The Effect of Tax Laws and the Cost of Capital on the Size of Newly Constructed Strip Shopping Centers

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Abstract

While the impact of tax policy and other economic variables on the total amount of construction has been widely studied, this article proposes that these variables also affect the size distribution of the properties constructed. The basic intuition is that there is a lower bound to the economically feasible size of a project due to economies of scale in construction. Events favorable to construction, such as lower interest rates and more favorable tax treatment, relax this lower bound permitting the construction of smaller properties. This proposition is tested using data on newly constructed neighborhood shopping centers in Clark County, Nevada from 1971 to 1999.

Introduction

This study shows that several factors, including federal tax laws, have a significant impact on the size distribution of newly constructed retail shopping centers. For example, because there are economies of scale in construction, smaller properties may be economically feasible only when tax laws are favorable to real estate investment.[1] The impact of tax laws on average property size after controlling for the real cost of construction, the required rate of return and per capita sales is demonstrated. Similarly, these same factors may have an impact on the standard deviation and skewness of the size distribution. In the following section, a brief review of the literature is presented. In the following section, the theoretical model is presented. This is followed by a discussion of the data and empirical results. The last section is the conclusion.

Review of the Literature

Optimal Size

Much of the research surrounding retail shopping centers has focused on the effect of tenant mix and anchor tenants on rental revenues, and, therefore profit maximization.[2]

Little research has been done pertaining to the optimal size of commercial real estate properties. The exceptions are two studies by Gat (1995) and Colwell and Ebrahim (1997) that look at the optimal size of office buildings. In these studies, rent is assumed to be invariant to the size of the structure and, because office buildings tend to have multiple stories, an optimal size results from the fact that the construction cost per square foot increases with each additional story. Shopping centers, on the other hand, are nearly all one-story structures and, as a result, the construction cost per square foot decreases with size. The optimal size of shopping centers results from the assumption that at some point rental revenue per square foot must fall with additional size. The concavity of the rent function is explained below.

The result of the mainstream research has a common, well accepted theme: shopping center owners seek to achieve a tenant mix that is relatively heterogeneous and include an anchor tenant for overall drawing power. The heterogeneous mix attracts shoppers that have a desire for one-stop shopping and reduces cutthroat price competition. The anchor tenant draws customers from greater distances and provides the smaller tenants with additional customers. In turn, the smaller tenants will pay a higher rent.

West, Von Hohenbalken and Kroner (1985) show that not only is the tenant mix important but that a well-planned center optimizes the location of the tenants within the center. They show that a well-planned center includes a proper mix of tenants that restricts excessive replication of tenant type. Eppli (1991) and Eppli and Shilling (1993) empirically test the effects of anchor tenant size and image on the surrounding non-anchor tenants. Both studies show an increase in non-anchor tenant sales from the presence of high image anchor tenants. Furthermore, the increase in sales is prevalent for virtually every type of non-anchor tenant.[3] Brueckner (1993) developed a theoretical model of inter-store externalities. Given that the sales of a tenant are dependent not only on the space allocated to that tenant but also to the space allocated to other tenants, the shopping center owner can allocate space to various tenant types so as to maximize revenues. Benjamin, Boyle and Sirmans (1990) show that shopping center owners reduce the rent of anchor (and some non-anchor) tenants according to their ability to produce sales revenue to the "non-producing" tenants by drawing customers to the center.

The research on the demand externalities of tenant mix and on anchor tenant presence has implications for the optimal shopping center size. First, it is clear that very small shopping centers are not economically feasible. A shopping center comprised of only a few stores would not provide for sufficient tenant mix. And, of course, there would be no benefits from an anchor tenant. As the tenant mix increases so does the size of the center. The size of the center would also increase (discontinuously) with the addition of one or more anchor tenants. But, for obvious reasons, the property size would not increase indefinitely. First, shopping centers tend to restrict head-to-head competition. Once the appropriate mix has been attained, additional space would have to be allocated to competitors of other tenants. Second, the size of each tenant space is constrained by diminishing returns (sales per square foot decrease beyond an optimal size). Gerbich (1998) as well as Tay, Lau, Clement and Leung (1999) both show that the rent per square foot received by the property owner is negatively related to the size of the tenant space. To reinforce this point one need only to observe that even in very large cities the size of shopping centers does not increase without limit.

