The Identification, Performance, and Tenant Mix of Dominant and Non-Dominant Malls

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I. Introduction

In this paper we determine which regional malls are more dominant in their markets, how dominant and non-dominant malls have performed over the past decade, and if the tenant mix in dominant centers differs from that in non-dominant centers. Retail dominance is defined as a function of relative sales per square foot. Using a variant of the Huff gravity model, we construct the Index of Retail Dominance (IRD) to test which mall characteristics make a center more dominant. To test the predictive power of the IRD, we estimate non-anchor tenant sales per square foot for 41malls using data that is new to the literature. Once a credible Index of Retail Dominance is established, we measure the performance of dominant and non-dominant malls over the decade 1988-1997. Lastly, we assess the similarity of tenant mix in dominant and non-dominant centers. Our findings reveal that shopping center dominance can be predicted, that dominant centers are increasing their market share over time while non-dominant centers are having a difficult time maintaining market share. We also find that tenant mix is different between dominant and non-dominant centers.

Advances in internet retail web sites and the construction of power centers and discount malls have encouraged industry spokespersons and the popular press to predict the demise of smaller regional shopping centers.[1] New retail formats (i.e., power centers and discount retailers) are competing with malls for price conscious consumers. Big-box retailers such as Best-Buy (electronic goods), Linen and Things (home furnishings), Ikea (furniture), Sports Authority (sports and recreational goods) and other similar retailers compete on price with both anchor and non-anchor retailers in regional malls. These big-

[1] See, for example, Morgenson (1993) and Finkel (1997).

box retailers often carry a wider selection of a particular merchandise type than most non-anchor retailers in regional malls. Similarly, internet companies are competing with regional mall bookstores, houseware retailers, and apparel outlets.

Competitive pressures have also been felt by the large anchor department stores. The effect that discount and big-box retailers, and to a smaller degree internet retailers, has permanently changed the retail mix of most department stores. Realizing that they cannot compete with the new retail formats, many department stores no longer carry electronics, appliances, furniture, and sporting goods, replacing the retail space with apparel and other soft goods. Department store's emphasis on soft goods has, in turn, placed additional competitive pressure on non-anchor retailers that also sell soft goods.

Further squeezing smaller regional shopping centers are competitive pressures from newer, larger super-regional centers that carry a better selection of comparison products (shoes, apparel, and jewelry). In short, all retailers in regional shopping center are feeling the competitive effects of new and alternative retail formats . In this highly competitive retail market, regional malls that do not or cannot respond to the new dynamics of the market place may be unable to compete. The sales performance of regional shopping centers is of critical importance to the lender and equity investor alike. Both look to retail sales as primary barometer of a center's health, as retail sales are the source of rent payments which is ultimately the source of value in regional mall investments.

While much has been published about the coming demise of regional shopping centers, little empirical evidence has been presented, leaving several questions unanswered. Is it shopping center size, in square feet of retail floor area, that determines a center's dominance or do other factors play a role in predicting retail patronage? Additionally, how have the larger/stronger centers performed relative to the

smaller/weaker centers over the past decade?

In section II present a theoretical model that measures the dominance of non-anchor retailers in regional and super-regional shopping centers. Using this model, we construct the Index of Retail Dominance (IRD). A detailed discussion of the data is given in section III. Empirical tests of the IRD along with time series sales performance of more dominant and less dominant malls are reported in section IV. Section V concludes the paper.

II. Research Methodology

In the extant literature the relative level of retail dominance is determined using a combination of one or more of three measures: number of anchor tenants, anchor tenant size (in square feet), and department store fashion image. Many industry practitioners suggest that the largest mall in a market area is the dominant mall, arguing that mall size or retail agglomeration is the over-riding factor in determining consumer patronage. Others measure the relative dominance of a mall using the number of anchor department store tenants. Following the definition advanced by the Urban Land Institute (ULI, 1985), super-regional shopping centers are considered dominant mall while regional shopping center are considered a non-dominant mall.[2] While most practitioners and academics agree that the number of anchor tenants and anchor tenant size are important to the overall success of the mall, they also suggest

[2] The ULI (1990) defines regional and super-regional shopping centers as follows:

> "The **regional center** provides a variety of goods comparable to those of a central business district in a small city, including general merchandise, apparel, and home furnishings, as well as a variety of services and perhaps recreational facilities. One or two full-line department stores of generally not less than 100,000 square feet of GLA are the principal tenants in this type of center."
>
> "The **super regional center** provides and extensive variety of shopping goods comparable to those of a central business district of a major metropolitan area, including a wide selection of general merchandise, apparel, and home furnishings, as well as a variety of services and recreational facilities. The principal tenants of a super regional center include at least three full-line department stores of generally not less than 100,000 square feet each."

that the fashion image of the anchor tenants plays a role in consumer patronage.[3] To determine which if any of these three shopping center characteristics are important to consumer patronage we develop an empirical model based on anchor tenant size, the number of anchor tenants, and anchor tenant image. We begin by constructing the Index of Retail Dominance (IRD). Next we examine the time-series growth in retail sales of dominant and non-dominant shopping centers. In the final stage we explore tenant-mix characteristics that differentiate dominant from non-dominant shopping centers.

A. The Index of Retail Dominance

Consumer utility functions for shopping centers generally follow the form of gravity or spatial interaction models where,

$$U_{ij} = A_j^{\alpha} D_{ij}^{-\beta}. \qquad (1)$$

The utility of shopping center j to consumer i is U_{ij}, the attractiveness of shopping center j is $A_{j,}$, and the distance disamenity between consumer i and shopping center j is D_{ij}. Reflecting the consumer's sensitivity to shopping center attraction is parameter estimate α and the consumer's sensitivity to distance is parameter estimate β. Following Luce's choice axiom (Luce 1959), Huff (1962, 1964) revealed that consumers often visit more than one store in a shopping center. Additionally, Huff showed that the utility of visiting a given shopping center equals the utility of that shopping center divided by the sum of the utility of all competing shopping centers. Under these conditions,

$$P_{ij} = \frac{U_{ij}}{\sum_{k=1}^{m} U_{ij}}, \qquad (2)$$

[3] Bucklin (1967), Stanley and Sewall (1976), Nevin and Houston (1980), and Eppli and Shilling (1996).

where P_{ij} is the probability that consumer i will visit shopping center j and m is the number of competing shopping centers considered by the consumer. Substituting 1 into 2 we obtain the familiar Huff gravity model,

$$P_{ij} = \frac{\left(\frac{M_j^{\alpha}}{D_{ij}^{\beta}} \right)}{\left(\sum_{k=1}^{m} \frac{M_k^{\alpha}}{D_{ik}^{\beta}} \right)}. \qquad (3)$$

In the Huff model, the attractiveness of a shopping center j, A_j, is replaced by a variable that measures the mass or size of the center, M_j.

