The Management of Positive Inter-Store Externalities in Shopping Centres: Some Empirical Evidence

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I. Introduction

Positive inter-store externalities, sometimes termed as demand externalities (Eppli and Benjamin 1994), are the positive effects generated from one or more tenant(s) to other tenant(s) without consent and compensation between the generator and receiver. In previous research, demand externalities were usually seen as the synonym of customer-spillover effects generated from anchor tenants (Gatzlaff, et al. 1994; Pashigian and Gould 1998). These demand externalities have been recognized as significant agglomeration economies that generate increased returns in shopping centres. However, agglomeration economies in shopping centres could be more than just the spillover of customer drawing power of the anchor tenants. Under a wider definition of positive inter-store externalities, these inter-store effects should have a broader content including compatibility and complementarity among tenants, enhancement of the shopping atmosphere and resulting sales efforts, shopper circulation and the public services and facilities provided by the shopping centre. These positive interactive effects are the sources generating increasing returns (Fujita and Thisse 2002).

Consequently, one of the most critical objectives in shopping centre management is to maximize these positive inter-store externalities in order to achieve the highest profits and investment returns possible. Although we know a well-managed shopping environment should be able to enhance or improve these external benefits, the question is how to internalise or manage these inter-store externalities. Three basic solutions for externalities provided by economic theories are Pigouvian tax/subsidy, Coase Theorem and regulation through government intervention. In practice, almost all management and internalising devices are designed under these three basic solutions. Management and internalisation processes are accomplished through the distribution of obligations and resources among tenants, such as rents, service charges, leasing incentives and other non-monetary obligations and regulations.

As a result, the most significant information needed to internalise or manage positive inter-store externalities is to find the dominant factors producing these benefits: what are the strongest positive inter-store externalities generator?. In this research, we try to look for the meaning of "strong" tenants and observe the internalising process through empirical study. In the empirical analysis, we examine regional shopping centres in the UK for both performance and characteristics information. In total, 148 regional shopping centres with a size above 27,870 square metres (300,000 sq ft) are collected. The major objective in the empirical study is to test for the impact of "strong" tenants base on three characteristics a) size of tenant, b) strength of chain stores and c) the top retailers in each retail/service categories. Some additional results are obtained for other regional and shopping centre characteristics variables, results that seem consistent with prior reasons on both shopping behaviour and urban land values.

II. Agglomeration economies and inter-store externalities-a review

Retail agglomeration

Retail and commercial service stores cluster together in certain streets or areas. For example, in London, Oxford Street has a cluster of major department stores and most of the major bookstores in the UK can be found in Charing Cross Road. This trend in retail store clustering must be motivated by some incentive or advantage for those stores agglomerating together. In retail location theory, Nelson (1958) was the first to illustrate that the agglomeration of retail activities is based on the theory of cumulative attraction and the principal of compatibility. In his research, the theory of cumulative attraction states that "a *given number of stores dealing in the same merchandise will do more business if they are located adjacent or in proximity to each other than if they are widely scattered" (Nelson 1958, p58).*

Retail store spatial affinities were also observed by Getis and Getis, (1976). In their research they suggested that retail store spatial affinities are based on three location theories; the theory of land use and land value, central place theory and the theory of tertiary activity. After examining retail stores in the CBDs of a sample of cities in the US, they confirmed that retail store spatial affinities do exist and are matched with notions from central place theory (Getis and Getis 1976). Among these location theories, Christaller's central place theory, which established the hierarchy of retail activities, and Hotelling's principle of minimum differentiation in homogeneous agglomeration of retailers are known the two location theories supporting this phenomenon (Eppli and Benjamin 1994). All the above theories relating to store clustering give us some hints concerning the agglomeration of retail stores; whether they are homogeneous or heterogeneous, whether they generate some kind of collective or inter-store advantages and whether these consequently increase transaction opportunities and store profits.

Nevertheless, these theories are not in themselves sufficient to reveal the precise forces determining micro-scale store location or how the interaction between these clustering stores influence each other. There are still two questions to be addressed. The first question concerns the inter-store advantages generated by agglomeration. The second question concerns whether it is possible to enhance or manage any positive inter-store effects so as to achieve higher collective benefits for all stores. The shopping centre or mall is as extreme good case study to pursue these questions of agglomeration economies.

Positive inter-store externalities

The shopping centre or mall is the agglomeration of selected multiple retailers and commercial service providers within a well planed, designed and managed building or a group of buildings as a unit (Urban Land Institution 1999; ICSC 2002). Within the shopping centre, tenants are able to receive mutual benefits, not only from other individual stores but also from the collective advantages of the whole shopping centre. For instance, small tenants depend on the strong customer drawing power generated by anchor stores and the "spill-over" of their customers to these smaller tenants (Benjamin, et al. 1992; Brueckner 1993; Gatzlaff, et al. 1994; Miceli, et al. 1998; Pashigian and Gould 1998). At the same time, the mixture of small tenants provide variety and supportive services for the whole centre (Wakefield and Baker 1998).

