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Disaggregating Neighborhood and Community Center Property Types

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Existing retail theory postulates a hierarchical space market with larger centers having greater drawing capacity and greater agglomeration benefits. In this study, rent determinants for two tiers of the proscribed hierarchical model are compared and the existence of retail center property type differences in rent determinants is evaluated. Property specific data, competing center data, and trade area data for 370 neighborhood and community centers derived from a census of retail centers for a single large MSA are used in the study. Study results indicate that community and neighborhood centers can be differentiated into distinct retail property types. The results also show that the presence of lower income households in a center's primary trade area has a pronounced negative impact on community center rents.

Introduction

Only a few studies of rental rates in non-mall retail shopping centers exist. An early study by Benjamin, Boyle, and Sirmans (1990) of retail leases investigates the interaction between percentage rents and lease terms and indicates that the base rent for leases is affected by tenant profile, lease term, and percentage rents. In another early work, Sirmans and Guidry (1993), using a small data set undifferentiated by retail property type, show that center size, age, and type of tenancy affect rental rates. Further preliminary studies using another small data set undifferentiated by retail property type by Gatzlaff, Sirmans, and Diskin (1994) and Sirmans, Gatzlaff, and Diskin (1996) show that the loss of an anchor tenant impacts a center's vacancy and rental rates. Hardin and Wolverton (2000, 2001) use a relatively large data set from the Atlanta MSA to investigate the determinants of rent specifically for the neighborhood center retail property type. Their studies indicate partial support for neighborhood center agglomeration, benefits from proximity to higher order retail centers, a positive correlation between trade area purchasing power and rents, and demand-externality benefits attributable to center specific accessibility and design. A subsequent study by Hardin, Wolverton, and Carr (2002) provides a similar analysis for community centers.[1]

The present study extends this nascent, but critical research stream, by comparing the rent generating attributes of neighborhood and community centers. Whereas previous studies have evaluated either retail property type specific determinants of rent or rent determinants undifferentiated by property type, this investigation tests the hierarchical model of retail centers by comparing neighborhood and community center rent determinants. The comparison of the factors impacting the two retail center property types allows for a rigorous evaluation of the theoretical constructs that provide the foundation for retail market analysis including agglomeration theory and the importance of demand-externalities. In addition, analysis of the potential to disaggregate the retail

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property sector builds on existing research that shows that many real estate property markets can in fact be decomposed into sub-markets with property type specific rent determinants. For example, Allen, Springer, and Waller (1995) show that rental rate generation differs between condominiums, apartments, and single-family property types while Black, Wolverton, Warden, and Pittman (1997) differentiate industrial, distribution, and manufacturing properties. Concurrently, with respect to apartments, Wolverton, Hardin, and Cheng (1999) and Berry, McGreal, Stevenson, Young, and Webb (2003) provide research that suggests that apartment rental markets can be disaggregated by both unit and property type.

In the sections that follow, a base empirical model of non-anchor rents is derived. Individual retail center property type specific models are generated and then compared using both Chow and Tiao-Goldberger tests. Study results indicate that the two retail property types can be disaggregated based on property type differences in the importance and magnitude of the factors determining non-anchor tenant rents. The study results are generally supportive of a hierarchical model of retail center trade and rents.

The Empirical Model

Most empirical analysis of retail center performance builds from Reilly's (1931) well-known gravity model. Huff (1964) modifies Reilly's base gravity model to include retail center amenities and attributes that attract consumers permitting a fuller evaluation of modern retail center market dynamics with the explicit use of center size as a proxy for multi-shopping opportunities and including consumer travel time. Huff's base model is as follows:

$$P_{ij} = \frac{S_j / T_{ij}^{\lambda}}{\sum_{j=1}^{n} S_j / T_{ij}^{\lambda}} \tag{1}$$

where P_{ij} = the probability of consumer i shopping at shopping center j,
S_j = the size of shopping center j,
T_{ij} = the travel time for consumer i to shopping center j,
n = the number of competing retail locations, and
λ = a parameter reflecting the effect of travel time on various types of shopping trips.

Building on Huff's model, Nevin and Houston (1980) control for demand-externality and multipurpose shopping constructs. Their model can then be modified, as suggested by Hardin and Wolverton (2001) and Hardin, Wolverton, and Carr (2002), as shown below:

$$P_{ij} = \frac{S_j I_j M_j / T_{ij}^{\lambda}}{\sum_{j=1}^{n} \left[S_j I_j M_j / T_{ij}^{\lambda} \right]} \tag{2}$$

where I_j = the image of shopping center j, and
M_j = multipurpose shopping opportunities at shopping center j.

Given that a higher probability of center patronage will have a direct impact on non-anchor rental rates, as noted by Hardin, Wolverton, and Carr (2002), center level shopping activity and economic rent constructs from Brueckner (1993) and Miceli, Sirmans, and Stake (1998) can be incorporated in a rental rate model as noted in equation 3.

$$R_j = f(S_j, I_j, M_j, T_{ij}, C_{ij}) \quad [+]\ [+]\ [+]\ [-]\ [+] \tag{3}$$

where R_j = the quoted rent for in-line non-anchor shop space at center j,
C_j = the purchasing power in the trade area of center j, and
T_{ij} = various delineations of the consumer trade area of center j.

Finally, the functional model used in this study is presented below and includes size as a separate component of the multipurpose shopping opportunity construct:

$$R_j = f(I_j, M_j, T_{ij}, C_{ij}) \quad [+]\ [+]\ [-]\ [+] \tag{4}$$

The image [I_j] vector includes center specific attributes such as design, accessibility, age, and renovation status.[2] In addition to the separate size [S_j] variable, the multipurpose shopping vector [M_j], which is generated at the center trade area level, includes distance to the closest regional mall, operationalized as the reciprocal of the distance to the closest regional mall, and the number of competitive community and neighborhood centers within one mile.[3] Two different demographic trade area delineations [T_{ij}] are modeled, including one- and two-mile radii from each site.