From the work of Gautschi (1981), Eppli and Shilling (1996), and others, the distance specification *(β)* has been called into question. As consumers today are more free to chose their retail locations, the disutility of distance has become relatively small, if not insignificant, in the decision of which shopping mall to patronize. If this is the case, it is not unreasonable to assume that consumers are equally distributed across a market and that they are distant indifferent within a 10-mile radius. Constraining the β parameter to zero, (3) indicates that the probability that a consumer visits shopping center j is a function of the mass of shopping center j relative to the mass of the competing retail units k.

If the allocation of sales within a retail market is proportional to size, the model implies that shopping centers in the retail market area have the same sales per square foot, holding other things constant. However, there are factors that could affect the level of sales per square foot in a shopping center. To examine these factors, our model can be specified as

$$R_j = \left(\frac{C_j}{\sum_{k=1}^{m} C_k} \right), \tag{4}$$

where R_j represents sales square foot in shopping center j, while C_j and C_k are vector of attributes for the subject shopping centers j and competitive shopping centers k[4]. We define these vectors as,

$$C_j = T_j^{\eta} M_j^{\alpha} I_j^{\phi} \tag{5}$$

and

$$C_k = T_k^{\eta} M_k^{\alpha} I_k^{\phi}. \tag{6}$$

In these equations, T_j and T_k represent the number of anchor-tenants in shopping centers j and k, M_j and M_k represent the size of shopping centers j and k, and I_j and I_k represent the image of anchor-tenants in shopping centers j and k. The parameters η, α, and ϕ weigh the importance of the number of anchor-tenants, mall size, and department store fashion image in a consumer's shopping decision.

When (4) is multiplied by the number of competing shopping centers in a retail market area, m, the result is a standardized measure of performance, R^*_j, for subject shopping centers. This standardized measure of performance associated the level of sales per square foot constitutes the Index of Retail Dominance (IRD) and is defined as

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

[4] If consumers are equally distributed across the market, have homogeneous incomes, and are indifferent to travel distances of up to 10 miles, all individual consumers (i) become equal and are not necessary in the notation.

If shopping center *j* maintains an IRD of greater than one, center *j* captures more than its proportionate share of retail sales for all shopping centers. Conversely, if the IRD is less than one, the shopping center captures less than its proportionate share[5].

Estimates of the parameters η, α, and ϕ associated with R^*_j are modeled via the OLS model

$$S_j = a + bR^*_j + cY + \varepsilon, \qquad (8)$$

where S_j is actual (1995) non-anchor tenant sales per square foot spent at shopping center *j*, Y is a control variable for aggregate household income in the trade area, and a, b, and c are parameters. The purpose of estimating (8) is to identify the values η, α, and ϕ that maximize the regression r-square[6]. The r-square

[5] In defining the IRD, three points are important. First, for notational purposes the shopping centers in the denominator are referred as competitive centers. However, our estimation of R^*_j implies that sum in the denominator includes attributes on all centers in a retail market area, including the subject center *j*.

Second, the use of *m* for standardization purposes is motivated by the fact that when all shopping centers in their retail market area are identical,

$$\left(\frac{T_j^{\eta} M_j^{\alpha} I_j^{\phi}}{\sum_{k=1}^{m} T_k^{\eta} M_k^{\alpha} I_k^{\phi}} \right) = 1/m.$$

When this statement holds, all shopping centers in the market area generate the same sales per square foot. Thus, when both sides of the equation are multiplied by *m* the IRD equals 1. However, when the ratio in patenthesis is greater (less) than 1/*m*, shopping center *j* is expected to generate higher (lower) sales per square foot. In this case, multiplying both sides of the equation by *m* makes the IRD different from 1. An IRD greater (less) than 1 implies that the is dominant (non-dominant) in its market.

Third, the IRD characterizes subject shopping center *j* as dominant if the shopping center captures more sales per square foot than those associated with its proportional size. This interpretation does not imply that the shopping center is the most dominant in the market. It is possible than one of the competitive shopping centers is also dominant if that competitive center captures more sales per square foot than those associated with its proportional size.

[6] An alternative approach to estimating the exponential weights η, α, and ϕ is a discriminant analysis, where the categorical dependent variable is associated with different levels of the logarithm of the subject shopping center sales. This variable takes, for example, the value of 1 when the logarithm of sales is above the median and 0 otherwise.

maximizing parameters η^*, α^*, and ϕ^* indicate the relative importance of *T, M*, and *I*, respectively, in determining a shopping center's market share[7].

B. Performance of Dominant and Non-Dominant Shopping Centers

Once the relative performance of the shopping centers is estimated, trends in sales per square foot are presented for the period 1988-1997. Plotting the trend-line in sales per square foot reveals the time series performance of dominant and non-dominant shopping centers. While the trend-line presents anecdotal evidence, the importance of this measure is critical to the viability of regional shopping centers.

C. Tenant Mix in Dominant and Non-dominant Malls

Using this approach, the discriminant variate, D^S_j, is defined as

$$D_j^S = f(\ln T_{jk}, \ln M_{jk}, \ln I_{jk}).$$

The variables T_{jk}, M_{jk}, and I_{jk} represent ratios where the numerator is a measure of the attribute in shopping center *j* and the denominator is an average of the attributes in the competitive shopping centers *k*. An average measure is used in this case because a sum operator such as that included in the denominator of (7) is not feasible (for mathematical reasons, the weights cannot be applied to a log of a sum).

