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Three Studies of Shopping Centers

by

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Abstract

The papers that comprise this thesis study the internal composition of shopping centers empirically from three different aspects. They examine several interesting economic issues, help to fill the gap in knowledge about shopping center internal configurations, and contribute to the literature on empirical investigations of shopping centers.

In Chapter 2, data on the internal compositions of 90 regional shopping centers in the five westernmost provinces in Canada are used to examine locational regularities in the placement of stores in shopping centers that can exploit both demand externalities and the physical features of the mall. Clustering occurs among stores of certain types. In addition, results of a regression analysis indicate that clustering of stores may depend upon a shopping center's characteristics.

Chapter 3 investigates the location pattern of stores in the proximity of department stores in planned regional shopping centers. It was demonstrated that, relative to the center level, more stores selling comparison shopping goods are located within 100 foot radius of a department store's entrance in centers that are older, have a larger gross leasable area, or contain fewer department stores. Because these mall characteristics are expected to reflect a developer's bargaining power, the above findings are consistent with the hypothesis that the location patterns of stores near department stores will depend on the relative bargaining power of the developer and the department store.

Using time series data on the tenant mix of regional shopping centers in the five major cities of the Canadian Prairie Provinces from 2000 to 2010, Chapter 4 carries out an empirical analysis of the competitive impact of power centers on regional shopping centers. The results show that the relationship between the changes in a regional center's tenant mix and the changes in the nearby presence of power centers is not prominent, which implies that regional centers and power centers might not directly compete with each other. The results also indicate that the local market condition has an impact on the tenant mix of a regional center.

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1. Introduction

As an important retailing phenomenon, shopping centers (or malls) have attracted wide research attention since they appeared. Studies in the literature on shopping centers discuss the driving force underlying the formation of shopping centers, the choice of tenant mix by the developer, the way in which store rents are set, the hierarchy of shopping centers, and the similarity of shopping centers. This thesis will study the internal composition of shopping centers empirically, a topic that has received little attention and needs deeper exploration. The main reason that motivates this thesis is that the empirical investigation of shopping centers gives us the opportunities to examine several interesting economic issues.

Firstly, a basic principle behind much of urban economics, and increasingly industrial organization, is that geographic space matters. Consumers, workers, and firms are located in space, and they face transportation costs which will influence their decisions. The recognition of the impact of transportation costs on the location decisions of firms and competition dates back to Hotelling (1929). When shopping in a mall, consumers incur transportation costs as well. One would expect a profit-maximizing mall developer to take consumer shopping behavior into account when deciding on the mall's tenant mix and where to locate various store types within the mall. Chapter 2 examines the implications of transportation costs in determining the internal organization of shopping centers. Data on the internal compositions of 90 shopping centers in the five westernmost provinces in Canada are used to examine locational regularities in the placement

of stores in shopping centers that can exploit both demand externalities and the physical features of the mall.

Secondly, studying the internal composition of shopping centers allows us to examine a bargaining power question. In Canada and the US, shopping center leases may contain restrictive clauses that give a department store veto power over the admission of new tenants and power to influence store locations in a given center. Regarding the store locations, the interests of center developers and department stores might not coincide. In the presence of a conflict of interests, the internal structure of shopping centers would depend on the relative bargaining positions of the two parties. In Chapter 3, data collected from 148 regional shopping centers in 2007 in the five westernmost provinces of Canada are used to examine the relation between variables that reflect store location patterns within a 100 foot radius of a department store's entrance, and variables that indicate the bargaining power of developers. While bargaining theory is well developed, the empirical literature on bargaining is limited. Most studies have focused on union contract negotiations and labour disputes; i.e., strike activity and strike duration. Chapter 3 studies the implications of the exercising of bargaining power in the internal organization of shopping centers.

For Chapter 2, a shopping center could only be included in the dataset if a detailed map of its layout (i.e., showing the location of each individual store) was available. In addition, some statistical tests are applied in this chapter. For the statistical tests to be valid, restraints such as a center's vacancy rate, the number of stores contained on a floor, and the minimum number of stores of certain types

are imposed. As to Chapter 3, maps showing the composition of stores near department stores can be included in the dataset. With fewer restraints, the dataset of Chapter 3 is larger than that of Chapter 2.

In Chapter 4, investigating the internal composition of shopping centers allows us to examine a market definition question that has policy implications. In the early 1990s, a retail format called "power center" emerged. Although there is no precise definition of power centers, they are distinguished from traditional shopping centers mainly on the power centers' structure: (1) they are open air; and (2) they usually include a discount department store (e.g., Walmart) and several big-box retailers (e.g., Toys-R-Us and Home Depot). The entry of a power center into a city with a shopping center hierarchy[1] could potentially have an impact on centers at any level of the hierarchy, depending on the power center's tenant list, size, and location. In this paper, the focus is on regional shopping centers because regional shopping centers that are managed by single developers have been the object of shopping center developer mergers that may have lessened competition in their markets. The assessment of a shopping center merger can turn on the question of the impact of power centers on competition in the shopping center hierarchy. Policy makers such as the competition authorities would be interested in understanding the definition of power center and the conditions that might allow a firm to exercise greater market power. In Chapter 4, using time series data on the tenant mix of regional shopping centers in the five major cities of the

[1] See Section 4.1 for a detailed discussion of shopping center hierarchy.

Canadian Prairie Provinces from 2000 to 2010, we carry out an empirical analysis of the competitive impact of power centers on regional shopping centers.

This thesis studies the internal composition of shopping centers empirically from three different aspects. In addition to examine the interesting economic issues discussed above, this thesis helps to fill the gap in knowledge about shopping center internal configurations and contributes to the literature on empirical investigations of shopping centers.

2. An Empirical Examination of Clustering and Dispersion within Canadian Shopping Centers

2.1 Introduction

A basic principle behind much of urban economics, and increasingly industrial organization, is that geographic space matters (see Eaton and Lipsey 1976, Archibald, Eaton and Lipsey 1986, and Gabszewicz and Thisse 1986). Consumers, workers, and firms are located in space, and they face transportation costs which will influence their decisions. The recognition of the impact of transportation costs on the location decisions of firms and competition dates back to Hotelling (1929).

While it is perhaps intuitive that the need to incur transportation costs will affect consumers' decisions regarding where to purchase the goods and services they require, it is also the case that consumers incur transportation costs (along with other shopping costs) when shopping in a mall[2] (or planned regional shopping center). A consumer may choose to patronize stores near a mall entrance which is close to his/her parked car, but no others. A consumer may choose to shop among a collection of stores close to one department store, but be unwilling to travel the distance to the other department store in the mall. Other consumers might select a mall on the basis that it contains a particular store brand, and they may be willing to traverse the entire mall to find it.

[2] Shopping centers are frequently classified into the following hierarchy: neighborhood centers, community centers, regional centers, and central business districts (see, for example, West, von Hohenbalken, and Kroner, 1985). A center at any level may be planned (e.g., owned and/or controlled by a single developer) or unplanned. A planned regional center is usually referred to as a mall. Centers at a higher level of the hierarchy contain the same store types as lower level centers plus additional store types as well.

A mall developer that wishes to maximize the profits of the mall will need to take consumer shopping behavior into account when deciding on the mall's tenant mix, but also where to locate various store types within the mall. Certain stores will be located near entrances, certain stores will be located more centrally in the mall, and certain stores will be clustered. The locational choices will likely depend in part on the type of demand externalities that a store can impose on its neighbors. Stores selling similar goods may be clustered in order to facilitate comparison shopping among them, while stores selling different, perhaps complementary, goods or services may be clustered in order to facilitate multipurpose shopping.

In this paper, we will use data on the internal compositions of 90 shopping centers in the five westernmost provinces in Canada to examine locational pattern of stores in shopping centers that can exploit both demand externalities and the physical features of the mall. There is very little theoretical or empirical work on this topic, so the empirical exercise undertaken here is of necessity exploratory and largely descriptive. However, some statistical tests are possible, and an econometric analysis designed to explain why clustering occurs in some centers and not others is carried out.

A secondary purpose of this paper is to assess the empirical relevance of so-called "rules of thumb" for locating stores in shopping centers. A number of "rules of thumb" appear in the shopping center literature, but it is not clear to what extent they hold, and to what extent they are stylized facts about store locations in planned shopping centers that could be the product of optimizing

behavior. We will examine a number of the rules of thumb empirically, and discuss their underlying economic motivations.

To anticipate results, we find that, consistent with expectations, there is clustering of service stores near mall entrances, and clustering of comparison shopping stores near corridor intersections and on the second floor of two-story malls. It is found that clustering tends to occur in the ladies' wear, jewelry/fashion accessory, and unisex clothing store categories, facilitating comparison shopping. Clustering also occurred in the service category, facilitating multipurpose shopping. There was also some evidence of clustering among ladies' wear and complementary store types. A regression analysis is used to find the mall characteristics where the significant clustering was being observed. The results indicate that clustering may depend upon the size, age, and type of the mall in question, with more clustering observed in larger and more upscale centers. Overall, our results are consistent with consumer transportation/shopping costs and demand externalities driving the internal store locations strategy of regional shopping centers

2.2 Theory and Literature

In this section, we consider predictions regarding store location in shopping centers that are found in the spatial economics literature, and the rules of thumb that have been articulated regarding the distribution of stores within a shopping center. We then examine the relevant empirical literature on shopping centers.

(a) Economic Theory

The literature on retail location and the clustering and dispersion of outlets has focused on the location decisions of competing retailers in an unplanned environment. Eaton and Lipsey (1979) consider the non-cooperative location decisions of retailers when consumers engage in comparison shopping. In their model, consumers are uniformly distributed over the unit interval. In this analysis, comparison shopping generates a positive demand externality. All consumers are assumed to visit two firms before returning home to order the product from the store with the lowest delivered price (price at the store plus transportation cost). Hence, firms that are located together will reduce the total transportation cost of consumers, and realize increased demand. In equilibrium, no firm is located alone: as the number of firms increases, firms remained clustered with two or three other firms as the number of clusters increases.[3]

In Eaton and Lipsey (1982), multipurpose shopping creates a different demand externality, resulting in the agglomeration of stores selling different products. In their multipurpose shopping model, there are fixed prices and no comparison shopping, and hence no benefit to consumers from the clustering of firms of the same type. Nonetheless, due to the lack of control of entry, multiple firms of the same type can locate in a shopping center in equilibrium, and this would be regarded as "excess capacity" in their model. Eaton and Lipsey (1982) also pointed out that, if the center was planned, the developer would choose the

[3] For additional theoretical analysis of the clustering of firms selling similar products, see Stahl (1982a, 1982b, and 1987).

profit-maximizing number of stores of each type to include in its center, as well as choose profit-maximizing locations.

Given the variety of externalities to be taken into account by the developer when choosing both the tenant mix and locations of stores in a shopping center, it is difficult to make firm predictions regarding the precise form in which either clustering or dispersion of stores of a type will appear in a shopping center. However, we can make some observations regarding the various forces affecting the developer's store location decisions for its shopping centers.

Prior to listing these forces, it will be useful to distinguish two broad categories of stores. These have been defined by Golosinski and West (1995, 462-63). "C" stores are

> those types of stores that cater to comparison shoppers on a multipurpose trip. C stores sell merchandise that is (a) highly differentiated in both horizontal and vertical dimensions and for which branding is important, and (b) sufficiently costly that there are perceived positive net returns to search across stores for price and quality.

Examples of C store types include ladies' wear and shoe stores. "M" stores are

> those types of stores that cater to multipurpose shoppers on multipurpose trips. Some M store types mainly sell goods, while other M store types sell services. For M stores that sell goods, (a) on a given shopping trip consumers are expected to engage in little search across M stores of a given type because expenditures on the goods involved and price variations between stores will tend to be small compared to the associated search costs, (b) the goods tend to be frequently purchased experience goods, and (c) the goods tend to be the same or very nearly so across M stores of a given type, hence reducing the incentive to search.

Examples of M stores include book stores and grocery stores. M stores that sell services are distinguished from those that sell good because while characteristics

(a) and (b) apply to both, characteristic (c) does not: there can be considerable quality variation among M stores of a given type that sell services.

We take as given that the developer of the regional shopping center has chosen a tenant mix that includes a wide variety of M stores, C stores, and other stores (such as medical offices and real estate offices) that cannot be classified as an M store or C store. Forces that can affect a developer's choice of store locations in its centers are:

1. Comparison Shopping. There may exist an incentive to cluster stores of the same C store type together. This clustering can lower shopping costs for consumers, making the center more attractive as a destination for comparison shoppers. The strength of the comparison shopping externality may differ by store type.
2. Multipurpose Shopping: The desire of consumers to engage in a multipurpose shopping trip may provide the incentive for the developer to group together C stores selling complementary products (e.g., ladies' wear and shoe stores). Multipurpose shopping is less likely to lead to the clustering of M stores given that (a) these stores can be patronized at lower level centers, (b) the reason for visiting the regional shopping center is to patronize stores (largely C stores) that can only be found at a center at that level of the hierarchy (see West, Von Hohenbalken, and Kroner, 1985), and (c) any one of the wide variety of M store types might be patronized on a multipurpose shopping trip for goods sold at C stores.

3. Traffic Flow: Store brands and store types that draw consumers to a shopping center may also influence where people walk within the center. Hence, they may impose a positive externality on neighboring tenants. A developer may have the incentive to locate these stores so as to increase consumer traffic past other tenants. This may involve dispersion of "magnet stores" throughout the center to increase traffic flow.[4]
4. Negative Externalities: Certain store types may impose negative externalities on other store types, creating an incentive to separate these types. Obvious examples could include separating pet stores and food stores, or separating restaurants from clothing stores. Likewise, discount stores and dollar stores may impose a negative externality on high end clothing stores.
5. Entrance Proximity: Locations near entrances will be more easily accessible to arriving consumers and their vehicles. Developers may wish to reserve a number of those locations for M store tenants as some of their customers are only visiting the regional center to purchase goods sold by M stores (given it could be the closest shopping center offering these store types for some set of consumers). Locations near entrances could also be reserved for M stores selling goods that are heavy or bulky (e.g., liquor and dry cleaning) for which easy access to a vehicle is important.

[4] See Urban Land Institute (1985, 149-53). Pashigian and Gould (1998) and Gould, Pashigian and Prendergast (2005) also discuss the role of department stores in attracting consumers to a shopping center, thereby conferring positive demand externalities on other stores in the center.

6. Competition: A standard result of the spatial literature is that competition between retailers selling similar goods increases as the distance between them decreases, providing an incentive for such retailers to disperse spatially.

The economic incentives pulling on a developer that would lead to a nonrandom allocation of stores are expected to result in many different types of locational regularities: clustering of stores of the same type, clustering of stores of different types, separation of certain store types, concentration of certain store types in high traffic areas, and concentration of certain store types in entrance areas. Which store types exhibit each of these patterns will be informative regarding the nature of demand externalities within shopping centers.

(b) Rules of Thumb

The shopping center industry has developed certain "rules of thumb" regarding store location within planned centers that are presumably based on trial and error by the industry.[5] These principles clearly reflect the importance of demand externalities within the planned center. The Urban Land Institute (1985, p.155) for example, suggests that the following groups of stores are complementary and should be clustered: (i) men's clothing, shoes, haberdashery and sporting goods stores; (ii) ladies' wear and shoes and children's clothing and toys; (iii) grocery stores and other food product businesses like meat markets,

[5] There is a large literature reviewing the conventional wisdom on locations within shopping centers. See, for example, Carter and Haloupek (2002) and Carter and Vandell (2005) for overviews of this literature, and Dawson (1983) and the Urban Land Institute (1985) for statements of many existing rules of thumb.

delicatessens, bakeries, and confectioners; and (iv) stores selling personal services and convenience stores. In addition, the Urban Land Institute (1985, 151) states that service and repair shops, food and food services, and variety, hardware, appliances, and home furnishing stores might also be clustered. The Urban Land Institute (1985, 149) emphasizes the importance of locating major tenants (such as department stores) so that consumers pass by complementary store types in order to visit them. As discussed by Brown (1992, 386), other rules of thumb generally include: (v) separate department stores and put them at each end of a mall; (vi) cluster service stores and put them close to the entrances; (vii) keep pet stores and dry cleaners away from food stores; and (viii) keep food stores away from apparel stores.

It is an interesting question whether the rules of thumb are actually followed by shopping center developers. To the extent that they are, it may indicate that the rules are the product of a profit maximizing locational strategy implemented by the developer.

(c) Empirical Studies of Locations within Shopping Centers

There exists an extensive empirical literature on certain aspects of planned shopping centers. Issues of leasing and rent determination are addressed, for example, in Benjamin, Boyle and Sirmans (1990, 1992) and Pashigian and Gould (1998). Shopping center sales are examined in Mejia and Benjamin (2002). Tests for the characteristics of a shopping center hierarchy are carried out by West, von Hohenbalken and Kroner (1985). A survey of some of the literature on shopping centers is given in Carter (2009).

There also exists a retailing literature studying the movement patterns and shopping tendencies of consumers within shopping centers, which provides evidence regarding the incentives of consumers to engage in multipurpose and comparison shopping. See, for example, Brown (1991, 1992) and Arentze, Oppewal, and Timmermans (2005). Brown (1992) studies the movement of shoppers in malls in Belfast and finds that customers who visited one store were likely to visit another store of this type when similar types of stores are located close to one another (e.g., food stores and ladies' apparel stores). According to Brown, the extent of the "customer interchange" among neighboring stores that are compatible to each other is "substantially greater than that between similar, spatially separated shops and contrasting outlet types in close proximity" (Brown, p. 398).