Purchasing power and percentage of households on public assistance for each trade area radius are included in the purchasing power vector [C_j] along with center longitude and latitude coordinates which control for any other spatially correlated differences in location. The operationalization of the demand model for each retail property type is similar to other recent research and is provided below.[4]

$$Rent_j = f(S_j, M_j, I_j, C_j, T_i, Longitude_j, Latitude_j) \quad (5)$$

where $Longitude_j$ = the longitude coordinate of the center j and is a control variable, and
$Latitude_j$ = the latitude coordinate of the center j and is a control variable.

The Data

The shopping center data are obtained from on-site evaluations and from Dorey Publishing and Information Services, Inc. The database from which the neighborhood and community center data are obtained is essentially a census of retail space for the Atlanta, Georgia MSA in the Southeastern United States. The non-retail population and purchasing power information is generated from Caliper Corporation's annual census updates. A total of 370 shopping center observations including 113 community center observations and 257 neighborhood center observations for the 1999 time period are used.[5]

Complete descriptive statistics are provided in Table 1. The mean quoted annual per square foot maximum and minimum non-anchor rental rates for community centers are $14.48 and $12.28, respectively. This can be compared with neighborhood center rents of $12.42 and $11.03 per square foot. The average vacancy rate for community centers in the study is 7.3% while the neighborhood center vacancy rate averages 8.3%. The typical community center in the study is 212,419 square feet while the average size of the typical neighborhood center is 86,175 square feet. Community centers average 1.03 competing community centers and 1.53 competing neighborhood centers within a one-mile radius. Neighborhood centers average 0.67 competing community centers and 1.31 competing neighborhood centers within a one-mile radius. The distance relationships between community and neighborhood centers and malls are similar, 0.65 and 0.60, respectively, as measured by the reciprocal distance to the closest regional mall. Trade area purchasing power for one- and two-mile trade areas for community centers average $162.25 million and $667.89 million, respectively. Trade area purchasing power for one- and two-mile trade areas for neighborhood centers average $175.91 million and $688.41 million. One- and two-mile percentages of households on public assistance for community centers average 3.9% and 3.8% with ranges of 0.0% to 21.5% and 0.5% to 22.0%, respectively. One- and two-mile percentages of households on public assistance for neighborhood centers average 3.4% with ranges of 0.00% to 32.9% and 0.30% to 27.0%, respectively. In addition, 48.6% of community centers and 70.0% of neighborhood centers have a grocery anchor.

Table 1. Community and neighborhood center descriptive statistics.

Variables	Mean	Std. dev.	Minimum	Maximum
Rent – maximum p.s.f.				
Community center	14.48	4.53	5.00	25.00
Neighborhood Center	12.42	4.00	4.00	33.00
Rent – minimum p.s.f.				
Community center	12.28	4.78	2.00	25.00
Neighborhood Center	11.03	3.79	2.00	30.00
Vacancy rate %				
Community center	0.07	11.98	0.00	63.48
Neighborhood Center	0.08	13.74	0.00	81.03
Multipurpose Shopping Variables				
Size (in 1,000 s.f.)				
Community center	212.42	88.95	85.08	491.00
Neighborhood Center	86.17	29.78	30.00	240.00
Community center competition (count)				
Community center	1.03	1.06	0.00	3.00
Neighborhood Center	0.67	1.06	0.00	4.00
Neighborhood center competition (count)				
Community center	1.53	1.55	0.00	6.00
Neighborhood Center	1.31	1.36	0.00	6.00
Distance to mall (reciprocal)				
Community center	0.65	1.12	0.05	7.09
Neighborhood Center	0.60	2.70	0.06	39.84
One-mile purchasing power (in $10 millions)				
Community center	16.23	11.35	0.68	67.94
Neighborhood Center	17.59	11.22	1.41	64.90
Two-mile purchasing power (in $10 millions)				
Community center	66.79	41.51	3.18	183.57
Neighborhood Center	68.84	41.66	6.15	180.78
One-mile % households on public assistance				
Community center	0.04	0.03	0.00	0.22
Neighborhood Center	0.03	0.04	0.00	0.33
Two-mile % households on public assistance				
Community center	0.04	0.03	0.01	0.22
Neighborhood Center	0.03	0.03	0.00	0.27
Longitude (1,000,000)				
Community center	-84.35	0.18	-84.78	-83.98
Neighborhood Center	-84.34	0.18	-84.77	-83.93

Table 1. (continued)

Variables	Mean	Std. dev.	Minimum	Maximum
Latitude (1,000,000)				
Community center	33.85	0.17	33.38	34.27
Neighborhood Center	33.84	0.17	33.40	34.23
Grocery anchor (1=yes)				
Community center	0.49	0.50	0.00	1.00
Neighborhood Center	0.70	0.46	0.00	1.00
Age				
Community center	16.98	11.74	3.00	46.00
Neighborhood Center	17.69	10.21	3.00	60.00
Access on major roads (count)				
Community center	1.38	0.58	0.00	3.00
Neighborhood Center	1.21	0.52	0.00	2.00
Left Turn lane (count)				
Community center	0.88	0.47	0.00	4.00
Neighborhood Center	0.92	0.54	0.00	3.00
Renovated (1=yes)				
Community center	0.20	0.40	0.00	1.00
Neighborhood Center	0.19	0.40	0.00	1.00
Strip-shaped				
Community center	0.32	0.47	0.00	1.00
Neighborhood Center	0.49	0.50	0.00	1.00
U-shaped				
Community center	0.07	0.26	0.00	1.00
Neighborhood Center	0.05	0.23	0.00	1.00
L-shaped				
Community center	0.42	0.50	0.00	1.00
Neighborhood Center	0.39	0.49	0.00	1.00
Other-shaped				
Community center	0.19	0.40	0.00	1.00
Neighborhood Center	0.06	0.24	0.00	1.00
Corner location (1=yes)				
Community center	0.70	0.46	0.00	1.00
Neighborhood Center	0.74	0.44	0.00	1.00
Non-traditional exterior (1=yes)				
Community center	0.02	0.13	0.00	1.00
Neighborhood Center	0.01	0.11	0.00	1.00