Under this mixture of tenants, strong brand name retailers and other popular stores spillover their sales efforts to other tenants (Miceli and Sirman 1995), establishing the positive image of the centre. Moreover, agglomeration generates positive shopping "atmospheres" (Burns and Warren 1995; Wakefield and Baker 1998; Bone and Ellen 1999) and saves customers' time in searching for and acquiring the goods and services they desire (Kaufman and Lane 1996). Furthermore, the tenants also share their obligations in the provision of quality public services and facilities (Corns and Sandler 1986; Oppewal and Timmermans 1999), which would not be available if they were scattered as single-freestanding stores. By sharing the total costs of the public services and facilities, these tenants obtain the collective benefits of higher quantity and quality of services and facilities so as to be able to draw and serve more customers in a shopping centre.

All of the above positive interactive effects, i.e. the positive inter-store externalities, form the centre's synergy (Nelson 1958; Anikeeff 1996) and generate increasing returns from economies of scale/scope (Goldstein and Gronberg 1984; Fujita 1989; Fujita and Thisse 2002) within the shopping centre. This synergy increases the interchange of customer footfall among stores and also raises operational performance, namely the turnover, profits and rental value of each tenant. Positive inter-store externalities are, therefore, favourable interactive effects generated from one store which spillover to other store(s) without the consent between generators and receivers or the receipt of proper compensation or subsidy (Meade 1952; Brueckner 1993; Papandreou 1994). The receivers of these positive effects are therefore "free riders" or "easy riders" (Corns and Sandler 1984) on the effect generators.

This implies an inefficient condition between these two parties because of unbalanced rights and obligations. The existence of inefficiency[1] is a harmful situation in the system, as the generators do not have any obligation to provide those positive externalities to the free riders. Accordingly, without any incentive or compensation, the generators will not maintain or enhance their ability to generate positive effects for others. However, despite these positive inter-store externalities being only a "by-product" to the generators, they are essential resources for those stores receiving benefits and for the centre as a whole. Consequently, maintaining and enhancing these positive inter-store externalities becomes one of the most crucial tasks for shopping centre management.

[1] The efficient condition equates to "Pareto optimality".

Unlike negative inter-store externalities, which directly damage the utility functions of the "victim" tenants[2], the influences of positive inter-store externalities are more crucial in establishing the value of the shopping centre. The main objective for tenants agglomerated in a shopping centre is to maximize their operational income and total profits. Hence positive inter-store externalities form the centre synergy in helping individual store operations are most significant effects to the tenants. Lack of centre synergy means lack of transaction opportunities and that damage may be as great as negative inter-store effects. Since centre synergy comes from positive inter-store externalities, the purpose in managing them is not only to internalise these externalities but also to maintain or increase the strength of these positive inter-store forces.

Internalisation and managerial solutions

Consequently, how should management seek to internalise or manage these inter-store externalities is the next issue. Three basic solutions to externalities provided by economic theories are a) Pigouvian tax/subsidy, b) Coase Theorem and c) constraint regulations through government intervention (Whitcomb 1972; Baumol and Oates 1975; Miyao and Kanemoto 1987). The Pigouvian tax/subsidy approach directly implies a tax/subsidy mechanism between the effect generators and receivers. Under this internalisation process, the benefit receivers should pay a "tax" which is equal to the amount of benefits received from the generators in subsidizing the beneficial production[3]. Coase theorem asserts that by clearly delineated the property rights of the externalities, the efficiency condition (Pareto Optimal) between the effect receivers and generators can be achieved by negotiation. However, high transaction costs usually become an obstacle to internalising externalities through these two approaches. Under such a circumstance, rules or regulations set and implemented by government or a third party become the best and most feasible way to manage externalities.

In practice, almost all internalisation and management devices are designed within these three basic approaches. For example, in shopping centres, clearly defined physical and intangible rights and obligations in the leasing contract can eliminate the sources of negative inter-store externalities, so as to prevent conflicts between tenants and the centre manager.

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[2] See Yuo (2002)

[3] Since external economies are the major concern in this research, this discussion in internalising focuses on benefit subsidies. However, the internalising process through Pigouvian tax/subsidies in negative externalities is a vis-à-vis case, that the victims of the externalities should be compensated by the negative effects generators with the amount equal to the difference between social marginal costs and private marginal costs.

A well designed and implemented tenant mix strategy can also prevent negative effects among tenants by tenant selection or zoning specific retail categories. Furthermore, agglomeration economies can be enhanced by internalising the externalities through properly distributing the rents, service charges, leasing incentives and other non-monetary obligations among tenants, so as to establish the strongest tenant mix.