Tax Laws

Tax laws affect several aspects of commercial real estate. Brueggeman, Fisher and Stern (1981) show how tax laws affect the optimal holding period for commercial real estate. A theoretical piece by Fisher and Lentz (1986) shows that tax laws combined with assumptions regarding how interest rates interact with inflation affect the value of commercial real estate. Smith and Woodward (1996) demonstrate empirically that after considering regional economies and vacancy rates, the 1986 Tax Reform Act had a negative effect on the values of apartment properties. Later Smith, Woodward and Schulman (2000) show a similar negative effect (of the 1986 Act) on commercial office properties.

Lentz and Fisher (1989) demonstrate that the Tax Reform Act of 1986 affected the optimal organizational structure (corporation vs. partnership) in which to hold real estate.

Liang, McIntosh and Webb (1995) report that the riskiness of real estate investment trusts (REITs) (in terms of their return generating processes) shifted significantly around the dates of major tax legislation (1976, 1981, 1986). Sanger, Sirmans and Turnbull (1990) found that *proposed* tax changes had significant effects on the returns to publicly traded real estate firms.

Thus, theoretically and empirically, it is clear that federal tax laws can affect many attributes of commercial real estate. To date, however, there has been no research regarding how tax laws may affect the optimal size of real estate properties. This study suggests that favorable tax laws will allow for smaller than otherwise properties to be constructed. This hypothesis is tested below.

A Model of Shopping Center Size

The model of shopping center size is a hedonic pricing model, in which the size of the site is the characteristic analyzed. In such models, equilibrium is characterized by offer curves, reflecting the supply of retail space, and by bid curves reflecting demand. The bid-rent curves are modeled as resulting from the behavior of retailers or groups of retailers who rent the space as an input for their operations. Thus, the bid-rent curve represents a derived demand for retail space. The suppliers of this space are modeled as builder-owners who first construct the establishment and then operate it. The minimum before-tax rent these builder-owners require (the offer curve) depends on factors including the cost of construction, required return and the tax-treatment of ownership. The offer and bid curves are expressed in per square-footage terms and define a basic static model. Changes in exogenous variables then create a dynamic version of the model with predictions concerning changes in the range of optimal sizes.

Supply—Offer Curves

The basic premise is that there are economies of scale in building retail shopping facilities. This is due to the fixed costs of developing a site as well as the geometric fact that the perimeter (of a square) increases in proportion to the length of its side while its area increases with the square of a side. Usable area is related to the area whereas building costs depend more on the length of the wall. Thus, the cost per square foot at which builders are able to provide new retail space declines with the square footage of the property. Per square footage costs do not decline to zero however, but rather asymptotically approach a minimum value.

Although the proposition that the cost per square foot declines with size seems apparent, nonetheless empirical support was found for this relationship. The real sales price (sales price restated in 1999 dollars) of 280 neighborhood shopping centers sold between 1990 and 1999 in Clark County, Nevada was examined. Assuming that in long run equilibrium the transaction price approaches the cost of construction, the real price per square foot was regressed against the size of the property (and lot size). The resulting equation was:

$$RPSQFT = \underset{(5.03)^{***}}{-.0185\, SQFT} + \underset{(6.94)^{***}}{3490589\, SQFT^{-1}} + \underset{(9.72)^{***}}{.0029\, LOT} \quad (1)$$

Adj. $R^2 = .3163$ F-Statistic $= 63.914^{***}$

t-Statistics in parenthesis, ***Significant at the .01 level.

The results suggest that, over the relevant range, the price per square foot is significantly related to the size of the property and that the price per square foot declines with size.

Next, it is assumed that in a competitive construction industry in which all builders have access to the same technology, competition among builders will force the cost of the retail property down to the costs of construction. The result is a builders' offer price curve reflecting the economies of scale:

$$P = F(q, x), \tag{2}$$

Where: $F_q < 0$.

Here: p = Cash flow per square foot;
q = Total square foot; and
x = Other relevant variables (*e.g.*, construction costs).

In the inequality, the subscript denotes the partial derivative of the function, F, with respect to the argument q. Thus, this condition indicates that the builder's average cost, F, declines with the size of the property; that is to say, there are economies of scale in construction.