Community center age averages 16.98 years with community centers having access to 1.38 major roads on average. Community centers on average benefit from 0.88 left turn access lanes. Neighborhood center age averages 17.69 years with neighborhood centers having access to 1.21 major roads on average. Neighborhood centers on average benefit from 0.92 left turn access lanes. Some 20.3% of community centers and 19.4% of neighborhood centers have been renovated. Over 31.8% of community centers are strip-shaped, 41.5% are L-shaped, 7.0% are U-shaped with the remaining being classified as other-shaped. For neighborhood centers, 49.0% are strip-shaped, 39.2% are L-shaped, 5.4% are U-shaped with the remaining being classified as other-shaped. 69.9% of community centers and 73.9% of neighborhood centers have corner locations. About 1.7% of community have non-traditional exteriors and 1.1% of neighborhood centers have non-traditional exteriors.

Community and Neighborhood Center Model Results

The results from OLS regression models of the log of maximum rent and the log of minimum rent for each retail center property type are provided in Table 2 and Table 3. For each property type, models for one-mile and two-mile primary trade areas are generated. For each model, White's test is used to evaluate heteroskedasticity. In addition, variance inflation factors (VIFs) are generated for each model to test for multicollinearity. Test results indicate neither heteroskedasticity nor multicollinearity problems.[6]

The Maximum Rent Models

The results from the trade area models for the natural log of the maximum center rents for community and neighborhood center rents provided in Table 2 indicate that both center types are impacted by similar size [S_i], multipurpose shopping [M_j], purchasing power [C_j] , and image [I_j] variables. Differences in the actual variables impacting rent and the magnitude of variable coefficients are found.

Community Center Maximum Rent

Neither the intercept term nor the vacancy rate variable are statistically significant in either the one-mile or two-mile trade area community center models. With respect to the multipurpose shopping variables [M_j], center size, community center competition, and the distance to mall reciprocal variables in the one-mile trade area model are statistically significant and appropriately signed at the 10%, 5%, and 1% levels, respectively. The neighborhood center competition variable is not statistically significant as might be expected in a hierarchical retail space market. In the two-mile primary trade area model only the center size and distance to mall reciprocal variables are statistically significant at the 1% and 5% levels, respectively.

Proximity to a regional mall, proximity to additional community centers, and an increase in center size improve maximum community center rents. The two purchasing power [C_j] variables, purchasing power and percentage of households on public assistance, are statistically significant in both trade area models while neither of the location control variables are statistically significant in either model. The purchasing power variable is positive and statistically significant at the 1% level in both models while the percentage of households on public assistance variable is negative and statistically significant at the 1% and 5% levels for the one-mile and two-mile models. The presence of households on public assistance negatively impacts maximum community center rent. Higher income households are less likely to be drawn to a center with higher levels of adjacent households on public assistance. This implies that higher income consumers may be willing to patronize community centers that are farther in distance in order to shop with consumers with similar income attributes. There may also be a merchandise mix problem at the closest center, but that is beyond the scope of this study.

Five of the image [I_j] variables are statistically significant in either the one-mile or two-mile trade area models. The age variable, measuring depreciation and obsolescence, is -0.008 in both trade area models and is statistically significant at the 1% level. The presence of a grocery chain as an anchor tenant variable is positive (0.101) and statistically significant at the 5% level in the two-mile trade area model. Community centers appear to benefit from a grocery anchor which can increase the volume of shopping contacts as consumers purchase lower order convenience goods on a more frequent basis. While higher order anchors may extend a community center's trade area, a grocery anchor increases the number of shopper visits relative to a center without a grocery anchor tenant. This finding supports the retail strategy pursued by some discounters to add grocery sections to their traditional product mix.[7] U-shaped center design has a negative impact in both models. The coefficient for the U-shaped dummy variable is -0.183 in the one-mile trade area model and -0.170 in the two-mile trade area model and is statistically significant at the 5% and 10% levels, respectively. The other-shaped design variable coefficient is positive (0.115) and statistically significant at the 5% level in the two-mile trade area model. Deviation from the more common strip and L-shaped designs impacts rents. The corner location variable coefficient is -0.121 for the one-mile trade area model and -0.104 in the two-mile trade area model and is statistically significant at the 5% and 10% levels, respectively. The congestion associated with a corner location reduces maximum community center rents.

Neighborhood Center Maximum Rent

Both the intercept term and the vacancy rate variable are statistically significant in both of the neighborhood center models of the log of maximum rent. The intercept term coefficients of -17.706 and -17.688 for the respective models are statistically significant at the 5% level. The vacancy rate variable coefficient is -0.348 in the one-mile trade area model and -0.369 in the two-mile model, and is statistically significant at the 1% level in both models. For centers with a given level of high vacancy, rents are lowered to attract new tenants.

Table 2. Maximum community and neighborhood center rent models.