In this research, the examination of the process of internalising positive inter-store externalities through a Pigouvian tax/subsidy mechanism is our main interest. Under the Pigouvain tax/subsidy approach, those tenants that generate positive externalities should be subsidized by those "free riders" that enjoy these benefits. In previous research on the internalisation of positive inter-store externalities generated by anchor stores, Pashigain and Gould (1998) suggested the concept of rent premiums and rent subsidies should be implied in this process. They asserted that "m*all developers internalise these externalities by offering rent subsidies to anchors and by charging rent premiums to other mall tenants" (Pashigian and Gould 1998, p115).* Their research suggested that anchor tenants receive a rent subsidy equivalent to 72% of the rent paid by non-anchors.

The power of anchor stores has already been proven in several previous studies (Gatzlaff, et al. 1994; Finn and Louviere 1996; Pashigian and Gould 1998). Nevertheless, the examination of positive inter-store externalities has not be comprehensive:

First, Brueckner (1993) suggested that tenants with stronger (positive) inter-store externalities should be allocated greater floor space. We thus know size matters. However, is it that larger tenants generate more positive inter-store externalities rather than strong positive inter-store externalities should be allocated more space? This is a question about what kind of tenant can provide more variety (both in width and depth of product lines) in merchandises and services. Our suggestion is that size can generate stronger positive inter-store externalities.

Ambiguity in positive effects generators is another problem. Who is the generator? In general, every tenant in the shopping centre has a role in the whole agglomeration economies environment, on customer drawing power spillover, on variety, on supportive services…etc. It is hard to distinguish who relies upon whom. For example, aside from power of anchor tenant, Pashigian and Gould (1998, p115) also observed "*lesser-known stores can free ride off the reputations of better-known stores.*"

This reputation free-rider effect is similar to the "sales efforts spillover" effects suggested by Miceli and Sirman (1995). These "better-known" or "sales efforts spillover" effects mean that weaker stores can free ride off the brands, the image or even the customer service satisfaction of stronger tenants. The suggestion is that the stronger the tenant, the lower the rent it should pay. Of course, the major issue here is how to define a "strong" tenant.

One of the main aims of this research is to find out some definition of "strong" tenant, i.e. the strong positive externality generators, the existence of rent premiums and subsidies and how they are distributed through different tenant characteristics. Three different indices will be used in defining "strong" tenants, a) different size band of the tenant (defined as anchor tenants, major space users ((MSUs)), large standard tenants, small standard tenants, and small tenants); b) the number of outlets appearing in (148) regional shopping centres in the database, (these will be classified as strong chains, medium chains, weak chains, and independent retailers); and c) the "top" retailers in each retail/service categories as provided by the Freeman's Guide (2002).

The examination of the internalising process is still not completed by this research since the definition of a "strong" retailer may be time varying due to changing market and fashion trends, consumer preferences in various shopping and recreation activities or the special market segmentation strategies of each shopping centre. Further, other internalising/managing devices like the terms of the leasing contract or leasing incentives under the principles of Coase Theorem and second-best regulation can also provide the same adjustment outcomes as the Pigouvian tax/subsidy approach. The appropriate use of these different internalising/ managing tools depends on each shopping centre manager's objectives in operation and management. Furthermore, there may be local or regional variances in positive (or negative) effects.

III. Empirical analysis

The Data

The data collection was targeted on all the regional shopping centres in the UK for both performance and characteristics information. In the final database, a total of 148[4] regional shopping centres under the definition of above 300,000 square foot are included. The database was collated from multiple published sources, including

[4] These 148 shopping centres are narrowed down from a total of 214 shopping centres drawn from different sources of data, by eliminating the centres that are under construction, not located in mainland Britain, or categorized as shopping/retail parks.

Freeman's Guide 2002, Shopping Centre and Retail Directory 2002 by William Reed Company, and EGI's Shopping Centre Research and Market Place databases during January 2002 to October 2002. From these sources, two linked databases were created. The first contains detailed characteristics information for these 148 shopping centres, including the tenant lists of all the shopping centres with 11,918 detailed records of individual tenants with name, retail category, also country of origin…etc. However, the availability of individual information in terms of size of units, rental levels, and service charges is limited. The second database provides information on unit size and rental levels for individual units within the 148 shopping centres from different sources. In the second database, some 1,930 records with detailed occupier information were collected including name of occupier, rental level (total rent per annum or rent per square foot/metre), retail activities, size of tenants, etc.

In addition to the two databases, additional contextual information such as regional retail rental levels and shopping centre rental growth rates have been collected from the Property Market Report 2002, Investment Property Databank, and Jones Lang LaSalle's 50 Centres Retail Rents (May, 2002).

All the shopping centre detail information was collected in year 2002. The tenant lists of shopping centres are dated for the period between January 2002 to March 2002. Since tenant composition will change over time, setting a specific time in data collection is crucial in maintaining data quality for later analysis. The rent level of each tenancy, however, is a difficult but crucial variable. Although the bulk at the rental data is contemporaneous, the rental date ranges from 1981 to 2002. Therefore, proper adjustment of the rental data on a regional basis is required. This will be discussed later.