As a result, the shopping center capture rate takes the form

$$R_j^* = \left(\frac{T_j^{\eta} M_j^{\alpha} I_j^{\phi}}{\tilde{T}_k^{\eta} \tilde{M}_k^{\alpha} \tilde{I}_k^{\phi}} \right),$$

where the tildes in the denominator represent averages. This form has two disadvantages. First, the transformation of the sales variable into a categorical variable leads to a loss of information about the dependent variable. Second, the use of an average measure in the denominator of the ratios between attributes of the subject center and attributes of the competitive centers leads to a loss of information about the independent variable. As a result, more accurate weights can be estimated via the OLS model (8), as proposed.

[7] Two comments about (8) are important. First, R_j is measured with some error and therefore ordinary least-squares estimates of *a*, *b,* and *c* may be inconsistent. In particular, the least-squares estimate of *b* will be biased downward. However, this problem is remedied by focusing on the calculation of r-square. Maddala (1992) describes the nature and direction of this bias and suggests the use instrumental variables via two-stage least squares (2SLS) as a tool to control it. Prelimiray estimation of the model using 2SLS in fact shows a higher value of *b* and provides results for η^*, α^*, and ϕ^* that are consistent with those presented in this paper. Second, it could be argued that equation (8) should test for a non-linear form of the *Rj* test. However, because of the exponential weights, equation (8) captures the non-linear relationship between sales and the attributes *T, M,* and *I*.

Lastly, a discriminant model is used to explore differences in the allocation of space among non-anchor tenants in more dominant and non-dominant malls[8]. The discriminant model includes a categorical dependent variable for dominant and non-dominant malls and a set of independent variables representing the allocation of space among tenant types within each shopping center. The binary variable has a value of 1 for shopping centers that have an IRD greater than 1 (i.e. are considered dominant centers), and 0 otherwise. The independent variables are expressed as percentages of occupied space allocated to a given tenant type. The discriminant model is built on

the relationship

$$D_j = \sum_{q=1}^{n} w_q t_q, \tag{9}$$

where D_j is the discriminant variate for shopping center j. The right-hand side terms capture shopping center j's tenant mix, where t_n is the proportion of space allocated to one of q tenant types, and the weights, w_n, indicate the relative importance of a tenant type as a discriminant factor. The ability of the discriminant variate D_j to explain changes in the categorical dependent variable indicates whether significant tenant mix differences exist between dominant and non-dominant shopping centers.[9]

If the discriminant analysis provides evidence that the allocation of space in dominant and non-dominant malls is different, it is necessary to include a measure of shopping center space allocation as a control variable in (8). Including this measure allows us to test the significance of the IRD variable after controlling for income and tenant mix characteristics. The extended version of the OLS model (8) is

$$S_j = a + bR_j^* + cY + dv_j + \varepsilon, \tag{10}$$

[8] For the purpose of this analysis the non-anchor tenant space is divided into 16 tenant types. In alphabetical order, the tenant types are: drug/variety, family apparel, fast food, gifts, home furnishings, jewelry, leisure and entertainment, men's wear, restaurant, services, shoes, specialty apparel, specialty food, women's specialty, women's wear, and others.

[9] For background on the discriminate analysis method, see Hair, Anderson, Tathan, and Black (1995) and The SAS Institute (1990).

where v_j represents tenant mix characteristics within subject shopping center j and d is the OLS coefficient associated with this variable.

III. The Data

The data used in the empirical tests come from three separate sources and are best described by the origin of the data. A private source provided tenant-by-tenant data on 41 malls with over 2,500 non-anchor tenants. These data include information on individual tenant sales, square feet occupied, rent, lease term, among other characteristics. National Decision Systems provided demographic data, as well as data on competitive malls greater than 400,000 square feet. Finally, department store fashion image values for the subject and competitive centers were compiled using survey data. These three data sets are combined to test the IRD[10].

A. Subject Shopping Center Data

The 41-mall dataset was obtained from a single source that develops, owns, and manages malls. While this analysis does not focus on tenant-by-tenant data, the detail and consistency of the tenant-by-tenant data are critical. Tenant specific data allows us to correctly account for vacant space in calculating sales per square foot. Similarly, space that was leased in 1995, the year the data were collected, is not included in the analysis to assure that sales per square foot measures are based on a year's worth of sales.[11] Finally, data from a single source reduces the possibility of definitional errors that come from the way space is measured, sales compiled, and tenants categorized.

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[10] It should be noted that more than data on more than 41 malls was provided, however, numerous mall were not included in the analysis because no competitive shopping centers existed in a ten mile radius ring.

[11] While some might argue that partial year sales should be annualized, the cyclical nature of retail sales makes simple annualizing an inaccurate method of estimating annual sales.

Summary statistics on the subject centers are provided in exhibit 1, all summary statistics are reported at the shopping center level. Non-anchor sales per square foot average $228.02 and vary from $91.25 to $513.15. There are slightly more than three anchors per center occupying 492,397 square feet and the average center has a total shopping area of 850,224 square feet. In general, the subject mall data are similar to the combined regional and super-regional data reported by the ULI (1997). Tenant mix for the 41 subject shopping centers is presented in exhibit 2. The mean allocation of space to the different tenant types range from 1.52% (home furnishings) to 21.09% (women's wear). The standard deviation of the space allocation is highest for drug/variety and lowest for specialty food.

B. Competitive Shopping Center and Socio-Economic Data

Competitive shopping center and socio-economic data for the subject center's 10-mile radius ring were provided by National Decision Systems (NDS) and are presented in exhibit 3. There are, on average, 2.83 shopping centers of 400,000 square feet or larger in the 10-mile radius of the subject centers[12]. Generally speaking, competitive malls have fewer anchor tenants and less anchor tenant space than the subject malls. Aggregate household income varies from $1.0 to $124.8 billion and averages $12.6 billion. While NDS presents data on the size and location of competitors, NDS does not identify the number and size of the anchor tenants in competitive centers. To identify the number and size of anchor department store tenants, we use individual center data from the *Directory of Major Malls* (Shor (1995)).

C. Department Store Fashion Image

A shopping center fashion image index was constructed using a department store image survey. The

[12] For the IRD to be meaningful, one or more competitors must be located within a 10-mile radius ring. All subject shopping centers with no competitive shopping centers in a 10-mile radius were removed from the subject shopping center data leaving the 41 centers summarized in exhibit 1.

image survey asked survey recipients to rank department stores based on their perception of each retailer's fashion image. As can be seen from the edited version of the survey in exhibit 4, an ordinal scale of one (a discount image) to ten (a fashion image) was used to rank individual department stores. Retailers included in the survey are full-line department stores that maintain outlets of 100,000 square feet or more.