	Community Centers		Neighborhood Centers	
	One-mile Primary Trade Area	Two-mile Primary Trade Area	One-mile Primary Trade Area	Two-mile Primary Trade Area
Variable	Log of Max. Rent	Log of Max. Rent	Log of Max. Rent	Log of Max. Rent
Intercept	14.003	16.246	-17.706	-17.688
	(-1.22)	(-1.29)	(-2.32**)	(-2.37)**)
Vacancy rate	-0.060	-0.121	-0.348	-0.369
	(-0.33)	(-0.64)	(-3.14***)	(-3.42***)
Multipurpose Shopping Variables				
Center size (10,000 s.f.)	0.008	0.007	0.014	0.014
	(3.16***)	(2.64***)	(2.69***)	(2.79***)
Community centers (1 mile)	0.040	0.040	0.050	0.043
	(1.68*)	(-1.66)	(2.97***)	(2.61***)
Neighborhood centers (1 mile)	0.003	0.001	0.002	-0.005
	(-0.22)	(-0.03)	(-0.16)	(-0.44)
Distance to mall reciprocal	0.055	0.048	0.015	0.012
	(2.64***)	(2.32**)	(2.66***)	(2.28**)
Purchasing Power Variables				
Purchasing power ($10 millions)	0.011	0.003	0.010	0.003
	(4.93***)	(4.87***)	(6.79***)	(7.80***)
Percent HH on public assistance	-2.253	-1.995	-0.322	-0.200
	(-2.68***)	(-2.31**)	(-0.72)	(-0.41)
Longitude (1,000,000)	0.136	0.155	-0.131	-0.143
	(-1.05)	(-1.18)	(-1.58)	(-1.76*)
Latitude (1,000,000)	-0.004	-0.022	0.261	0.230
	(-0.03)	(-0.17)	(2.66***)	(2.39**)
Image Variables				
Grocery anchor	0.085	0.101	0.059	0.051
	(-1.63)	(1.92**)	(-1.63)	(-1.46)
Age	-0.008	-0.008	-0.011	-0.011
	(-3.25***)	(-3.05***)	(-6.07***)	(-6.51***)
Access on major roads (count)	0.048	0.031	-0.015	-0.015
	(-1.22)	(-0.78)	(-0.53)	(-0.53)
Left turn lanes	0.010	0.003	0.071	0.060
	(-0.22)	(-0.06)	(2.52**)	(2.19**)
Renovated	0.063	0.071	0.022	0.046
	(-0.88)	(-0.99)	(-0.52)	(-1.07)

Table 2. (continued)

	Community Centers		Neighborhood Centers	
	One-mile Primary Trade Area	Two-mile Primary Trade Area	One-mile Primary Trade Area	Two-mile Primary Trade Area
Variable	Log of Max. Rent	Log of Max. Rent	Log of Max. Rent	Log of Max. Rent
U-shaped	-0.183	-0.170	-0.022	-0.022
	(-2.01**)	(-1.86*)	(-0.34)	(-0.34)
L-shaped	0.005	0.003	0.039	0.026
	(-0.12)	(-0.06)	(-1.23)	(-0.85)
Other-shaped	0.104	0.115	0.032	0.032
	(-1.60)	(1.75*)	(-0.51)	(-0.51)
Corner location	-0.121	-0.104	-0.009	-0.013
	(-2.21**)	(-1.93*)	(-0.27)	(-0.38)
Non-traditional exterior type	0.197	0.185	-0.201	-0.177
	(-1.11)	(-1.03)	(-1.42)	(-1.30)
Adjusted R^2	0.556	0.544	0.475	0.500
F-statistic	8.38	8.03	13.21	14.51
n	113	113	257	257

(*t*-statistics in parentheses)

** Significant at the 10% level.* *** Significant at the 5% level.* **** Significant at the 1% level.*

As was the case with respect to the community center rent models, the center size, community center competition, and the distance to mall reciprocal variables are statistically significant in either one or both of the trade area models. The center size variable is 0.014 in both the one- and two-mile trade area models and is statistically significant at the 1% level. The community center competition variable is 0.050 in the one-mile trade area model and 0.043 in the two-mile trade area model, and is statistically significant in both models at the 1% level. The neighborhood center competition variable is not statistically significant in either model. Finally, as is the case for community centers, the distance to mall reciprocal variable coefficients are statistically significant at the 1% and 5% levels respectively. Maximum neighborhood center rents benefit from proximity to community centers and regional malls as would be expected with a hierarchical retail space market.

The purchasing power variable is statistically significant in both trade area models. The purchasing power variable coefficient is 0.010 in the one-mile trade area model and 0.003 in the two-mile trade area model and is statistically significant at the 1% level in both models. However, unlike the findings for community centers, the percentage of households on public assistance variable is not statistically significant in either model. The locational control variables are statistically significant in both the neighborhood center models.

Table 3. Minimum community and neighborhood center rent models.

	Community Centers		Neighborhood Centers	
	One-mile Primary Trade Area	Two-mile Primary Trade Area	One-mile Primary Trade Area	Two-mile Primary Trade Area
Variable	Log of Min. Rent	Log of Min. Rent	Log of Min. Rent	Log of Min. Rent
Intercept	5.698	6.646	-14.637	-14.710
	(-1.21)	(-1.40)	(-1.75*)	(-1.79*)
Vacancy rate	-0.010	-0.033	-0.846	-0.862
	(-0.14)	(-0.43)	(-6.99***)	(-7.24***)
Multipurpose Shopping Variables				
Center size (10,000 s.f.)	0.003	0.002	0.003	0.003
	(3.05***)	(2.57**)	(-0.60)	(-0.64)
Community centers (1 mile)	0.014	0.014	0.053	0.045
	(-1.50)	(-1.45)	(2.84***)	(2.47**)
Neighborhood centers (1 mile)	0.002	0.001	0.006	-0.001
	-0.42	-0.23	-0.42	(-0.06)
Distance to mall reciprocal	0.019	0.017	0.021	0.018
	(2.22**)	(2.01**)	(3.35***)	(3.04***)
Purchasing Power Variables				
Purchasing power (10 millions)	0.003	0.001	0.009	0.003
	(4.22***)	(4.18***)	(5.80***)	(6.72***)
Percent HH on public assistance	-1.117	-1.042	-0.781	-0.445
	(-3.22***)	(-2.93***)	(-1.60)	(-0.83)
Longitude (1,000,000)	0.055	0.062	-0.124	-0.133
	-1.03	-1.16	(-1.37)	(-1.48)
Latitude (1,000,000)	-0.013	-0.014	0.187	0.167
	(-0.08)	(-0.27)	(1.75*)	(-1.58)
Image Variables				
Grocery anchor	0.037	0.042	0.074	0.066
	(1.73*)	(1.95**)	(1.89*)	(1.71*)
Age	-0.003	-0.003	-0.014	-0.015
	(-2.97***)	(-2.75***)	(-7.18***)	(-7.57***)
Access on major roads (count)	0.021	0.011	0.025	0.027
	(-1.34)	(-0.72)	(-0.79)	(-0.86)
Left turn lanes	0.003	-0.001	0.066	0.056
	(-0.15)	(-0.04)	(2.15**)	(1.86*)

