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Abstract: *This paper empirically examines inter-center externalities in regional shopping centers. Specifically, we use a non-linear retail share model to measure the impact that department store size and image in subject and competitive centers have on subject center in-line retail sales. Our findings reveal that department store size and image attributes have a significant and non-linear impact on subject center sales. More importantly, the results show that the effect of department store fashion image dominates that of department store size.*

1. Introduction

The retail real estate literature broadly recognizes the existence of inter-store externalities in enclosed shopping centers. Brueckner (1993), Gatzlaff et al. (1994), Eppli and Shilling (1995), and Miceli and Sirmans (1995) all argue that the presence of department stores benefit in-line retailers in enclosed shopping centers by creating a customer spillover effect. This research implies that profit-maximizing shopping center developers/owners should maximize inter-store externalities to attain optimal in-line retail sales and rents.

Inter-store externalities are also discussed in the economics and marketing literatures. The economics literature usually explains external economies through size agglomeration. Gabszewicz and Thisse (1986), Dudey (1993), and Pashigian and Gould (1998), for example, describe inter-store externalities as a benefit of store clustering. In this view, store clustering reduces uncertainty associated with consumer search, where department stores provide the critical mass for the efficient clustering of retailers in enclosed shopping centers. The marketing literature takes a different view, explaining external economies through department store fashion image. Nevin and Houston (1980), Keller (1993), and Simon and Sullivan (1993), among others, find that department store brand name recognition is of critical importance to in-line retailer performance.

While the real estate, economics, and marketing literatures broadly recognize the importance of size and image externalities *within* an enclosed shopping center (i.e., inter-store externalities), the literature narrowly addresses the effect of size and image externalities *between/among* competing enclosed shopping centers (i.e., inter-center externalities). Sirmans and Guidry (1993) examine rent variations across shopping centers in a large metropolitan market using shopping center area, age, and anchor tenants as proxies for customer drawing power and find that these factors increase shopping center attractiveness and center rents. Similarly, Eppli and Shilling (1996) use a retail gravity model to examine the effect of distance to competing malls and size of competing shopping centers on in-line retail sales in subject centers. These studies suggest that the attributes of one center affect the retail sales of others and therefore shopping center developers/owners must consider competitive center externalities when making decisions to enter a market or renovate an existing enclosed shopping center.

Building department store space and securing department store tenants in enclosed shopping centers is costly. Thus, resource-constrained developers need to assess the impact of competition on their investments when allocating capital to department store physical assets (space) and intangible assets (image). The "bricks and mortar" costs of building the physical space for a department store is clear. What is less clear are the "image" costs/subsidies associated with securing the department stores in an enclosed center. It has been legally argued that department store character varies across brands.[1] However, quantifying the benefits of department store character to the in-line retailers is not simple.

The following examples help clarify the cost of department store image by illustrating the magnitude of subsidies paid to department store operators to entice them to locate in an enclosed center. In addition to free pad sites, the developers of the Mall of America paid a total of $112,000,000 to Macy's, Nordstrom's, Bloomingdale's, and Sears to locate in the center[2]. In 1995 these four department stores maintained total sales that exceeded $164,000,000 and paid a combined rent of only $1,783,466 for a 1.6 percent return on the cash incentives paid to them, not including the value of the land.

A second example is the subsidy paid to Dayton Hudson Corporation to keep Dayton's Department store from leaving the Southdale Mall in Edina, Minnesota after the store's lease expired. To convince Dayton's to stay in the mall, Equitable Life Assurance Society paid $26,800,000 to Dayton Hudson Corporation to enable Dayton's to build a new store, acquire a building pad, and construct a one-level parking deck. In return Dayton's agreed to operate at the center for 15 years[3] Similarly, Salt Lake City staked the viability of its downtown shopping area on keeping the Nordstrom's Department store downtown, wrestling with the incentives necessary to do so.[4]

Extending Sirmans and Guidry (1993) and Eppli and Shilling (1996), we use department store size and image in competing centers to explain variations in in-line retail sales per square foot in subject centers. Using a non-linear retail share model we estimate the cross-center effects of department store size and fashion image on subject center in-line retail sales. In the model, we assume that shopping centers operate under the presence of inter-center department store externalities.

