11.433J / 15.021J Real Estate Economics
Fall 2008

Week 6: Retail Location and Market Competition.

- Retail Real Estate must understand Retailing (a Business) to correctly attract tenants.
- Patterns in Retail location, travel and shopping behavior.
- Classical theory: trip frequency, price competition, entry and the determination of retail density.
- Neo-classical theory: retail clusters, inter-store externalities, shopping centers, incentive leases.
- Simulating and forecasting shopping center demand.

Retail Sales Data:

Surveys of sales establishments = $ by SIC
Surveys of consumers = $ by product or line of Merchandise

Boston CMSA Retail Census Data, 1987

SIC Code	Kind of Business	Number of Establishments	Sales (thousands)	Sales per Establishment (thousands)	Paid Employees	% of Personal Income (thousands)
	Total Retail Trade	25,419	$32,109,978	$1,263	375,662	37.2%
52	Building and Garden Materials	1,020	1,679,530	1,647	11,756	1.9
531	Department Stores	168	2,914,184	17,346	NA	3.4
54	Food Stores	3,075	5,756,751	1,872	66,223	6.7
541	Grocery Stores	1,794	5,178,412	2,887	51,992	6.0
546	Retail Bakeries	665	223,496	336	9,159	0.3
55*	Automotive Dealers	1,228	7,102,357	5,784	24,978	8.2
56	Apparel and Accessory Stores	2,585	2,051,969	794	26,684	2.4
562,3	Women's Clothing and Specialty Stores	1,076	809,699	753	11,754	0.9
566	Shoe Stores	712	321,123	451	4,304	0.4
57	Furniture and Home-furnishings Stores	1,887	1,555,169	824	13,442	1.8
58	Eathing and Drinking Places	6,950	3,372,405	485	127,978	3.9
591	Drug and Proprietary Stores	900	1,148,159	1,276	12,978	1.3
59**	Miscellaneous	5,515	4,138,376	750	44,669	4.8
592	Liquor Stores	834	154,438	185	1,480	0.2
5944	Jewelry Stores	504	326,084	647	3,719	0.4
5961	Catalog and Mail-Order Houses	148	558,813	3,776	3,670	0.6

** Except 554, Gasoline Service Stations.* *** Except 591, Drug and Proprietary Stores.* *NA, not available.*

adapted from DiPasquale and Wheaton (1996)

Centers exhibit the same patterns as do individual stores in classical theory: Many smaller centers, fewer larger ones.

Boston Shopping Centers, 1992

(National Research Bureau)

	Neighborhood	Community	Specialized / Regional	Super Regional
Number of Centers	144	112	22	10
Average GLA (sq. ft.)	50,996	165,226	448,130	1,037,266
Average Number of Stores	11	20	69	139
Average GLA/Stores	4,540	8,196	6,504	7,494
Total Stores	1,584	2,354	1,518	1,390
Grand Total: 6,846				