The determinants of store locations within a planned shopping center have received surprisingly little recent academic attention, and, as lamented in Brown (1994), even basic empirical evidence on clustering patterns within modern planned shopping centers is lacking. Only a few studies could be identified that quantify location patterns in planned shopping centers and test theories about such patterns. Carter and Haloupek (2002) extend the spatial economic model of Ingene and Ghosh (1990) and propose that stores should be located so as to minimize the total distance traveled by customers within a shopping center. They investigate the dispersion of stores in centers for four store types: men's and women's apparel stores, and men's and women's shoe stores. Using data on nine US shopping centers collected from 1991 to 1992, they find groupings of stores of

the same type for the above store types. In addition, the groupings of stores of the same type are found to be dispersed on both sides of a center, where a side of a mall is determined by the midpoint of the mall.

Carter and Vandell (2005) assumed that the mall center had the highest customer traffic and that different types of retailers bid for location and space. The authors construct a model in which the total profit of a mall is determined by unit price and quantity of goods sold, store size, customer traffic, rent, and miscellaneous costs. Using data from eight regional centers in the US, they find that a store's distance from the mall center is negatively related to the unit rent and positively related to its size. They also find that distance to the mall center varies by store type, and the rate at which rent declines with distance from the center varies by store type as well.

Fong (2005) tests rules of thumb regarding location patterns of certain store types in seven shopping centers in the UK by examining whether stores in a certain category tend to be located centrally in the mall or on the periphery. The author finds that jewelry stores are frequently put in central locations, whereas the other store categories do not have a consistent pattern of location across the sample malls. Fong concluded that her analysis provided little evidence in support of the rules of thumb.

2.3 Data Description

The focus of this paper is on describing the basic spatial features of store distribution within planned regional shopping centers, and to consider which

economic incentives are most likely driving these features. For this purpose, data on regional shopping centers located in the provinces of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario were collected from the *2008 Canadian Directory of Shopping Centers*. Attention was restricted to enclosed and planned regional centers with at least one department store (Sears, The Bay, Zellers, and Walmart). As well, the focus was on malls with store counts greater than 40. Finally, a shopping center could only be included if a map of its layout was available. Maps were collected from September 2007 to December 2007, obtained directly from shopping centers' or developers' websites where possible, and directly from developers otherwise. The final sample consists of 90 shopping centers (16 from Alberta, 18 from BC, 4 from Manitoba, 47 from Ontario, and 5 from Saskatchewan). The store counts at each of these centers ranged from 43 to 336, with an average of 135, including department stores, food court stores, and stand-alone stores.[6]

Data on center characteristics, such as gross leasable area (GLA), store count, and age, were available from the *2008 Canadian Directory of Shopping Centers*. Tenant lists of shopping centers were obtained directly from the websites of the centers, from the developers, or from the maps.

Stores in each shopping center are classified by type. Store type classification is provided by the Canadian Directory of Shopping Centers, which allocates each store to one of 62 store types. Store types in turn are designated as either C, M-good, M-service, Non-retail Service, or Other. The C store and M

[6] West Edmonton Mall is excluded from the analysis because the available mall map did not specify precise store locations.

store categories were originally defined by Golosinski and West (1995), and that categorization of store types, with some modifications, is adopted here.[7] The breakdown of store types into these categories for the purposes of this paper is given in Table 2.11 in Appendix.

Golosinski and West (1995) classified department stores and mass merchandisers as C stores. Sears, The Bay, Zellers, and Walmart stores are reported as department stores/mass merchandisers by the Canadian Directory of Shopping Centers. However, we treat these four stores differently (as anchor stores) from the other stores reported in this category (e.g., Canadian Tire), and did not count them in the C store category. These four stores are different from regular mall stores: they carry a variety of comparison shopping and convenience goods that could be purchased by consumers on a comparison shopping/multipurpose shopping trip. They generate demand externalities for other stores in the center, largely determine the success of a center, and enjoy substantial rent subsidies (Pashigian and Gould, 1998; Gould, Pashigian, and Prendergast, 2005).

On average, a shopping center contains 1.9 department stores (two percent of the stores in the sample centers), with the number of department stores in a center ranging from one to four. Considering all stores in the shopping centers, but excluding vacancies, fifty-eight percent of the stores in the shopping center sample are C stores. M-good stores and M-service stores account for 13 percent

[7] The store type categories in the shopping center directory are similar to, but not identical to, the ones used by Golosinski and West (1995). In addition, Golosinski and West (1995) did not include non-retail services and most of the store types in the Other category in their analysis because these stores were not considered retail stores.

and 9 percent of stores on average, respectively, with four percent of a shopping center being non-retail services on average, and 14 percent consisting of Other stores. Within the C store category, on average, 25 percent are ladies wear stores, 13 percent are jewelry/fashion accessories stores, 15 percent are unisex clothing stores, and 10 percent are footwear stores. The remaining 37 percent are composed of other C store types.

2.4 Spatial Patterns in Planned Regional Shopping Centers

We turn now to an analysis of the nature of clustering and dispersion of store types within the shopping centers in our sample. We begin by considering basic spatial patterns driven by the physical features and layout of the shopping center. Forms of clustering that may be generated by comparison and multipurpose shopping are then examined. The importance of particular rules of thumb appearing in the shopping center literature will be referred to as appropriate throughout this discussion. Finally, we consider how clustering varies across shopping centers, and what center features best explain any observed variation.

(a) Store Location Regularities Based on Center Layout

A first step in examining the spatial distribution of stores in a shopping center is to consider whether store locations in the shopping center are associated with particular features of the shopping center.

An immediate observation concerns the clustering of restaurants and fast food outlets in large single food courts. Consistent with rule of thumb (iii), easily

distinguished food courts were found in 85 of the 90 malls in the sample.[8] For these 85 shopping centers, on average 73.6 percent of the restaurants and fast food outlets in the center are contained within a single food court. In addition, 74.1 percent of food courts have an external entrance, while 64.7 percent of food courts are located in the peripheral area of the mall (i.e., located on a branch[9] of the mall, and not surrounded by other retailers).

Next, we consider whether certain store types are more or less likely to appear near a shopping center entrance than elsewhere in the mall. As suggested by rule of thumb (vi), certain service stores may be located near entrances to make them convenient to single purpose shoppers. In contrast, other store types that can be used to draw people into a shopping center may be located away from the entrances. Such a comparison requires a determination of which stores are to be considered near an entrance. We identify a store as near a mall entrance if it is one of the six closest stores to a mall entrance that is not also a department store entrance. The choice of six closest stores is arbitrary. To test for robustness, alternative criteria (e.g. four closest stores) are adopted and results are compared.

Table 2.1 presents the percentage of stores close to an entrance that falls into each of the five major store categories: Non-retail service, M-service, M-goods, C, and Other.[10] For comparison, Table 2.1 also reports these percentages

[8] Food courts are usually marked on mall maps. If not, they can be easily distinguished: a number of fast food restaurants are located side by side around a common area where a large number of customer seats are located.

[9] A branch of a mall is generally connected to one of the mall's main corridors, and leads to the exit from the mall.

[10] Non-retail service outlets are distinguished from M-service stores because we do not expect strong multipurpose shopping externalities to be produced by non-retail service outlets. These

for those stores not near any entrance. Department stores and food court stores are excluded. Only entrances that are located on the first floor are considered. Within the first floor of a sample shopping center, approximately 31 percent of stores are located near an entrance. Mall entrances on the second floor are not included because they are rarely marked on mall maps. The six nearest stores to a mall entrance may include vacant spots. Such vacant spots are included in the analysis and allocated to the Other category.

Table 2.1: Store Composition near and away from Mall Entrances (percent)

Category	6 nearest	Rest of the mall	Z score
Non-retail services	9.77	2.58	6.64***
M-service	16.02	6.76	6.01***
M-goods	15.70	13.55	2.00**
C stores	41.96	68.14	-8.75***
Other	16.55	8.97	5.17***

***denotes significance at the one percent level, **denotes significance at the five percent level

Table 2.1 confirms rule of thumb (vi) regarding store entrances. Stores in the M-service, non-retail service, and other categories are much more likely to be located near entrances than elsewhere in the mall. While 42 percent of stores near a mall entrance are M-service, non-retail service, and other stores on average, these stores represent only 18 percent of the rest of the mall. In contrast, comparison shopping stores appear less likely to locate near an entrance; while

outlets take up space in some malls, and we wish to account for them, but their appearance in malls is likely motivated by non-shopping considerations.

approximately 42 percent of stores near an entrance are C stores, C stores represent two thirds of stores not near an entrance.[11]

In order to test for the significance of differences in store composition among stores near and away from entrances, the two-sample sign test for matched pairs can be used. The test requires that the data consist of paired observations, and it can be carried out when (1) the two samples are not independent, and (2) the differences of the matched pairs are not expected to be normally distributed. In the application of the test here, the two samples consist of the area of interest and the area in the rest of the mall.

Using non-retail services near entrances as an example, and given the rule of thumb, the hypothesis is that non-retail service stores are more likely to locate near entrances than in the rest of the mall. A plus sign will be assigned to centers where the fraction of nonretail service stores near entrances is bigger than the fraction of such stores in the rest of the mall, whereas a minus sign will be assigned to centers if the opposite is true. The null hypothesis is H_0: $p=½$ and the alternative hypothesis is H_A: $p>½$. Let X equal the number of positive signs. Assuming that the result for each shopping center is independent, under the null hypothesis, the distribution of X is binomial and the probability of success is ½. In the sample, the number of observations is large and X will follow a normal distribution (Khazanie, 1996, p.725).

[11] Qualitative conclusions are unchanged if only the four closest stores are examined.

When n is large (as in our case), a normal distribution can be approximated under the null hypothesis, and the statistic is defined as:

$$Z = \frac{X - \frac{n}{2}}{\sqrt{\frac{n}{4}}} = \frac{2X - n}{\sqrt{n}}.$$

Including the continuity correction term 0.5 (Khazanie, 1996, 726), the statistic becomes:

$$Z = \frac{2(X - 0.5) - n}{\sqrt{n}}.$$

This equation is used to conduct the sign test[12].

Using the non-retail service stores as an example, X=77 (i.e. in 77 centers, the fraction of non-retail service stores near mall entrances is larger than the fraction of such stores in the rest of the mall), and n=90 (i.e., 90 observations). Then, as shown in the 4th column of Table 2.1, Z=6.64, which is greater than 2.326 (the critical value at the one percent level). Therefore, the null hypothesis that p=½ is rejected. The fraction of non-retail service stores near mall entrances is statistically larger than the fraction of such stores in the rest of the mall at the one percent level.

For comparison, consider the C stores. The null hypothesis is H_0: $p=½$ and the alternative hypothesis is H_A: $p<½$. X=4 (i.e. in 4 centers, the fraction of C stores near mall entrances is bigger than the fraction of such stores in the rest of the mall), n=90. Then Z=-8.75, which is smaller than -2.326 (the critical value at

[12] The sign test simply tests whether there tends to be greater or fewer stores in a particular place (e.g. mall entrance) than elsewhere in the mall. This test does not say anything about the size of the difference. Therefore, the statistical significance in terms of the sign test need not equate with economic significance: the clustering may be statistically significant, but not large in magnitude.

the one percent level). Therefore, the null hypothesis that p=½ is rejected. The fraction of C stores near mall entrances is statistically smaller than the fraction of such stores in the rest of the mall at the one percent level.

Another physical feature that may be associated with the location of stores is proximity to a department store.[13] Due to their attractiveness to consumers, department stores generate demand externalities for other stores in the center, and perhaps greater demand externalities for those located nearby. If this is so, locations near department stores will command higher rents, and only stores likely to experience strong demand externalities would be willing to pay those rents.

To be consistent with the analysis of mall entrances, we only consider the first floor. On the first floor of a sample shopping center, approximately 15 percent of stores are located near a department store. Table 2.2 presents the percentages of stores "near" a department store (i.e., among the closest six stores to a department store's entrance within the mall) and away from a department store that fall into each of the five major categories.

Table 2.2: Store Composition near Department Stores (percent)

Category	6 nearest	Rest of the mall	Z score
Non-retail service	3.93	4.93	-4.16***
M-service	10.55	9.34	-0.96
M-goods	14.14	14.24	-0.11
C stores	61.06	60.25	-0.53
Other	10.33	11.24	-0.96

***denotes significance at the one percent level.

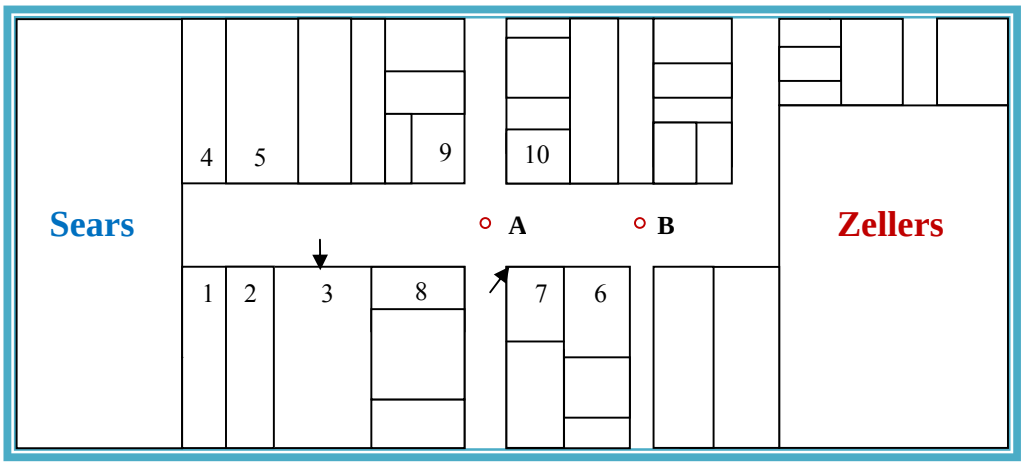
[13] See Chapter 3 of this thesis for a detailed discussion on how the location patterns of stores in an area close to department stores within planned regional shopping centers are determined.

As can be seen, Table 2.2 does not identify any important association between store type and proximity to a department store, at least for the broad categories. However, non-retail services do tend to be located more in the rest of the mall than near department stores.

As suggested earlier, store locations may also be chosen to increase traffic flow in a mall. To consider this possibility, we examine whether store type is associated with whether a store location is near an internal intersection of mall corridors. To be defined as an intersecting corridor, the corridor must have at least six stores located along it (both sides included). This definition is adopted to exclude branches that lead to exit of a mall, and either have a small number of stores or no stores located along them. A store is considered to be near intersecting corridors if it is among the six closest stores to the intersection.

Figure 2.1 shows the floor plan of a hypothetical mall. On the mall's map, each store is represented by a unique dot. This dot is plotted at the front door of a store, which is defined as the midpoint of the store's front edge that is facing a mall corridor. For example, for store 3, the dot is plotted where the arrow points. For stores which have more than one edge facing different mall corridors, the dot is set at the corner (i.e. where the edge intersects). For example, for store 7, the dot is plotted where the arrow points. On the map, point A represents an intersection, which is the centroid where two mall corridors meet. Point B is not an intersection. A corridor is included in the analysis if there are at least six stores located on both sides. The corridor that point B faces has only four stores located on both sides and is thus excluded.

Figure 2.1: Floor Plan of a Hypothetical Mall



Since intersecting corridors are anticipated to be higher traffic locations, commanding higher rents, one might expect those locations to be occupied by store types that can pay the higher rents.[14]

Table 2.3 shows the breakdown of store categories near and away from internal intersections. On the first floor of a sample shopping center, approximately 23 percent of stores are located near an internal intersection. (Approximately 31 percent of stores on average are near an entrance, and 47.5 percent are not located near intersecting corridors or an entrance.) According to this table, non-retail service stores and M-service stores are substantially under-represented near the internal intersections, while a higher proportion of C stores are found near the intersections than elsewhere. These results are statistically significant on the basis of the two-sample sign test. (Recall from Table 2.1 that non-retail services and M-service stores are more likely to be located near

[14] Carter and Vandell (2005) found that the mall's center experiences the greatest mall traffic and the highest per-unit rents, suggesting that intersecting corridors with high traffic will also command higher rents.

entrances than elsewhere in the mall.) This result then may be capturing in part the result from Table 2.1, since internal intersections are typically not near external entrances.

Table 2.3: Store Composition near Corridor Intersections (percent)

Category	6 nearest	Rest of the mall	Z score
Non-retail service	1.82	5.75	-7.08***
M-service	6.80	10.40	-4.72***
M-goods	15.90	13.89	0.43
C stores	66.11	58.42	3.65***
Other	9.36	11.54	-2.79***

***denotes significance at the one percent level.

Finally, we compare the tenant composition on the main floor of a shopping center with the tenant composition on an upper floor. The second floor of a mall could require more shopping effort to access. Consumers might be willing to incur this additional shopping cost provided the expected net benefits are positive, which they could be if the second floor offers comparison shopping opportunities. We might then expect to find proportionately more C stores on the second floors of malls than on the first floors. Thirty of the malls in the sample have at least two floors. Store compositions on the first and second floors are given in Table 2.4. As expected, the table shows that C stores are more prominent on upper floors, and this result is statistically significant. This result is also consistent with prior results given that lower floors typically have more external entrances near which C stores are underrepresented.