Demand—Bid-Rent Function

Retail properties observed in an urban area serve a variety of functions. Large malls attract customers intent on a major shopping expedition from throughout the region. Other, smaller, properties will be more convenience oriented providing items that consumers may prefer to acquire more frequently and on shorter trips nearer to their home. Still others, such as super-category stores or warehouse stores may lie somewhere in between. For any given location there exists some value-maximizing combination of retail activities. Furthermore, the precise nature and combinations of retail activities may vary widely by location. In this study, the concern is not so much of explaining why certain retail mixes occur but rather that the ultimate size of the property that can be affected by such factors as the tax laws.

As indicated in the literature review, it is well recognized that tenant mix and the existence of anchor tenants is important to the economic success of a retail property. Both factors tend to provide an incentive for larger properties. This study treats the problem of space allocation and contracting among the tenants as being solved in the sense that the collection of retailing activities is treated as being carried out by a single retail ''renter.'' For multiple-user sites, the bid-rent function of this ''renter'' is viewed as the total rent generated when the site is optimally allocated to retail tenants according to optimally specified rent contracts. In effect, the analysis treats the allocation and incentive problem as being internalized by a single retailing entity, rather than being coordinated by the property owner through rental contracts. Absorbing the allocation and contract problems into the bid-rent function considerably simplifies the exposition.

Thus, the renter in this model represents the retail activity or combination of retail activities carried out at a given property location. As with the case of builders, it is assumed that competition among property operators eliminates any economic profit to them.

The bid-rent function for any individual type of retailer for space at a particular location can be derived as follows. Given the technology of this type of retailing a ''restricted profit function,'' Varian (1978:8) defines profit as a function of the prices of all other inputs (except retail space) and outputs and the amount of retail space used.

$$\pi^i(q, w, z), \tag{3}$$

Where:

π^i = Profit for retailer type i;
q = Total square feet;
w = The vector of input and output prices; and
z = Other relevant variables.

In general, the other types of relevant variables might include the characteristics of location (traffic flow, for example) or characteristics of the retailer (product/service, sales staff). The function presumes an optimal use of the space including the number of retailers at the location and possibly anchor tenant(s).

Since restricted profit is the profit a renter of this type could earn using a retail site, this function represents the maximum bid for the property, the derived demand for its use. For consistency with the rest of the model, this bid-rent function is more conveniently expressed in terms of the rent per square foot:

$$R^i(q) = \pi^i(q)/q, \tag{4}$$

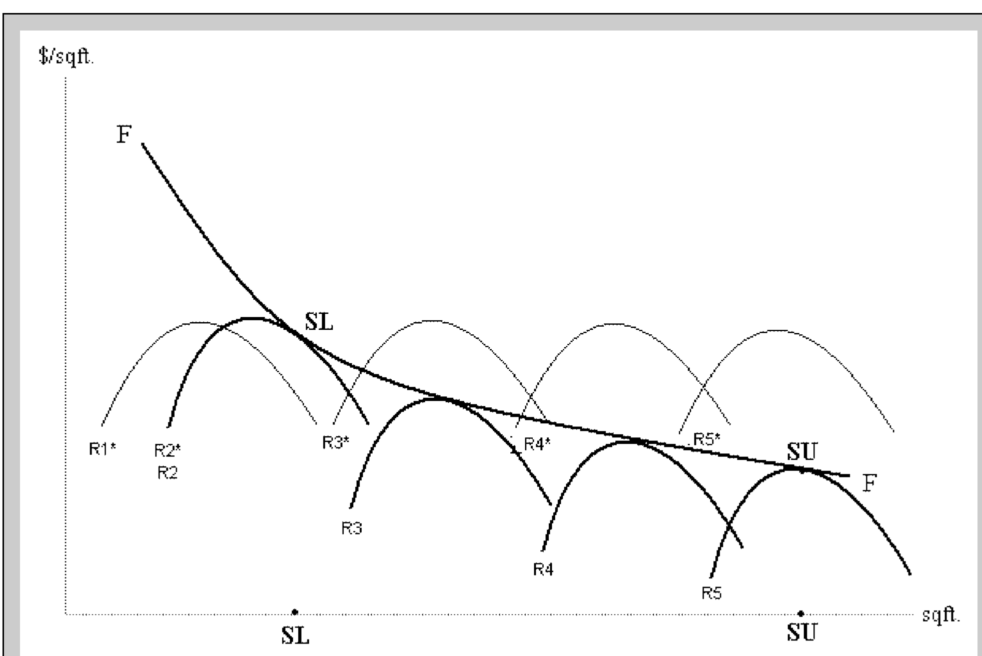
Where R^i denotes the bid-rent function for a renter of type i, and the vectors of price and control variables for economy of notation are surpressed.