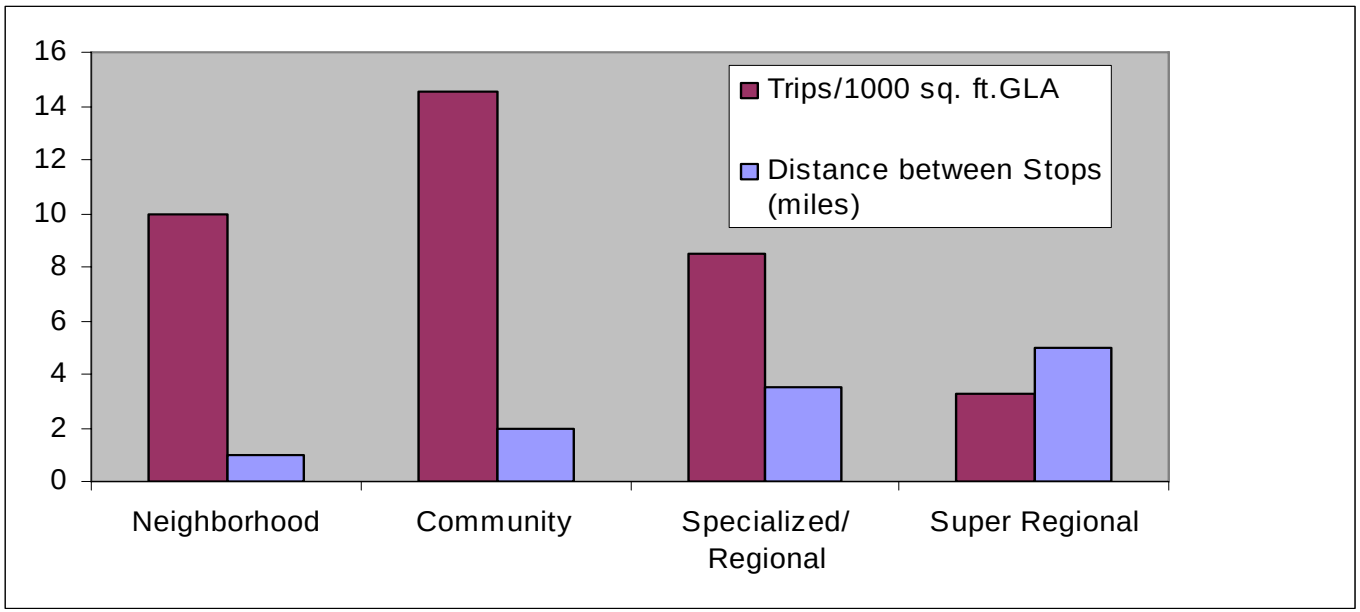
GLA, gross leasable area.

adapted from DiPasquale and Wheaton (1996)

Smaller, more numerous shopping centers have more frequent and shorter shopping trips.

Larger, more sparsely located centers have less frequent and longer shopping trips

Travel behavior for retail shopping, 1991.



Averages for midday and P.M. trips

GLA, gross leasable area.

adapted from DiPasquale and Wheaton (1996)

1). Purchase frequency (V).

u = units of good purchased annually

p = price per unit

i = storage cost per dollar of purchase

k = transport cost per trip

V = annual trip (purchase) frequency.

Q = quantity purchased per trip

2). Average inventory = Q/2

Q = u/V

3). Annual consumption costs (CC):