Table 2.4: Store Composition: First Floor vs. Second Floor (percent)

Category	First Floor	Second Floor	Z score
Non-retail service	5.12	3.48	0.55
M-service	9.61	8.79	0.55
M-goods	14.48	11.53	1.28
C stores	59.64	67.00	-2.37***
Other	11.14	9.21	1.28

***denotes significance at the one percent level.

The location regularities based on physical features of planned regional shopping centers can now be summarized. First, restaurants and fast food outlets are overwhelmingly clustered in "food courts" with particular physical features. Secondly, looking at broad store categories, support is found for rules of thumb (iii) and (vi); food outlets are clustered and services are much more likely to be located near mall entrances. Third, C stores tend to be located away from entrances, and closer to intersecting corridors. Fourth, proximity to a department store is not disproportionately associated with stores in a particular brand category.

(b) Clustering and Dispersion of Certain Store Types

The second type of regularity to be considered is whether certain store types are found to cluster within a shopping center or to disperse. Clustering would be consistent with comparison shopping if the clustered stores are selling similar items, or multipurpose shopping among C stores if the clustered stores are C stores selling complements. By examining which, if any, store types exhibit

clustering, one can get a sense of the relative strength of particular demand externalities that are important in shopping center configuration.

To distinguish between comparison and multipurpose shopping motives for clustering, we focus on smaller store categories, as opposed to the broad classifications of the previous subsection. The following categories are considered: menswear, ladies wear, and services (including non-retail service and M-service stores). Part of the motivation for these categories comes from the rules of thumb, which identified each of these categories as one that would be clustered (along with complementary store types). In addition, footwear, jewelry/fashion accessories, and unisex clothing stores are also analyzed. These latter store types are selected because they are C store types and are well represented in the sample malls (i.e. there is store replication for them in a shopping center).

As a first step we identify for each store in one of these categories, and for the entire mall, the closest six stores, and then compute the fraction of these neighbors that are of the same category. This fraction is then averaged across all stores of the same category in the mall to get a shopping-center level statistic. These are then averaged across malls. Table 2.5 contains, for each of these categories, the average percentage of the nearest six stores that are of the same type, and for comparison reports the average percentage of the entire mall represented by this category.

Table 2.5: Clustering of Stores among the Same Type (percent)

Category	6 Nearest	Entire Mall	Z score
Services	21.52	13.85	5.38***
Menswear	2.16	2.78	-4.16***
Ladies' Wear	23.51	15.53	7.06***
Footwear	5.73	5.98	-2.21**
Jewelry/Fashion Accessories	9.89	8.15	2.21**
Unisex Clothing	11.98	9.73	1.79**

***denotes significance at the one percent level, **denotes significance at the five percent level

Table 2.5 suggests the presence of clustering within the services (includes non-retail service and M-service stores) and ladies' wear categories, and to a lesser extent, in the jewelry and unisex categories.[15] These results are statistically significant by the two-sample sign test. Clustering is not observed in the menswear and footwear categories. These stores could be dispersed to complement other store types. (It should be noted that 57.8 percent of all stores in the sample malls are among the six closest to at least one ladies' wear store.) Of course, at this point, the observed clustering might be resulting from the association documented earlier between the locations of certain stores and physical characteristics of the mall; for example, as shown from Table 2.5, one is more likely to find a service store near another service store than generally in the mall because service stores all tend to be near entrances. However, rules of thumb (ii) and (iv), that suggest clustering of ladies' wear stores and clustering of service stores, gain some support from Table 2.5.

[15] Non-retail service and M-service store categories were combined so that a sufficient store count could be generated where clustering might be observed.

A second consideration is whether stores in these categories are clustered with stores in categories that are considered complementary. Rule of thumb (i) suggested that one should expect menswear stores clustered with complementary stores selling shoes, sporting goods and athletic apparel stores. In addition, rule of thumb (ii) suggested that children's wear stores and toy stores are complementary to ladies' wear stores. When analyzing complements to ladies' wear stores, in addition to those suggested by rule of thumb (ii), we also included jewelry/fashion accessories and unisex clothing stores as these store types sell merchandise that is commonly found in ladies' wear stores.

Table 2.6 reports for the ladies' wear and menswear store types the average percentage of the nearest six stores that are considered complements, along with the proportion of the entire mall accounted for by these complements. There is no strong evidence of clustering of complementary store types for menswear, but there is some evidence of clustering of complementary store types for ladies' wear.

Table 2.6: Percentage of Stores that Are Complementary Types, among the Six nearest and for the Entire Mall (percent)

Category	6 nearest	Entire mall	Z score
Menswear	11.45	9.09	1.39
Ladies' Wear	33.75	27.16	7.48***

***denotes significance at the one percent level.

The results of Tables 2.5 and 2.6 could be sensitive to how nearby stores are identified. As a robustness check, these statistics were recomputed using the four nearest stores. Similar results were obtained. For example, out of the four

nearest neighbors to a service store in the sample malls, the fraction of stores that also provide services is 23.81 percent. For ladies' wear, the share is 24.53 percent. As for menswear, variety/convenience, and unisex stores, the fraction is slightly higher than the one based on the six nearest stores, with the difference being less than 1 percent. The two categories that have slightly lower percentages when using the four nearest stores are footwear and jewelry/fashion accessories. Regarding the percentage of stores of complementary types, when four nearest stores are used, the fraction is lower for all three categories. The difference is less than 1 percent.

To consider clustering of the same C store type further, statistical tests were conducted. The tests adopted for this purpose are based on join count analysis, dating to Moran (1948). In join count analysis, connected geographic shapes (such as countries or U.S. states) can each take on one of a small set of possible discrete values.[16] A join count test tests whether these values are randomly assigned across geographic regions against the alternative that a region is more (or less) likely to have a certain value if its geographic neighbors have that value. In the current context, the categorical variable is whether or not a particular store is of the category in question (for example, a dummy variable for whether a particular store is a ladies' wear store). Further detail on join count tests and their application to shopping center data can be found in Appendix.

Because join count tests require that a certain proportion of stores be in the category of interest, the test can be meaningfully carried out only for certain

[16] A standard example would be a map of U.S. states, with each state categorized as Democrat or Republican.

categories.[17] Table 2.7 reports, for several store types, the proportion of shopping centers in the sample for which randomness of location of stores of each type could be rejected in favor of clustering at the 5 percent level of significance.

Table 2.7: Results of Join Count Analysis

Store Type	No. of Malls with Clustering	Percentage of Malls
Ladies' Wear	36	40.00
Unisex/men's & ladies' wear	24	26.67
Jewelry/fashion accessories	19	21.11
Footwear	7	7.78

As can be seen in Table 2.7, none of the categories exhibit statistically significant clustering in the majority of malls examined, based on join count analysis. Ladies' wear exhibits the most clustering, with randomness being rejected in 40% of shopping centers.

The results of this subsection can now be summarized. We have found weak evidence for clustering of stores of a type, and for clustering of complementary store types. Evidence exists that, at least in some malls, ladies' wear stores tend to cluster, although this result may be due in part to the propensity of ladies' wear stores to locate away from entrances. Some evidence exists for the clustering of services, although again this may be driven in part by the proximity of service stores to entrances.

[17] For the join count statistics to be normally distributed, it is required that the probability of a category be at least 0.2 percent. If the probability is less than 0.2, the distribution of the join count statistics will be closely approximated by the Poisson distribution having the same mean. See Burt, Barber and Rigby (2009, 553) and Upton and Fingleton (1985, 163). In this paper, join count analysis is conducted for store types that are well represented in the sample malls. In addition, for malls with more than one floor, the join count analysis is carried out for each floor. However, mall floors with a vacancy rate greater than 30 percent are excluded from the analysis.

(c) Variation in Clustering Across Shopping Centers

As described above, the evidence suggests that clustering of stores within the same type is not observed in all malls. A remaining question is whether the presence and degree of clustering varies systematically according to shopping center characteristics in ways that are easily understood from an economic viewpoint. The focus will be on ladies' wear stores and services.

We have two ways of measuring clustering for ladies' wear. The first, called Lclust, is a difference of two quantities: the average percentage of stores near (i.e., among the six closest to) a ladies' wear store that are also ladies' wear stores, less the percentage of stores in a mall (excluding department stores and food stores) that are ladies' wear. Essentially, the first term is the probability that if a store is drawn at random from a mall knowing it is near a ladies' wear store, it would be a ladies' wear store. The second term is the probability of drawing a ladies' wear store if a store is drawn at random from the entire mall. Hence, the variable measures the increase in the probability of getting a ladies' wear store from a random draw if you know that the store being drawn is within the closest six of another ladies' wear store. A similar variable can be defined for services (Sclust). For robustness, similar variables can be constructed by defining "nearness" using the closest four stores to the ladies' wear or service store. A second measure of clustering is the result of the join count tests for ladies' wear. This is a binary variable that takes on a value of one if the test could reject randomness in favor of clustering, and zero otherwise. Call this variable Ladyjoin.

Unfortunately, there does not exist a formal economic model of which we are aware that provides much guidance regarding how clustering should vary across shopping centers. However, basic intuition suggests that certain shopping center characteristics may be associated with the degree of clustering. We focus on the following variables describing shopping center characteristics:

Line = 1 if the mall has a linear shape, and 0 otherwise;

Rcount = real store count of the mall;

Age = age of the mall in years;

Ndept = the number of department stores in the mall;

Single = 1 if the mall has only one floor, and 0 otherwise;

Ladychain = the fraction of ladies' wear stores that are members of chains;

Walmart = 1 if the shopping center contains a Walmart department store, and 0 otherwise.

Malls come in different shapes, and the variable Line is a control variable for one of the principal shapes of a mall. With respect to Rcount, one would expect clustering of ladies' wear and service stores to be positively associated with real store count. Larger malls will be more attractive to consumers as they provide opportunities for more comparison shopping among C stores of various types and multipurpose shopping among service stores. The Age of a mall could be negatively associated with clustering. Older malls will have seen more turnovers of their stores, with perhaps less attention to maintaining clusters during recession years when finding any rent paying tenant might have been viewed as acceptable.

Ndept should be positively associated with the amount of C store clustering in a mall, as certain C stores will see locations near department stores as facilitating comparison shopping. Single is a mall structure control variable. We might see less clustering in single floor malls if it is the case that certain C store types will tend to locate on the second floor of two-story malls. Ladychain is expected to be positively associated with clustering of ladies' wear stores if chain ladies' wear stores exercise any bargaining power to acquire locations that facilitate comparison shopping. The presence of a Walmart store is expected to reflect that the mall serves a different purpose from other shopping centres and caters to a clientele with different objectives; as a result, such malls may be less of a comparison shopping location, and may have less incentive to cluster stores for this purpose.[18]

Summary statistics for the variables in the regression analysis appear in Table 2.8. Note that for both store types, there are some malls which appear to disperse the stores of the same type – a negative value of Lclust, for example, means that you are less likely to get a ladies' wear store from a random draw if you know that the store is near a ladies' wear store. Ten out of 90 malls have negative values.

[18] Other variables were considered, but were found to exhibit too little variation for the purposes of this analysis. For example, one might expect clustering to be greater in malls operated by large developers, who have greater planning sophistication. However, in our data, only five malls out of ninety were operated by small developers (those who operate fewer than three malls). Likewise, although whether a mall has a downtown location could influence clustering, only four such malls were identified in our sample.

Table 2.8: Summary Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
Lclust	0.08	0.07	-0.06	0.26
Sclust	0.08	0.08	-0.05	0.35
Ladyjoin	0.40	0.49	0.00	1.00
Line	0.49	0.50	0.00	1.00
Rcount	113.167	47.102	39	284
Age	36.46	8.88	13.00	54.00
Ndept	1.94	0.75	1.00	4.00
Single	0.57	0.49	0.00	1.00
Ladychain	0.93	0.10	0.45	1.00
Walmart	0.18	0.38	0.00	1.00

Table 2.9 contains the correlation coefficients between the three clustering variables and the variables measuring mall characteristics. Note that the only variables that seem to demonstrate any notable correlation with the cluster variables are Rcount (whose sign reverses, even across the two ladies' wear cluster variables), Age (with one of the ladies' wear cluster variables), Ndept (which has a correlation coefficient of 0.57 with Rcount, and hence may be picking up a mall size effect), and Walmart, which has a correlation coefficient of -0.26 with Lclust. Hence, these correlations do not suggest any strong and consistent associations between clustering and any of the mall characteristic variables.[19]

[19] Note that the association between Walmart and Lclust may be nonlinear, and therefore understated. For example, further examination indicates a much higher presence of Walmart among those malls with very low clustering or even dispersion. Of the ten malls with the lowest values of Lclust, six contain Walmart stores; in contrast, none of the ten malls with the highest Lclust values contain Walmart.

Table 2.9: Correlation Coefficients

	Lclust	Ladyjoin	Sclust
Line	0.15	0.15	-0.05
Rcount	-0.05	0.21	0.29
Age	-0.26	-0.11	0.07
Ndept	0.06	0.21	0.21
Single	-0.16	-0.16	-0.05
Ladychain	0.14	0.22	0.02
Walmart	-0.26	-0.08	0.03

In order to consider further whether there exist any statistically significant relationships between any of the variables measuring clustering and mall characteristics, exploratory linear regressions were estimated; for the discrete variable Ladyjoin, a probit equation was estimated. Ndept was excluded as a regressor because of its strong correlation with Rcount. Table 2.10 reports regression results. Robust standard errors are reported. For both regressions, the coefficients are jointly different from zero at the five percent level.

In general, results for the ladies' wear specifications are weak and the fit is poor. In the Lclust regression, only Age and Walmart have statistically significant coefficients, while in the Ladyjoin probit regression the only significant coefficients are on Rcount and Ladychain. Hence the results provide some weak supporting evidence that ladies' wear clustering is negatively associated with the age of a mall, the presence of Walmart, the size of the mall and the absence of independent ladies' wear stores.

Table 2.10: Regression and Probit Results: Dependent Variables Lclust, Ladyjoin & Sclust[1]

	Lclust	Ladyjoin	Sclust
Line	0.009	0.464	0.004
	(0.014)	(0.317)	(0.018)
Rcount	-0.000	0.007*	0.0005***
	(0.000)	(0.004)	(0.0002)
Age	-0.002*	-0.011	0.000
	(0.001)	(0.017)	(0.001)
Single	-0.015	-0.019	0.011
	(0.017)	(0.327)	(0.019)
Ladychain	0.058	3.103**	
	(0.057)	(1.483)	
Walmart	-0.041**	-0.312	0.001
	(0.018)	(0.388)	(0.025)
constant	0.106	-3.767**	-0.012
	(0.070)	(1.774)	(0.046)
R^2 or Pseudo-R^2	0.16	0.11	0.09
N	90	90	90

[1]Standard errors in parentheses; * denotes significance at the 10 percent level, ** denotes significance at the five percent level, *** denotes significance at the one percent level

Some robustness checks were conducted. Specifications were estimated controlling for GLA (gross leasable area) instead of store count, with similar results. The Lclust regression was re-estimated combining unisex stores with ladies' wear. Again qualitative results were unchanged.

Overall, therefore, the analysis into the variables associated with the presence and degree of clustering has yielded only mild conclusions, suggesting that clustering may depend upon the size and type of the mall in question, with more clustering observed in larger and more upscale centers (the latter suggested by the results on Ladychain and Walmart). Further work could explore in more detail the second result, by examining which types of ladies' wear stores enter

malls with little clustering (and no Walmart), and comparing these to the ladies' wear stores in other malls.

2.5 Conclusion

Shopping centers are clusters of stores, sometimes selling similar products and sometimes selling different products and services. Depending on the type of shopping trip being targeted by the center, the center can be the product of either or both multipurpose and comparison shopping on the part of consumers, and profit maximizing locational choice on the part of firms. It can also be planned by a single developer that chooses store characteristics to maximize profits.

Consumers choose the shopping center to patronize based on their shopping needs at a given time as well as the transportation costs they will incur to visit a particular center. Once that choice is made, consumers will again incur transportation costs during the shopping trip itself. A shopping center developer that is sensitive to these costs will select the locations of stores in its center to help consumers economize on these costs, thereby increasing the attractiveness of the center. The purpose of this paper is to use data on the internal compositions of 90 shopping centers in the five westernmost provinces in Canada to examine locational regularities in the placement of stores in shopping centers that can exploit both demand externalities and the physical features of the mall. A secondary purpose of this paper is to assess the empirical relevance of so-called "rules of thumb" for locating stores in shopping centers.

It was found that there was clustering of service stores near mall entrances, and clustering of comparison shopping stores near corridor intersections and on the second floor of two-story malls. Looking at where the most significant clustering occurs among store types, it was found that clustering tends to occur in the ladies' wear, jewelry/fashion accessory, and unisex clothing store categories, facilitating comparison shopping. Clustering also occurred in the service category, facilitating multipurpose shopping. There was also some evidence of clustering among ladies' wear and complementary store types.

We next examined clustering within certain store types further with a join count test. This test showed that there was statistically significant clustering among ladies' wear stores and service stores, at least in a subset of malls in the sample. We then carried out a regression analysis designed to explain on the basis of mall characteristics where the significant clustering was being observed. The results indicate that clustering may depend upon the size, age, and type of the mall in question, with more clustering observed in larger and more upscale centers.

The empirical analysis carried out in this paper is exploratory. Future work could utilize other measures of clustering, other measures of nearness, other store categories, and additional mall characteristics.

