

Assumptions of the representative manufacturing firm:

1. Firm produces fixed number of bats, B , per month.
2. Firm's inputs found everywhere, nonland input prices do not vary geographically.
3. Firm is perfectly competitive.
4. All of the firm's output shipped from rail station at CBD.

t - output transportation cost per unit/mile

P_b - price of bats (output)

B - number of bats firm produces

C - cost (composite) of nonland inputs (labor, capital) used to produce bats

μ - number of miles firm is away from CBD (rail station)

R - land rent

T - amount of land (in acres) used by firm to produce B number of bats

$$\pi = P_b B - C - tB\mu - RT$$

Assumptions for the representative household:

1. Households value proximity to central business district (CBD) because one member commutes to work at the CBD.
2. All other transport costs insignificant.
3. All other factors that influence household location (taxes, pollution) insignificant.

Scenario I.

- A. Each dwelling in city has 1000 sq. ft. of living space.
- B. Each household spends \$300/month on commuting and housing costs.
- C. Commuting transport cost is \$20/per mile/per month.

H – fixed housing consumption
= 1000 sq. ft.

P – price of housing per sq. ft.

t – transport cost
= \$20/mile/month

total expenditure on housing and commuting:

$$\text{I. } 300 = t\mu + PH$$

isolate P

$$\text{II. } P = \frac{300}{H} - \frac{t\mu}{H}$$

$$\text{III. } P = .3 - .02\mu$$

Schedule of bid rents:

distance from CBD	Price Bid (per square foot)
0	0.3
4	0.22
6	0.18
15	0

Slope of bid rent function for households with fixed amount of housing:

$$\begin{aligned}\Delta P &= \frac{-t}{H} \Delta\mu \\ &= .02 \Delta\mu\end{aligned}$$

Notes:

1. With fixed housing, rent gradient is linear.
 2. No household locates beyond 15 miles from city center.
 3. Households are trading off transport costs with housing costs along line.
 4. Households are indifferent to locating anywhere along line.
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Suppose H is not fixed at 1000 sq. ft.

If demand curve for housing is downward sloping, less housing quantity will be demanded at higher prices

Less housing will be demanded as we draw closer to CBD

In the equation giving the slope of the housing price relationship, H is now a function of distance from CBD

$$\Delta P = \frac{-t}{H(\mu)} \Delta \mu$$

as $\mu \uparrow$ $H(\mu) \uparrow$

as $\mu \downarrow$ $H(\mu) \downarrow$

this will cause slope to vary with distance from CBD