Hypotheses and definitions

The internalising process provided by the Pigouvian tax/subsidy approach told us that the positive externalities receivers, i.e. the free riders or perhaps, the "weaker" tenants, need to pay higher rents as rent premiums in subsidizing those benefit generators. Those tenants who enjoy lower rents are usually treated as "strong" tenants because other mall tenants or the whole shopping centre demand their presence to generate spillover and other positive effects. As noted above, strong tenants can be defined in several ways: they are either:

a) anchor tenants or major space users (MSUs) who occupy a large proportion of space in the centre and have a major magnetic effects in drawing customers; or

b) they are major/strong chain stores that can provide the shopping centre with a stable and reliable income stream and also have customer drawing power; or c) they are well-know international/national brand names that are highly popular to customers and, therefore, who can increase the image quality of the shopping centre.

Hence, three major hypotheses in this empirical research are:

H_a: Larger tenants should pay lower rents, and smaller tenants will have to pay higher rents as a rent premium compensating for the positive external effects they have enjoyed.

H_b: The stronger the chain, the lower the rent paid; by contrast, the weaker the chains, the higher the rents paid to in compensate for the benefits enjoyed results from the presence of stronger chains.

H_c: Top retailers, that is, the leading brands in a particular retail category, will pay lower rents, other things equal.

The significance of size of units as a dominant variable in rentals per square unit in shopping centres has been confirmed by several empirical studies (Gerbich 1998; Tay, et al. 1999). Nevertheless, under the positive inter-store externalities hypothesis, we still want to make confirm the negative relationship between unit size and rent per square foot. More importantly, we seek further to test rental levels among different size groups to understand the nature of the rent distribution. From preliminary analysis of the collected data, tenants are classified in to five different size groups, the anchor tenants, MSUs, large standard tenants, small standard tenants, and small tenants. The size bands are shown in Table 1.

Table1: The definition of tenants grouping by size

Groups	***Tenant categories***	***Size Range***	***N***
5	Anchor tenants	over 30,000sq ft	14
4	Major space users (MSUs)	10,000-30,000sq ft	61
3	Large Standard tenants	4,000-10,000 sq ft	216
2	Small standard Tenants	1,500-4,000 sq ft	711
1	Small Tenants	under 1,500 sq ft	819

To test the second hypothesis, we calculated the number of outlets each brand had in the 148 shopping centres. These figures were then used to band tenants into five categories, as shown in Table 2.

Table2: Chain strength determined by number of outlets			
Groups	***Definition***	***Number range***	***N***
3	Strong Chain	Over 50 outlets	382
2	Medium Chain	10-50 outlets	573
1	Weak Chain	2-10 outlets	441
0	Independent	Single outlet	394

Inter-store externalities are clearly not the sole determinant of rent. From previous urban economic and shopping centre research (e.g. Sirmans and Guidry 1993; Tay, et al. 1999; Hardin III, et al. 2002), we know that regional factors and shopping centre characteristics are also crucial in determining outlet and centre rents. In order to test for the effects of externalities, we need to include Key regional demand driver variables that capture purchasing power, income levels and population density. Thus variables such as footfall, shopping catchement and regional retail rental rent averages are included.

Shopping centre characteristic variables are more complex in that they may interact with the collective benefits from inter-store externalities. Hence the image of the centre, shoppers' circulation, tenant placement, variety, amenity, atmosphere, public services and facilities are derived from store interactions. Other shopping centre characteristic variables act more like adjustment variables for rents. We include factors such as age of centre, shopping centre size, number of units, lease terms, shopping centre location type, enclosure type and parking spaces in our model. By including these regional and shopping centre variables in the model, we can focus on testing the three hypotheses.

Modelling Shopping Centre Rents

The analysis is designed in two stages. The first stage is to test the influence and significance of the independent variables to the response variable rent per square foot of the tenants using multi-regression models. The second stage focuses explicitly on the externalities variables using an ANOVA approach. The multiple regression models include regional urban and shopping centre variables along with proxies for inter-store externalities.

Unit size, unit size grouping, number of outlets, chain strength and strongly branded tenants are the major independent variables used to examine the three hypotheses concern positive inter-store externalities. However, both size and number of outlets and the derived groupings are highly collinear. Therefore, they will be tested in two linked but separate models.

Model 1 directly uses the size of unit and number of outlets as quantitative variables. Model 2 is identical other than using the categorical variables defined in Table 1 and Table 2.

Several adjustments are needed prior to analysis. The most important adjustment is to the dependent variable, rent variable. Rental data available was mostly recent but targeted in date from 1981 to 2002. We use the following formula to adjust rents to a common 2002 date:

$$\bar{y}_i = \frac{Yit}{Si} \prod_{t_n} (1 + r_{jt_n})$$

$\bar{y}_i$: adjusted retail rent per sq ft of retail i

Y_{it} : total rent per annum of retailer i at year t.

S_i : unit size of retailer i (sq ft)

r_{jt_n} : retail rental growth rate in region j at year t_n

t_n : years from the time of occupation to year 2002

We note that, with UK lease terms and five year rent reviews, such an adjustment is problematic. Fortunately, the majority of data comes from new lettings so that this should not materially affect the results.