This bid-rent function initially increases in q, has an internal maximum and ultimately begins to decline (see Gerbich, 1998; and Tay et al. 1999) so that: ($R^i_q(0) > 0$, $R^i_{qq} < 0$, where subscripts again denote first and second partial derivatives). These results are intuitive as well: a miniscule space generates no profit so that initially increasing the size adds to profit. However, given a finite customer flow past a given location at some point adding space reduces the profit *per square foot*.

Market Equilibrium

The interaction of the builders' offer price curve and the renter's bid-rent function determine the equilibrium price per square foot of properties of various sizes. It also determines whether a property of a given size will be built at all. Exhibit 1 illustrates an equilibrium in this market. The curves R^1 to R^5 represent bid-rent functions for five distinct types of renters. Each has the inverted U-shape described above. Those indexed with smaller numbers, represent uses for which a relatively small size is optimal, perhaps one or a few tenants drawing a limited number of customers. Those curves with larger indices indicate uses for which a larger space is optimal, such as a large mall drawing from most of the region. The five curves drawn are purely representative, in practice one would expect a very large number of bid-rent curves interspersed between these, reflecting the wide variety of potential uses for retail space. The profits to a renter of any type, and thus the location of the associated bid-rent function, depend on the degree of competition from similar operations, because, all else equal, an increase in competition reduces the flow of customers to the site. Because of the nature of spatial competition (customers seek out the nearest location providing the service they desire, but only if its net value exceeds travel costs), there is some maximum profit attainable even in the absence of competition. Associated with this is a maximum bid-rent

Exhibit 1 | Bid-rent Functions for Five Distinct Types of Renters



function. The maximum bid-rent functions for the various types of renters are denoted by the curves R^{i*} in Exhibit 1.

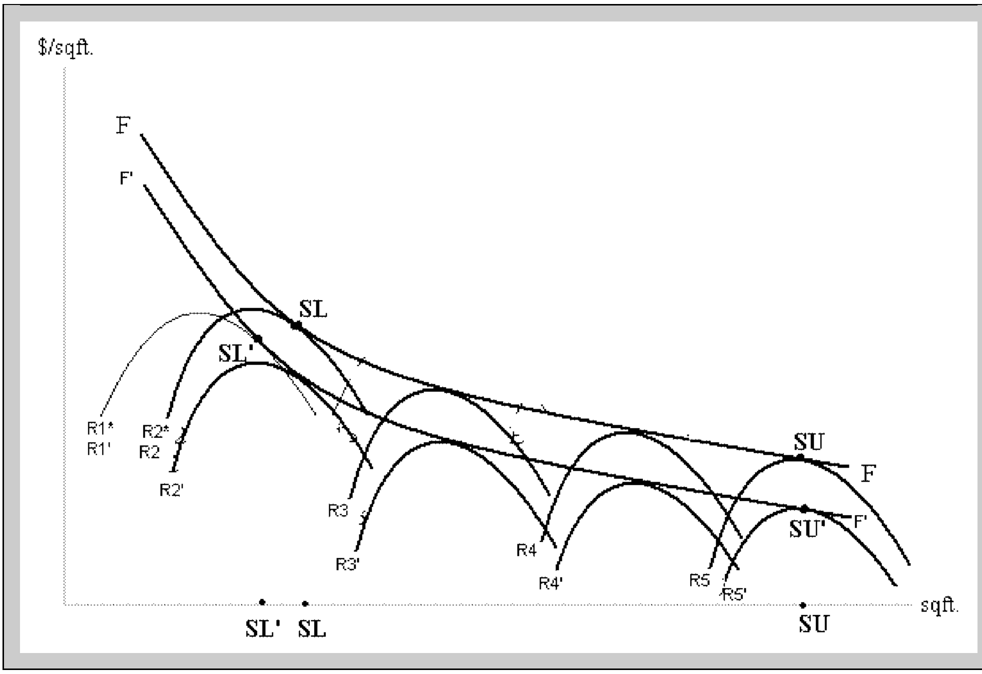
The curve FF in Exhibit 1 denotes the builder's offer curve, Equation (1), the minimum payment per square foot required. As indicated in the discussion of that equation, it declines (and reaches a minimum) with size because of economies in construction. Its position depends on the overall cost of construction, the required rate of return and tax provisions affecting owners of property. In order to analyze conveniently the impact of tax code changes along with these other factors, the offer and bid curves are defined in terms of before-tax dollars. Thus, the offer curve would be shifted down by any event making construction more advantageous: reduced construction costs, lower interest rates or more favorable tax treatment.