$$CC = pu + kV + i[pu/2V]$$

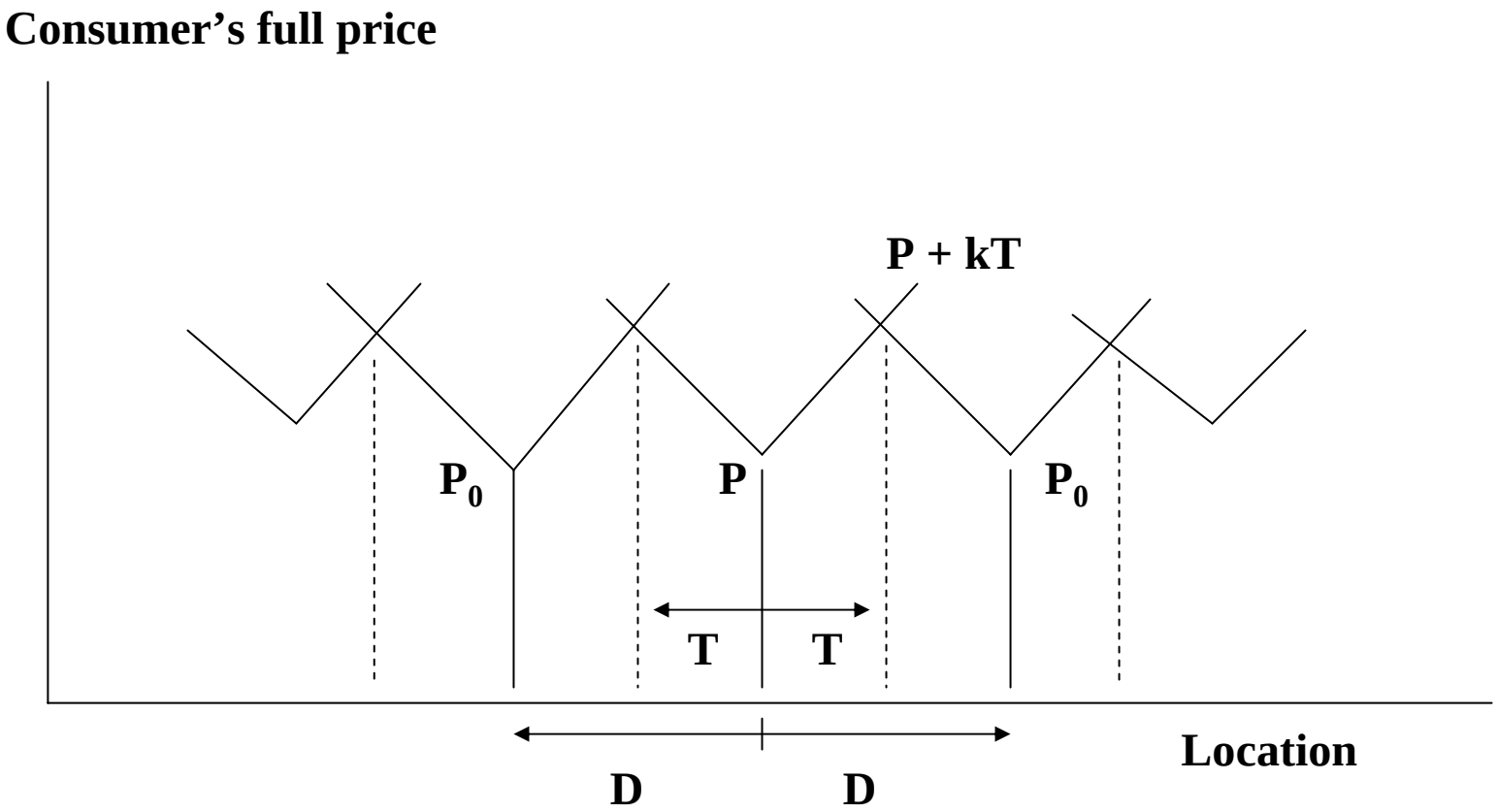
4). Minimizing with respect to V:

implies $\partial CC/\partial V = k - ipu/2V^2 = 0$

or: $V^* = [ipu/2k]^{1/2}$

5). How do V^* (and Q) vary with i, u, k?

Classical Retail Market Areas when retailers compete over only price and consumers shop where the full price (including travel cost is lowest).



6). Market areas and imperfect competition.

v = frequency of purchase trips (good consumption)

f = density of buyers along line

mc = wholesale price or marginal cost of goods to retailer.

c = fixed cost of retailers (structure…)

P = retail price of good.

D = distance between stores [even spacing?]

T = market area size (one side distance)

S = retailer sales

7). Market areas based on equal purchase costs:

$P + kT = P_0 + k(D-T)$ implies

$T = [P_0 – P + kD]/2k$

$S = 2vTf = vf[P_0 – P + kD]/k$

8). Profit maximization (with respect to P given P_0):

$\pi = [P – mc]S - c$

$\partial \pi/\partial P = S + \partial S/\partial P [P-mc] = 0$ implies:

$P = [P_0 + kD + mc]/2$

9). Nash ("A Beautiful Mind") Equilibrium assumption: $P_0 = P$ implies:

$$P = kD + mc, \quad T = D/2, \quad S = Dvf$$

[profits higher with less competition, why?]