The survey was faxed (when a telephone number was available) or mailed to Chief Executive Officers (CEOs) of the 147 retailers that maintain seven or more retail outlets in the subject mall data set.[13] Follow-up phone calls and mailings to non-respondents were completed in the weeks that followed the original distribution of the survey. All survey work was completed in August and September 1997. CEOs of non-anchor tenants were surveyed because they were expected to have the best and most complete knowledge of each department store in the survey. While survey respondents were familiar with most of the 87 department store tenants listed, Glass Block and Hennesey's both have less than ten responses. Thirty survey forms were completed and returned for a 20% response rate.

Because of the limitations of data based on ordinal scales, the survey responses are used as a guide to derive a more appropriate department store image measure. The measure chosen is the percentage of survey observations for each retailer that falls above the center point of the survey scale (in this case the center point of the scale is 5.5). For example, a retailer that has 4 out of 20 observations above the center point of the scale would have an image measure of 0.2. This measure is referred to as the department store's fashion image level. The advantage of this measure is that it is independent of the scale used in the survey, which means that opinions based on different scales are comparable.[14]

[13] There were 198 retailers that maintained seven or more outlets. Because of mergers, corporate name changes, bankruptcy, and other factors, only 147 retail companies could be located.

[14] The derivation of this image measure causes some loss of information. However, the loss of information is offset by the

Exhibit 5(a) presents the survey results. The average fashion image level for the 87 department stores is 0.44 with a standard deviation of 0.32 and a range between 0 and 1. Retailers that maintain a deep discount image, with a fashion image of less than 0.05, include: Clover, Hills, Jamesway, Kmart, Prange Way, Value City, Venture, and Wal-Mart. Conversely, high fashion image department stores, with a fashion image level of more than 0.95, include: Bloomingdales, Burdines, Macy's, Neiman Marcus, Nordstrom, and Saks Fifth Avenue.

Anchor tenant image data for the 41 subject shopping centers and the competitive shopping centers are presented in exhibit 5(b). The aggregate fashion image characteristics of the subject and competitive shopping centers are very similar. The mean fashion image level for the 41 subject shopping centers is 0.50, with a standard deviation of 0.31 and a range of 0.07 to 0.98. By the same token, the mean fashion image level for the competitive shopping centers is 0.49, with a standard deviation of 0.30 and a range of 0 to 0.98.

IV. Empirical Findings

Empirical results are presented for the three stages of the study described in section II. The first stage examines the relationship between non-anchor tenant sales and the IRD. The second stage discusses the time series performance of dominant and non-dominant malls. And the IRD stage examines differences in tenant mix between dominant and non-dominant malls.

A. IRD and the Factors that Affect Non-Anchor Tenant Sales

Following model (8), we estimate non-anchor tenant sales per square foot, S_j. The purpose of modeling

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benefit of overcoming the limitations associated with a purely ordinal measure.

S_j is to identify the parameters η^*, α^*, and ϕ^* that maximize the regression r-square. The variable S_j is the mean non-anchor tenant sales per square foot spent at shopping center j. The exponential weights, η^*, α^*, and ϕ^*, show the relative importance of number of anchor-tenants, mall size, and department store fashion image in a consumer's shopping decision. The equation that maximizes the regression r-square is

$$S_j = \underset{(9.10)}{129.35} + \underset{(6.8)}{60.48} \frac{T_j^{1.46} M_j^{-0.05} I_j^{4.59}}{\sum_{k=1}^{m} T_k^{1.46} M_k^{-0.05} I_k^{4.59}} m + \underset{(6.2)}{2.48} Y + \varepsilon, \qquad (11)$$

where the values in parentheses under each parameter estimate represent t-statistics[15].

The estimated model predicts 68% of the variability in non-anchor tenant sales per square foot after controlling for aggregate household income. Both the IRD and Y parameter estimates have the expected sign and are significant at the 1% level. The coefficient for the IRD variable shows that a 0.1 change in shopping center IRD leads to a change of $6.05 per square foot in non-anchor tenant sales, holding Y constant.

To interpret the estimated weights, η, α, and ϕ, it is important to look at their signs and relative values. The signs indicate that the number of anchor tenants and department store fashion image, as opposed to

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[15] In deriving these estimates, we use the fashion image level derived earlier in section III. For illustrative purposes, this model is estimated using the fashion image ordinal scales from the survey. The resulting equation is

$$S_j = \underset{(9.5)}{129.07} + \underset{(7.1)}{63.11} \frac{T_j^{1.31} M_j^{-0.10} I_j^{7.82}}{\sum_{k=1}^{m} T_k^{1.31} M_k^{-0.10} I_k^{7.82}} m + \underset{(6.3)}{2.44} Y + \varepsilon$$

The results are robust in the sense that they keep the signs and relative values of the weights and OLS parameters. As discussed earlier in the paper, estimates based directly on ordinal responses are dependent on the measurement scale. That is, the absolute value of the weights and parameters could change if responses based on another scale are used. This problem, of course, is handled by using a measure such as the fashion image level derived in section III. Using the fashion image level produces estimates that are comparable under different ordinal scales.

mall size, have a positive effect on sales per square foot. The relative values, in turn, show that I_j is more important to the model than T_j and M_j, suggesting that department store fashion image and the number of anchor tenants are critical factors in determining shopping center dominance, with mall size being almost irrelevant. However, direct interpretation of each of the exponential weights, η, α, and ϕ, is difficult because each is included in both the numerator and denominator of the IRD.

Exhibit 7 illustrates the sensitivity of non-anchor tenant sales to changes in number of anchor-tenants, mall size, and department store fashion image. Expanding each of the anchor-tenants by 50,000 square feet reduces non-anchor tenant sales per square foot by less than one dollar. However, if the 150,000 square feet expansion is used to include another anchor, non-anchor tenant sales per square foot are expected to grow by $30.29 tenant, keeping the shopping center fashion image constant. In the last two rows of Exhibit 7 we assess the effect of a change in the department store fashion image on the non-anchor tenant sales per square foot. For instance, if Nordstrom (fashion image level of 1.00) is the fourth anchor-tenant added to the shopping center, non-anchor tenant sales per square foot are estimated to increase to $201.88 per square foot. This increase represents a $171.59 change over adding a department store with a fashion image similar to that of the existing department stores. Conversely, if Wal-Mart (fashion image level of 0) is added as the fourth anchor, the reduction in the overall shopping center fashion image reduces the non-anchor tenant sales per square foot.