To deal with potential problems of heterosedasiticity, White's adjustment is applied to provide consistent standard error and covariance. We also test for nonlinear relationships among numerical variables via a variety of transformation include natural log, square root, square and combinations of these. In our models, we found clear that multicollinearity problems with three variables: shopping centre size, shopping centre unit number and average unit size of each shopping centre. These variables are important in understanding the influence of variety and economies of scale and each has its own influence. However, in order to reduce multicollinearity problems, the "average unit size of each shopping centre" variable (the one contributing least to explanation) has been eliminated from the models reported.

Model 1:

$$Lnrentsqft_i = f\begin{pmatrix} RRRL, STenant, USize, SCage, Lterms, Noutlets, SQRTSCsize, LnSCunits, SClevels, \\ SClocation, SCenclose, SCcathment, SQSCcatchment, Footfalls, Parking \end{pmatrix}$$

Model 2:

$$Lnrentsqft_i = f\begin{pmatrix} RRRL, STenant, Sgrouping SCage, Lterms, Ngrouping, SQRTSCsize, LnSCunits, \\ SClevels, SClocation, SCenclose, SCcathment, SQSCcatchment, Footfalls, Parking \end{pmatrix}$$

where

Table3: Definitions of variables

Variables	***Description***	***Data Type***
Lnrentsqft$_i$	Logarithm of rent per square foot of the occupied retailer i.	Numerical
RRRL	The appropriate regional retail rental level in April 2002	Numerical
STenant	Strong tenants, from Freeman's Guide 2002, all top retailer/service providers in each retail categories, 1(top retailer), 0(non-top retailer)	Dummy
Usize	Retail unit size	Numerical
Sgrouping	Size grouping of tenants (as defined in Table1)	Categorical
Scage	Shopping centre age from the original opening date	Numerical
Lterm	Retailer's lease term (years)	Numerical
Noutlets	Number of outlets retailer has in the 148 shopping centres	Numerical
Ngrouping	Number of outlets grouping (as defined in Table2)	Categorical
SQRTSCsize	Square root of GLA of the shopping centre	Numerical
LnSCunits	Logarithm of total number of unit in the shopping centre	Numerical
SClevels	The number of level in the shopping centre	Numercial
SClocation	Location type of the shopping centre, 3(in Town), 2(out of town, district), 1(out of town, regional)	Categorical
SCenclose	Enclosure type of the occupied shopping centre, 3(enclosed), 2(covered), 1(open).	Categorical
SCcatchment	The catchment area population defined by EGI's Shopping Centre Research Database	Numerical
SQSCcatchment	Square of the catchment area population	Numerical
Footfalls	The average weekly footfall of the shopping centre	Numerical
Parking	Total parking spaces within the shopping centre	Numerical

The second stage uses one-way ANOVA to test differences in average rent per square foot among the different size and chain strength as defined in Table 1 and Table 2, in an attempt to clarify the rental distribution among different retail categories. In relation to the size groups we test the null hypothesis that $H_0 : m_{s1} = m_{s2} = m_{s3} = m_{s4} = m_{s5} = m_s$, where $m_{s1}...m_{s5}$ are the mean rent per square foot for group1 to 5 in table1, and m_s is the mean rent per square foot of all size

groups, i.e. the average rent per square foot for all tenant sizes. For chain strength, the null hypothesis is $H_0 : m_{N0} = m_{N1} = m_{N2} = m_{N3} = m_N$, where $m_{N0} ... m_{N3}$ are the mean rents per square foot for group 0 to 3 in Table 2, and m_N is the mean rent per square foot of all groups.

Results and Discussion

The two-stage process gives encouraging results. In the regression models, the majority of variables are significant and corrected signed- including those that relate to inter-store externalities. The analysis of variance tests also identify significant relationships between rents and the retail characteristics that relate to shopping centre cross-benefits.