Table 3. (continued)

	Community Centers		Neighborhood Centers	
	One-mile Primary Trade Area	Two-mile Primary Trade Area	One-mile Primary Trade Area	Two-mile Primary Trade Area
Variable	Log of Min. Rent	Log of Min. Rent	Log of Min. Rent	Log of Min. Rent
Renovated	0.025	0.028	0.006	0.020
	-0.85	-0.97	-0.14	-0.43
U-shaped	-0.067	-0.062	0.107	0.105
	(-1.79)*)	(-1.65)	(-1.48)	(-1.48)
L-shaped	0.001	0.000	0.081	0.068
	(-0.07)	(-0.04)	(2.30**)	(1.97*)
Other-shaped	0.042	0.046	-0.013	-0.013
	(-1.56)	(1.71*)	(-0.19)	(-0.19)
Corner location	-0.050	-0.043	0.012	0.009
	(-2.22**)	(-1.92*)	(-0.32)	(-0.25)
Non-traditional exterior type	0.078	0.073	-0.262	-0.245
	(-1.08)	(-1.00)	(-1.72*)	(-1.63)
Adjusted R^2	0.537	0.527	0.532	0.545
F-statistic	7.84	7.58	16.33	17.17
n	113	113	257	257

(*t*-statistics in parentheses)

** Significant at the 10% level.* *** Significant at the 5% level.* **** Significant at the 1% level.*

The smaller drawing area for neighborhood centers appears to amplify MSA growth, population, and income trends. The presence of households on public assistance does not negatively impact maximum rent for neighborhood centers. These centers cater to their primary trade area residents, sell convenience products, and are not dependent on drawing from households outside their primary trade areas.

Unlike the results for the community center maximum rent models where five of the image [I_j] variables are statistically significant in either the one-mile or two-mile trade area models, only two image variables are statistically significant in the neighborhood center models. The age variable, similar to the effect found for community centers, is -0.011 in both models and is statistically significant at the 1% level. The left turn lane dummy variable is the other image variable that is statistically significant. The variable coefficient is positive in both models, 0.071 in the one-mile trade area model and 0.060 in the two-mile trade area model, and is statistically significant at the 5% level. Neighborhood centers are dependent on core trade area purchasing power and benefit from proximity to community centers and regional malls.

The Minimum Center Rent Models

The results from the trade area models for the natural log of the minimum center rent for community and neighborhood centers are provided in Table 3 and indicate that both center types are impacted by multipurpose shopping [M_j] including size [S_j], purchasing power [C_j], and image [I_j] variables. Again, differences in the variables impacting rent between center property types and differences in the magnitude of impact are found.

Community Center Minimum Rents

As was the case for the log of maximum rent models, neither the intercept term nor the vacancy rate variable are significant in any of the community center minimum rent models. The multipurpose [M_j] and center size [S_j] variables have similar effects in the minimum rent models as compared to the maximum rent models with the exception that the community center competition variable is not statistically significant in either model. The center size variable is 0.003 in the one-mile trade area model and 0.002 in the two-mile trade area model, and is statistically significant at the 1% and 5% levels, respectively. The reciprocal distance to mall variable is 0.019 in the one-mile trade area model and 0.017 in the two-mile trade area model, and is statistically significant at the 5% level in both models.

As was the case in the log of maximum community center rent models, the two purchasing power [C_j] variables, purchasing power and percentage of households on public assistance, are statistically significant in both trade area models. The purchasing power variable coefficient is 0.003 in the one-mile trade area model and 0.001 in the two-mile trade area model, and is statistically significant at the 1% level in both models. The percentage of households on public assistance variable is -1.117 for the one-mile model and -1.042 for the two-mile model, and is statistically significant at the 1% level in both models. The locational control variables are not statistically significant. The presence of households on public assistance in close proximity to a community center negatively impacts minimum community center rents. This confirms the maximum rent results.

The same general image variables that are statistically significant in the maximum community center rent models are statistically significant in the minimum center rent models. The age variable coefficient is -0.003 in both models and is statistically significant at the 1% level. The presence of a grocery chain as an anchor tenant variable coefficient is 0.037 in the one-mile trade area model and 0.042 in the two-mile trade area model and is statistically significant at the 1% and 5% levels, respectively. This, again, confirms the results from the maximum rent models. Community centers benefit from a grocery anchor.

While the U-shaped design variable is not statistically significant in the two-mile trade area model, as is the case in the maximum community center rent model, it is statistically significant at the 10% level in the one-mile trade area model with a coefficient of -0.067. The corner location variable is statistically significant in each model (5% and 10%, respectively) and negative as was the case with the maximum rent models.

Neighborhood Center Minimum Rents

The intercept term and vacancy rate variable in the neighborhood center log of minimum rent models are statistically significant as was found in the log of maximum neighborhood center rent models. The intercept coefficients of -14.637 and -14.710 for the respective models are statistically significant at the 5% level. The vacancy rate variable coefficient is -0.846 in the one-mile trade area model and -0.862 in the two-mile model, and is statistically significant at the 1% level in both models. The coefficients indicate a substantial impact of existing center vacancy rate on minimum neighborhood center rents.

The community center competition, neighborhood center competition, and the distance to mall reciprocal variables have similar impacts in the minimum neighborhood rent models when compared to the maximum rent models. The community center competition variable is positive and statistically significant at the 1% and 5% levels respectively. The neighborhood center competition variable is not statistically significant. And, the distance to mall reciprocal is positive and statistically significant at the 1% level in both models. The center size variable, however, is no longer statistically significant in either of the trade area models. There are no same center agglomeration effects for minimum neighborhood center rents.