10). Free entry determines store density (1/D) so as to erode profit:

$$\pi = [P - mc]Dvf - c = 0 \text{ implies:}$$

$$P = mc + c/Dvf$$

11). Solving (9) and (10) simultaneously:

$$D = [c/kvf]^{1/2} \text{ , } P = mc + [kc/vf]^{1/2}$$

- As f doubles (population) the distance between stores less than halves. Hence sales per store rise. Is the average (clothing) store larger in larger MSAs (NBER paper 9113)?

- store selling more frequently purchased items (v) have more dense distributions.

- stores with high fixed costs [showroom space] are less densely distributed.

- What happens with higher Gas Prices?

How well does this classic theory explain Shopping Center success *(see: Eppli, Shilling, JRER, 1996)*? Sales/sqft across 40+ Regional Shopping Centers explained by range of center characteristics, market area income, weighted distance of center to other competing centers [R^2=.86]. Without Center characteristics [R^2=.73] !

Shopping Center j Size (000 s.f.)	*Base Case*	*Competitive Shopping Centers Decrease 20% in Size*	*Competitive Shopping Centers Increase 20% in Size*	*Distance to Competitive Shopping Centers Increases 20%*	*Distance to Competitive Shopping Centers Decreases 20%*	*Aggregate Household Income Increases 20%*	*Aggregate Household Income Decreases 20%*
800	212	275	178	221	202	235	190
		(30%)	(-16%)	(4%)	(-5%)	(11%)	(-10%)
1000	220	297	178	231	206	247	192
		(35%)	(-19%)	(5%)	(-6%)	(12%)	(-13%)
1200	233	327	183	248	217	267	201
		(40%)	(-21%)	(6%)	(-7%)	(15%)	(-14%)

Estimated Shopping Center Sales per Square Foot Based on a Changing Set of Competitive and Socioeconomic Variables

Complimentary, Comparative, and Competitive Shopping

Complimentary:

-Shoppers more likely to *come* to one store if the other is there.

- Shoppers *more* likely to *purchase* at one store if also purchase at the other. [Shoes & Clothing, Antiques]

Comparative:

-Shoppers more likely to *come* to one store if the other is there (compare prices-quality).

- Shoppers *less* likely to *purchase* at one store if also purchase at the other.

Competitive:

-Shoppers no more likely to *come* to one store if other is there.

- Stores selling *same* product in *same* price range.

Complimentary – Comparison Shopping Synergy

v: # visits to each store if in and isolated location

n: number of stores in "cluster" or center

s: # visits to each store in cluster = total cluster visits x probability of store visit given visit to cluster.

Total cluster visits = vn^{α}

α: attraction factor for "clustering" [≥ 0]

Probability of store visit if at cluster = $1/n^{\beta}$

β: degree stores compliment/compete [=0 if pure compliments, =1 if pure competitors]

Hence: $s = vn^{(\alpha - \beta)}$, and stores cluster if $(\alpha - \beta) > 0$

Store Mix and Shopping Centers

- **Center Size $S = \sum S_i$, i = space of store type (one of n)**
- **Store revenue $R_i = R_i (S_1 \ldots S_n)$**
- **Complimentary/Competitive: $\partial R_i / \partial S_k >< 0$**
- **"Draw power": $\partial R_i / \partial S_k > 0$ for all i (e.g. Anchors).**
- **Center Revenue: $= \sum S_i R_i (S_1 \ldots S_n)$**
- **The rent stores are willing to pay depends on: their expected revenue – which depends on the overall mix!**
- **Given fixed S, allocate space (S_i) to maximize rent.**
- **Landlord: Charge high rent to stores that "live off of other stores", charge lower rent to stores that draw customers and create synergy" = "rent discrimination".**
- **Brueckner (1993)**