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2.7 Appendix

Table 2.11: Classification of Non-Retail Service, M-Service, M-Good, C, and Other Stores

Non-Retail Service	M-Service	M-Good
Automotive	Dry Cleaner	Beauty Supply
Business Services	Hairstyling/Esthetic	Book/Newsstand
Car & Truck Rental	Laundromat	Card/Stationery
Educational/Training	Optical	Drug/Health & Beauty Aids
Financial	Other Services	Florist/Nursery
Fitness/Recreation Place	Printing	Grocery
Insurance	Shoe Repair	Music/Video
Medical/Dental	Tailoring/Alterations	Specialty Food & Drink
Other Non-Retail	Travel	Variety/Convenience
Postal Services		
Real Estate		
Rental Equipment/Furniture		
Theatre/Entertainment		
Non Retail		
C	**Other**	
Athletic Apparel	Pet	
Camera	Restaurant & Fast Food	
Children's Wear	Second Hand Merchandise	
Computers/Office Supply	Specialty Merchandise	
Department/Mass Merchandiser	Ticket/Lotto Sales	
Electronics	Vacant	
Fabric/Sewing Access.		
Family Wear		
Footwear		
Furniture & Home Décor		
Gift		
Hardware/Paint & Paper		
Hobby/Craft		
Home Appliance		
Home Improvement		
House Wares		
Jewelry/Fashion Access.		
Ladies' Wear		
Leather Access. & Luggage		
Menswear		
Photo		
Sporting Goods		
Toy/Games		
Unisex/Men's & Ladies' Wear		
Window Coverings		
Wireless/Telecommunication		

Technical Notes

Based on Cliff and Ord (1973), under the null hypothesis that there is no spatial autocorrelation among store types, $p_i = \frac{n_i}{n}$, where p_i is the probability that a spot is filled with a store of type *i (i=r,s,t,u…)*, n_i is the number of stores of type *i*, and *n* is the total number of stores in the center (with department stores, stand-alone big box retailers, and food court retailers being excluded). Let L_i be the total number of stores joined to the i^{th} store and *A* be the total number of joins in a shopping center, then:

$$A = \frac{1}{2}\sum_{i=1}^{n} L_i \quad (1)$$

The reason that $\sum_{i=1}^{n} L_i$ is divided by two is because a join between two stores is counted twice when L_i is counted for each store individually. Under the assumption of nonfree sampling, the probability that a join is between two stores of type *R* is *E(RR)*:

$$E(RR) = A \cdot \frac{n_r}{n} \cdot \frac{n_r}{(n-1)} = \frac{An_r^2}{n(n-1)} \quad (2)$$

According to Cliff and Ord (1973, 5, 22-27) and Burt, Barber, and Rigby (2009, 553), these join count statistics are asymptotically normally distributed, and the significance of the difference between an observed join count and the count generated by an independent random process can be tested using a standard normal deviate (or Z-score). The Z-score for stores of the same type is defined in equation (3):

$$Z(RR) = \frac{RR - E(RR)}{\sigma_{RR}} \quad (3)$$

where *RR* is the actual number of joins between two stores of type *R*. $\sigma_{RR} = \sqrt{V(RR)}$, where the corresponding variance *V(RR)* is defined as:

$$V(RR) = \frac{An_r^2}{n(n-1)} + \frac{2Dn_r^3}{n(n-1)(n-2)} + \frac{[A(A-1)-2D]n_r^4}{n(n-1)(n-2)(n-3)} - \left[\frac{An_r^2}{n(n-1)}\right]^2 \quad (4)$$

$$D = \frac{1}{2}\sum_{i=1}^{n} L_i\,(L_i - 1) \quad (5)$$

In this paper, *Z(RR)* are calculated for four C store types: ladies' wear, unisex clothing, jewelry/fashion accessories, and footwear. The null hypothesis of randomness is H_0*: RR = E(RR)*, where *RR* is the observed joins between stores of type *R* and *E(RR)* is the expected joins. For each store type, clustering of stores selling the same goods could facilitate comparison shopping. On the assumption that a profit-maximizing developer has an incentive to cluster stores for each of the four types, the alternative hypothesis *Ha* is *RR > E(RR)*.

There are some requirements for the join count statistics to be normally distributed. For example, the total number of stores needs to exceed 30 (see Burt, Barber, and Rigby, 2009, 553). The study area in this analysis is a shopping center. When a center has multiple floors, each floor is considered as a separate observation. The total number of stores (excluding department stores, food court retailers, and big-box retailers) is required to be at least 30 for an observation to be included in this analysis. In addition, the probability of a category (i.e. p_i) needs to be at least 0.2 for the join count statistics to be normally distributed (Burt, Barber, and Rigby, 2009, 553). For the cases when p_i is less than 0.2, the distribution of the join statistics will be closely approximated by that of the Poisson distribution having the same mean (Upton and Fingleton, 1985, 163).

3. An Empirical Analysis of Tenant Location Patterns near Anchors in Regional Shopping Centers

3.1 Introduction

As an important retailing phenomenon, shopping centers have been widely investigated since they appeared. According to the International Council of Shopping Centers (ICSC), a shopping center is a group of retail and other commercial establishments that are developed and operated as a single property[20]. In addition, on-site parking is usually available. The theoretical work of Eaton and Lipsey (1979, 1982) and Stahl (1982a, 1982b) on the agglomeration of firms can be used to explain the formation of shopping centers. The clustering of stores selling similar goods can be explained in terms of the comparison-shopping tendencies of consumers and the locational response of profit-maximizing firms (Eaton and Lipsey, 1979; Stahl, 1982a, 1982b), whereas the clustering of stores selling different goods can be explained in terms of the multipurpose shopping tendencies of consumers and the locational response of profit-maximizing firms (Eaton and Lipsey, 1982).

Most studies of shopping centers focus on the choice of tenant mix by the developer (Bean, Noon, Ryan, and Salton, 1988; Brown, 1992) and the way in which store rents are set (Benjamin, Boyle, and Sirmans, 1990, 1992; Gatzlaff, Sirmans, and Diskin, 1994; Gerbich, 1998; Gould, Pashigian, and Prendergast, 2005; Pashigian and Gould, 1998). Other studies have investigated the hierarchy of shopping centers (West, Von Hohenbalken, and Kroner, 1985; West, Ryan, and

[20] See the website of ICSC: http://www.icsc.org/srch/lib/SCDefinitions.php

Von Honhenbalken, 1988; Ryan, Von Hohenbalken, and West, 1990) and shopping center similarities (West, 1992; Golosinski and West, 1995). However, the location of stores within shopping centers has been largely overlooked. According to Brown's study (1992) on the movement of shoppers in malls in Belfast, customers appear to be influenced by the locations of stores. When deciding on store locations, developers would take this into account. In addition, the possibly divergent interests of different parties on how stores should be located further complicate the location puzzle. Since shopping centers are the primary method for retailing many products, and a center's internal composition plays an important role in its success, the location issue needs to be explored.

In this paper, we investigate the location pattern of stores in the proximity of department stores in planned regional shopping centers.[21] The word "planned" means there is a developer who controls entry and exist of stores in the shopping center. Department stores are also called "anchors" because they attract customers to visit the shopping centers where they are located (Pashigian and Gould, 1998; Gould, Pashigian and Prendergast, 2005; and Yeates, Charles, and Jones (2001). The interests of developers and department stores, in regard to the location pattern of stores near department stores, might not coincide since the department stores only care about their own profits whereas developers care about the profits of the entire shopping center[22]. The possible conflict of interest between developers and

[21]Regional shopping centers are also called regional malls. See Section 3.3.1 for the definition of regional shopping centers.

[22] These profits are based in part on the rents that the developer can charge to its tenants, which are based on the tenants' sales.

department stores makes the store configuration close to department stores an interesting issue.

In a regional shopping center, a developer would be expected to have the power to decide where a store will be located. However, shopping center leases may contain restrictive clauses that give department stores veto power over the admission of new tenants (Wunder, 1988) and the power to influence the locations of other stores in the center (Note, 1973; Mason, 1975). In the event of a conflict of interest, the location pattern of stores near department stores would depend on the relative bargaining power between the developer and the department store.

Using data collected from 148 regional shopping centers in 2007 in the five westernmost provinces of Canada, we examine the relationship between variables that reflect store location patterns near a department store's entrance, and variables that indicate the bargaining power of developers. Based on the results, the density of stores selling comparison shopping goods is bigger near department stores within centers that are older or have a larger gross leasable area. In addition, such a density is negatively related to the number of department stores contained in the center. Because a shopping center's age, gross leasable area, and the number of department stores in a center are expected to reflect a developer's bargaining power,[23] the above findings are consistent with the hypothesis that the store location patterns near department stores depend on the relative bargaining power of the developer and the department stores.

[23] See Section 3.3 for a detailed discussion of the indictors that reflect the bargaining power of developers and department stores.

This paper helps to fill the gap in knowledge about shopping center internal configurations and contributes to the literature in empirical investigations of shopping centers. It explores store locations in centers that could be affected by the demand externalities between neighboring stores and the relative bargaining power of the developer and the department stores. It enriches the economic literature on demand externalities. In addition, while bargaining theory is well developed,[24] the empirical literature on bargaining is limited. Most studies have focused on union contract negotiations and labor disputes; i.e., strike activity and strike duration (Kennan and Wilson, 1993; Morton, Zettelmeyer, and Silva-Risso, 2004). This research analyzes the impact of factors related to the bargaining power of developers and department stores on store locations within shopping centers and suggests that the outcome from exercising bargaining power can be studied in other contexts.

The remainder of this paper is organized as follows: Section 3.2 briefly reviews the literature on the internal composition of shopping centers. Section 3.3 presents a discussion of the developers, the department stores, and bargaining power. Section 3.4 describes the data. Section 3.5 discusses the econometric strategy. Section 3.6 presents the summary statistics and the regression results. Finally, Section 3.7 is the conclusion.

[24] For a detailed survey of the theoretical models of bargaining, see Osborne and Rubinstein (1990) and Muthoo (1999).

3.2 Studies on Shopping Center Composition

According to the shopping center industry, developers should follow some "rules of thumb" when deciding on store locations in their centers. As discussed by Dawson (1983, p.48-50) and the Urban Land Institute (1985, p.149-155) and as reviewed by Brown (1992, p. 386) and Carter and Haloupek (2002, p. 291-292), the rules generally include: keep department stores away from the shopping center's main entrances; cluster service stores and put them close to the entrances; keep pet stores and dry cleaners away from food stores; keep food stores away from apparel stores; cluster men's stores, women's and children's stores, food stores, and personal services stores; scatter jewellery stores and record stores throughout the shopping center; and locate fast food stores, jewellery and electronics stores in high traffic areas. These rules are mainly descriptive and lack theoretical discussion. In addition, the theoretical motivation for some rules is unknown. For example, one rule suggests that jewellery stores should be separated; however, when shopping for jewellery, one might want to compare quality, style, and price before making a purchase. Thus, a clustering of jewellery stores would seem to better attract comparison shoppers.

Brown (1992) studied the movement of shoppers in malls in Belfast and found that customers who visited one store were likely to visit another store of this type when similar types of stores are located close to one another (e.g., food stores and ladies' apparel stores). According to Brown, the extent of the "customer interchange" among neighboring stores that were compatible to each other is "substantially greater than that between similar, spatially separated shops

and contrasting outlet types in close proximity" (Brown, p. 398). This finding supports the conventional wisdom.

Carter and Haloupek (2002) extended the spatial economic model of Ingene and Ghosh (1990) and proposed that stores should be located so as to minimize the total distance traveled by customers within a shopping center. They investigated the dispersion of stores in malls for four store types: men's and women's apparel stores, and men's and women's shoe stores. Using data collected from nine malls across the US from 1991 to 1992, they found groupings of stores of the same type for the above store types. In addition, the groupings of stores of the same type were not found to be bunched together on one side of a shopping center, but were dispersed on both sides.

Other empirical studies that focused on the internal composition of malls include: Carter and Vandell (2005) and Eckert and West (2008). Carter and Vandell (2005) assumed that the center of a mall had the highest customer traffic and that different types of retailers bid for location and space. Assuming profit-maximizing behaviour on the part of mall developers and stores, they constructed a model where the total profit of a mall was determined by such variables as: price per unit of goods sold, quantity of goods sold, size of a store, customer traffic, proportion of customer traffic that purchases, miscellaneous costs (e.g., labor costs, maintenance costs, utility costs, etc.), and rent.

Based on their model, Carter and Vandell (2005) developed the following hypotheses: 1) non-anchor store rents and sales decrease when the store is farther away from the mall center, and the rents and sales of different store types decrease

at different rates; and 2) non-anchor store sizes increase with distance from the mall center. The authors believed that store types with high sales in response to customer traffic (e.g., in the food court) and high price per item (e.g., jewellery stores) will be smaller and locate themselves closer to the mall center, because they can bid for a higher rent for the location; whereas, store types with low sales in response to customer traffic and lower-priced goods relative to their costs (e.g., family apparel and housewares) will locate themselves away from the center and near the anchors. Using data from eight regional shopping centers in the U.S., the authors found that a store's distance from the mall center was negatively related to the rent per square foot and positively related to the store size, thus supporting their hypotheses.

Carter and Vandell's (2005) discussion is helpful for interpreting the location pattern of stores in malls. Nevertheless, they ignored the demand externalities generated by the comparison-shopping tendencies of consumers and their impact on store locations. Family apparel and houseware stores cater to comparison shoppers and provide merchandise that overlaps with that of department stores. Locating these stores near a department store is consistent with the developer's incentive to facilitate comparison-shopping opportunities.

Eckert and West (2008) analyzed the implications of the developer/retailer relative bargaining for "radius restrictions", a restrictive clause imposed by developers on tenants that prohibits tenants in a particular center from opening another store within a certain radius. Using data collected from regional malls in western Canada, the authors investigated the tenant mix of neighboring malls and

estimated the probability that a retail chain would appear in both centers as a function of chain characteristics, mall characteristics, and location characteristics. They found that large and well established chains are more likely to enter neighboring malls. In addition, chains are more likely to enter neighboring malls that are owned by large developers. These empirical evidences are consistent with the hypothesis that a chain would enter neighboring malls depending on the relative bargaining power of the developer and the retail chain. Although Eckert and West (2008) investigated a facet of the internal composition of malls, their discussion of demand externalities and bargaining power is also relevant to the issues studied in this paper.

Vitorino (2008) constructed a model of entry that allowed for externalities among firms and explained the joint entry decisions made by department stores in a regional mall. She used an optimization approach, which included maximizing the likelihood function subject to the constraint that the equilibrium conditions given by the economic model were satisfied, to estimate the impact of the strategic effect (through positive or negative demand externalities) among different types of department stores,[25] mall-specific demographic variables, and store-specific characteristics. Using data collected from all U.S. regional malls, Vitorino found that mid-scale department stores were strategic complements, whereas, upscale department stores were strategic substitutes. Upscale department stores benefit considerably from the presence of mid-scale department stores, but

[25] Vitorino (2008) breaks down department stores into three categories: upscale department stores, mid-scale department stores, and discount department stores.

not vice versa. Discount department stores have no positive effect on any other type of department store.

Vitorino explained the relation between demand externalities and the joint entry decisions of department stores in a regional shopping center. She also provided empirical evidence showing that mall-specific demographic variables and store characteristics influence the anchor stores' profits and entry decisions,[26] though her study did not mention store location patterns in regional centers.

Theoretical studies that focus on the internal composition of malls include those by Brueckner (1993) and Miceli, Sirmans, and Stake (1998). Brueckner investigated a developer's space-allocation problem in the presence of externalities among stores and proposed that developers allocate space to a store until its marginal revenue from an additional square foot equals the marginal cost of space minus the marginal increase in sales enjoyed by all other stores, due to the spillover effect. Brueckner's analysis, later supported by Miceli, Sirmans, and Stake (1998), explained why department stores with higher externality-generating ability will have a larger space than will other stores in a shopping center. Both studies emphasized the role played by demand externalities in determining the size of the space for a store type being allocated in a shopping center; however, neither model says anything about where a store should be located in the presence of demand externalities.

[26] For example, Vitorino (2008) showed that the purchasing power of the area surrounding a mall has a positive effect for upscale department stores and a negative effect for discount and mid-scale department stores. A department store's profit increases when it has a bigger square footage, or is located in a shopping center opened more recently. In addition, the results showed that upscale and midscale department stores prefer to anchor larger centers.

3.3 Developer, Department Store, and Bargaining Power

3.3.1 Regional Shopping Centers and Department Stores

Every city can sustain a hierarchy of shopping centers,[27] with two important characteristics: 1) a small number of large centers and a large number of small centers; and 2) centers at each level contain all of the store types that can be found in lower level centers, plus additional ones (West, Von Hohenbalken, and Kroner, 1985). Regional shopping centers sit at the top of the hierarchy and have the following characteristics: 1) they contain a large variety of store types that include stores selling convenience goods or providing personal services (e.g., food, drugs, drycleaner, tailor shops), plus stores selling comparison shopping goods that could be purchased on a multi-purpose shopping trip (e.g., shoes, clothing, jewelry); and 2) they have multiple stores selling similar comparison shopping goods (e.g., multiple ladies' apparel stores and shoe stores) (West, Von Hohenbalken, and Kroner, 1985). In this paper, we study how the location pattern of stores near department stores in a shopping center is related to the relative bargaining powers of the developer and the department store. For this purpose, the focus is on planned regional shopping centers, since department stores are largely found in such centers and rarely found in centers at the lower levels of the shopping center hierarchy (Urban Land Institute, 1985). In addition, there is a developer who controls the entry and exit of stores in the center.

[27] A shopping center hierarchy was originally derived on the basis of Christaller's (1966) theory of central places. Eaton and Lipsey (1982) explain the formation of the shopping center hierarchy based on the interaction of consumers' multipurpose shopping behavior and firms' profit maximizing locational response.

