measure of population (or total HH income, or…),
E is a measure of per capita expenditure or retail expenditures as a function of income (on consumer items in general, or on your particular product category), and
R is a measure of the amount of retail space (or space devoted to your particular product category), each within the market area, and
max [R / (P E)] is the maximum value of *R / (P E)* that can be sustained in any market area. (You can get this from trade sources.)

SI is a real **index**; it must take a value between 0 and 1. (Would a retailer be more attracted to a market area with an SI near 0 or near 1?) Alternatively, the denominator could be a national average of retail space divided by retail market size, in which case the SI would be a **saturation quotient**, analogous to a location quotient.

THE HUFF MODEL

The **Huff model** allows us to designate a primary and secondary market area based on probabilities of consumer behavior.

Five steps:

1. Divide the area into small statistical units.
2. Determine the square footage of retail selling space of all shopping centers included within the area of analysis.
3. Compute travel times.
4. Calculate the probability of consumers in each unit going to the particular shopping center.
5. Map the trading area of the shopping center in question by drawing lines connecting all statistical units having like probabilities.

$$P(C_{ij}) =$$

probability that a consumer in small area *i* will shop at your store *j*

$$= R_j \, d_{ij}^{-\alpha} \,/\, \Sigma_j \left(R_j \, d_{ij}^{-\alpha}\right)$$

where *R* is a measure of retail attractiveness, such as the retail floor space in each retail store or shopping center, and *d* is distance.

See Jones & Simmons pp. 307-313.

We can attempt to increase $P(C_{ij})$ by increasing R_j relative to $\sum_j R_j$ -- by reducing price, or by increasing sales area, selection, or service.