Table4: the multi-regression results of Model 1 and Model 2

Dependent variable LnY: Logarithm of adjusted rent per square foot

	Model 1				*Model 2*			
Variables	*Coeffi*	*SE*	*t-Stat*	*Prob.*	*Coeffi*	*SE*	*t-Stat*	*Prob.*
Intercept	1.903	0.30	6.26	0.00	2.542	0.28	9.02	0.00
RRRL	0.001	0.00	2.22	0.03	0.001	0.00	2.49	0.01
STenant	-0.171	0.05	-3.26	0.00	-0.105	0.05	-2.31	0.02
SCage	-0.015	0.00	-5.89	0.00	-0.013	0.00	-5.87	0.00
Lterm	0.004	0.00	1.07	0.29	0.011	0.00	3.33	0.00
Usize	-0.001	0.00	-4.73	0.00				
Sgrouping					-0.477	0.02	-22.94	0.00
Noutlets	0.005	0.00	7.16	0.00				
Ngrouping					0.152	0.02	7.26	0.00
SQRTSCsize	0.001	0.00	2.35	0.02	0.001	0.00	2.72	0.01
LNSCunits	0.188	0.07	2.61	0.01	0.128	0.07	1.93	0.05
SCLevels	-0.002	0.03	-0.07	0.95	0.011	0.03	0.43	0.67
SCLocation	0.106	0.04	2.45	0.01	0.102	0.04	2.61	0.01
SCenclose	0.044	0.04	1.06	0.29	0.062	0.04	1.62	0.11
SCcatchment	0.000	0.00	-2.67	0.01	0.000	0.00	-1.94	0.05
SQSCcatchment	0.000	0.00	2.13	0.03	0.000	0.00	1.78	0.08
Footfalls	0.000	0.00	4.78	0.00	0.000	0.00	4.45	0.00
Parking	-0.000	0.00	-0.34	0.74	0.000	0.00	0.04	0.97
R-squared	0.34				0.44			
Adj. R-squared	0.33				0.44			
F-statistic	36.97				57.79			
Prob(F-statistic)	0.0000				0.0000			

White Heteroskedasticity-Consistent Standard Errors & Covariance
Sample (adjusted): 1892,
Included observations: 1108
Excluded observations: 784 after adjusting endpoints

As discussed above, one of the major objectives in this research is to define "strong" tenants. According to the three hypotheses, those larger in size, stronger in chain numbers or defined as "top" retailers in different retail categories, should generate positive inter-store externalities. Therefore, these retailers should enjoy lower rent as "rent subsidies". From the estimated results (Table 4), the results are consistent with the first and third hypotheses. But the second hypothesis, the number of outlets in 148 shopping centres, the result is opposite to that as expected. We explore these factors in more depth before returning to the other variables.

Unit Size

The results from Model 1 and Model 2 show that both unit size and size grouping have a significant negatively relation with rent per square foot (at = 1%). This means, in effect, the larger the tenant, the lower the rent. In Model 2, the significance of the size grouping is even stronger than the numerical variable used in Model 1.

Table5: The GLM[5] Procedure between rent/sq ft and size groups

Dependent Variable: Y Adjusted Rent(sq ft)

Source	*DF*	*Sum of Squares*	*Mean Square*	*F Value*	*Pr > F*
Model	4	465434	116359	44.33	<.0001
Error	1816	4766241	2625		
Corrected Total	1820	5231679			

Class level information: Class variable "Sgroup", Levels 5, Value 1,2,3,4,5

Table6: Average rent/sq ft of different size group of tenants

Sgrouping	*N*	*Least square means (average adjusted rent/sq ft)*
1 Small Tenants under (under 1,500 sq ft)	819	66.51
2 Small standard Tenants (1,500-4,000 sq ft)	711	41.67
3 Large Standard tenants (4,000-10,000 sq ft)	216	28.30
4 Major space users (10,000-30,000sq ft)	61	15.99
5 Anchor tenants (over 30,000sq ft)	14	11.47
Y_s (All tenant size groups)	1821	50.16

NOTE: Number of observations 1924
Due to missing values, only 1821 observations can be used in this analysis.

The next step in testing unit size is to know more detail about the distribution of rent per square foot among different size groups. The result from one-way ANOVA (Table 5) shows that the null hypotheses, i.e. all means per square foot in each group are equal has been strongly rejected (P (F=0)<1%).

[5] General Linear Model (GLM)

Table6 shows the distribution of average rent per square foot among the different size groups and gives us detailed information on rent subsidies and premiums. The average rent per square foot for all size groups is about £50.16. This average rent, surprisingly, falls between group1 (small tenants) and 2 (small standard tenants). This implies that typical group5 (anchor tenant), group4 (MSUs), group3 (large standard tenants), and many tenants in group4 (small standard tenants) can enjoy relatively lower rents. Most of the responsibility for the burdens of rent premiums falls on small tenants and some small standard tenants.

This does not mean that the lower mean rent for all size groups above small tenants is only because they are inter-store externalities generators. Other possible reasons include the diminishing marginal utility in space usage such that the marginal price of extra space has to be lower and cost savings for landlords through scale economies in letting to larger tenants. Despite the lower rent/sq ft for larger tenants, their overall total rent for the shopping centre is higher. Compared to small tenants, their operating cost in relation to rent may not be as high. Moreover, larger space users usually can reduce the overall vacancy rate and provide a more stable income stream. Therefore, the landlord may be willing to provide some allowance in the form of lower rent for larger tenants.

Number of outlets

The second variable linked to positive inter-store externalities is strength of chain stores. From previous research (Benjamin, et al. 1990; West 1992), strong chain stores should provide a relatively more stable income stream and market popularity. Therefore, we might predict that the stronger the chain store, the lower the rent other things equal. However, Table 4 shows that both in Model 1 and Model 2, prior expectations are not met. Both the numerical and categorical variables based on number of outlets firmly suggest that the stronger the chain store, the higher the rent (both significant at α =1%).