B. Performance of Dominant and Non-dominant Malls

Equation (11) allows us to derive the IRD for each shopping center. The IRD in the sample ranges from 0 to 4 (see column (b) of exhibit 6). A mall with an IRD of 1.0 maintains its proportionate share of retail sales for shopping centers greater than 400,000 square feet. The results identify dominant (IRD greater

than 1) and non-dominant (IRD less than 1) centers. However, the results do not imply that shopping centers with an IRD greater (less) than 1 are the most (least) dominant centers in their markets. The results imply that they are dominant or non-dominant in their markets because they earn more or less sales per square foot than those associated with their proportional market share.

The asterisks in column (a) of exhibit 6 identify the 21 centers that have time-series data for the period 1988-1997. The other centers in the dataset were either opened or acquired by the data supplier after 1988. Using the set of shopping centers with time series data, we anecdotally test the time series performance of dominant (IRD greater than 1) and non-dominant (IRD less than 1) centers. Exhibits 8(a) and (b) illustrate the time series difference in retail sales per square foot. More dominant centers have higher sales per square foot over time, but more importantly, the growth in sales per square foot rate is significantly higher for the dominant centers than for the non-dominant centers[16]. Exhibit 8(b) reveals that dominant shopping centers have an increase in retail sales of 32.6% (3.2% annually) from 1988 to 1997, while non-dominant shopping centers have an increase of 10.7% (1.1% annually). These results have significant implications for investors in the determining the appropriate income growth rate for retail real estate investments.

C. Tenant Mix

Our final step explores the tenant mix in dominant and non-dominant malls. To identify the differences in space allocation among non-anchor tenants in dominant and less dominant centers, we use stepwise discriminant analysis[17]. The discriminant function (9) tests whether the tenant mix is the

[16] It should be noted that sales for shopping center 6 in panel A of Exhibit 8(a) fell 34% between 1994 and 1995. We are unable to explain this significant drop and thus do not include it in exhibit 8(b). Similarly, shopping center 30 in panel B of exhibit 8(a) maintained a 9 sales year growth of 98%. Center 30 is located in a New Jersey suburb of New York and may substantially benefit from cross-border tax differentials that are not captured in our model. As such, center 30 is not included in exhibit 8(b).

[17] This procedure reduces the noise caused by a high number of tenant types and identifies those tenant types that have the

same for dominant and non-dominant malls. The base model contains 16 explanatory variables corresponding to the allocation of occupied space to each tenant type (see exhibit 2).

The results of the discriminant analysis returned an overall Wilks' Lambda statistic of 4.04, which indicates that the difference in the tenant mix of dominant and non-dominant malls is significant at the 5% level. The stepwise method shows that the categories that best discriminate between dominant and non-dominant malls are women's specialty apparel, family apparel, home furnishings, gifts, and women's wear. The difference in space allocated to each of the tenant types by mall dominance is revealed in Exhibit 9. For example, women's specialty apparel has a mean of 2.80% for dominant malls and 1.21% for non-dominant malls. Similarly, family apparel has a mean of 7.89% for dominant malls and 4.90% for non-dominant malls, while home furnishings has a mean of 2.13% and 0.78% for dominant and non-dominant centers, respectively[18].

These results imply that tenant mix characteristics explain a portion of the variability in a shopping center's sales per square foot. More specifically, centers with a more even distribution of space among different tenant types tend to be more dominant. As exhibit 9 shows, the variance in the proportions of space allocated to each tenant type is higher for non-dominant malls than for dominant malls. One reason why malls that carry a more even distribution of tenant types are more likely to attract more customers is that they more effectively meet consumer needs for multipurpose shopping.

Given the evidence that the allocation of space in dominant and non-dominant malls is different, we

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highest discriminant power in the model.

[18] The ability of the discriminate variate to classify the subject centers as dominant or non-dominant beyond mere chance is confirmed through a cross-validation method. Malls can be classified by chance into one of two categories with a 50% probability. The estimated model has a classification power of 73.6% for the non-dominant malls and 69.5% for the dominant malls, for an average 71.55%. The classification percentages are higher than the chance probabilities of 50%,

estimate (10), an extended version of (8) that controls for tenant mix characteristics, v_j. In this test, the control variable, v_j, measures the variance of non-anchor space allocation within the shopping center. When this variable is included, the result is

$$S_j = \underset{(6.65)}{175.10} + \underset{(5.24)}{50.69} \frac{T_j^{1.49} M_j^{-0.04} I_j^{5.22}}{\sum_{k=1}^{m} T_k^{1.49} M_k^{-0.04} I_k^{5.22}} m + \underset{(5.91)}{2.36} Y - \underset{(1.89)}{0.67} v_j + \varepsilon. \qquad (12)$$

The model has an r-square of 69.29%. In this equation, v_j maintains a negative sign and is significant at the 5% level. These results confirm that shopping centers with more evenly distributed tenant mixes are more likely to have higher sales per square foot than those with less evenly distributed space allocations, other things constant,. Additionally, the IRD variable remains significant and the weights associated with the *T, M*, and *I* variables are robust.

V. Conclusion

Our findings reveal that the growth in retailer sales per square foot in dominant shopping centers vastly outperform the growth in non-dominant sales per square foot for the period 1988-1997. During this decade dominant mall retail sales per square foot grew at an annual rate of 3.2% while non-dominant center retail sales per square foot grew only 1.1% per annum.

To categorize centers as dominant and non-dominant we construct the Index of Retail Dominance (IRD). The index incorporates anchor size, number of anchor tenants, and anchor tenant fashion image for both subject and competitive shopping centers to estimate a variant of the Huff gravity model. Data used in the model was obtained from a large mall owner/developer, National Decision Systems, and survey results. The IRD is able to explain approximately 70% of the variation in non-anchor tenant sales per square foot after controlling for

confirming the discriminant power associated with tenant mix.

aggregate household income.