As depicted in Exhibit 1, many of the no-competition bid-rent curves, R^{i*}, lie above the offer curve. This means that builders would find it profitable to provide retail space of a size appropriate for those types of renters. As building occurs, activities of this type became more competitive and less profitable, shifting down the bid-rent functions for this type of renter. This process of building continues until the incentive to enter these kinds of activities has been eliminated, that is to say until the bid for a location of the optimal size just equals the builders' required payment. This is the equilibrium depicted in Exhibit 1. For the uses favoring larger locations, entry has occurred until the bid-rent curves have shifted downward to the point of tangency. The upper limit of the size distribution, SU, is determined by the location of the rightmost bid-rent function. Presumably, this reflects demand from the largest scale mall the region is able to support. As discussed, its size is limited by the regional population and technical considerations discussed previously. However, at the lower end of the distribution, some types of renters, specifically those indexed by 1, do not rent space and no space is built for them. The maximum they are willing to pay, even absent competition, is less than the minimum required by builders to provide the space. In effect, economies of scale in construction mean that there is some minimum size below which it is not economical to build. Thus, the lower bound of the size distribution, SL, is determined by that type of user that can just pay for a space of the appropriate size. In Exhibit 1, these are renters of type 2. For this marginal renter type, the bid-rent of a renter not exposed to competition just suffices to pay for the space desired. Renters with an index less than two are not accommodated. Those with indices greater than two, indicated by the bid-rent curves R^2 through R^5 enter until a tangency results. Retail sites ranging in size from SL to SU are observed.

Comparative Statics

Exhibit 2 shows how any change in conditions that favors construction affects this size distribution. The original equilibrium from Exhibit 1 is represented by the builders' offer curve, FF, the post-entry bid-rent curves for renter types seeking larger establishments, R^2 to R^5, the maximum (no competition) bid-rent curve from

Exhibit 2 | Conditions that Favor Construction Affect Size Distribution



renter types seeking smaller locations, such as R[1]*, and the resulting size distribution SL to SU. Any event that favors the construction or ownership of retail property, including reduced construction costs, lower interest rates and more favorable tax treatment, will result in the willingness of builders to provide space at a lower before-tax cost per square foot. This is reflected in the downward shift of the builders' offer curve to F'F'.

As a result of this shift, builders now find it attractive to provide more locations to types of renters already in operation (types indexed 2 through 5). Entry into these activities increases competition, reducing bid-rents until equilibrium is restored with bid-rent functions R2' through R5'. If the shift of these curves is approximately vertical, there will not be significant changes in the size of property desired by each renter type. However, the downward shift of the builder's offer curve has one additional effect. Some renter types, who were previously excluded from the market, are now able to obtain space. These are renters such as type one, who desired smaller spaces. As a result of the shift in the offer curve, builders are now willing to provide space to such renters. The marginal renter type shifts to the left, and the lower bound of the size distribution shifts from SL to SL'. In essence, the lower construction cost or more favorable treatment of ownership relaxes the lower bound imposed by economies of scale. More favorable treatment results in an increase in construction of all types, but a greater than proportional increase occurs in the range of smaller properties because of this effect.