As was the case for minimum community center rents, the purchasing power variable is statistically significant at the 1% level in both models. The purchasing power variable is 0.009 in the one-mile trade area model and 0.003 in the two-mile trade area model. The percentage of households on public assistance variable is not statistically significant in either of the trade area models. Only one of the locational control variables, latitude in the one-mile trade area model, is statistically significant.

The image variables have a greater impact on minimum neighborhood rents than on maximum neighborhood center rents. Five image variables impact minimum center rents. The age variable coefficient is -0.014 in the one-mile trade area model and -0.015 in the two-mile trade area model, and is statistically significant at the 1% level in both models. The presence of a grocery chain as an anchor tenant is 0.074 in the one-mile trade area model and 0.066 in the two-mile trade area model, and is statistically significant at the 10% level. The presence of a grocery anchor increases a neighborhood center's rent generation capability for its less desirable space.

Having a L-shaped design also is associated with higher neighborhood center minimum rents as the L-shaped design variable is positive and statistically significant in both trade area models. While the image variables have little impact on the generation of maximum rents in neighborhoods, they are very important in the determination of minimum rents. The presence of a grocery anchor and an L-shaped design indicate higher minimum center rents. The grocery anchor generates a higher volume of shopping contacts and the L-shaped design is more convenient for shoppers.

The initial evaluation of the rent determinants for community and neighborhood retail centers confirms prior research and retail theory. Three important results not highlighted in prior research are found. First, a hierarchical retail space market is shown. Community centers benefit from proximity to other community centers and regional malls, but not to neighborhood centers. Neighborhood centers benefit from proximity to community centers and regional malls, but not to other neighborhood centers. Second, the importance of grocery anchors to the generation of rents is implied. Higher minimum rents in both community and neighborhood centers are associated with the presence of a grocery anchor. Finally, the presence of lower income households receiving public assistance within a community center's primary trade area has a significant negative impact on both maximum and minimum center rents. This implies that higher income households bypass the closest community center to shop in centers serving higher income consumers. While not the focus of this paper, this finding has potentially profound implications on urban renewal and community center redevelopment options. Higher income households with greater mobility than households on public assistance may simply re-orient their higher order shopping to other larger centers that may be farther away or closer to their place of employment.

Table 4. Chow test of differences between community and neighborhood centers.

Rent and property types combinations	Chow test statistic
One-mile primary trade area	
Log of minimum rent – community and neighborhood	1.559
Log of maximum rent – community and neighborhood	77.485***
Two-mile primary trade area	
Log of minimum rent – community and neighborhood	1.415
Log of maximum rent – community and neighborhood	78.883***

*** *Significant at the 1% level.*

Distinguishing Community and Neighborhood Center Property Types

Evidence of Community Center and Neighborhood Center Sub-markets

In order to statistically evaluate whether the rent determinants for community and neighborhoods centers differ, a number of Chow (1960) tests that allow for statistical comparisons of model coefficients are performed with the results presented in Table 4. The null hypothesis of the Chow test is that the coefficient vectors for community and neighborhood centers are equal. A single undifferentiated model combining both community and neighborhood center observations along with retail center property type specific models are generate and compared.

The Chow tests comparing models with both one-mile and two-mile primary trade areas for the log of minimum shopping center rent indicate that the community and neighborhood center property types are not distinct when modeling minimum rent. Neither the one-mile primary trade area model Chow test statistic of 1.559 nor the two-mile primary trade area Chow test statistic of 1.415 is statistically significant. With respect to the models of the log of maximum rent, however, both the one-mile primary trade area and two-mile primary trade area Chow test statistics of 77.485 and 78.883 are statistically significant at the 1% level. Retail center property types can be disaggregated, especially when evaluating the maximum rent a center can generate.

Evaluating Which Rent Generation Variables Differ

In order to evaluate which variables differentiate community and neighborhood centers a series of Tiao-Goldberger (1962) tests, which compare regression coefficient estimates, are generated.[8] The null hypothesis of the *F*-distributed Tiao-Goldberger test is that β_i (community) = β_i (neighborhood) for coefficient $i = 1$ to k. The results of these comparisons are provided in Table 5 and Table 6. The results in Table 5 are based on the minimum center rent models and the results in Table 6 are based on the maximum center rent models. Table 7 provides a summarization of the statistical significance of each variable in the rent models and highlights those variable coefficients that differ by center type.

Three of the variables in the minimum rent models have statistically distinguishable differences in their regression coefficient estimates. The vacancy rate coefficients for the neighborhood centers and the community centers are statistically different at the 1% level. On a relative basis the impact of existing vacant space has a substantially greater negative impact on neighborhood centers than for community centers which can be attributed to the smaller ultimate trade areas associated with neighborhood centers and an inability to substantially expand a neighborhood center's trade area. With respect to the purchasing power variable, a statistically significant difference in coefficients is manifested in the one-mile trade area model, but not in the two mile trade area model. This is indicative of a hierarchical retail model as neighborhood centers are more dependent on core trade area purchasing power than are community centers.

Table 5. Tiao-Goldberger test results for differences in minimum rental rate model variables.