Department stores are important to regional shopping centers and determine the size, character, and success of a center (Vitorino, 2008). Such influence is expected to mainly come from their attractiveness to customers. Department stores provide a large variety of products and services, which attract customers to visit the shopping centers where they are located, and increase the sales of the rest of the stores in the center, as well as increase their rents (Pashigian and Gould, 1998; Gould, Pashigian and Prendergast, 2005).[28] Another aspect of the department stores' influence comes from their ability to help developers get outside financing (Note, 1973). To develop a shopping center, outside financing is usually critical to a developer.[29] Leases with department stores allow developers to easily fulfill the terms, floor area, and credit risk conditions imposed by lenders. At this point, other retailers cannot help developers as much as the department stores can.

Because of the above two reasons, department stores are crucial to regional shopping centers. Developers attract department stores to shopping center locations by charging them lower rents (Pashigian and Gould, 1998; Gould, Pashigian, and Prendergast, 2005).[30] Furthermore, department stores usually negotiate some privileges in the centers where they locate. Shopping center leases

[28] Gatzlaff, Sirmans, and Diskin (1994) found that the rental rates of non-anchor tenants declined by an estimated 25% in response to the loss of an anchor.

[29] Mortgage lenders typically require 60 to 70% of the total floor area to be under long-term lease to firms with low credit risk before they approve financing (Kinnard and Messner, 1972).

[30] Specifically, department stores "receive a per foot rent subsidy of no less than 72 percent which other stores pay" (Pashigian and Gould, 1998, p. 115).

may contain restrictive clauses[31], including "the right of approval or veto clause," which is intended to give an anchor "veto power over the admission of new tenants" (Wunder, 1988, p. 30) and power to influence the locations of other stores in a center (Note, 1973; Mason, 1975).

3.3.2 Conflict of Interest

When a department store and a developer negotiate a new agreement, they enter a bargaining situation. They share a common interest; i.e., both desire the customer traffic at the shopping center to increase, and thus have an incentive to co-operate. Nevertheless, their interests may also be divergent: department stores only care about their own profits; whereas, developers care about the profits and sales volume of the entire centre, because their rental income depends on these factors. In this section, the possibly divergent interests of developers and department stores, with regards to store configurations near department stores, are discussed.

a) Developers' Incentive

Developers would have a clear interest in increasing the non-anchor stores'[32] sales volume since department stores enjoy significant rent subsidies and the developers' income largely depends on the rental payments from the non-

[31] Unfortunately, because shopping center leases are usually confidential, there is no detailed information regarding how widespread these clauses are, how they are used, and what radius is adopted. As to what kinds of stores do department stores keep out, it is an empirical question to be answered in this part of the thesis.

[32] Non-anchor stores include all retailers (except the department stores) that would be found in a shopping center.

anchor stores.[33] In addition, the nature of the stores' rent differs from that of the department stores. Shopping center rent generally consists of two parts: base rent, which is fixed; and percentage rent, which increases with sales volume after it passes a certain threshold (Benjamin, Boyle, and Sirmans, 1990, 1992). The rents of anchors are largely fixed and independent of their sales volumes, whereas the rents of non-anchor stores are based on sales volume (Gould, Pashigian, and Prendergast, 2005). Therefore, one would expect the developers to have an important incentive to increase the sales volume of non-anchor stores.

Inside a regional shopping center, due to the attractiveness of department stores, the area near the department stores would have high customer traffic, and the stores located in such areas would be important to the developers because of their potential rental payments.

Supportive evidence for this concept comes from the findings of Yeates, Charles, and Jones (2001), who investigated the impact of Eaton's closure on the sales volume and profit of the other stores in the shopping center. Using data collected from 18 regional centers in eastern Canada, they found that a store's profit was related to how far it was located from a department store, and that different store types were affected differently. They investigated stores in two zones in a shopping center: within 100 foot of Eaton's entrance, and from 100 to 200 feet of Eaton's entrance. Their results showed that merchandise categories that were most negatively affected by Eaton's closure in both zones were variety

[33] Using data collected from 35 malls across the US in 1994, Gould, Pashigian, and Prendergast (2005) showed that anchors occupy over 58% of the total leasable mall space, yet pay only 10% of the total rent collected by the developer.

stores, food, and ladies wear. In addition, within 100 feet of Eaton's entrance, stores offering fashion accessories, gifts/books/stationery, shoes, and men's wear were also greatly affected in their sales.

In the following section, we analyze the store types that a developer would want to have located near the department stores. Instead of looking at a specific store category (e.g., shoe stores or hair salons), we break down the non-anchor stores into two types: C stores and M stores. These terms were defined by Golosinski and West (1995, 462-63). "C" stores are

> those types of stores that cater to comparison shoppers on a multipurpose trip. C stores sell merchandise that is (a) highly differentiated in both horizontal and vertical dimensions and for which branding is important, and (b) sufficiently costly that there are perceived positive net returns to search across stores for price and quality.

Examples of C store types include ladies' wear and shoe stores. "M" stores are

> those types of stores that cater to multipurpose shoppers on multipurpose trips. Some M store types mainly sell goods, while other M store types sell services. For M stores that sell goods, (a) on a given shopping trip consumers are expected to engage in little search across M stores of a given type because expenditures on the goods involved and price variations between stores will tend to be small compared to the associated search costs, (b) the goods tend to be frequently purchased experience goods, and (c) the goods tend to be the same or very nearly so across M stores of a given type, hence reducing the incentive to search.

Examples of M stores include book stores and grocery stores. M stores that sell services are distinguished from those that sell good because while characteristics (a) and (b) apply to both, characteristic (c) does not: there can be considerable quality variation among M stores of a given type that sell services.

When shopping at C stores, like clothing stores, customers may wish to visit different stores to compare prices, quality, and style. If comparison shopping

goods are carried in both department stores and non-anchor stores, a comparison shopper may wish to visit stores of both types. Locating C stores near a department store could therefore facilitate comparison shopping and increase the developer's rental income, though it could also intensify competition in such areas and decrease profits of both sides. The developer might want to locate other types of stores (e.g., M stores) near department stores. No precise prediction is generated. It is then an empirical question as to what types of stores a developer actually locates near department stores.

b) Department Store Incentive

Regional shopping centers contain a variety of store types, and department stores want to have store types in their proximity that would be expected to increase their sales volume and profit. Department stores provide products and services that cater to comparison shoppers as well as multipurpose shoppers. Having C stores in their proximity would enhance comparison shopping opportunities, generate positive demand externalities, and attract comparison shoppers. Nevertheless, the department stores' sales volume and profit could also be diluted by competition coming from these stores. In addition, M stores in close proximity that sell merchandise that is also carried by the department stores (e.g., beauty shops, houseware) could steal customers from the department stores. As a result, the department stores might have an incentive to be close to non-retail firms (e.g., doctors, lawyers, or real estate firms) to avoid any direct competition. Still, such stores could not generate positive demand externalities for the department stores, since the customers would be expected to be target shoppers

who visit specific stores and might not visit other stores on the same shopping trip. Consequently, the interests of department stores, in regards to the location pattern of stores near them, are ambiguous.

The interests of department stores and shopping center developers might be divergent, and thus, could depend on bargaining power. If true, then the variables that measure bargaining power of the developers should be significantly related to the locational configuration around a department store. This empirical question is explored in Sections 3.5 and 3.6.

3.3.3 Developer/Department Store Bargaining

As discussed in the previous section, to avoid being located near stores that might intensify competition, department stores would want to negotiate restrictive clauses that give them the power to determine store locations in a center. Such clauses are vertical restraints in economic terms. Whether or not a department store can successfully negotiate such clauses with a developer depends on the relative developer/department store bargaining power.

A player's bargaining power is its ability to influence the other players and to negotiate a bargaining outcome that is favourable to the player. In the rest of this section, factors that are expected to influence the relative developer/department store bargaining power are discussed in the specific context of shopping centers.

First, a department store might not be successful at imposing a restrictive clause that grants the store the power to determine store locations on large

developers operating multiple regional shopping centers. While the efforts of a developer play an important role in the success of its shopping center, a developer could engage in an insufficient amount of advertising or under-invest in the maintenance of common areas or the center's structure and operating systems (Golosinski and West, 1995). Given the potential moral hazard problem, developers that operate multiple centers may be more attractive to department stores and have a more favourable bargaining position than developers that own a single center, as they may have less incentive to shirk on advertising expenditures or the maintenance of all the centers they own.

Another factor is the shopping center's gross leasable area (GLA). A large center can contain more stores, which would facilitate comparison and multipurpose shopping and be attractive to customers. Hence, such a center would also be attractive to department stores and would give the developer a more favourable bargaining position.[34] Nevertheless, a smaller GLA could also give a developer a favourable position, since limited opportunities would be available to serve a given geographic area, and the developer could control all of the opportunities within a center having a smaller GLA. More intense competition could exist for a spot in such a center, compared to the competition for a spot in a larger center or in a center where tenants have alternative locations nearby. As a consequence, the relation between a center's GLA and the developer's bargaining power is uncertain.

[34] Eppli and Shilling (1996) found that aggregate retail sales at regional malls are largely determined by center size.

The age of a shopping center could also affect the developer's bargaining power. An older center may have built a significant reputation and customer loyalty. On the other hand, older centers "tend to embody older shopping center technology and, in the absence of costly maintenance and renovation, will display more signs of deterioration than newer centers" (Ryan, Von Hohenbalken, and West, 1990, p. 316). This feature would not be appealing to retailers and customers. Again, the relation between a developer's bargaining power and the age of a center is unclear.[35]

A developer's bargaining power also depends on the competition it faces from neighboring centers at the same level of the shopping center hierarchy. If the developer owns every regional center in a geographic area, one would expect it to exercise monopoly-like power to tenants that seek position in this type of center in this area. A department store may compromise on locational pattern of stores in its proximity to seek locations in this area since it has no "outside option."[36] Therefore, the competition a developer faces from its neighboring centers could affect its bargaining power.

The population surrounding a shopping center is expected to reflect a developer's bargaining power because it signals the potential customer base and purchasing power, and hence, has implications for a department store's profits. A

[35] Vitorino (2008) showed that, everything else held constant, department stores in regional shopping centers that have been constructed more recently have larger profits than those located in older ones. On the hand, the results of Eppli and Shilling's (1996) study show that the impact of the age of regional shopping center on the center's aggregate retail is negative but is statistically insignificant.

[36] According to Muthoo (2001), a player has an outside option if the player can make a deal with a party outside the current negotiation.

department store may compromise on the composition of stores close to it, to enter a shopping center that serves a large population.

In addition, the number of department stores in a shopping center may also indicate the developer's bargaining power. Only four department store chains operate in Canada. As the number of department stores located in a center increases, fewer options are available. In the extreme case, if a developer wants all four department store chains in its center, no outside options would be available. One would expect the developer to compromise during the process of negotiations with the department store chains. From this discussion, the relation between the number of department stores in a shopping center and a developer's bargaining power is expected to be negative.

A department store chain's yearly aggregate revenue reflects its customer-drawing ability and is a sign of its bargaining power relative to a developer. In addition, the size of a department store chain, measured by the number of stores it owns, would also indicate its bargaining power. In this way, a department store chain with more locations would build a stronger brand name than another chain with smaller coverage. A department store chain's reputation attracts customer traffic and, therefore, is attractive to developers.

3.4 Dataset Description

3.4.1 Shopping Centers

As discussed in Section 3.3.1, the focus of this paper is on planned regional shopping centers with department stores. Data on these centers were

collected from the *2008 Canadian Directory of Shopping Centers*. Shopping centers that are enclosed, located in the five westernmost provinces of Canada (i.e., Alberta, British Columbia, Manitoba, Ontario, and Saskatchewan), and have at least one department store (i.e., Sears, The Bay, Zellers, and Walmart) were initially included in the dataset.[37] In addition, the actual store counts of a shopping center are required to be greater than 40. The choice of threshold is arbitrary. Other thresholds will be used later as robustness checks. With these criteria, 183 shopping centers were included (35 from Alberta, 35 from British Columbia, 6 from Manitoba, 94 from Ontario, and 13 from Saskatchewan).

In addition, a shopping center is required to have a detailed map showing the specific store locations in the center (especially the area near department stores).[38] Center maps were collected from September 2007 to December 2007 and obtained directly from the websites of the shopping centers or from the developers where possible. For centers that had no detailed map available online, I contacted their developers for the most recent map at the time. From these steps, the sample was comprised of 148 shopping centers (29 from Alberta, 29 from British Columbia, 6 from Manitoba, 74 from Ontario, and 10 from Saskatchewan). The store counts at each of these centers ranged from 40 to 589.

In this paper, a firm is defined as a "developer" if it is responsible for managing and controlling a shopping center. On this basis, 26 developers were included in the sample. As shown in Table 3.1, the number of centers that were

[37] In some cases, shopping centers can be unplanned, where stores cluster by themselves with no-one controlling the entry and exit. These centers were not included in this analysis.

[38] See Figure 3.3 in the Appendix for a map of a hypothetical regional shopping center.

operated by a developer in the sample ranged from 1 to 25. Of the developers, 54 percent operated only one center. Ivanhoe Cambridge, Inc. was the largest developer in this dataset, operating 25 sample centers.

Table 3.1: Developers in the Sample.

Developer With Multiple Regional Malls	Number of Regional Malls	Developer with a Single Regional Mall
Ivanhoe Cambridge Inc.	25	Bayfield Realty Advisors
The Cadillac Fairview Corporation Ltd.	19	BOSA Development Corp.
Oxford Retail Group	17	Boultbee Realty Ltd.
Morguard Investments Ltd.	15	Chez Belle Ltd.
20 Vic Management Inc.	13	Colliers International
RioCan Property Services	13	Doral Holdings Ltd.
Redcliff Realty Management Inc.	12	First Gulf Development Corp.
Bentall Retail Services L.P.	9	ICI Shopping Centers
FCB Property Management Services	4	Londonderry Shopping Center Inc.
T&T Properties	3	Park Royal Shopping Center Holdings Ltd.
Calloway REIT	2	Shape Property Management Corp.
Darton Property Advisors & Managers Inc.	2	Sterling Vanreal Ltd.
		Tanurb Developments Inc.
		West Edmonton Mall Property Inc.

Data on a shopping center's GLA and age were available from the *2008 Canadian Directory of Shopping Centers*. For some shopping centers, the age or GLA was missing from the directory. In these cases, I contacted the developer to obtain the information. The population served by a regional shopping center was calculated based on the 2006 Census of Canada. The method of calculation is explained in detail in Section 3.5.1 (b).

3.4.2 Retailers

Tenant lists of shopping centers in the sample were obtained directly from the website of the centers or from the developers where possible. For the rest of the sample centers, tenant lists were obtained from the maps obtained from developers, since the maps showed all tenants located in each center. In the 148 sample centers, a total of 17,520 tenants were present, including non-retail stores like doctors, lawyers, accountants, real estate firms, and insurance companies. Of the 17,520 tenants, 3,491 stores had only one location in the sample and were categorized as independent stores. The remaining 14,029 stores were members of chains that had two or more stores sharing a common name in the sample. Based on the definition of chains, 1,356 chains were represented in the dataset. The largest chain in the dataset, Source by Circuit City, had 138 stores in the sample.

Stores in the sample were assigned a store type, according to the *2008 Canadian Directory of Shopping Centers*. In some shopping centers, stores with the same name were put into different categories. To address this problem, the websites of retailers were searched to determine the products or services being provided by the retailers, and the information was used to determine the store categories. After the stores were categorized, the stores were separated into C stores, M stores, and other stores, by considering the types of merchandise sold in each store category, and using the definitions of C stores and M stores from Section 3.3.2. Table 3.9 in the Appendix shows the composition of C stores, M stores, and other stores, as proposed by Golosinski and West (1995, p.467), and

which was revised using the new store categorizations of the *2008 Canadian Directory of Shopping Centers.*[39]

To check if the list of C stores, as proposed by Golosinski and West, was well represented in the sample malls, the average fraction of stores of a particular type of C store (e.g. ladies' apparel and footwear) was calculated for the sample malls. Multiple C stores of the same type would be expected to be found in a shopping center to facilitate comparison shopping. The average store counts of the regional shopping centers in the sample was 117, which means that the average percentage of a type of C store should be at least 1.71% to ensure store replications and comparison shopping opportunities ($117 \times 1.71\% \approx 2$; i.e., at least two stores of the same type).

Table 3.2 shows the fraction of stores in the sample malls that were a particular type of C store. According to the table, on average, the types of stores that pass the replication threshold (i.e., 1.71%) included: ladies' wear, unisex clothing, jewelry/fashion accessories, footwear, athletic apparel, menswear, and gift. These stores are defined as C stores in this empirical analysis. Although conceptually sound, the other C store types, as proposed by Golosinski and West (e.g., toy/game, camera, computer, etc.) are not well represented in the sample centers and, hence, are excluded.

[39] Minor differences exist between store categorizations made by Golosinski and West (1995, p.467) and by the *2008 Canadian Directory of Shopping Centers*. Because the dataset used the directory, for the sake of consistency, we revised the composition of C stores, M stores, and Other Stores, that were defined by Golosinski and West. For example, athletic apparel was listed as a category in the directory. Therefore, we added it to the list of C stores, suggested by Golosinski and West. Footwear and leather goods were listed as separate categories, rather than a single one. Drapery was not listed as a category in the directory and therefore was not listed as a C store in this study.