Results of the OLS estimation model reveal that anchor tenant image are of primary importance when predicting non-anchor sales per square foot. The number of anchor tenants also positively affects sales per square foot while anchor tenant size was found to have a slight negative affect on non-anchor tenant sales per square foot.

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Exhibit 1

Shopping Center Characteristics, 1995
(Subject Centers)

Characteristic	Mean	Standard Deviation	Minimum	Maximum
Non-Anchor Tenant Sales/Sq. Ft. ($)	228.02	87.43	91.25	513.15
Number of Anchor Tenants	3.24	1.34	1.00	6.00
Anchor Tenant Area (Sq. Ft.)	492,397	221,408	111,026	914,512
Shopping Center Total Area (Sq. Ft.)	850,224	381,230	333,273	2,480,044

Exhibit 2

Non-Anchor Tenant Mix*
(Subject Centers)

Tenant Type	Mean (%)	Standard Deviation
Women's Wear	21.09	6.59
Leisure and Enter	14.82	4.05
Shoes	9.97	3.28
Gifts	8.20	4.78
Fast Food	6.46	5.88
Family Apparel	6.46	3.71
Services	4.83	2.40
Specialty Apparel	4.64	2.39
Others	4.60	6.43
Drug/Variety	4.59	9.03
Jewelry	3.68	1.52
Men's Wear	2.93	2.51
Restaurant	2.48	3.16
Women's Specialty	2.07	1.83
Specialty Food	1.74	0.79
Home Furnishing	1.52	2.36

* Percent of occupied space.

Exhibit 3

Competitive Centers and Socio-Economic Characteristics
within a 10-mile Radius Ring of Subject Center, 1995

Characteristic	Mean	Standard Deviation	Minimum	Maximum
Number of Competitive Centers greater than 400,000 Sq.Ft	2.83	2.39	13.00	1.00
Number of Anchor Tenants in Competitive Centers	2.43	1.25	1.00	6.00
Anchor Tenant Area (Sq. Ft.) in Competitive Centers	374,652	215,175	59,888	959,909
Total Area (Sq. Ft.) Competitive Centers	815,316	348,243	402,086	2,350,000
Aggregate Household Income ($ Bill)	12.6	20.0	1.0	124.8

Exhibit 4

Department Store Image Survey

Department Store Image Rating

Please rank from 1 to 10 each of the stores below based on your perception of the store's image as a discount retailer or fashion retailer or somewhere in between. Fashion retailers are more likely to maintain higher quality merchandise with greater fashion appeal, whereas discount retailers carry more price sensitive merchandise. Please mark "?" if you are not familiar with the store. Your responses will be used as part of a study assessing how department store image affects shopping center sales. When you have completed the survey, please fax or mail it to:

Store Name	Discount Retail Image ←								→ Fashion Retail Image		Not Familiar
A&S	1	2	3	4	5	6	7	8	9	10	?
Ames	1	2	3	4	5	6	7	8	9	10	?
Bacons	1	2	3	4	5	6	7	8	9	10	?
Wal-Mart	1	2	3	4	5	6	7	8	9	10	?
Younkers	1	2	3	4	5	6	7	8	9	10	?
Z C M I	1	2	3	4	5	6	7	8	9	10	?

Thanks for your time. If you want a copy of the survey results, please provide the following:

Name:_____

Fax:_____ **Phone:**_____

Exhibit 5(a)
Department Store Fashion Image

Store Name	Mean	S.D.	Min.	Max	Obs.	Fashion Image Level
A & S	6.1	1.7	3	10	22	0.43
Ames	2.7	1.9	1	7	28	0.10
Bacons	5.8	1.1	4	8	13	0.23
Belk	5.8	1.4	2	8	29	0.57
Bergner's	6.0	2.1	2	10	15	0.20
Bloomingdales	9.4	0.8	8	10	29	0.97
Bonwitt Teller	9.0	0.9	7	10	27	0.90
Boscov's	4.6	1.9	2	10	23	0.23
Boston Store	5.4	1.6	2	8	18	0.30
Bradlees	2.3	1.8	1	8	24	0.07
Bullock's	7.8	1.0	6	10	28	0.93
Burdines	7.9	0.9	6	10	29	0.97
Caldor	3.0	2.2	1	8	24	0.13
Carson Pirie Scott	6.3	1.3	5	8	29	0.73
Castner-Knott	5.9	1.9	1	8	18	0.37
Clover	1.8	1.1	1	4	12	0.00
Crowley's	3.9	1.9	1	7	15	0.10
Dayton's	7.9	1.2	6	10	28	0.93
Dillard's	7.8	1.3	5	10	29	0.90
Elder-Beerman	5.8	1.8	3	8	26	0.50
Famous-Barr	6.4	1.7	1	8	29	0.77
Filene's	6.4	2.1	1	9	30	0.73
Foley's	7.3	1.1	5	9	26	0.80
Fortunoff	5.9	2.4	1	10	21	0.40
Fred Meyer	3.5	1.8	1	8	22	0.07
Gayfer's	5.4	1.8	2	8	24	0.40
Glass Block	4.8	1.0	4	6	7	0.07
Goldblatts	3.9	2.2	1	8	13	0.10
Goldsmith's	6.7	1.4	5	8	18	0.47
Gottschalks	6.1	1.4	4	9	27	0.50
Harris	6.0	1.8	4	10	15	0.27
Hecht's	6.7	1.5	3	9	28	0.70
Hennesey's	5.3	1.5	3	7	7	0.07
Herberger's	5.7	1.7	3	8	13	0.17
Hess's	5.0	1.7	2	8	22	0.33
Hills	2.8	1.4	2	6	19	0.03
Horne's	5.6	1.9	2	8	17	0.27
Hudson's	7.5	1.4	4	10	26	0.77
I. Magnin	8.9	1.0	7	10	26	0.87
J.C. Penney	5.4	1.4	3	8	30	0.60
Jacobson's	8.2	1.3	6	10	20	0.60
Jamesway	1.5	0.6	1	3	20	0.00
John Wanamaker	6.7	1.4	4	9	20	0.53
Jones	6.3	1.6	4	10	18	0.40
Jordan Marsh	7.0	1.6	3	10	24	0.70
Joslins	6.1	1.6	2	9	23	0.47
K Mart	1.8	1.1	1	6	30	0.03
Kaufmann's	6.2	1.7	1	8	26	0.60
Kohl's	4.0	1.7	2	7	24	0.20
L.S. Ayres	6.0	1.4	3	8	23	0.50
Lamonts	4.9	1.8	2	7	17	0.23
Lazarus	7.0	1.4	4	10	27	0.77
Leggett's	5.9	1.5	3	8	16	0.30
Lord & Taylor	8.5	1.3	5	10	29	0.93
M.M. Cohn	6.5	1.6	3	8	11	0.27
Macy's	8.0	1.2	5	10	30	0.97
Maison Blanche	7.0	1.0	5	8	24	0.70
Marshall Field's	7.7	1.6	3	10	29	0.90
Mc Alpin's	5.9	1.6	3	8	24	0.43
McRae's	5.6	1.7	3	8	21	0.40
Meler & Frank	5.8	1.9	3	9	21	0.40
Mervyn's	3.4	1.5	1	7	30	0.10
Montgomery Ward	3.1	1.8	1	6	30	0.07
Neiman Marcus	9.6	0.5	9	10	30	1.00
Nordstrom	9.4	0.8	8	10	30	1.00
Parisian	7.9	1.4	5	10	30	0.93
Prange Way	2.9	1.4	1	5	15	0.00
Proffitts	6.0	1.6	3	8	25	0.60
Rich's	7.2	1.2	4	9	29	0.90
Robinsons-May	7.5	1.2	4	10	28	0.90
Saks Fifth Avenue	9.3	1.2	4	10	30	0.97
Sears	4.7	1.3	3	8	29	0.23
Shopko	2.5	1.0	1	4	19	0.00
Steinbach	3.5	1.9	1	7	16	0.13
Sterns	5.1	1.7	3	8	22	0.30
Strawbridge & Clothier	6.6	1.5	3	9	22	0.53
Target	2.8	1.5	1	6	30	0.07
The Bon-Ton	5.7	1.5	3	8	22	0.37
The Bon Marche	6.8	1.3	4	8	25	0.70
The Broadway	6.8	1.3	4	9	24	0.63
The Popular	5.4	1.7	2	8	11	0.20
Value City	1.5	0.6	1	3	22	0.00
Venture	1.9	0.8	1	3	24	0.00
Von Maur	6.5	1.9	3	10	14	0.30
Wal-Mart	1.9	1.1	1	5	30	0.00
Younkers	5.5	1.4	3	8	23	0.33
ZCMI	6.1	1.7	3	10	20	0.40