We find that in-line retail sales performance is highly sensitive to inter-center competition when there is minimum size and fashion image differentiation between subject and competitive enclosed malls (e.g., other malls act as product substitutes). The results also show that in-line retail sales performance is largely unaffected by changes in competition when there is large size and fashion image differentiation between subject and other enclosed malls (e.g., other malls act as product complements). Additionally, competitive center department store fashion image dominates competitive center department store size as a predictor of subject center in-line retail sales.

The remainder of this paper is organized as follows: the following section describes the effect of department store size and image on in-line retail sales in a multi-center market; Section 3 presents an estimation model; a discussion of the data is provided in Section 4; empirical findings are reported in Section 5; and Section 6 concludes the paper.

2. Size and image externalities in enclosed shopping centers

Consider two entrepreneurs, *j* and *k,* operating in the same retail market. Entrepreneurs *j* and *k* develop enclosed shopping centers with comparable in-line retail space but different department store attributes. Department stores are characterized by size and image attributes that are assumed to affect in-line retail sales. Also, assume that the market is homogeneous across locations.

Recognizing the potential externalities associated with the presence of department stores, entrepreneur *j* chooses department store size and image attributes *Mj* and *Ij* while entrepreneur *k* chooses size and image attributes *Mk* and *Ik.* Since entrepreneurs *j* and *k* operate in the same market, decisions about *M* and *I* are expected to affect competitors. Assuming that shopping center *j* is differentiated from center *k* only by the levels of *M* and *I,* shopping center *j'* s sales performance can be defined as

$$S_j = f\,(M_j, I_j, M_k, I_k), \qquad (1)$$

where *S* is shopping center *j*'s in-line retail sales per square foot. Changes in shopping center *j*'s sales are characterized by the derivatives of (1), such that

$$S_1 = \frac{\partial S_j}{\partial M_j} > 0; \qquad S_2 = \frac{\partial\, S_j}{\partial I_j} > 0; \qquad (2)$$

and

$$S_3 = \frac{\partial S_j}{\partial M_k} < 0; \qquad S_4 = \frac{\partial S_j}{\partial I_k} < 0. \tag{3}$$

The positive signs of S_1 and S_2 reflect the ***inter-store*** externalities at shopping center *j,* where increases in department store size and image at the center increase in-line retail sales per square foot at center *j.* Alternatively, S_3 and S_4 capture the ***inter-center*** externalities, where increasing levels of size and image at competitive center *k* decrease in-line retail sales at center *j.* We presume that the inter-center externalities represented by the derivatives $S_{3\text{-}4}$ change with changes in M_j/M_k and I_j/I_k. The intuition behind this assumption is that when there is little differentiation in the levels of *M* and *I* at centers *j* and *k* (i.e., centers *j* and *k* tend to be substitutes), center *j'* s sales are more sensitive to center *k's M* and *I* attributes and the derivatives S_3 and S_4 are high. Conversely, when there is a high degree of differentiation (i.e., centers *j* and *k* tend to be complements), center *j'* s sales are less sensitive to center *k's M* and *I* attributes and the derivatives S_3 and S_4 are low. The non-linear assumption between $S_{3\text{-}4}$ and the M_j/M_k and I_j/I_k ratios is not a necessary result of (2) and (3) but an economic characterization of our inter-center externality argument.

Under these principles, shopping center *j'* s market share is a function of entrepreneur *j*'s choice of department store size and image relative to entrepreneur *k's* department store size and image. Being a resource-constrained developer, entrepreneur *j* must choose between costly size and image attributes when allocating capital to department store physical and intangible assets. Beyond minimum levels of department store size and image, the decision to invest in center *j's* size or image depends on shopping center *k's* department store size and image attributes.