Table 3.2: Fraction of Stores of Type C in the Sample Malls.

C Store Types	Avg. Fraction of Stores in the Sample Malls
Ladies' Wear	12.36%
Unisex/Men's & Ladies' Wear	7.87%
Jewellery/Fashion Accessories	7.69%
Footwear	4.80%
Athletic Apparel	2.24%
Menswear	2.05%
Gift	1.89%
Children's Wear	1.67%
Furniture & Home Décor	1.64%
Leather Accessories & Luggage	1.62%
Department/Mass Merchandiser	1.56%
Electronics	1.40%
Housewares	1.32%
Toy/Games	1.04%
Family Wear	1.00%
Camera	0.58%
Hobby/Craft	0.21%
Sporting Goods	0.18%
Computer	0.14%
Home Appliance	0.13%
Home Improvement	0.02%
Window Coverings	0.01%

3.4.3 Department Stores

In this empirical analysis, the department store chains included: Sears, The Bay, Walmart, and Zellers. These chains mainly differ in site selection, merchandise selection, target audience, and price level (Vitorino, 2008). Table 3.3 reports the characteristics of regional shopping centers where a specific type of department store chain is located.

Table 3.3: Characteristics of Sample Malls where a Department Store Chain is Located.

Department Store Chain	Store Counts	C Stores%	M Stores %	GLA
Sears	138	40.9%	19.4%	728,931
The Bay	161	41.6%	18.6%	796,608
Walmart	128	36.4%	22.0%	654,284
Zellers	115	34.8%	21.7%	598,208
Sample Mean	117	37.1%	20.9%	603,768

According to Table 3.3, compared with centers anchored by other department store chains, those containing the Bay stores have, on average, the largest store count, biggest GLA, biggest share of C stores, and smallest share of M stores in the sample. Centers containing Zellers stores, in contrast, have an average store count and GLA that are below the sample mean. Centers containing Walmart stores have, on average, the biggest share of M stores. Table 3.3 indicates that the four department store chains may not prefer to anchor the same kind of shopping center.

Table 3.4 reports a department store chain's size and how a chain is distributed across provinces in the sample.[40] Zellers has 83 stores, which is the most among the four. Walmart has only 22 stores, which is the fewest among the four. According to Table 3.4, the distribution of these department store chains across provinces follows a similar pattern. All of them have the most stores in

[40] Table 3.4 only reports the size of a department store chain in the sample malls. Some Walmart and Zellers stores are not located in regional shopping centers, and thus, these stores are not included in this table.

Ontario, about the same number of stores in Alberta and BC, and the fewest stores in Manitoba or Saskatchewan.

Table 3.4: Department Store Chains in the Sample Malls

Department Store	Sample Size	AB	BC	MB	ON	SK
Sears	80	14	15	4	43	4
The Bay	67	13	16	2	33	3
Walmart	22	4	4	1	12	1
Zellers	83	15	15	4	42	7

3.5 Econometric Model

In this section, the measure of "being close to a department store" is discussed. Variables that reflect the store location patterns near department stores in a regional shopping center are explained. Then, the econometric method used to analyze how these variables are related to the relative developer/department store bargaining power will be presented.

3.5.1 Variable Definitions

a) Dependent Variable

In this paper, a store[41] is defined as being close to a department store if it is located within a radius of 100 feet[42] from an entrance of the department store,

[41] Kiosks and carts are excluded because they are movable. For example, kiosks and carts selling Christmas merchandise appear across shopping centers in November and December, and are then removed in January.

[42] Yeates, Charles, and Jones (2001) investigated the impact of Eaton's closure on the sales of stores located within 100 feet and within 200 feet of Eaton's entrance. They found that sales of the stores located 100 to 200 feet from an Eaton's entrance were remarkably insulated from the negative impact of Eaton's closure. In this paper, we choose 100 feet as the benchmark. In

measured by the Euclidean distance.[43] Two variables are used to reflect the store location patterns near department stores: *ratio_c* and *ratio_m*, defined in equation (1) and (2):

$$ratio\_c = \frac{c_{100}/c_{center}}{s_{100}/s_{center}} \quad (1)$$

$$ratio\_m = \frac{m_{100}/m_{center}}{s_{100}/s_{center}} \quad (2)$$

where c_{100}, m_{100}, and s_{100} are the number of C stores, M stores, and the total number of stores within a radius of 100 feet from a department store's entrance, respectively. c_{center}, m_{center}, and s_{center} are the number of C stores, M stores, and the total number of stores in a regional shopping center, respectively.

The numerator in equation (1) is c_{100}/c_{center}, which is the fraction of C stores that are located close to a department store in a shopping center. The c_{100} is normalized at the center level because the number of stores near a department store that are C stores could be related to the number of C stores for the entire center. When more C stores are seen near department stores in a shopping center, the case could simply be that more C stores are in the center. To capture the impact of the relative developer/department store bargaining power on store composition near department stores, the store composition for the entire center should be controlled. Another concern is that c_{100} and c_{center} could be jointly

sensitivity tests, we also adopt another definition of "being close to a department store" to test if the conclusions are robust to different measures.

[43] A total of 58 shopping centers are in the sample for which the exact measurement of distance or scale is not available from their maps. Fortunately, for these centers, the area of stores in square footage was available either from the *2008 Canadian Directory of Shopping Centers* or from their maps. Thus, the scale of a map can be derived by comparing the area of a store in the map and its actual area.

determined by the developer/department store bargaining. By including an explanatory variable that measures the level of C stores in the center, an endogeneity problem could result, leading to biased and inconsistent estimations. From these considerations, c_{100} are normalized at the center level.

In addition, the internal structure of a shopping center also matters. For example, some centers are constructed in such a way that more stores can be located near department stores. To isolate the impact of bargaining on store composition near department stores, the above factor should be controlled. s_{100}/s_{centre}, the fraction of stores that are located within 100 foot radius of a department store's entrance in a shopping center, is expected to reflect the center's internal structure. Hence, it is controlled in the measurement of location pattern of stores near department stores.

The variable $ratio_c = \frac{c_{100}/c_{center}}{s_{100}/s_{center}}$ is expected to indicate the concentration, or density, of C stores in an area near the department stores in a shopping center. Likewise, $ratio_m = \frac{m_{100}/m_{center}}{s_{100}/s_{center}}$ is expected to indicate the concentration, or density, of M stores in this area.

Ratio_c and *ratio_m* can also be explained from another perspective. Equation (1) and (2) can be rewritten as (1)' and (2)', respectively:

$$ratio\_c = \frac{c_{100}/c_{center}}{s_{100}/s_{center}} = \frac{c_{100}/s_{100}}{c_{center}/s_{center}} = \frac{percnt\_c_{100}}{percnt\_C_{centre}} \quad (1)'$$

$$ratio\_m = \frac{m_{100}/m_{center}}{s_{100}/s_{center}} = \frac{m_{100}/s_{100}}{m_{center}/s_{center}} = \frac{percnt\_m_{100}}{percnt\_m_{center}} \quad (2)'$$

where c_{100}/s_{100} and m_{100}/s_{100} are the fraction of stores that are C stores and M stores within 100 foot radius of a department store's entrance, respectively (i.e., $percnt\_c_{100}$ and $percnt\_m_{100}$). c_{center}/s_{center} and m_{center}/s_{center} are the fraction of stores in a regional center that are C stores and M stores, respectively (i.e., $percnt\_c_{center}$ and $percnt\_m_{center}$). *Ratio_c* would be the fraction of spots that are filled by C stores near department stores, normalized by the fraction of stores that are C stores for the center, whereas, *ratio_m* is the fraction of spots that are filled by M stores near department stores, normalized at the center level.

In the econometric specification, *ratio_c* and *ratio_m* are estimated as a linear function of variables indicating the bargaining power of developers and department stores and other determinants that are expected to have an impact on the location pattern of stores near department stores, respectively. The specification of the regression function is as follows: $Y = \beta' X + \varepsilon$, where Y = *ratio_c* or *ratio_m*, β is a vector of parameters, X is a vector of independent variables, and ε is a vector of error terms. OLS (Ordinary Least Squares) is used to estimate the two regression functions.[44]

b) Independent Variables

The independent variables used in this econometric analysis include: developer variables, department store dummies, and the other control variables. Dummy variables for developers that operate at least two regional shopping

[44] Alternatively, the seemingly unrelated regressions (SUR) model could be used. Nevertheless, with the same set of explanatory variables on the right hand side, the SUR estimation of parameters and standard errors are the same as estimating the models separately using OLS.

centers in this dataset are included as independent variables. Compared with a variable that shows a developer's size (i.e., the number of sample centers operated by a developer), these dummies capture not only the difference between developers that operate multiple centers and those that operate a single center, but also the idiosyncratic difference of a developer, including bargaining strength. The fixed effect of a developer across the shopping centers that it owns can be controlled in this way. *GLA*[45] is a shopping center's gross leasable area, measured in 100,000 square feet. The variable *centrage* measures the age of a shopping center, which is calculated by subtracting the year that the center was opened from 2009. As discussed in Section 3.3, the relation of *GLA* and *centrage* to a developer's bargaining power is ambiguous.

Population is the number of people, measured by 100,000, living in a regional shopping center's primary trade area. In this paper, a shopping center's primary trade area is defined as the intersection of its Voronoi market area and a 25-mile radius circle around this center. *Population* is predicted to be directly related to a developer's bargaining power, since a large population signals the potential purchasing power and is attractive to department stores. To estimate the Voronoi market area, the first step is to plot all 183 regional shopping centers (i.e., including those that have no detailed map and are therefore excluded from the regression analysis) in the maps of the five westernmost provinces in Canada, using the centers' geographic coordinates (i.e., longitude and latitude) obtained

[45] Both a center's GLA and its store counts would be expected to indicate the center's bargaining power. The correlation between a center's GLA and store counts is 0.91. Therefore, only GLA is included as an explanatory variable.

from the Google map. Then, for each center, a Voronoi market area[46] is calculated by finding the set of points that are closer to this center than to any other regional shopping center located within the province.

Economically, this approach to calculating trade areas can be justified by the utility-maximizing consumer's tendency to minimize transportation cost and visit the nearest shopping center,[47] given the assumption that regional shopping centers are the same and charge the same price. Although regional shopping centers are not in fact identical, a large fraction of their stores are chain stores. As a result, regional shopping centers exhibit similarity in store brands, especially for centers located within the same province (Golosinski and West, 1995). Therefore, many consumers are likely to visit the nearest regional shopping center, as assumed in the calculation of the Voronoi trade area for shopping centers. The provincial boundary is chosen instead of the city boundary for the maximum outer boundary of a Voronoi market area, since regional shopping centers are frequently located in the suburb of a city and might attract customers outside the city. Using the city limits to bound the Voronoi trade area could lead to an underestimation of the market area of a shopping center.

After a regional shopping center's Voronoi market area is calculated, it is then intersected with a 25-mile radius circle around this center. The intersected area is considered as the shopping center's "primary" trade area. A 25-mile radius

[46] This paper follows the methodology of Von Hohenbalken and West (1986) to calculate the Voronoi diagram. See Von Hohenbalken and West (1986) for a detailed discussion of the Voronoi diagram and its economic meaning.

[47] Based on the discussion of Von Hohenbalken and West (1986), the assumption of the Voronoi diagram is that firms (i.e., shopping centers, in this case) are homogenous and are therefore equally attractive to consumers.

threshold is chosen because customers are not expected to visit a regional shopping center on a regular basis if it is located more than 25 miles away.[48] Once the regional shopping center's primary trade areas are calculated, they are overlapped with the census tracts. The population of a shopping center's trade area consists of the pieces of census tracts that fall into this area.[49]

The Voronoi market areas of regional shopping centers and census tracts in Alberta are shown in Figure 3.1. The black dots in the figure are location points of regional shopping centers. In the figure, Voronoi market areas have bold boundaries and the 2006 census tracts have light boundaries. In Figure 3.2, the primary trade areas of regional shopping centers in Edmonton are shown (shaded areas). In the lower-left part of the figure, two centers can be seen, each with their primary trade areas depicted as a half-circle shape. In the middle of the figure, a group of shopping centers can be seen with primary trade areas shown as either fan-shaped or polygons.

[48] A regional shopping center's primary trade area is not well defined in the literature. Vitorino (2008) defined it as a circle with a radius of 20 miles. The ICSC defined it as a circle with a radius of 5 to 15 miles for regional shopping centers and 5 to 25 mile for super-regional centers (i.e., regional shopping centers with three or more anchors). The Urban Land Institutes (1985) defined the primary trade area as a circle with a radius of 8 miles for regional centers and 12 miles for super-regional centers. All of these criteria are based on regional shopping centers in U.S.

[49] All calculations were made using the GIS (geographic information system software) Arcview 9.3.

Figure 3.1: Voronoi Market Area of Regional Shopping Centers and Census Tracts in Alberta.

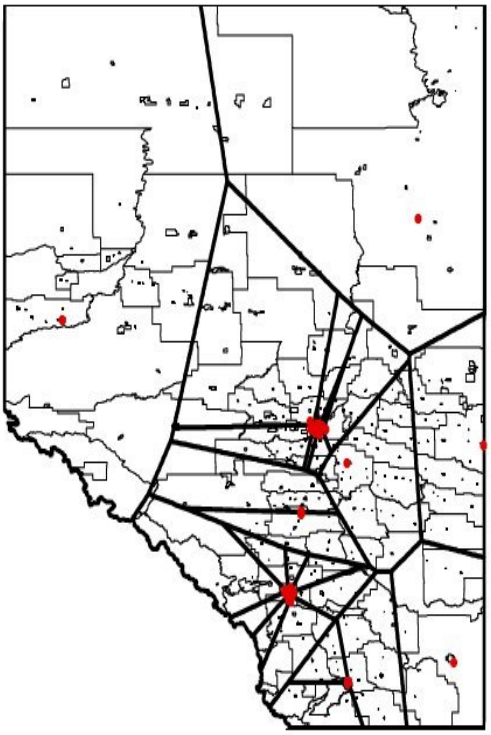
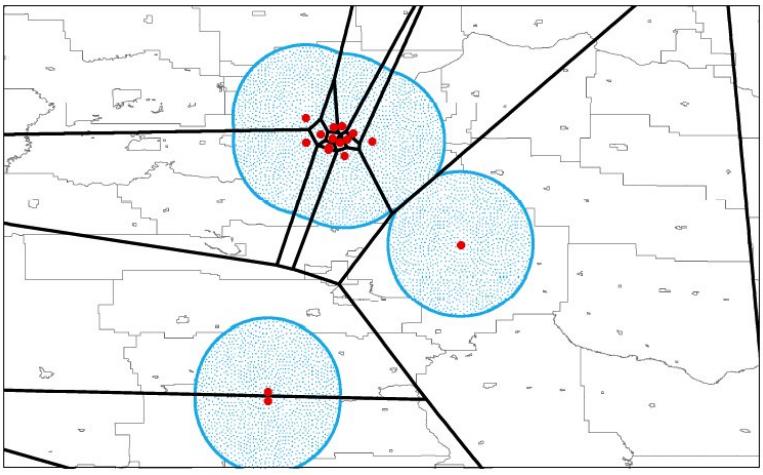


Figure 3.2: Primary Trade Areas of Regional Shopping Centers in the Edmonton Area.



The variable *competition* measures the proportion of a regional shopping center's neighboring centers that are at the same level of the shopping center hierarchy and managed by different developers. Two regional shopping centers are defined as neighbors when their primary market areas share a boundary segment and the distance between these two centers is less than 25 miles. This variable is expected to show the extent of competition that a shopping center faces from its neighbors. Everything else constant, developers operating more neighboring centers would have more control over this region and would have more bargaining strength. The value of *competition* ranges from 0 to 1. When *competition* is 1, all of the neighboring centers are owned by other developers. When *competition* is 0, the developer owns all of the neighboring centers. *Competition* is defined as having a value of 0 if a regional center has no neighboring centers. *Competition* is expected to be negatively related to the bargaining power of a developer.

As discussed in the previous section indicators of department store bargaining power would include a department store chain's annual revenue and size. Nevertheless, including these variables as explanatory variables would be inappropriate, since the dataset only contains four department store chains and these variables lack sufficient variation. To solve this problem, department store chain dummies (i.e., *Sears*, *Walmart*, and *Zellers*) are used instead, which are expected to pick up the systematic differences across department stores regarding their bargaining positions and the store location patterns close to them. The Bay stores are used as the base group.

The location related variables include: *Downtown*, *Mainentry*, and *Upperflr*. *Downtown* is a dummy, which equals 1 if the shopping center is located in downtown area and 0 otherwise. In the dataset, all centers located in downtown have multiple floors, which could be explained by the fact that land in such an area is more expensive than that in the suburbs. Such a floor plan might have an impact on store configurations.

Mainentry is a dummy, which equals 1 if the observation is the main entrance of a department store, and 0 otherwise. A department store's main entrance is defined as the one that faces a main corridor connecting anchors or leading to the main exit of a mall, whereas a side entrance of a department store is defined as the one that faces an aisle leading to a side exit of a mall. One would expect the area close to a department store's main entrance to have more customer traffic than that of a side entrance. As a result, the store location patterns are expected to be different across entrances. *Upperflr* indicates whether a department store's entrance is located on a floor above the ground floor, which is included to capture the difference in location pattern of stores across floors.