Exhibit 5 (b)

Department Store Fashion Image for the
Subject and Competitive Centers

Characteristic	Mean Fashion Image Level	Standard Deviation	Minimum	Maximum
Subject Center Anchor-Tenant Fashion Image	0.50	0.31	0.07	0.98
Competitive Center Anchor-Tenant Fashion Image	0.49	0.30	0.00	0.98

Exhibit 6

Index of Retail Dominance (IRD)
(Subject Centers)

(a) Primary Center		(b) IRD	(c) Sales/Sq. Ft. ($)
1	*	4.000	427.64
2		2.445	513.15
3		2.417	313.12
4	*	2.000	158.30
5	*	2.000	170.21
6	*	2.000	229.49
7		1.999	245.33
8		1.997	308.29
9		1.994	197.84
10		1.978	344.76
11	*	1.915	311.26
12	*	1.776	239.97
13	*	1.750	148.56
14		1.748	291.49
15		1.484	229.24
16		1.473	225.93
17		1.392	292.09
18	*	1.345	236.09
19		1.175	226.60
20		1.156	219.78
21	*	1.141	234.33
22		1.124	232.04
23		0.980	263.98
24		0.723	158.23
25	*	0.655	208.86
26	*	0.635	144.12
27	*	0.582	170.65
28	*	0.579	124.09
29	*	0.279	137.78
30	*	0.217	391.59
31	*	0.198	170.18
32		0.140	219.18
33	*	0.129	251.88
34		0.045	177.22
35		0.045	170.74
36	*	0.044	148.51
37	*	0.029	189.76
38		0.025	292.55
39	*	0.000	133.77
40		0.000	91.25
41		0.000	108.91

Exhibit 7

Predicted Effect of Adding Anchor Tenant Space on
the IRD and Non-Anchor Tenant Sales*

Estimated Model	IRD	Estimated Non-Anchor Tenant Sales Per Square Foot ($)	Effect on Non-Anchor Tenant Sales Per Square Foot
Base Sales	1.00	221.08	
Effect on non-anchor tenant sales if each of the existing anchor tenants expands by 50,000 sq.ft.	0.99	220.22	(0.86)
Effect on non-anchor tenant sales of adding a fourth anchor tenant of 150,000 sq.ft. with an image equal to that of existing anchor tenants	1.50	251.37	30.29
Effect on non-anchor tenant sales of adding a 150,000 sq.ft. Nordstroms (fashion image level of 1.00)	4.36	422.96	201.88
Effect on non-anchor tenant sales of adding a 150,000 sq.ft. Wal-Mart (fashion image level of 0.00)	0.40	184.82	(36.26)

* Estimates based on (11). The IRD inputs for the base model assume a subject shopping center with a total area of 815,000 squate feet and three anchor tenants (Broadway, J.C. Penney, Sears, which maintain an average fashion image level of 0.49) . The competitive market is assumed to be identical to the subject in all aspects. That is, the subject center maintains a proportional share of the market, or an IRD of 1. Aggregate household income is assumed to be the data set mean of $12.6 billion.