Average Shopping Center Lease terms by store category

1. Anchor
2.Access
3. Apparel Unixex
4. Children
5. Women specialty
6. Women
7. Mens
8. Shoes
9. Jewelry
10. Misc.
11. Discount
12. Drug
13. Books
14. Services
17. Hobby
18. Audio
20. Theatre
21. Restaurant

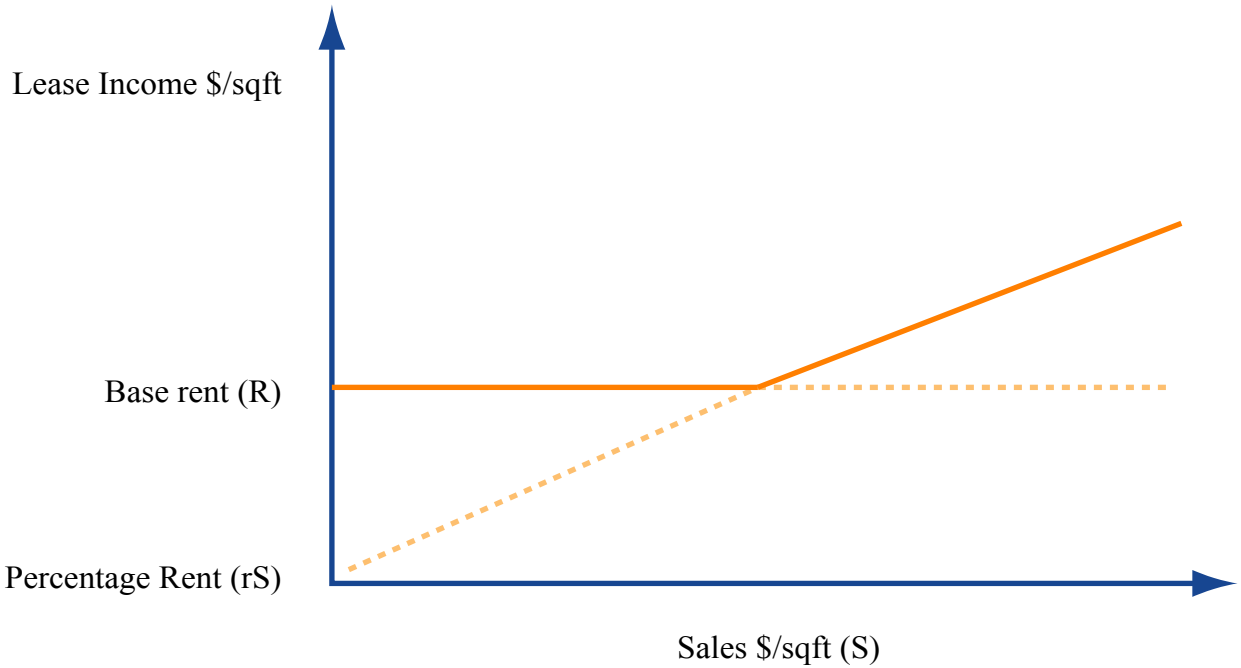
Table 1: Average lease terms by type of store.

Store category	ULI area[1]	Sample area	ULI %[2]	Sample %	ULI Rent[3]	Sample rent	ULI Sales[4]
1	102.9	126.4	1.01	.47	2.18	2.36	148.1
2	.8	.7	7.9	8.3	33.5	72.1	278.4
3	2.7	5.5	6.0	5.8	20.3	36.8	261.2
4	2.1	3.3	5.0	5.4	21.0	35.5	268.9
5	2.6	3.7	5.1	5.9	20.1	36.9	235.4
6	3.9	5.9	5.0	5.3	15.0	28.9	175.6
7	2.3	2.5	6.0	6.0	16.2	36.2	203.9
8	2.2	2.4	6.0	6.2	18.8	37.3	232.5
9	1.1	1.3	6.0	6.6	40.5	82.1	525.4
10	1.8	2.3	5.6	5.7	18.7	42.8	231.1
11	42.6	29.7	2.5	2.4	3.5	13.2	129.3
12	8.0	6.4	3.7	3.2	8.6	19.3	210.8
13	2.9	2.9	6.0	7.4	17.3	40.4	207.2
14	1.3	2.3	4.7	6.1	19.1	39.7	237.8
15	1.8	3.0	6.2	6.3	24.2	36.1	266.1
17	3.9	4.1	5.5	6.0	13.8	31.0	191.2
18	2.4	2.5	4.7	5.8	19.6	42.3	290.3
20	8.9	5.6	8.9	17.1	13.7	40.9	93.4
21	5.6	4.1	5.0	6.5	12.8	40.5	225.4
22	.9	.9	7.9	8.7	32.2	74.2	305.1
23	.8	.7	7.8	8.9	39.5	112.3	336.2