Variables	One-mile primary trade area			Two-mile primary trade area		
	Community	Neighborhood	*F*-test statistic	Community	Neighborhood	*F*-test statistic
Intercept	5.698	-14.637	2.274	6.646	-14.710	2.581
Vacancy rate %	-0.010	-0.846	14.768***	-0.033	-0.862	15.727***
Multipurpose Shopping Variables						
Size (10,000s)	0.003	0.003	0.000	0.002	0.003	0.020
Community center competition (count)	0.014	0.052	1.627	0.014	0.045	1.144
Neighborhood center competition (count)	0.002	0.006	0.026	0.001	-0.001	0.014
Distance to mall (reciprocal)	0.019	0.020	0.006	0.017	0.018	0.004
One mile purchasing power ($10 millions)	0.004	0.010	4.650**			
Two mile purchasing power ($10 millions)				0.001	0.003	0.248
One mile % households on public assistance	-1.117	-0.781	0.121			
Two mile % households on public assistance				-1.042	-0.445	0.388
Longitude (1,000,000)	0.055	-0.124	1.343	0.062	-0.133	1.723
Latitude (1,000,000)	-0.004	0.187	1.393	-0.014	0.167	1.336
Image Variables						
Grocery anchor (1=yes)	0.074	0.037	0.346	0.042	0.066	0.155
Age	-0.003	-0.014	11.429***	-0.003	-0.015	14.576***
Access on major roads (count)	0.021	0.025	0.006	0.014	0.027	0.074
Left Turn lane (count)	0.003	0.066	1.249	-0.001	0.056	1.108
Renovated (1=yes)	0.025	0.006	0.046	0.028	0.020	0.010
U-shaped	-0.067	0.107	2.391	-0.062	0.105	2.401
L-shaped	0.001	0.081	1.741	-0.000	0.068	1.404
Other-shaped	0.042	-0.013	0.365	0.046	-0.013	0.464
Corner location (1=yes)	-0.050	0.012	0.916	-0.042	0.009	2.048
Non-traditional exterior (1=yes)	0.078	-0.262	2.459	0.073	-0.245	2.155

*** Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table 6. Tia-Goldberger test results for differences in maximum rental rate model variables.

Variables	One-mile primary trade area			Two-mile primary trade area		
	Community	Neighborhood	*F*-test statistic	Community	Neighborhood	*F*-test statistic
Intercept	14.003	-17.688	5.102**	16.246	-17.688	6.026**
Vacancy rate %	-0.060	-0.348	1.705	-0.121	-0.369	1.305
Multipurpose Shopping Variables						
Size (10,000s)	0.008	0.014	0.942	0.007	0.014	1.562
Community center competition (count)	0.040	0.050	0.108	0.040	0.043	0.007
Neighborhood center competition (count)	0.003	0.002	0.004	0.000	-0.005	0.090
Distance to mall (reciprocal)	0.055	0.015	3.218*	0.048	0.012	2.708
One mile purchasing power ($10 millions)	0.011	0.010	0.032			
Two mile purchasing power ($10 millions)				0.003	0.003	0.080
One mile % households on public assistance	-2.253	-0.322	3.912**			
Two mile % households on public assistance				-1.995	-0.200	3.367*
Longitude (1,000,000)	0.136	-0.131	2.881*	0.155	-0.143	3.705*
Latitude (1,000,000)	-0.004	0.261	2.592	-0.022	0.230	2.390
Image Variables						
Grocery anchor (1=yes)	0.085	0.163	0.163	0.101	0.051	0.609
Age	-0.008	-0.011	0.510	-0.008	-0.011	1.135
Access on major roads (count)	0.048	-0.015	1.604	0.031	0.015	0.880
Left Turn lane (count)	0.010	0.071	1.127	0.003	0.060	1.023
Renovated (1=yes)	0.063	0.022	0.221	0.071	0.037	0.166
U-shaped	-0.183	-0.022	1.964	-0.170	-0.022	1.730
L-shaped	0.005	0.039	0.393	0.003	0.026	0.150
Other-shaped	0.104	-0.032	0.603	0.115	0.032	0.845
Corner location (1=yes)	-0.121	-0.009	2.872*	-0.104	-0.012	2.048
Non-traditional exterior (1=yes)	0.197	-0.201	3.036*	0.185	-0.177	2.577

*** Significant at the 1% level. **Significant at the 5% level. *Significant at the 1-% level.

Table 7. Summary of rent determinants and differences by property type.

Variables	Statistically Significant Coefficients					
	One-mile primary trade area model			Two-mile primary trade area		
	Community	Neighborhood	Centers Differ	Community	Neighborhood	Centers Differ
Intercept	No	Yes	Yes	No	Yes	Yes
Vacancy rate %	No	Yes	Yes	No	Yes	Yes
Multipurpose Shopping Variables						
Size (10,000s)	Yes	Yes	No	Yes	Yes	No
Community center competition (count)	Yes	Yes	No	No	Yes	No
Neighborhood center competition (count)	No	No	No	No	No	No
Distance to mall (reciprocal)	Yes	Yes	Yes	Yes	Yes	No
One mile purchasing power ($10 millions)	Yes	Yes	Yes	NA	NA	NA
Two mile purchasing power ($10 millions)	NA	NA	NA	Yes	Yes	No
One mile % households on public assistance	Yes	No	Yes	NA	NA	NA
Two mile % households on public assistance	NA	NA	NA	Yes	No	No
Longitude (1,000,000)	No	Yes	Yes	No	Yes	Yes
Latitude (1,000,000)	No	Yes	No	No	Yes	No
Image Variables						
Grocery anchor (1=yes)	Yes	Yes	No	Yes	Yes	No
Age	Yes	Yes	Yes	Yes	Yes	Yes
Access on major roads (count)	No	No	No	No	No	No
Left Turn lane (count)	No	Yes	No	No	Yes	No
Renovated (1=yes)	No	No	No	No	No	No
U-shaped	Yes	No	No	Yes	No	No
L-shaped	No	Yes	No	No	Yes	No
Other-shaped	No	No	No	Yes	No	No
Corner location (1=yes)	Yes	No	Yes	Yes	No	No
Non-traditional exterior (1=yes)	No	Yes	Yes	No	No	No

The retailers located in neighborhood centers are limited in their capacity to extend their market for prospective shoppers. There is also likely some tenant self-selection with tenants requiring a larger trade area being drawn to the larger community centers. In both the one-mile and two-mile minimum rent models the age variables are statistically different at the 1% level with neighborhood centers evidencing greater magnitudes of depreciation as proxied by the age variable. This implies a higher depreciation and obsolescence cost for neighborhood centers than for community centers. When taken with the results from the maximum rent models where no differences are evident, these results indicate that neighborhood centers may be subject to greater variability in maintenance requirements and that changes in functionality may have a greater impact on this type of center.