Exhibit 8(a)

Non-Anchor Tenant Sales
per Square Foot by Shopping Center
Dominance Category (1988-1997)

Subject Center	Sales/Sq.Ft. by Year 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	IRD
A. Most Dominant Shopping Centers											
1	267.0	289.0	323.0	341.0	354.0	364.0	373.0	374.0	378.0	388.0	4.000
4	164.0	147.0	149.0	179.0	181.0	184.0	185.0	174.0	186.0	192.0	2.000
5	159.0	170.0	178.0	176.0	164.0	173.0	176.0	194.0	208.0	195.0	2.000
6	327.0	401.0	418.0	417.0	419.0	392.0	379.0	251.0	298.0	330.0	2.000
11	231.0	256.0	256.0	262.0	285.0	284.0	290.0	301.0	309.0	323.0	1.915
12	181.0	211.0	223.0	227.0	232.0	226.0	229.0	242.0	258.0	272.0	1.776
13	147.0	149.0	151.0	150.0	136.0	150.0	150.0	151.0	160.0	150.0	1.750
18	205.0	229.0	237.0	232.0	250.0	238.0	227.0	229.0	235.0	250.0	1.345
21	168.0	186.0	190.0	216.0	227.0	227.0	234.0	240.0	234.0	248.0	1.141
Avg.	205.4	226.4	236.1	244.4	249.8	248.7	249.2	239.6	251.8	260.9	
Avg.*	190.3	204.6	213.4	222.9	228.6	230.8	233.0	238.1	246.0	252.3	
B. Non-Dominant Shopping Centers											
25	177.0	197.0	202.0	211.0	202.0	245.0	233.0	234.0	250.0	258.0	0.655
26	144.0	160.0	164.0	162.0	154.0	154.0	155.0	150.0	147.0	148.0	0.635
27	157.0	166.0	173.0	172.0	179.0	189.0	200.0	212.0	212.0	200.0	0.582
28	160.0	164.0	159.0	138.0	147.0	136.0	135.0	131.0	145.0	143.0	0.579
29	137.0	154.0	166.0	162.0	166.0	174.0	177.0	151.0	156.0	173.0	0.279
30	229.0	245.0	287.0	327.0	376.0	414.0	435.0	442.0	463.0	454.0	0.217
31	120.0	125.0	119.0	144.0	136.0	141.0	142.0	139.0	146.0	142.0	0.198
33	192.0	243.0	253.0	203.0	220.0	235.0	263.0	262.0	269.0	281.0	0.129
36	142.0	144.0	142.0	152.0	146.0	155.0	153.0	156.0	146.0	145.0	0.044
37	232.0	233.0	219.0	206.0	201.0	211.0	213.0	194.0	202.0	216.0	0.029
39	222.0	138.0	155.0	162.0	229.0	206.0	177.0	146.0	165.0	157.0	0.000
Avg.	173.8	179.0	185.4	185.4	196.0	205.5	207.5	201.5	209.2	210.6	
Avg.**	168.3	172.4	175.2	171.2	178.0	184.6	184.8	177.5	183.8	186.3	

* Average without including shopping center 6.

** Average without including shopping center 30.

Exhibit 8(b)

Non-Anchor Tenant Sales
per Square Foot by Shopping Center
Dominance Category (1988-1997)

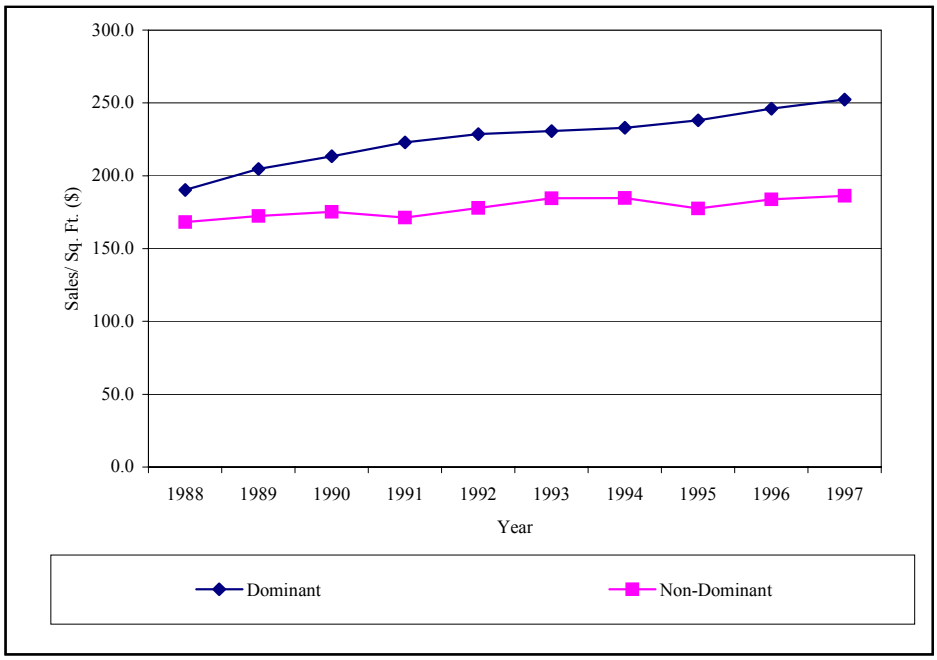

Exhibit 9

Non-Anchor Tenant Mix in
Dominant and Non Dominant Centers*

Dominant Malls			Non-Dominant Malls		
Tenant Type	Mean (%)	Standard Deviation		Mean (%)	Standard Deviation
Women's Wear	20.41	4.33	Women's Wear	23.26	3.89
Leisure/Entertainment	15.56	3.71	Leisure/Entertainment	13.29	3.66
Shoes	9.09	2.65	Shoes	11.33	2.53
Family Apparel	7.89	3.74	Fast Food	8.64	2.51
Gifts	7.85	3.97	Gifts	8.63	3.77
Services	5.03	2.68	Family Apparel	4.90	3.82
Fast Food	4.82	2.50	Services	4.83	2.58
Specialty Apparel	4.76	1.68	Others	4.77	4.98
Others	4.59	5.51	Specialty Apparel	4.74	1.66
Jewelry	3.69	0.98	Jewelry	3.89	0.88
Drug/Variety	3.61	5.14	Drug/Variety	3.27	5.14
Men's Wear	3.60	2.24	Restaurant	2.53	3.41
Women's Specialty	2.80	1.71	Men's Wear	2.20	2.33
Restaurant	2.55	3.47	Specialty Food	1.82	0.64
Home Furnishing	2.13	2.52	Women's Specialty	1.21	1.79
Specialty Food	1.62	0.60	Home Furnishing	0.78	2.74
Variance in proportions of space allocation**	26.24			33.58	

* Percent of occupied space.
** The variance of the space allocation measures how even the spacedistribution is among tenant types.