3.5.2 Econometric Concern

A shopping center can contain multiple department stores and a department store can have multiple entrances. The location pattern of stores close to a department store varies across entrances within a shopping center, which could be a result of the relative developer/department store bargaining power. Thus, the observation in this analysis is set at each entrance of a department

store[50] in a sample mall. When multiple observations are made within a shopping center; however, the amount of within-center correlation among observations could invalidate the usual OLS standard error (Wooldridge, 2003). This lack of independence within a shopping center should be accounted for.[51] In this analysis, each shopping center is assumed to be a group, or cluster, and the observations are assumed to be independent across shopping centers but not necessarily independent within shopping centers. Following Wooldridge (2002, 2003, and 2006), the error term $\varepsilon = \varepsilon_{gm}$ is designed to contain two parts:

$$\varepsilon_{gm} = c_g + u_{gm}, m = 1, \ldots, M_g \quad (3)$$

where c_g is an unobserved group effect within a shopping center, u_{gm} is the idiosyncratic error, and M_g is the number of units within a group g. The error term ε_{gm} is assumed to be independent between clusters.

The presence of a cluster effect does not cause OLS parameter estimates to be biased or inconsistent. In addition, the R^2 is not affected; however, the test statistics are no longer valid. In this paper, the robust cluster variance estimator is used to estimate the variance, which is defined in equation (4)[52]:

---

[50] For a department store, any entrance facing a corridor that is inside a shopping center is included in the analysis. Any entrance that is facing outside (e.g., parking lot) is excluded unless stores are located close to it.

[51] Froot (1989) may be the first in the literature to formally discuss the cluster sample error. Williams (2000) briefly proves the validity of the cluster robust variance estimator. See Wooldridge (2002, 2003, and 2006) for a more detailed discussion of how to deal with the cluster sample error in different situations.

[52] See STATA Reference Manual, Release 7, Volume 3, Q-St (p.87) and STATA User's Guide, Release 7, U 23.11 (p.254 ~258). To make a finite-sample adjustment, equation (4) is multiplied by a constant q_c. $q_c = [G/(G-1)][(N-1)/(N-K)]$, G is the total number of groups, N is the total number of observations, and K is the number of variables.

$$V_{group} = (X'X)^{-1} * \sum_{g=1}^{G} u_g' * u_g * (X'X)^{-1} \quad (4)$$

where, $u_g = \sum e_i * x_i$, G is the total number of groups, e_i denotes the residual for the i^{th} observation, and x_i is a row vector of predictors with the constant included. The robust standard error is the square root of V_{group} (i.e., $\sqrt{V_{group}}$), which is used to construct the robust t statistic and F statistic.

When the robust cluster variance estimator is used, the heteroskedasticity-robust error correction is also implied. Both of them deal with the issue when the residuals are not identically distributed, with the robust cluster variance estimator further relaxing the assumption of independence within a group. The formula in equation (4) is simply that of the ordinary heteroskedasticity-robust variance estimator with the individual $e_i * x_i$ being replaced by their sums over each group.[53]

3.6 Summary Statistics and Regression Results

3.6.1 Summary Statistics

The first column of Table 3.5 lists the store categories that are most frequently located within 100 foot radius from an entrance of a department store in the sample malls, sorted descendingly, and the second column reports whether these store are C Store, M store, Other Store, or Non-Retailer.

[53] Another difference is that, the multiplier is $q_c = \mathrm{N}/(\mathrm{N} - \mathrm{K})$ for the heteroskedasticity-robust variance estimator, though both multipliers have a value that is close to 1.

Table 3.5: Composition of Stores: Near Department Stores Vs. Whole Mall.[54]

Store Category	Type	(a) Within 100 Feet	(b) the Whole Mall	(c)=(a)/(b) Ratio
Ladies' Wear	C Store	15.42%	12.36%	1.25
Jewellery/Fashion Access.	C Store	8.79%	7.69%	1.14
Unisex/Men's & Ladies' Wear	C Store	8.79%	7.87%	1.12
Footwear	C Store	5.56%	4.80%	1.16
Hairstyling/Esthetic	M Store	5.47%	3.54%	1.55
Restaurant & Fast Food	Other Store	5.18%	12.95%	0.40
Wireless/Telecommunication	Other Store	3.28%	3.66%	0.89
Optical	M store	2.86%	2.05%	1.39
Menswear	C Store	2.82%	2.05%	1.37
Athletic Apparel	C Store	2.65%	2.24%	1.19
Furniture & Home Décor	C Store	2.24%	1.64%	1.36
Variety/Convenience	M Store	2.07%	1.30%	1.60
Drug/Health & Beauty Aids	M Store	2.07%	1.60%	1.30
Gift	C Store	1.99%	1.89%	1.05
Non Retail	Non-Retail	1.99%	5.42%	0.37
Beauty Supply	M Store	1.91%	2.52%	0.76
Leather Access. & Luggage	C Store	1.70%	1.62%	1.05
Card/Stationery	M Store	1.70%	1.18%	1.45
Financial	Other Store	1.70%	1.69%	1.01
Housewares	C Store	1.66%	1.32%	1.26

Column (a) of Table 3.5 reports the share of each store category within 100 feet from department stores and column (b) reports the share for the entire shopping center. According to Table 3.5, the four store types most often located near department stores in the sample malls are stores selling ladies' wear, jewellery/fashion accessories, unisex clothing, and footwear. All of them are C

[54] Furniture & Home Décor, Leather Accessories & Luggage, and Housewares are not well represented in the sample malls and are therefore excluded from this analysis.

stores. In addition, the fraction of these store types located near department stores is greater than the fraction of these stores for the entire shopping center, though the magnitude of the difference is not big.[55] As shown in Table 3.5, hairstyling/esthetic stores are most frequently located near department stores among M store types, while *ratio_m* is highest for variety/convenience stores. The other store types and non-retail firms, with the exception of restaurant & fast food stores and wireless/telecommunication stores, were seldom located near a department store in the dataset.

Table 3.6 reports the summary statistics for variables used in this analysis.

Table 3.6: Summary Statistics (N=383)

Variable	Mean	Std. Dev.	Min	Max
ratio_c	1.102	0.722	0	6.095
ratio_m	1.023	0.910	0	4.454
GLA	7.587	5.202	1.52	38
centrage	35.337	9.256	13	59
population	1.078	0.669	0.034	2.965
competition	0.798	0.345	0	1
deptnumbr	2.089	0.798	1	4
Sears	0.313	0.464	0	1
Walmart	0.076	0.265	0	1
Zellers	0.292	0.455	0	1
downtown	0.065	0.247	0	1
mainentry	0.919	0.273	0	1
upperflr	0.300	0.459	0	1

[55] Using a two-sample t test for equal means, the mean of the percentage of stores near department stores that are C stores is not significantly different from the mean of the percentage of stores not near a department store that are C stores. Nevertheless, for 80.4% of the sample malls, the ratio of the percentage of stores near department stores that are C stores and the percentage of stores not near a department store that are C stores is either smaller than 0.75 or greater than 1.25, and is considered to be relatively big.

As shown in Table 3.6, a total of 383 observations were obtained in the sample. *Ratio_c* ranged from 0 to 6.095. One observation of *Ratio_c* has a value of 6.095 and lies outside the range of the rest of the observations. *Ratio_m* ranges from 0 to 4.454 and has an average value of 1.023.

Regarding the center-specific variables, the GLA of shopping centers ranged from 1.52 to 38, measured by 100,000 square feet. On average, the age of the shopping centers was 35 years. The average population in a shopping center's primary trade area was 1.078, measured by 100,000 persons. In the sample, two centers had fewer than 10,000 people in their primary trade areas, which were substantially smaller than the population of the other malls in the dataset. One had neighboring shopping centers located in its close proximity and the other was located in a small town with a relatively dispersed population.[56]

The shopping centers in the dataset face substantial competition from neighboring centers. As shown in Table 3.6, on average, the fraction of neighboring centers owned by other developers was about 80%. With regards to the department store chains, 31.3% of the observations were for Sears, which was slightly higher than for Zellers. Only 7.6% of the observations were for Walmart stores. On average, shopping centers in the dataset contain two department stores. As to the location-related variables, 6.5% of the observations were in downtown areas, less than 10% of the observations were on side entrances, and about 30% of the observations were for a floor above the ground floor.

[56] The models were also estimated by excluding these two outliers. The changes in the results were minor.

The simple correlation coefficients between any two explanatory variables were examined to detect the possible presence of severe multicollinearity. The value of the correlation coefficient between *GLA* and *deptnumbr* was 0.52, which was the highest among the explanatory variables. The correlation coefficient that had the second highest absolute value was for *population* and *deptnumbr*, which was 0.35. The absolute value of the correlation coefficients of the rest of the explanatory variables was below 0.3. Empirically, researchers become concerned about multicollinearity if the absolute value of the correlation coefficient exceeds 0.8 (Studenmund, 2006). Since the value of the correlation coefficient between the explanatory variables was well below 0.8, severe multicollinearity was not diagnosed.

In addition, as robustness checks, the variance inflation factor (VIF) was calculated. The VIF for each coefficient β_i is defined as:

$$VIF(\beta_i) = \frac{1}{1-r_i^2} \quad (5)$$

where r_i^2 is the unadjusted R squared obtained by regressing each individual explanatory variable on all the other explanatory variables (Studenmund, 2006). The value of VIF can range from 1 to infinity. If an explanatory variable x_i is closely related to the other explanatory variables, the estimation of the OLS regression will generate a big r_i^2. Accordingly, the value of VIF will be big. On the other hand, if x_i is not related to the other explanatory variables at all, r_i^2 will have a value of 0 and the VIF will be equal to 1. Empirically, VIF = 5 is used as the benchmark (Studenmund, 2006). If the value of VIF is below 5, severe multicollinearity is not diagnosed.

Table 3.7 reports the variance inflation factor (VIF) generated for each explanatory variable. The results for the developer dummies are suppressed.

Table 3.7: the Variance Inflation Factor (VIF)

Variable	VIF	Variable	VIF
GLA	1.87	*Walmart*	1.24
centrage	1.30	*Zellers*	1.58
population	1.43	*downtown*	1.59
competition	1.28	*mainentry*	1.11
deptnumbr	2.07	*upperflr*	1.19
Sears	1.43		

As shown in the table, the size of VIF is well below 5, the commonly used benchmark (Studenmund, 2006), indicating that severe multicollinearity is not diagnosed.

3.6.2 Regression Results

Table 3.8 reports the results of the two regression functions when either *ratio_c* or *ratio_m* are used as the dependent variable. When *ratio_c* is the dependent variable, R^2 is 0.12. The estimated coefficient on *GLA* is 0.015, which means that, everything else held constant, *ratio_c* is expected to increase by 0.015 units when the GLA of the regional shopping center is increased by one unit (i.e., 100,000 square feet). Although the impact of *GLA* on *ratio_c* is estimated to be small, it is statistically significant at the 5% level. Since a center's *GLA* is expected to be related to the developer's bargaining power, this finding is consistent with the hypothesis that the location pattern of stores in an area close to

department stores would depend on the bargaining power of a developer. The positive sign of the coefficient for GLA is consistent with the scenario that large shopping centers provide more comparison and multipurpose shopping opportunities and are attractive to customers and department stores. As a result, developers of large shopping centers possess greater bargaining power and are able to locate more C stores near department stores.

Table 3.8: Regression Results.[57]

Variables	***Y = ratio_c***	***Y = ratio_m***
GLA	0.015**	-0.006
	(0.006)	(0.006)
centrage	0.008**	-0.011**
	(0.003)	(0.005)
population	0.023	0.035
	(0.049)	(0.066)
competition	-0.103	0.069
	(0.099)	(0.128)
Sears	-0.009	0.044
	(0.081)	(0.129)
Walmart	-0.159	0.110
	(0.119)	(0.156)
Zellers	-0.143	0.173
	(0.087)	(0.135)
deptnumbr	-0.158***	0.065
	(0.047)	(0.064)
mainentry	0.334***	-0.445**
	(0.114)	(0.213)
downtown	-0.106	-0.095
	(0.116)	(0.169)
uppflr	0.135	-0.246**
	(0.091)	(0.123)
Constant	0.883***	1.453***
	(0.219)	(0.305)
R^2	0.12	0.07

***Indicates significance at the 1% level. **Indicates significance at the 5% level.
*Indicates significance at the 10% level. The variables in brackets are standard errors.

[57] The estimation results on the developer dummies are suppressed.

The coefficient on *centrage* is significant at the 5% level, which supports the hypothesis that variables reflecting a developer's bargaining power have explanatory power in the location pattern of stores near department stores. The positive sign of the coefficient of *centrage* implies that older centers may be attractive to department stores due to their established reputation and customer loyalty. Hence, developers of older centers have a more favorable bargaining position and could locate more C stores near department stores.

The coefficients on *competition* and *population* are not statistically significant at any conventional level, indicating that the impact of *competition* and *population* on *ratio_c* is not identified in this analysis. The coefficient on *deptnumbr* is -0.158, which means that *ratio_c* is expected to decrease by 0.158 unit when a regional shopping center contains one more department store, all else held constant. Such an impact is statistically significant at the 1% level of significance. This finding is consistent with the hypothesis that developers have more limited outside options as the number of department stores increases in a shopping center and therefore possess less bargaining power and would not be able to locate more C stores near department stores.

The coefficients on the department store chain dummies *Sears*, *Walmart*, and *Zellers* are negative; however, none of them are statistically significant at any conventional level. These dummies are expected to capture the idiosyncratic properties and bargaining strength of a department store chain. The finding that they have no explanatory power in *ratio_c* implies that the bargaining strengths of department store chains might not significantly differ from each other, since only

four department store chains are available to anchor a regional center in Canada. As a result, the location pattern of stores is mainly determined by the bargaining position of the developers.

Regarding the location-related variables, the coefficient on *mainentry* is 0.334 and statistically significant at the 1% level, indicating that *ratio_c* is bigger for department store main entrances than for their side entrances. The coefficients on *upperflr* and *downtown* are not statistically significant at any traditional level.

Dummy variables for all developers operating at least two sample centers are included as independent variables. These variables are expected to capture the difference between developers that operate multiple sample centers and developers that operate a single one, as well as the idiosyncratic difference of a developer, including bargaining strength. A robust *F* statistic that tests the joint significance of these developer dummies yields *F(12,147)=22.49* with *P-value=0.0000*, which means that the joint impact of the developer dummies is significantly different from zero at the 1% level. The regression results show that, compared with shopping centers owned by developers that operate a single sample center, *ratio_c* is smaller in centers operated by RioCan Property Services. Such a difference is significant at the 5% level. Given the fact that RioCan Property Services operates 13 sample centers, this finding is not consistent with the expectation that developers who own multiple shopping centers would have a more favourable bargaining position and would locate more C stores near department stores. Nevertheless, the results also show that shopping centers operated by T & T Properties have a bigger *ratio_c*, whereas centers operated by

Darton Property Advisors & Managers Inc. have a smaller *ratio_c*. These findings, combined with the fact that T & T Properties operates more sample centers than does Darton, implies that the size of a developer alone does not decide its bargaining position or the location pattern of stores near department stores in a shopping center. The coefficients on the other developer dummies are not statistically significant at any conventional level. The estimation results on the developer dummy variables are not included in this paper.

RESET (Ramsey's regression specification error test) was conducted to test for functional form misspecification and omitted variables. Powers (i.e., second, third, and fourth powers) of the fitted value are included in the regression functions as extra explanatory variables. The test result shows that *F (3, 356)* = 0.38 and the associated *P-value* is 0.7687, indicating that the coefficients of the second, third, and fourth power of fitted values are jointly insignificant. The result of RESET suggests that evidence of functional form misspecification and omitted variable was not detected. Additionally, a robust *F* statistic, testing the joint significance of all slope variables yields *F(23,147) = 44.17* with *P-value = 0.0000*, indicates that the joint impact of the slope variables is significantly different from zero at the 1% significance level.

When *ratio_m* is the dependent variable, the generated R^2 is 0.07. The coefficient on *centrage* is significant at the 5% level, which is consistent with the hypothesis that variables reflecting a developer's bargaining power have explanatory power in the location pattern of stores near department stores. The negative sign for the coefficient of *centrage* is consistent with the scenario that

older centers with established reputation and customer loyalty would have more bargaining strength and could locate fewer M stores near department stores. However, the relation between *ratio_m* and the other indicators of a developer's bargaining power was not identified in this analysis. This finding implies that the interests of developers and department stores regarding the locations of M stores near department stores might not be substantially divergent as it is for C stores. In addition, the coefficients on *mainentry* and *upperflr* are negative and statistically significant at the 5% level, indicating that (1) fewer M stores are located near a department store's main entrance than its side entrance, and (2) fewer M stores are located near a department store's upper floor entrance than its first floor entrance.

A robust *F* statistic that tests the joint significance of all developer dummies yields *F(12,147)=1.68* with *P-value=0.0776*, indicating that the joint impact of these dummies is significantly different from zero at only the 10% significance level. The regression results show that, compared to centers owned by small developers that operate a single sample center, *ratio_m* is bigger in shopping centers operated by RioCan Property Services, the Cadillac Fairview Corp. Ltd., 20 Vic Management Inc., and Darton. The differences are significant at the 10%, 5%, 5%, and 10% level, respectively.[58]

The robust *F* statistic examining the joint significance of all slope variables yields *F (23,147) =1.84* with *P-value* = 0.0164, which means that the joint impact of the slope variables is significantly different from zero at the 5%

[58] The estimation results on the developer dummy variables are not included.

level. The result of RESET shows that *F (3, 356)* = 1.64 and the associated *P-value* is 0.1791, indicating that the coefficients of the second, third, and fourth power of the fitted values are jointly insignificant; hence, showing that evidence of functional form misspecification and omitted variable was not detected.