3. Empirical model

The theoretical presentation suggests that in-line retail sales, S_j, are interactively determined by the department store size and image attributes of centers *j* and *k.* To test this assumption, consider the following definition of shopping center *j*'s sales performance:

$$S_j = P_j \frac{Y}{q_j}, \tag{4}$$

where Pj is defined as

$$P_j = \left(\frac{M_j I_j}{\sum_{k=1}^{m} M_k I_k}\right). \tag{5}$$

In equation (4), S_j represents shopping center *j*'s in-line sales per square foot, P_j is shopping center *j*'s share of aggregate household income *Y*; and q_j is shopping center *j*'s occupied in-line retail space. Shopping center *j*'s share of market sales, P_j, is defined in (5). This expression defines shopping center *j*'s share of sales as the ratio of shopping center *j*'s size and image attributes relative to competitive center *k's* size and image attributes, across *m* competitive centers.[5]

Extending (4) to include an intercept term, a set of control variables and parameters, and an error term, we construct an empirical model of shopping center *j*'s sales that we can use to test the effect of *M* and *I* on *S*. The empirical model is specified as follows:

$$S_j = a + b_1 P_j \frac{Y}{q_j} + b_2 Z + e \tag{6}$$

where

$$P_j = \left(\frac{M_j^{\phi} I_j^{\eta}}{\sum_{k=1}^{m} M_k^{\phi} I_k^{\eta}}\right). \tag{7}$$

In equations (6) and (7), *a* is the intercept term while the parameter b_1 can be thought of as the proportion of aggregate household income allocated to the in-line space at shopping center *j. Z* is a vector of variables that control for market, property, and tenant mix factors outside *M* and *I* that may explain variations in S_j. The set of b_2 parameters captures the significance of the control variables. The parameters ϕ and η represent the empirically estimated weights of *M* and *I* in explaining P_j while e accounts for model error.

The additive nature of (6) and the additive denominator of P_j make the model inherently non-linear (i.e., not subject to linear transformation). As such, (6) needs to be estimated using a non-linear optimization procedure that identifies the values of a, b_1, b_2, ϕ, and η that minimize the residual sum of squares.[6]

4. The data

Data used in the empirical tests come from three sources. A private source provided tenant-by-tenant data (year 1995) on 41 shopping centers with over 4,000 non-anchor in-line retailers. National Decision Systems (NDS) and the *Directory of Major Shopping Centers* (Shor, 1995) supplied demographic and competitive shopping center data (for competitive centers greater than 400,000 sq. ft.) for a 10-mile radius retail market area. Department store fashion image was compiled using survey data.

4.1. Subject shopping center data

The 41-shopping center dataset is provided by a single source that develops, owns, and manages shopping centers. The centers are located across different regions of the United States (eight in the East, 17 in the South, 15 in the Mid-West, and one in the West). Summary statistics on the subject centers are presented in Table 1. In-line retail sales per square foot of occupied space average $228 and vary from $91 to $513. On average, there are slightly more than three department stores per center occupying 492,397 sq. ft., and the average center has a total shopping area of 843,956 sq. ft. Subject centers have an average age of 16 years, with a range from 3 to 35 years. Tenant mix is measured through a tenant mix index constructed by multiplying the proportion of the 16 retail merchandise categories represented in the center multiplied by the center's occupancy rate.[7] On average, approximately 88 percent of the 16 categories are found in subject shopping centers. When the percent of categories in the center is multiplied by the center's occupancy rate, the resulting vacancy-adjusted tenant mix index averages 0.7 and ranges between 0.3 and 0.9. The average distance to competing centers of greater than 400,000 sq. ft. is 6 miles, with the closest competing center 0.6 miles from the subject and the most distant 9.5 miles from the subject.

4.2. Competitive shopping center and socio-economic data

Competitive shopping center and socio-economic data for the subject center's 10-mile radius ring are provided by NDS and the *Directory of Major Shopping Centers* (Shor, 1995), see Table 2. There are, on average, 2.8 shopping centers of 400,000 sq. ft. or larger in the 10-mile radius of the subject centers. Generally speaking, competitive shopping centers have fewer anchor tenants and less anchor tenant space than subject shopping centers. On average, 14 percent of households have an income of greater than $75,000. The average market area population is ≈ 649,000.

4.3. Department store fashion image

Department store image is constructed using survey information. Survey recipients were asked to rank department stores based on their perception of fashion image. An ordinal scale of one (a discount image) to 10 (a fashion image) is used to rank department stores by fashion image. All full-line department store retailers that generally maintain outlets of 100,000 sq. ft. or more are included in the survey.