In the next section, this prediction is tested by examining the impact of such variables on the first three moments of the size distribution of newly constructed shopping centers (average, standard deviation and skewness). Specifically, since any change favoring construction implies a disproportionate increase in smaller properties built, such changes should reduce the average size of new properties. To predict the effect on the standard deviation, note that the distribution of construction projects is skewed (has positive skewness). That is, there are a relatively large number of smaller projects concentrated near the left end of the distribution, with relatively fewer large projects scattered out into the right tail. The mean lies toward the more densely populated lower end. Since a construction-favoring event disproportionately increases the number of small projects (those closer to the mean), its effect will be to reduce the standard deviation. It will also increase the skewness of the distribution. (It will lean to the left more than before.) To summarize: any change that makes construction more attractive is predicted to decrease the mean, decrease the standard deviation and increase the skewness of the size distribution of newly constructed properties.

Data and Empirical Results

The specification is a reduced form equation containing variables affecting the attractiveness of construction:

$$DESC_t = \alpha + \beta_1 PRIME_t + \beta_2 COST_t + \beta_3 PCSALES_t + \beta_4 TAX_t + e_t. \quad (5)$$

Where:

$DESC_t$ = A description of the size distribution (average, standard deviation or skewness) in square feet of new retail shopping properties constructed in year t.

$PRIME_t$ = The prime rate in year t is used as proxy for the required return on retail properties. Since interest rates tend to move in a synchronous fashion changes in the prime rate should reflect changes in the required rate of return.

$COST_t$ = The real cost of construction in year t.

$PCSALES_t$ = Per capita sales in year t. As per capita sales increase, so should the profitability per square foot of retail space and thus the bid-rent function of retailers. Note this differs from an increase in sales resulting from an increase in population inasmuch as the latter would require the number of retail outlets to expand in proportion to the population.[4]

TAX_t = Federal tax law regarding the capital gains rate or first-year depreciation allowance in year t.
e_t = Statistical error term.

Data

Annual data is from 1971 through 1999. Variable definitions appear in Exhibit 3. Descriptive statistics are given in Exhibit 4.

Some observations should be made about the data. First, Clark County, Nevada is uniquely well suited to study the behavior of new construction. Because of its rapid growth over the last few decades, numerous shopping properties have been added to the stock each year. In 1971, the population of the county was 293,000 and in 1999, it was 1,343,540. In 1971, there were 108 neighborhood shopping centers in Clark County. By 1999, there were 1,022 such centers. In addition, Clark County is an isolated local economy. This fact reduces the problem of confounding data across local economies.

Exhibit 3 | Definitions of Variables

Size
Data on the size in square feet of all retail shopping properties constructed each year in Clark County, Nevada were obtained from the Clark County Assessor's office.

Prime
The prime rate for each year was obtained from the Federal Reserve System data.

Cost
The real cost of construction was obtained by taking the construction cost index as reported in *Engineering News Record* and dividing by the CPI.

PCSales = Sales/Population

Pop
The population of Clark County.

Sales
Total sales are provided by the State of Nevada and are based on sales tax receipts.

Tax
Two alternative measures of the effect of tax laws on property size are used: Capital Gains Rate, which is the maximum capital gains tax rate, and First-Year Depreciation, which is the amount of depreciation (as a percent) allowed in the first year. For example, currently retail properties must be depreciated on a straight-line basis over thirty-nine years so that the first-year depreciation is 2.56%.

Exhibit 4 | Selected Descriptive Statistics

Year	Total Shopping Centers	Average Size of New Properties	Capital Gains Rate (%)	First-Year Depreciation (%)	Prime Rate (%)	Real Construction Cost Index	Per Capita Sales ($)
1971	108		39	6.66	5.73	39.04	3,389
1972	114	10,704	45	6.66	5.25	41.94	3,773
1973	126	18,480	45	6.66	8.03	42.68	4,342
1974	140	18,306	45	6.66	10.81	40.97	4,512
1975	155	19,830	45	6.66	7.86	41.11	4,958
1976	177	15,398	49	6.66	6.84	42.20	5,434
1977	193	11,497	49	6.66	6.83	41.93	6,253
1978	229	14,412	48	6.66	9.06	42.22	7,049
1979	267	17,158	28	6.66	12.67	41.10	7,487
1980	305	17,646	28	6.66	15.26	38.81	7,184
1981	321	38,671	24	11.66	18.87	34.46	7,399
1982	329	12,546	20	11.66	14.85	39.53	7,048
1983	341	20,372	20	11.66	10.79	40.89	7,236
1984	352	9,822	20	9.70	12.04	40.05	7,624
1985	388	13,488	20	9.70	9.93	39.04	8,088
1986	422	20,065	20	9.20	8.33	39.26	8,671
1987	501	19,206	28	3.17	8.21	38.62	9,199
1988	567	21,037	33	3.18	9.32	38.25	9,691
1989	617	22,701	33	3.17	10.87	37.09	10,695