The comparisons of the maximum center rent models found in Table 6 are extremely insightful. A total of six variables have coefficients that differ between the retail center property types. Only three of these variables, however, are statistically different in both models, the intercept term (at the 5% level), the percentage of households on public assistance (at the 5% and 10% levels) and the longitude control variable (at the 10% level). With regard to the intercept term, the community center intercept terms are positive while the neighborhood center intercept terms are negative. The statistically significant difference in intercept terms indicates that for maximum rents community centers are able to systematically generate higher rents than neighborhood centers as would be postulated under a hierarchical retail center model. The percentage of households on public assistance variables are negative in all models with the magnitudes of effect being greater and statistically significant for community centers. Community centers are more negatively affected by the presence of lower income households.

Higher income earners when shopping for higher order goods may not be willing to patronize centers surrounded by neighborhoods with a high concentration of households on public assistance. These relatively high income shoppers are more likely to shop at another, perhaps more distant, higher order retail center. They are less constrained than lower income shoppers in their retail center selection. The longitude location control variable partially captures overall market trends for the MSA and indicates that there is greater spatial variation for neighborhood centers. This should be expected given the smaller primary trade areas for neighborhood centers.

The three additional variables that differ between community and neighborhoods centers are the distance to mall (reciprocal to mall), corner location, and other exterior variables. These variables are only statistically different in the one-mile primary trade area model. While both community and neighborhood centers benefit by proximity to a mall, community centers generate a greater benefit. Because community centers sell more higher order goods relative to neighborhood centers community centers should obtain more benefit from proximity to a regional mall as shoppers take advantage of the agglomeration of higher tiered retailers adjacent to regional malls.

The congestion associated with having a corner location has a more negative impact on community centers than on neighborhood centers while having a non-traditional exterior benefits community centers, but not neighborhood centers. The exact composition of the non-traditional exteriors by property type, however, is not provided in the data which makes it difficult to fully interpret this variable. Finally, the lack of a statistically significant age variable in the maximum rent model comparisons, given the comparison results for the minimum rent models, implies that there may be differences in the management of the two center types and that the presence of two anchors may signal a better core trade market. Neighborhood centers may also have a different product life cycle with lower incentives on maintaining marginal space.

Community and neighborhood retail center property types can be disaggregated. Center maximum rents differ by retail property type. The results from the Tiao-Goldberger tests indicate that community centers have systematically higher base levels of rent than neighborhood centers. The magnitudes of variable effects for other center attributes, however, are generally similar across property type. The impact of the percentage of households on public assistance in a center's trade area is more pronounced for community centers. Higher income households are less willing to shop for higher order goods in areas with larger numbers of households on public assistance. This willingness to shop at a more distance community center creates additional hurdles for redevelopment and urban regeneration. These findings highlight an additional need to study the criteria shopping center investors use when making investment decisions with regard to initial development and redevelopment opportunities.

Conclusions

The determinants of neighborhood and community center rents include center specific image related characteristics, multipurpose shopping opportunities, and core trade area purchasing power. While the actual variables that determine center rents vary only slightly across property types, community and neighborhood center property types can be disaggregated into separate product types and a hierarchical retail space market can be confirmed. For maximum retail center rent, a series of Chow tests indicates that community centers can be differentiated from neighborhood centers. Further analysis shows that for maximum center rents community centers have systematically higher rental rates than neighborhood centers. Concurrently, the rent generating capacity of community centers is much more sensitive to the presence of households on public assistance in close proximity than is found in neighborhood centers. Higher income households, when shopping for higher order goods may not patronize centers surrounded by relatively high concentrations of households on public assistance. For neighborhood centers, which tend to provide lower order convenience goods and services, there is no statistically significant impact in rent generation based on the percentage of trade area households on public assistance. Neighborhood centers serve the needs of their core trade areas by providing lower order and convenience goods and do not need to extend their trade areas to distances required by community centers.

As has been found to be the case with other property types such as office, industrial, and apartments, the real estate market for retail space is too complicated to be modeled by simple aggregate models. This complexity points to additional research areas that need to be addressed within the broad retail property category inclusive of research on other retail property types, the interaction between retail property types, the interaction between retail property types and other real estate property types, and the performance of all retail property types temporally.

The study also highlights a need for additional research into the provision of quality retail opportunities for lower income households. When higher earning households are not willing to shop in areas with high concentrations of households on public assistance, retail investment above a provision for lower order and convenience goods will likely be minimal. Investors in community centers will favor strong core trade area demographics and locate new centers in higher income areas. This may limit higher order shopping opportunities for lower income households and constrain the redevelopment of some older community centers.

Notes

1. Neighborhood centers are generally defined by retail market participants as centers with one anchor, typically a grocery store, with additional in-line retail space. Community centers are defined as centers normally having two or more anchors, often including a grocery store anchor, with additional in-line retail space. The stereotypic neighborhood center would have a grocery chain anchor and in-line space while the stereotypic community center would have a grocery anchor, a discount store anchor, and in-line space. Variations on these typical configurations occur.

2. The image variables used are consistent with demand-externality variables that have been shown in prior research to be factors impacting non-anchor tenant rents.

3. The center primary trade area is defined as a one-mile radius. The two-mile radius results provide a more robust evaluation. Support for the use of these definitions comes from Vernor and Rabianski (1993), Gatzlaff, Sirmans, and Diskin (1994), and others.

4. In this model, OLS regression is used. This follows Hardin and Wolverton (2001) and allows for a cleaner evaluation of the differences in the variable effects being evaluated.

5. The Atlanta MSA can be considered typical of fast growing urban centers in the United States. While it is very likely that the results from this market are reflective of overall retail patterns, this can not be confirmed with certainty without additional studies of other urban centers. Additional confirmatory studies are warranted.

6. The actual White's test statistics and VIF factors are not shown to reduce the number and size of exhibits presented in the text.

7. The Wal-Mart SuperCenter concept is a prime example of a strategy of merging discount and grocery products under one anchor.

8. A prior example of an application of the Tiao-Goldberger test to real estate is found in Wolverton, Hardin, and Cheng (1999), including a delineation of the test statistic.

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