The survey, conducted in 1997, was faxed or mailed to Chief Executive Officers (CEOs) of the 147 retailers that maintain seven or more in-line retail outlets in the subject shopping centers. CEOs of the in-line retailers were surveyed because they were expected to have the best and most complete knowledge of department store image. Thirty survey forms were completed and returned for a 20 percent response rate. The average fashion image for the 87 department stores is 5.71 with a standard deviation of 2 and a range of 1.5-9.6. Department store retailers that maintain a deep discount image include: Clover, Jamesway, Kmart, Value City, Venture, and Wal-Mart. Conversely, high fashion image department stores include: Bloomingdales, Neiman Marcus, Nordstroms, and Saks Fifth Avenue.[8]

Department store fashion image data for the subject and the competitive shopping centers are presented in Table 3. The fashion image characteristics of the subject and competitive centers are very similar. The mean fashion image for the 41 subject shopping centers is 5.5, with a standard deviation of 1.3 and a range of 3.1-8.7; the mean fashion image for the competitive shopping centers is 5.3, with a standard deviation of 1.2 and a range of 2.5-8.4.[9]

5. Empirical findings

Using equations (6) and (7), we measure the effect of department store size and image on in-line retail sales per square foot. Specifically, we assess the significance of the *P* term and the relative importance of *M* and *I* by estimating the parameters a, b_1, b_2, ϕ, and η that minimize the non-linear model's residual sum of squares. The estimation is completed using mall-level observations derived from our tenant-by-tenant, competitive shopping center, and fashion image datasets. In the estimation model, the vector of control variables, *Z*, is specified as,

$$Z = (INC, POP, DCOMP, AGE, MIX), \qquad (8)$$

where *INC* is the percent of households in the market with a household income greater than \$75,000, *POP* is the market area population expressed in thousands, *DCOMP* is the average number of miles to competitive centers in the market, *AGE* is the center age in years, and *MIX* is the tenant mix index constructed by multiplying the proportion of merchandise categories represented in the center by the center's occupancy rate.[10] A shopping center's market area is defined as a 10-mile radius ring around the center.

5.1. The estimated model

The estimated model is

$$S_j = \underset{(0.38)}{17.46} + \underset{(4.19)}{0.00358}\left(\frac{M_j^{\overset{2.02}{(2.14)}} I_j^{\overset{8.82}{(2.70)}}}{\Sigma_{k=1}^{m} M_k^{\overset{2.02}{(2.14)}} I_k^{\overset{8.82}{(2.70)}}}\right)\frac{Y}{q_j} + \underset{(2.18)}{351.03}\, INC + \underset{(2.50)}{0.021}\, POP + \underset{(0.79)}{2.49}\, DCOMP$$

$$- \underset{(-2.20)}{2.36}\, AGE + \underset{(4.35)}{187.75}\, MIX + \varepsilon. \qquad (9)$$

The estimates are obtained using a non-linear least square procedure based on the Newton algorithm.[11] The model returns a pseudo *r*-square of 77.5 percent. The values in parentheses under each parameter estimate represent approximate *t*-statistics calculated based on standard errors from the last iteration of the model.

The regression results indicate that b_1 is positive and significant with a value of 0.358 percent, which suggests that approximately one-third of 1 percent of aggregate household income is spent at in-line retailers in subject centers. To interpret the estimated weights, ϕ and η, we assess their signs and relative values. The signs indicate that department store size and image have a positive effect on in-line retail sales per square foot, which is consistent with expectations. The relative values (ϕ= 2.02 and η = 8.82), in turn, reveal that *I* is relatively more important to the model than *M,* suggesting that department store image is of greater importance in explaining the variance of in-line retail sales per square foot.

The combination of additive and multiplicative terms in P_j does not allow for a simple interpretation of ϕ and η. These terms can generally be defined as sensitivity or elasticity parameters. Following the logic in Nakanishi and Cooper's (1974) quasi-logarithmic transformation of P_j, the term ϕ can roughly be interpreted as the percentage change in the market share as a result of a one percent change in the ratio of *Mj* to the average *Mk* across competing centers. The term η, in turn, can generally be interpreted as the percentage change in the market share term as a result of a one percent change in the ratio of *Ij* to the average I_k across competing centers.