Exhibit 4 | (continued)

Selected Descriptive Statistics

Year	Total Shopping Centers	Average Size of New Properties	Capital Gains Rate (%)	First-Year Depreciation (%)	Prime Rate (%)	Real Construction Cost Index	Per Capita Sales ($)
1990	656	12,684	28	3.17	10.01	36.21	11,125
1991	717	33,497	28	3.17	8.46	35.37	10,105
1992	754	19,266	28	2.56	6.25	35.45	10,178
1993	789	18,665	28	2.56	6.00	36.40	11,130
1994	810	19,682	28	2.56	7.15	36.49	12,460
1995	829	23,865	28	2.56	8.83	35.64	13,071
1996	861	28,640	28	2.56	8.27	35.67	14,160
1997	906	17,163	28	2.56	8.44	36.51	14,336
1998	965	15,563	20	2.56	8.35	36.16	14,852
1999	1,022	14,363	20	2.56	8.00	36.25	15,272
Mean		18,740	31.1	5.74	9.35	38.74	8,853
Minimum		9,822	20.2	2.56	5.25	35.37	3,389
Maximum		38,671	49.0	11.66	18.87	42.68	15,272
Std. Dev.		6,475	10.0	3.11	3.06	2.41	3,436

It may also be useful to clarify which types of properties are included in the data. The Clark County Assessors Office distinguishes three types of retail properties:

- **Regional shopping centers:** Large centers containing many varied retail shops and stores that caters to buyers from all areas (Contains at least three major stores).
- **Neighborhood shopping centers:** Similar to shopping centers but contains fewer retail outlets and cater primarily to local residents.
- **Retail stores and shops:** Department stores dealing in a full line of merchandise, drug stores, food and meat markets, specialty shops, shoe and wearing apparel shops, and hardware stores.

Regional shopping centers are excluded because the focus is primarily an examination of the impact of economic events on smaller properties. During the sample period, the size of ''retail stores and shops'' was influenced by nationwide trends in retailing (for example, the emergence of ''category killer'' stores and discounters), which were not modeled. For these reasons, only data on neighborhood shopping centers are used. This approach excludes observations likely to be driven by forces other than those modeled here, but includes a wide range of data. (The definition of this category tends to be very broadly construed—verbal communication.) The average size of neighborhood centers was 18,740 square feet. The smallest average size added in any one year was 9,822 while the largest average size was 38,671.

The real construction cost index can be understood as the ratio of a price index of goods and services used in construction (specifically the *Engineering News Record* construction cost index) to a general price index (the CPI). This quantifies the extent to which construction has become more or less expensive relative to the overall price level.

The data exhibit substantial variation, both with respect to tax policy and the economic environment. For example, first-year depreciation is most favorable

Exhibit 5 | Predicted Effect of Changes in Independent Variables on Characteristic of the Size Distribution of Shopping Centers

	Average	Std. Dev.	Skewness
Prime rate	+	+	−
Real cost of construction	+	+	−
Pre capita sales	−	−	+
Capital gains rate	+	+	−
First-year depreciation	−	−	+