Testing the distribution of rent using one-way ANOVA (Table7) shows that null hypothesis cannot be rejected at 1% or 5% confidence level; therefore, the average rents among these 4 groups may be equal. Independent tenants even pay a relatively lower average rent per square foot (£44.26) than the other three groups (Table 8).

Table7: The GLM Procedure Between Rent/sq ft And Number of Outlets Groups					
Dependent Variable: Y Adjusted Rent(sq ft)					
Source	*DF*	*Sum of Squares*	*Mean Square*	*F Value*	*Pr > F*
Model	3	20602	6867	2.37	0.0690
Error	1786	5179186	2900		
Corrected Total	1789	5199788			
Class level information: Class variable "Ngrouping", level 4, value 0,1,2,3					

Table 8: Average Rent/sq ft of Chain Store Grouping of Tenants		
Ngrouping	*N*	*Least square means (Adjusted rent/sq ft)*
0 Independent (1 outlet)	394	44.26
1 Weak Chain (2-10 outlets)	441	52.08
2 Medium Chain (10-50 outlets)	573	50.54
3 Strong Chain (Over 50 outlets in 148SCs)	382	53.85
Y_c (Y Mean)	1790	50.24

NOTE: Number of observations 1924
Due to missing values, only 1790 observations can be used in this analysis.

The regression result is the opposite of our original hypothesis and the result of Benjamin, et al. (1990), though is consistent with the result provided by Tay, et al[6]. (1999). However, we wish to add some other rationale for the result obtained here that differs from the reasons provided by Tay, et al. (1999). The first reason is that after examination of the membership of the strong chain group, we found out that many strong chains are relatively small tenants, in terms of space use. They, therefore, have to pay a higher rent for their occupation. The second plausible reason is that some of the stronger chains are in relatively "weak" retail categories. This means they are either impulsive goods retailers or in a retail category, such as cards, gifts and gadgets or ladies' accessories, which are relatively more dependent on other retailers' positive inter-store externalities for turnover. The higher the rent may, thus, capture this effect.

Top retailers

Although the number of outlets, as a proxy for the strength of chain stores, does not confirm our second hypothesis, we still believe that size should not be the sole index for "strong" tenants. Therefore a third variable for testing the relationship between rent and strength of tenant is derived from published data in Freeman's Guide 2002 that provides the top rankings in each retail/commercial service category. The "top" retailers are defined by Freeman's in terms of their number of branches, turnover, or number of outlets all over the UK.

[6] Their reasons for arguing that the stronger the chain stores, the higher the rents are a) lower probability of default implies higher willingness to pay and b) chain stores have a greater demand for prime space.

The result from Table 4 gives us a significant (α <5%) negative relation between rent per square foot and the strong tenant (***STenant***) variable. This shows that top retailers do enjoy a lower rent than other non-top tenants. In Model 1 ***STenant*** is significant at the α = 0.01 level and beyond; in Model 2 the significance of the t-statistic is slightly lower, (p=0.0212).

Once again, we examined the detailed distribution of average rent per square foot of the top retailers among various retail and service categories. In Table 9, the average rent per square foot for all categories is £50.07, and this average rent/sq ft for all the non-top tenants is £50.86. Most of the top retailers/service providers in their categories (all those from label 1 to 22) actually pay a relatively lower rent. However, there are some tenants (from label 23 to 29) who seem to pay a relatively higher rent no matter whether they are "top" retailers or not. Examining the detail of these latter retailers, we can see that they are either occupy the prime space (on the highest pitch of pedestrian flow) or/and have high rental payment capacity (like jewellers and mobile phone retailers). Some generally require the best/longest storefront position. Although one can argue that the sample size of each retail categories are not equally sampled, this still can give us some clue that to be a "strong" tenant and to enjoy a lower rent, a retailer may need to be both highly ranked within their retail category and, at the same time, be in a retail category that does not need a special location, placement or other costly physical/operational needs.

Table 9: Average Rent(sq ft) Among Top Tenants of Different Retail Categories

Label	Categories	LSMEANS (adjusted rent sq ft)	N
1	Top 5 Night Club	9.42	1
2	Top 10 Supermarket	14.02	1
3	Top 10 Furniture and Carpet	14.17	4
4	Top 10 Department store	14.44	19
5	Top 10 Homeware (Variety store, Catalogue store)	15.22	29
6	Top 5 Pub	18.06	2
7	Top 5 Car, Cycling accessories	18.69	2
8	Top 10 Estate Agencies	27.14	2
9	Top 10 Restaurants and Fast food	28.82	16
10	Top 5 Music, video, computer game	29.39	14
11	Top 10 Shoe	31.47	10
12	Top 10 DIY, Builders	32.52	1
13	Top 5 Hairdressers	33.46	6
14	Other High Fashion Trade Names	34.33	9
15	Top 5 Toy and Game	37.76	19
16	Top 20 Fashion Trading	39.08	78
17	Top 5 Childrenswear	41.38	9
18	Top 5 Opticians	44.02	27