Both the *INC* and *POP* parameter estimates are positive and significant. *DCOMP* is positive but non-significant. Shopping *AGE* is negative and significant, while *MIX* has a positive and significant parameter estimate.[12]

5.2. Sensitivity of in-line retail sales to changes in department store externalities

To assess the sensitivity of center performance to changes in department store size and image we estimate in-line retail sales per square foot using (9). We use dataset averages for all control variables and a range of department store size and image values for both subject and competitive centers. The purpose of the exercise is to explore the effect of inter-center size and image externalities on subject center in-line retail sales per square foot.

Table 4 presents the results of the sensitivity analysis where department store fashion image of the subject and competitive shopping centers are permitted to change, with all else held constant. Consistent with expectations, the results show that the performance of subject shopping centers is highly sensitive to small changes in fashion image when competitive centers are thinly differentiated from subject centers. For instance, in column 1 of Table 4 the subject center is compared to competitors that maintain a discount fashion image of3.0. Estimated in-line sales per square foot increase $113 (from $231.3 to $344.7) when the subject center department store fashion image increases from 3.0 to 5.0. However, with a 4.0 increment in fashion image from 5.0 to 9.0, the estimated increase in in-line retail sales per square foot is $5 (from $344.7 to $349.7). The non-linearity of the changes in sales per square foot as we change department store image reveals the substitutability of centers that are thinly image differentiated and the complimentary relationship of centers that are highly image differentiated. A similar relationship exists when the subject center maintains a significantly lower fashion image than that of the competition.

Table 5 reveals that department store size has a more muted effect than fashion image on in-line retailer sales per square foot. As the square feet of space occupied by department stores in both subject and competitive centers change, in-line retailer sales per square foot change in a non-linear pattern. Estimated subject center sales per square foot increase approximately $20-$30 when going from a single department store to four department stores across a range of competitive center department store size scenarios. This sensitivity analysis highlights the effect of inter-center externalities on in-line retail sales per square foot and the need for shopping center developers to consider competitor department store size and image attributes when determining the size and image makeup of their own centers.

For instance, if the replacement of a low image department store with a high image store increases in-line retail sales per square foot by $100 (e.g., replacing a Sears with a Nordstrom's increases center image for a three anchor center:::::; 2.0 image units, when the other two department stores maintain a 5.0 image in a 5.0 image competitive center market, see Table 4), center in-line rents per square foot are estimated to increase on average $6.60 (the average overage percent in the data set is 6.6 percent multiplied by $100). Across 340,000 sq. ft. of in-line space, rents would increase an estimated $2,244,000.13 Using a 9.0 percent capitalization rate, the developer could justify a $24,936,000 investment in department store image to obtain

Nordstrom's, all else equal. While this example takes some liberties to connect the effect of a change in department store image on property rents and value, it provides a valuable link in the valuation of inter-center externalities in enclosed shopping centers.

6. Conclusion

In this paper we find that inter-center externalities have a significant and non-linear impact on in-line retail sales. The empirical analysis reveals that undifferentiated shopping malls in the same market compete for customers using department store fashion image and to a lesser extent department store size. As expected, consumers willingly substitute a center with a better fashion image for one with a marginally lower fashion image. However, malls that are substantially image-differentiated maintain a complementary relationship in the market (as opposed to a competitive relationship), as consumers largely do not substitute high-image malls for low-image malls.

These results are important to developers and shopping center owners contemplating the replacement of an existing department store or the development of a new center in a multicenter market. In markets where developers face similar size and image department store competitors, investment in department store image is likely to be more profitable to the developer. Conversely, in markets with large differences in department store fashion image, additional investment in department store size is likely to be more profitable to the developer.

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Notes

1. Gralla (1991) reveals that a judge in Texas rejected the replacement of a Bloomingdale's with a Ward's, stating that the two department stores are not of similar character.