Exhibit 6 | Empirical Results

Variable	Average Size		Std. Dev.		Skewness	
Constant	107,347	76,848	332,062	335,100	10.11	24.58
	(6.26)***	(3.02)***	(5.82)***	(5.33)***	(1.26)	(3.11)***
Prime	1,173.47	1,089.94	1,260.70	564.52	−0.240	−0.332
	(5.10)***	(3.74)***	(2.37)**	(0.74)	(2.24)**	(2.68)**
Cost	−2,614.63	−1,440.77	−8,064.65	−7,617.93	0.105	−0.448
	(6.36)***	(2.57)**	(5.68)***	(5.14)***	(0.543)	(2.57)**
Per capita sales	−0.674	−0.904	−2.772	−4.140	−0.0002	−0.00004
	(2.19)**	(2.12)**	(3.15)***	(3.74)***	(1.31)	(0.287)
Capital gains rate	25,383		52,649		11.38	
	(4.02)***		(2.58)**		(3.85)***	
First-year depreciation		−759.14		−794.42		0.520
		(2.04)*		(0.856)		(3.95)***
Adj. R^2	0.6431	0.674	0.760	0.445	0.869	0.867
Durbin-Watson stat	2.039	1.855	1.864	2.034	1.686	1.578
F-Statistic	10.73***	12.17***	18.05***	5.33***	36.97***	36.18***

Notes: Dependent variable: average size, standard deviation and skewness of neighborhood shopping centers constructed: 1972–1999. The model was estimated assuming a first-order moving average error structure because of correlation in the uncorrected residuals. Inspection of the correlation coefficients among the independent variables indicates there was no multicollinearity. Also, a standard White test for heteroscedasticity indicate this was not a problem.

during the period 1981 to 1986. The capital gains rate is most favorable during almost the same period 1982 to 1986. However, interest rates are at their highest during the period from 1978 to 1985, which includes the period of favorable tax policy. Given the conflicting forces at work, multiple-regression analysis was used to examine the impact of each variable.

Empirical Results

Of the variables included in the regression, increases in the prime rate, real construction costs and the capital gains tax rate would be considered to be unfavorable for construction. As discussed, each would be predicted to increase the mean and standard deviation, but decrease the skewness of the size distribution. Conversely, increases in per capita sales or first year depreciation favor construction. They should have the opposite effects.

Exhibit 5 summarizes the predictions of the model, while Exhibit 6 shows the actual empirical results.

Of the variables for which an increase is unfavorable to construction, the prime rate and capital gains rate behave as predicted. Mean and standard deviation increase, while skewness decreases. The variables for which an increase is favorable to construction, per capita consumption and first year depreciation have the predicted signs, although only three of the six coefficients are significant.

The construction cost coefficients behave differently. Because increased cost would be thought to reduce construction, its coefficients were predicted to have the same signs as those of the prime rate and capital gains rate. The negative and significant statistic in one specification of the skewness regression is consistent with this prediction. However, the regressions of the average and standard deviation display coefficients with the opposite sign to that predicted. One possible explanation could be a simultaneity problem. The theory asserts that exogenous events favorable to construction will tend to have a stronger impact on smaller sites, reducing average size. However, the same events will lead to a general increase in construction, and thus—if they are demand side events—also to higher construction costs. The result could be a negative relation between size and building costs as observed here. While consistent with the results reported here, verification of this explanation would require further investigation.

In general the results are supportive of the proposition that factors favoring construction—including favorable tax laws—affect the size of construction undertaken. The basic idea is that these favorable conditions partially overcome the economies of scale characterizing construction to permit smaller projects to be constructed.

The effect of tax laws and other economic factors on the total amount of construction has been well documented. The findings indicate that these factors influence the size distribution of construction as well.

Conclusion

The empirical results confirm that the factors that affect the attractiveness of construction do have a significant impact on the size distribution of retail properties. The average (mean), standard deviation and skewness are all affected. The factors that affect the size distribution include the tax laws. One definite conclusion is that favorable tax laws encourage the construction of smaller properties that may otherwise not be completed. Smaller parcels that would otherwise not accommodate an economically feasible retail establishment are, in fact, feasible with sufficiently favorable tax laws. Thus, it is possible to establish that economic forces influence the size of retail shopping centers. This result should be of interest to private developers, urban planners or anyone else with an interest in projecting patterns of land use.

Endnotes

[1] Tax laws that are favorable to real estate investment include: lower income tax rates, allowance for capital gains treatment and at low marginal rates, and allowance for a greater amount of depreciation in the early years of the property's life.

[2] Those interested in a comprehensive review of the literature can reference Eppli and Benjamin (1994).

[3] The implication of this sales effect is, of course, that the shopping center owner can charge higher rent from the non-anchor tenants.

[4] The regressions were also run using various price indices to deflate per capita expenditure. In all cases, they reduced the fit of the model.

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