1. Gross leased area per store, 1000s of square feet.

2. Percentage of gross sales paid as

Retail Rent: Percentage plus Base



Retail lease income as a function of store sales

Rental payments = R + max[0, r(S - B)]

R = Flat rent per square foot.
r = Percentage of sales to be made as a rental payment.
S = Sales per square foot.
B = Threshold sales per square foot, or breakpoint.

Explanation for Percentage Rent

- Risk Sharing: tenant pays fixed rent, absorbs business risk if landlord more risk adverse. If both equally risk adverse =% rent [why only retail?].
- Not a substitute for fixed rent [notice that tenants paying higher fixed tend to pay higher % as well]
- With fixed rent, landlord can relet space to the detriment of existing tenants – and face no consequences until their leases renew.
- With percentage rent, landlord faces immediate loss in rental revenue if his actions in any way hurt the sales of existing tenants [Wheaton]

Centers, “Main Streets”, BIDs, Traditional Business Districts

- Stores are attracted to each other – to the degree they do not compete. This is not necessarily efficient! [examples]
- Centers “won” the battle against older business districts partly from location, but also from the mix/management advantages of centers.
- BIDs and Main Streets solve the mix issue *only* if they are owned and managed in entirety.
- Arbitrage. Buy up the disconnected stores in an old business district and run as a center?

Retail Market Analysis – done Right

Predicting Shopper patronage at 13 major retail centers and regional malls in the Boston Market

Map of Boston metropolitan area removed due to copyright restrictions.

Boston Area Regional Center/Mall characteristics

Characteristics of Boston-Area Shopping Centers

	Size (000 sq. ft.)	Parking Spaces	Stores	Discount Stores	Department Stores	Variety Stores	Furniture Stores	Restaurants	Parking Costs[a]
Boston CBD	1,750	0	300	1	2	9	29	247	$3.50
Back Bay	886	0	402	0	3	0	15	250	3.50
Harvard Square	635	0	300	0	0	0	10	50	2.50
Chestnut Hill	440	2,400	67	0	2	2	11	17	0
New England	458	3,300	27	1	1	5	2	3	0
North Shore	1,550	6,700	102	1	3	5	7	8	0
Liberty Tree	1,020	5,500	118	2	0	2	10	22	0
Burlington	1,137	6,000	100	0	4	6	10	13	0
Dedham	575	2,500	50	2	1	3	4	4	0
South Shore	1,300	6,000	130	0	4	4	11	13	0
Natick	549	3,000	91	1	2	4	12	11	0
Lowell	400	3,000	161	1	2	2	15	40	0
Brockton	450	3,000	117	1	2	4	13	21	0

[a]Cost of parking is for two hours.

Source: Census of Retail Trade, 1987; and telephone surveys by the MIT Center for Real Estate.

13). Shopper utility function:

$$U^{ijk} = \alpha^{j} T^{ik} + \sum_{l=1,g} \mu^{lj} Z^{lk}$$

i= origin (home) zone [i=1,n]

j= income category of shopper [j=1,h]

k= destination (center) zone [k=1,m<n]

l = center attribute [l=1,g]

α^{j} = marginal disutility of travel to j.[<0]

μ^{lj} = marginal utility of attribute l to j.