2. For committing to enter into long-term operating agreements at the Mall of America, the four department store tenants were granted the following cash incentives in addition to no-cost land: Macy's received

$35,000,000 to construct the improvements and agreed to pay a total base rent of $10 per year; Nordstrom's was granted approximately $32,000,000 to construct the improvements and agreed to pay a total base rent of $4 per square foot per year; Bloomingdale's was granted $38,500,000 for improvement costs and confirmation of the lease and agreed to pay a total rent of $9,000 per year; and Sears was granted $6,000,000 for improvement costs and agreed to pay $10 per year in rent (see Mall of America v. Minn. (1995)).

3. See Equitable Life Assurance Society of the United States v. Minn. (1995).

4. See Grant (2002). Additionally, in informal discussions with numerous industry experts, Nordstrom's requires multi-million dollar subsidies and no-cost land to locate in a center.

5. This specification, consistent with Huff (1963) and Nakanishi and Cooper (1974), is common in the retail literature.

6. Eppli and Shilling (1996) use a similar optimization procedure. An alternative approach to estimating the exponential weights 1> and *11* is a quasi-logarithmic transformation such as that proposed by Nakanishi and Cooper (1974). Under this approach, the term X would be a function of separate ratio terms where the numerators measure the attribute *M* or *I* in shopping center *j* and the denominators are geometric averages of that attribute in competitive shopping centers. This approach is appealing because it does not require the use of non-linear optimization methods that may be subject to convergence problems. However, this approach simplifies the summation in the denominator of (7) through a geometric average, leading to loss of competitive shopping center information. Additionally, the separation of *M* and *I* does not permit the interactive effect of *M* and *I* on *Sj.*

7. The 16 merchandise categories include: family apparel, specialty apparel, men's apparel, women's wear, women's specialty apparel, shoes, gifts, jewelry, restaurants, fast food, specialty food, home furnishings, leisure and entertainment, drug and variety, services, and other. The purpose of multiplying the percent of categories found in the center by the center's occupancy rate is to account for the interaction between tenant mix and vacancy. The tenant mix index can have a minimum value of 0 and a maximum value of 1.

8. For a non-ordinal treatment of the survey data, survey responses could be transformed from an ordinal scale to a ratio scale using, for example, the proportion of survey responses that fall above the center point of the survey scale (5.5). An advantage of this type of measure is that it is independent of the survey scale, which means that opinions based on different scales are comparable. However, this approach may result in loss of information about the survey responses.

9. Results from the department store fashion image survey are consistent with the Consumer Reports (1998) consumer ratings of department store quality. The correlation between our fashion image survey and the Consumer Reports survey is above 0.75.

10. A variety of other site, improvement, and market attributes may also be important in the estimation of in-line retailer sales per square foot. We considered several attributes, such as parking ratio, center shape, among others, but found them statistically insignificant. Other attributes, such as visibility or freestanding retail competition were not measurable.

11. The estimates are obtained using a spreadsheet programmed to calculate the model matrices and obtain the model parameters. The optimization assumes starting values of 1 for 1> and 11. The spreadsheet estimation is validated using SAS' NUN non-linear least squares procedure.

12. For validation and diagnostic purposes, we conduct additional estimations and tests, as follows:

(a) We estimate an instrumental variable model and find results that are highly consistent with the reported non-linear least square estimates. That is, any measurement error or endogeneity associated with *P* does not seem relevant enough to affect the significance of the model.

(b) We estimate a non-linear least square model using a transformed image variable (i.e. from an ordinal scale to a ratio scale). The transformed image variable estimates are comparable to those obtained using the ordinal survey scale.

(c) The model is also checked for multicollinearity, heteroskedasticity, and outlier/influential observations. Multicollinearity is not a concern given the low correlations among independent variables. Correlations are in all cases below an absolute value of 0.45 with an average absolute value of 0.19. This observation is supported by looking at the model's variance inflation factors (VIFs). All VIFs are lower than 1.6, which is well below the maximum admissible VIF value of 10 suggested by Lardaro (1993). Heteroskedasticity is also examined, both visually and through a Spearman Rank correlation test. A visual examination indicates that the residuals do not have increasing or decreasing patterns across values of the predicted dependent variable. This observation is confirmed by the Spearman Rank correlation test, which shows low and non-significant rank correlations (see Dougherty, 1992, for a description of this test). Lastly, outlier/influential observations are checked both visually and through studentized residual and DFFITS tests. Visually, no observation appears unreasonably outside the data ranges. When looking at the studentized residuals, the results suggest the possibility that three observations have relatively high influence on the fitted regression. Of those observations, one shows relatively high DFFITS. When excluding that observation from the regression, the ϕ, η, and b_1 parameters do not show fundamental changes. The terms ϕ and η change to 2.4 and 8.2, respectively, while b_1 changes to 0.00458, with similar levels of significance.