19	Top 10	Books, cards and stationery	44.79	55
20	Top 5	Sports and Specialty clothing	45.08	40
21	Top 5	Boots, Perfume and beauty	45.97	32
22	Top 5	Dry cleaner, shoe repair	48.37	6
0		Other non top retailers	50.86	1144
23	Top 5	Photographic	55.21	9
24	Top 10	Electrical retailers	55.95	24
25	Top 10	Special Food	56.27	50
26	Top 5	Fashion Accessories	58.85	14
27	Top 10	Travel agent	60.91	24
28	Top 10	Mobile Phone Retailers	65.17	103
29	Top 5	Jewellers	72.30	80
Y		**Average of all tenants(Adjusted rent/sq ft)**	**50.07**	1830

Other Factors Influencing Rents

Our analysis of inter-store impacts on rental levels has been set within a wider context of urban and regional influences and determinants of retail rents. The results obtained are broadly consistent with prior theory and with the influences identified in previous research (see, for example, Benjamin, et al. 1990, 1992; Gatzlaff, et al.1994; Sirmans & Guidry, 1993; Tay, et al. 1999).

Rental levels will depend on the economic potential of the area in which the centre is located. From Table 4, we see that the regional retail rental level (which proxies both for regional income and for competitive demand for retail space) is positively related to tenant rent ($\alpha < 0.05$). Shopping centre footfall, as a local indicator of consumer demand, is also positively related to rent. It is harder to specify a simple relationship between catchement area and tenant rent. After examining various transformations, the best model suggests a non-linear relationship combining **SCcatchment** and **SQSCcatchment**. This would be consistent with a gravity model interaction effect with increasing returns linked to population potential and place in the local and regional retail hierarchy. We also found that, other things equal, tenant rents were at their highest in town centres, falling for centres located in districts and at their lowest out of town. Such an effect is often masked by size of centre and date of construction, but is consistent with a standard bid-rent model of land values.

We also examined shopping centre characteristics and their contribution to rent. Age of centre is negatively related to rent – the older the centre, the lower the rent. This result is consistent with the US findings of Sirmans & Guidry (1993) and Gatzlaff, et al. (1994), although Tay, et al. do not find such a relationship in Hong Kong. We also examined date of refurbishment but found no link to rent.

Similarly, number of parking places, the number of floors (levels) and a categorical variable measuring whether or not the centre was enclosed could not be related to rent at the 5% or 10% level of significance. While some of these variables have proved to be significant in other studies, it may be that they are proxied elsewhere in our model. Lease length is not significant in Model 1 but is positively related to rent in Model 2 – a result similar to that found by Tay, et al. (1999) but opposite to the suggestion in Benjamin, et al. (1990). This might indicate that tenants are prepared to pay higher rents for longer leases (associated perhaps with security of tenure, amortization period for fit out). However, the issue of the optimal lease length is complex and more work is needed here.

Finally, shopping centre characteristics related to variety, image and overall customer drawing power were examined. We examined the overall size of the centre, the number of units and the average unit size. Considering all these variables would lead to major collinearity problems. The models reported in Table 4 show shopping centre size (as a measure of overall drawing power) and total number of units (as an indicator of variety and choice). In Model 1, transformed versions of both are found to be significantly and positively related to tenant rent ($\alpha < 0.05$ in both cases).

IV Conclusion

In this paper, we have attempted to model the rents of tenants in UK regional shopping centres, drawing on an extensive database of tenant and shopping centre characteristics. The results are highly encouraging. Factors influencing tenant rents include market potential factors derived from urban and regional economic theory and shopping centre characteristics identified in prior retail research. However, the model also includes variables that proxy for the interaction between tenants and the impact of positive in-centre externalities. We find that store size is significantly and negatively related to tenant rent extending prior work on anchor store effects. In addition to anchor stores, other larger tenants, perhaps as a result of the positive effects generated by their presence, pay relatively lower rents while smaller stores, benefiting from the generation of demand, pay relatively higher rents. Similarly, we find that brand leader tenants pay lower rents than other tenants within individual retail categories. However, our initial measure of chain strength does not seem to be strongly related to rental levels.

These results suggest that a full understanding of in-centre externalities and the way that the contribution of generators of positive benefits is "rewarded" by a lower rent in a form of Pigouvian subsidy is important in modelling shopping centre rents. There are many avenues for developing this work. They might include closer examination of chain strength in the rent setting process; incorporation of measures of tenant variety and tenant quality in the models, perhaps using some diversity or concentration index like a Herfindahl index; and further exploration of tenant mix issues using multivariate procedures. It would also be interesting – if difficult – to consider negative externalities as a contributor to rent. However, it is likely that many of these are controlled through "regulatory" means by exclusion of non-conforming uses by landlords or through terms in lease contracts. Nonetheless, we believe that the current paper makes a contribution to the retail literature both in confirming the significance of accepted rental drivers and in emphasising that contribution to agglomeration economies and positive externalities leads to lower unit rents for certain types of tenants: those occupying more space and those who are brand leaders within their retail category.

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