14). Probability [P]of shopper type j living in i patronizing center k:

$$P^{ijk} = e^{Uijk} / \sum_{k=1,m} e^{Uijk}$$

15). Total patronization [S] at center k by shoppers of type j

$$S^{jk} = \sum_{i=1,n} P^{ijk} N^{ij}$$

Implementation: Center characteristics (easy)

Zone income (census, towns), Travel times (local transportation planning agency). Shopper behavior (ante up for a survey - $$$).

16). Estimation of utility parameters from actual Shopper patronization [S]:

$$\ln(S^{ij1}/S^{ijk}) = \alpha^{j} (T^{i1} - T^{ik}) + \sum_{l=1,g} \mu^{lj} (Z^{l1} - Z^{lk})$$

Estimated over i,k (n x m-1 observations) for each shopper type j (h separate equations- one for each income group j).

Estimated Utility Parameters

Estimated Values for Attributes of Major Boston-Area Shopping Centers

	Marginal Utility by Income Categories (j)				
LOW	1	2	3	4	5 HIGH
Travel, α_j:	–0.2962	–0.2224	–0.1486	–0.0748	–0.001
	9,000	18,000	27,000	36,000	45,000 Y
Center Characteristics, μ_{ij}:					
Square Feet	0.0021	0.0012	0.0003	–0.0006	–0.0015
No. Stores	0.0261	0.0162	0.0063	–0.0036	–0.0135
No. Discount Stores	1.154	0.488	–0.178	–0.844	–1.5
No. Department Stores	–1.35	–0.36	0.63	1.62	2.61
No. Variety Stores	1.595	0.83	0.065	–0.7	–1.465
No. Furniture Stores	–0.03	0.06	0.15	0.24	0.33
No. Restaurants	0.0118	0.0136	0.0154	0.0172	0.019
No. Parking Spaces	0.00028	0.00046	0.00064	0.00082	0.001
Parking Costs	–0.042	–0.024	–0.006	0.012	0.03

Source: MIT Center for Real Estate; Cambridge Systematics, Inc.

Predicted Shopping Center Patronage

Predicted Number of Shoppers for Major Boston-Area Shopping Centers, by Income

$\bar{Y}$		Income Categories (j)					
	LOW	1	2	3	4	5 HIGH	Total
29	Boston CBD	9,318	20,928	31,218	20,928	2,545	84,938
39	Back Bay	84	1,009	8,244	34,806	27,990	72,134
19	Harvard Square	25,517	23,196	9,021	1,496	46	59,276
38	Chestnut Hill	117	1,506	8,145	24,334	13,674	47,776
15	New England	19,959	11,047	1,639	42	0	32,687
23	North Shore	8,728	19,568	16,582	1,431	13	46,322
19	Liberty Tree	8,985	10,193	4,010	144	0	23,333
28	Burlington	7,020	20,864	31,160	15,868	932	75,843
16	Dedham	8,555	6,610	1,157	77	1	16,400
32	South Shore	8,799	23,400	45,283	56,054	12,529	146,066
24	Natick	7,669	15,974	15,530	3,052	137	42,363
34	Lowell	357	2,154	8,568	12,326	3,263	26,668
23	Brockton	9,806	18,175	12,119	2,751	149	42,999
	Total	114,915	174,624	192,676	173,309	61,281	716,805

Source: MIT Center for Real Estate; Cambridge Systematics, Inc.

How will the Retail system respond to higher Gasoline Prices?

- People want to shop “more locally”.
- Less “cross hauling” – driving to other than the nearest center.
- Centers located near population masses do well, those remotely located suffer.
- Neighborhood and Community Center Sales expand.
- Stores previously locating in larger centers and catering to lower income consumers now willing to increase outlets and locate more locally.