(d) We estimate the model with an alternative anchor tenant size specification. Instead of absolute anchor tenant size, we use relative anchor tenant size, which is quantified as anchor tenant size divided by total shopping center size. This specification generates less significant results.

13. This presumes that rent increases flow directly to property net operating income.

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Appendix
Table 1
Subject center characteristics

Characteristic	Mean	Standard Deviation	Minimum	Maximum
In-line retailer sales per square foot ($)	228	87	91	513
Number of anchor tenants	3.3	1.3	1	6
Anchor tenant are (sq. ft.)	492,397	221,408	111,026	914,512
Shopping center total area (sq. ft.)	843,956	378,982	333,273	2,480,044
Shopping center age (in years)	16	7.6	3	35
Tenant mix index*	0.7	0.2	0.3	0.9
Average distance to competing centers (miles)	6	2.3	0.6	9.5

Notes. *Percent of 16 merchandise type categories (i.e., women's apparel, fast food, shoes, etc.) that are represented in a center multiplied by the center's occupancy rate.

Table 2
Competitive centers and socio-economic characteristics

Characteristic	Mean	Standard Deviation	Minimum	Maximum
Number of competitive centers > 400,000 sq. ft. (number of centers)	2.8	2.4	1	13
Number of anchor tenants in competitive centers	2.4	1.2	1	6
Anchor tenant area in competitive centers (sq. ft.)	374,365	214,618	59,888	959,909
Total area in competitive centers (sq. ft.)	815,316	348,243	402,086	2,350,000
Households with income > &75,000 (%)	14	30.1	6.8	5.5
Population (000)	649	931	68	5,933

Table 3
Department store fashion image for the subject and competitive centers

Characteristic	Mean Fashion Image	Standard Deviation	Minimum	Maximum
Subject center department store fashion image	5.5	1.3	3.1	8.7
Competitive center department store fashion image	5.3	1.2	2.5	8.4

Table 4
Estimated in-line retail sales per square foot by shopping center image level*

	Competitive Center Fashion Image		
Subject Center Fashion Image	3.0	5.0	7.0
3.0	$231.3	$192.4	$191.9
4.0	$319.6	$198.9	$192.2
5.0	$344.7	$231.3	$194.5
6.0	$348.7	$290.5	$204.3
7.0	$349.5	$328.7	$231.3
8.0	$349.7	$342.6	$273.9
9.0	$349.7	$347.2	$310.9

Notes. *Estimates are obtained using the parameters in equation (9) and the data averages in Tables 1 and 2. The estimation assumes that the subject shopping center maintains a total area of 850,000 sq. ft. with department stores occupying 510,000 sq. ft. The retail market area is assumed to have three competitive shopping centers (in addition to the subject shopping center); each of the three competitive centers are assumed to be identical in all aspects with each maintaining 510,000 sq. ft. of department store space.

Table 5
Estimated in-line retail sales per square foot by department store square feet occupied*

	Competitive Center Occupied Department Store Space		
Subject Center Occupied Department Store Space	340,000	510,000	680,000
170,000	$228.0	$208.5	$201.3
340,000	$251.2	$222.3	$209.9
510,000	$259.8	$231.7	$216.7
680,000	$259.9	$236.1	$221.5

Notes. *Estimates are obtained using the parameters in equation (9) and the data averages in Tables 1 and 2. The estimation assumes that the subject and competitive centers maintain an image of5.0. The size of the in-line space is 40% of the center for both subject and competitive centers. The retail market area is assumed to have three competitive shopping centers (in addition to the subject shopping center); each of the three competitive centers are assumed to be identical in all aspects.