To test for robustness of the results, an alternative measurement of being close to department stores is used. A store is defined as being close to a department store when the store's entrance is located within 100 feet of a department store's entrance, measured by walking distance. When individuals walk from a department store to another store in a shopping center, presumably, they will choose the shortest possible route. Here, "possible route" means a pathway that a customer would have to follow in a mall (i.e., no walking through walls). The length of the shortest route is defined as the walking distance. Using the Euclidean distance, 2,412 stores were defined as being close to department stores in the sample malls. When walking distance is used; however, only 2,007 stores were defined in this way.[59]

As the definition changes, the estimated coefficients do not exhibit big differences, which indicates that the estimation results are robust. When *ratio_c* is the dependent variable, the variables that are significant in both regressions include *GLA*, *deptnumbr*, *mainentry*, and developer dummies for T & T Properties and Darton Property Advisors & Managers Inc. When different measurements of distance are used, minor changes occur in the level of significance for *GLA*. With the walking distance, the coefficient on *GLA* is more statistically significant. The

[59] See Figure 3.3 in the Appendix, which discusses the group of stores that are identified as being close to department stores under the above two definitions.

main changes are for *centrage*, *downtown*, and *Walmart.* In the new estimation, the coefficient on *centrage* becomes insignificant, though the sign remains the same. The coefficient on *Walmart* becomes significant. The negative sign for the coefficient on *Walmart* indicates that *ratio_c* is smaller for Walmart stores than for the Bay stores, holding everything else constant. In addition, the coefficient on *downtown* remains negative but becomes significant, though at the 10% level only. The coefficient on dummy for RioCan Property Services is no longer significant, whereas the coefficient on dummy for MorGuard Investments Ltd. is positive and significant at the 10% significance level.

Regarding the estimation when *ratio_m* is the dependent variable, using the walking distance, the estimated coefficient on *centrage* is significant at the 10% level rather than at the 5% level. The coefficient on *deptnumbr* becomes significant, though only at the 10% level. The coefficient on *upperflr* becomes insignificant at any reasonable level of significance. In addition, the results show that shopping centers operated by 20 Vic Management Inc. have a bigger *ratio_m* than those operated by small developers that own only one sample mall. As to the other developers, the difference in *ratio_m* was not identified.

In this paper, regional shopping centers were required to have at least 40 retailers. To explore the robustness of the empirical findings, the models were estimated for a subset of the sample malls that had at least 60 retailers. In addition, alternative dependent variables were used. For example, instead of the ratio, the difference between the fraction of stores near department stores that are C stores (or M stores) and the fraction of C stores (or M stores) for the entire shopping

center were used. The store location patterns near department stores were also compared with the rest of the shopping center (i.e., areas that were not close to any department store in a shopping center) instead of the entire shopping center. The results of the above estimations showed that changes in the results are minor, which means that the findings of this paper are robust.

3.7 Conclusions

Inside a regional shopping center, the area near department stores is expected to have higher customer traffic due to the ability of department store to attract customers, and the stores located in such areas would be important to the developers because of their potential rental payments. Regarding the types of stores that should be located in such areas, the interests of developers and department stores may not coincide, since department stores only care about their own profit while developers care about the rental payment they can extract from the entire center. In the presence of a conflict of interest, the store location patterns near department stores are expected to depend on the relative bargaining power of the two parties.

In this paper, we empirically examine the above hypothesis. Variables indicating the composition of stores within 100 foot radius of a department store's entrance were used as the dependent variable. Indicators of bargaining power for developers were included as explanatory variables. Because only four department store chains were in the sample, indicators of department store bargaining power were not used as independent variables in the analysis since the data on these

indicators lack sufficient variation. Instead, department store dummies were included. In addition, location-related variables were also included.

The results of estimation show that the concentration of stores that cater to comparison shoppers on a multipurpose shopping trip (e.g., clothing store and shoe store) within 100 foot radius of a department store's entrance is bigger in regional shopping centers that are older or have a larger gross leasable area (GLA). The results also show that this concentration is negatively related to the number of department stores contained in a center. A regional shopping center's GLA and age, and the number of department stores in the center are expected to reflect the developer's bargaining power. Hence, the finding that these variables have explanatory power in the composition of stores near department stores is consistent with the hypothesis that the location pattern of stores in an area close to department stores depends on the bargaining power of the developer. In addition, the estimated coefficients on developer dummies imply that the size of a developer alone might not decide its bargaining position or the location pattern of stores selling comparison shopping goods near department stores in a center.

The positive sign of the coefficient on a center's GLA is consistent with the scenario that developers of large shopping centers possess greater bargaining power because such centers can provide more comparison and multipurpose shopping opportunities and are attractive to customers, and hence, are attractive to department stores. The positive sign of the coefficient on a center's age is consistent with the scenario that older centers may have built a reputation and customer loyalty and have a more favorable bargaining position. As a developer

has more bargaining power, they would be able to locate more stores selling comparison shopping goods near department stores. The estimated coefficient on the number of department stores contained in a shopping center is negative, consistent with the hypothesis that developers have more limited outside options as the number of department stores increases in a shopping center. Therefore, they have less bargaining power and are not able to locate more stores that sell comparison shopping goods near department stores.

The results of estimation show that the concentration of stores that cater to multipurpose shoppers on a multipurpose shopping trip (e.g., bookstore, liquor store, supermarket, dry cleaners) within 100 foot radius of a department store's entrance is estimated to be smaller in older centers. Compared with shopping centers owned by small developers that operate a single sample mall, this concentration seems to be bigger in shopping centers operated by big developers that operate at least two sample malls. However, the relation between this concentration and the other indicators of a developer's bargaining power was not identified. The results of estimation imply that the interests between developers and department stores regarding the locations of stores catering to multipurpose shoppers near department stores might not diverge substantially.

To explore the robustness of the empirical findings, the models were estimated for a subset of the sample malls that have at least 60 retailers. In addition, alternative variables measuring the location pattern of stores near department stores and alternative definitions of being close to a department store

were used. The changes in the results were minor, which means that the findings described above are robust.

This empirical analysis examines how the store location patterns near department stores vary with the relative bargaining power of developers and department stores. A caveat should be mentioned for the above assumption: instead of bargaining over store locations, developers might choose the location configuration within the regional shopping center that maximizes overall center profit, and then compensate department stores through rents for having less than ideal stores located near them.

This paper investigates the location pattern of stores within 100 foot of a department store's entrance in regional shopping centers. The location patterns of stores in the rest of the shopping center were not investigated. This issue is explored in Chapter 2 of the thesis.

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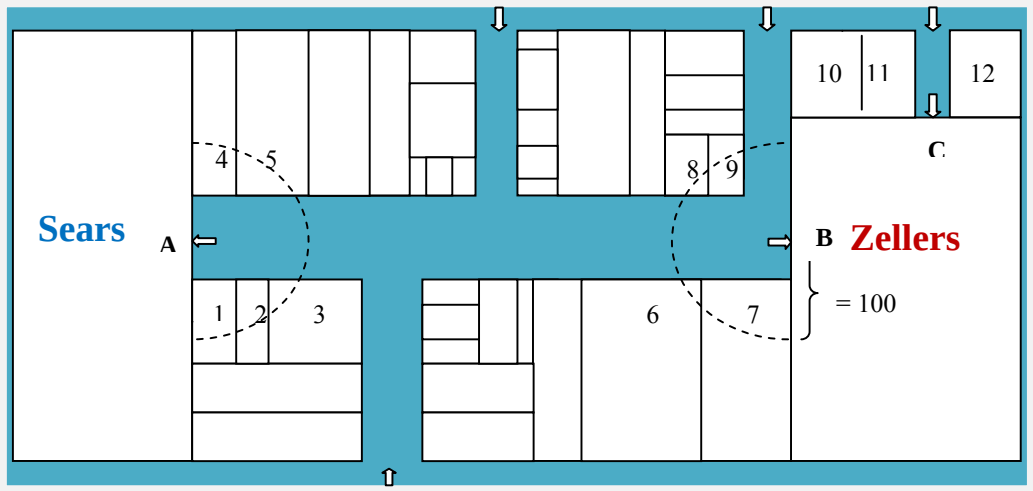
3.9 Appendix

Table 3.9: Classification of C, M, Other Stores and Non-Retail Stores by Golosinski and West (1995).

C Stores	M stores	Other Stores	Non-Retail Stores
Athletic Apparel	Beauty Supply	Automotive	Educational/Training
Camera	Book/Newsstand	Business Services	Insurance
Children's Wear	Card/Stationery	Car & Truck Rental	Medical/Dental
Computers	Drug/Health & Beauty Aids	Financial	Non Retail
Department/Mass Merchandiser	Dry Cleaner	Fitness/Recreation Place	Other Non-Retail
Electronics	Fabric/Sewing Access.	Hardware/Paint & Paper	Postal Services
Family Wear	Florist/Nursery	Laundromat	Real Estate
Footwear	Grocery	Other Services	
Furniture & Home Décor	Hairstyling/Esthetic	Pet	
Gift	Music/Video	Printing	
Hobby/Craft	Office Supply	Rental Equipment/Furniture	
Home Appliance	Optical	Restaurant & Fast Food	
Home Improvement	Photo	Second Hand Merchandise	
Housewares	Shoe Repair	Specialty Food & Drink	
Jewellery/Fashion Access.	Tailoring/Alterations	Specialty Merchandise	
Ladies' Wear	Travel	Theatre/Entertainment	
Leather Access. & Luggage	Variety/Convenience	Ticket/Lotto Sales	
Menswear		Wireless / Telecommunication	
Sporting Goods			
Toy/Games			
Unisex Clothing			
Window Coverings			

Figure 3.3: Floor Plan for a Hypothetical Regional Shopping Center



This hypothetical shopping center has two department stores: Sears and Zellers. Sears has a single entrance (point A) and Zellers has two entrances (points B and C). As defined in Section 3.5.1 (b), points A and B are the main entrances, whereas C is the side entrance. Altogether, three entrances would be made for this center.

In this paper, a store is defined as being close to a department store if it is located within 100 foot radius from the entrance of a department store, measured by the Euclidean distance. Based on this definition, the stores near Sears include stores 1-5. Stores near Zeller's main entrance include stores 6-9, and those near Zeller's side entrance are stores 10-12. The alternative measurement measures the 100 foot radius by the walking distance (i.e., the shortest possible route a consumer would choose). Based on this definition, the stores near Sears include stores 1, 2, 4, and 5. Stores near the main entrance of Zellers include stores 7-9. Stores near the side entrance of Zellers include stores 11 and 12.

4. The Impact of the Entry of Power centers on the Tenant Mix of Regional Shopping centers

4.1 Introduction

It is well known that cities contain a hierarchy of shopping centers, where there exist a small number of large centers and a large number of small centers; centers at each level contain all of the store types that can be found in lower level centers, plus additional ones. It is identified in the literature that a shopping center hierarchy usually contains the following types of shopping centers: neighbourhood centers, community centers, regional centers, and the central retail district[60] (West, Von Hohenbalken, and Kroner, 1985).

In the early 1990s, a retail format called "power center" emerged. Although there is no precise definition of power centers, they are distinguished from the above hierarchical shopping centers mainly on the power centers' structure: (1) they are open air; and (2) they usually include a discount department store (e.g., Walmart) and several big-box retailers (e.g., Toys-R-Us, Home Depot, etc.). Power centers' drawing power to customers is well recognized in the literature (Hahn, 2000; Lord and Bodkin, 1996; Haltiwanger, Jarmin, and Krizan, 2010), which includes the wide selection of merchandise and discounted price that they offer, compared with stores in hierarchical shopping centers. Inside a power center, with the store's name on each building, consumers can easily locate a store and drive up to the store front. In this way, customers can economize on time

[60] See Section 4.3 for the detailed definition of each type of shopping center contained in the hierarchy.

spent searching for stores, which is considered as another benefit of shopping at power centers (Hahn, 2000).

The emergence of power centers has sparked research interest. Researchers have investigated the emergence of big-box retailing (Spector, 2005, and Munroe, 2001) and power centers (O'Mara, Beyard, and Casey, 1996), the relation between the form of power centers and the movement of consumers within a center (Lorch, 2005; and Lord and Bodkin, 1996), and the difference between power centers and the other types of shopping centers (Hahn, 2000; Biba et al., 2006; and Lee, Atkins, Kim, and Park, 2006). However, work remains to be done on the analysis of competition among power centers and hierarchal shopping centers in the same geographic area. Fundamentally, this is a product market definition problem. Under what conditions will the entry and expansion of power centers in a city have significant competitive impacts on shopping centers that are part of the shopping center hierarchy?

The purpose of this paper is to use time series data on the internal composition of regional shopping centers in the five major cities of the Canadian Prairie Provinces from 2000 to 2010 to carry out an empirical analysis of the competitive impact of power centers on regional shopping centers. Regional shopping centers sit at the upper end of the shopping center hierarchy. They contain a large variety of store types that include stores selling convenience goods or providing personal services (e.g., food, drugs, dry cleaners, tailor shops), plus stores selling comparison shopping goods that could be purchased on a multi-purpose shopping trip (e.g., shoes, clothing, jewelry); and they have multiple

stores selling similar comparison shopping goods (e.g., multiple ladies' apparel stores and shoe stores) (West, Von Hohenbalken, and Kroner, 1985). The entry of a power center into a city with a shopping center hierarchy could potentially have an impact on centers at any level of the hierarchy, depending on the power center's tenant list, size, and location. In this paper, the focus is on regional shopping centers because regional shopping centers that are managed by a single developer have been the object of shopping center developer mergers that may have lessened competition in their markets. The assessment of a shopping center merger can turn on the question of the impact of power centers on competition in the shopping center hierarchy.

Investigation of the potential competition between power centers and regional shopping centers will contribute to the literature on the empirical investigation of shopping centers. In addition, power centers and regional centers compete in both a spatial dimension (i.e., location) and a product dimension (i.e. tenant mix). This provides a good opportunity to examine the predictions proposed by the theory regarding the spatial competition of firms in multiple dimensions, for which empirical support is lacking (Netz and Taylor, 2002).

The remainder of this paper is organized as follows: Section 4.2 briefly reviews the literature on the impact of big-box retailing. Section 4.3 presents a discussion of shopping center hierarchy and power centers. Section 4.4 describes the data. Section 4.5 discusses the econometric strategy. Section 4.6 presents the regression results. Finally, Section 4.7 is the conclusion.

4.2 Studies Related to the Impact of Power Centers

Power centers are defined as open-air shopping centers that contain mass merchandisers as their anchors and include "big box" retailers as their major tenants (O'Mara, Beyard, and Casey, 1996; Bodkin and Lord, 1997; and Hahn, 2000). The anchors can be discount department stores (i.e., retail establishments that have a reputation for selling a variety of merchandise at prices lower than competitors, e.g. Walmart), superstores (a retail format that provides a selection of food and household merchandise that is large in the total number of merchandise categories and the number of choices within the same category), and warehouse clubs (i.e. retail establishments that are similar to discount department stores but require customers to pay a membership fee to enter and shop at the store, e.g. Costco and Sam's Club)[61]. Big box retailers are retail outlets that are "several times larger than the average store in the same retail sector" (Hernandez and Simmons, 2006, p.468). However, using size alone as the criterion is not enough. The goods sold in the store and whether a discounted price is offered are the other two determinants of big box retailers (Haltiwanger, Jarmin, and Krizan, 2010). A typical big box retailer is a store which sells a narrow category of goods (e.g., toys, electronics) but carries a wide selection of this type of goods in the store (Lord and Bodkin, 1996, p.34). It thus permits comparison shopping across goods of a type. Because the store focuses on a particular category of goods, it is also called

[61] There are studies in the literature that include discount department store and warehouse clubs as big-box retailers (e.g. Hahn, 2000; and Hernandez and Simmons, 2006). In this paper, we distinguish them because discount department stores and warehouse clubs carry a variety of merchandise whereas the so-called big-box category killers focus on a particular category of goods. See Hernandez and Simmons (2006, p.472) for the average size of the above stores in Canada in 2003.

a “category killer”, e.g. Toys-R-Us, Home Depot and Best Buy. Regarding the number of big-box retailers that are necessary for a center to be considered a power center, there is no precise criterion in the literature. A power center could thus consist of a small number of large big box stores and a mass merchandiser, but it might contain a number of conventional retailers as well.

There are three streams of studies in the literature that are related to this paper: (1) studies analyzing the impact of big-box retailing and power centers; (2) studies discussing the entry of Walmart and its impact on local retailers; and (3) theoretical discussion of locations of firms in multiple-dimensions and the empirical evidence. These studies will be discussed in this section.

4.2.1 Empirical Literature on Big-Box Retailing and Power Centers

This stream of literature shows the change in various aspects of the retail industry after the emergence of big-box retailers and power centers in the past two decades. Jones and Doucet (2000) evaluated the growth and impact of power centers and big-box retailers in the Greater Toronto Area, using three key variables: store closures in the major retail strips, the redistribution of retail sales, and employment in the retail sector. They found that the fraction of service stores has been increasing on Toronto’s retail strips during the 1990s. The fraction of other type of retail stores slowly decreases, with stores selling office products and hardware having the largest closure rate.

Later, relying on data collected from 8 regional malls in the Greater Toronto Area over the period 1992 to 1999, Jones and Doucet (2001) examined

how retail store types within these malls change over time since the emergence of big box retailing. Descriptive statistics show that drug stores and movie theatres were the store types that displayed the most stability over the entire sample period. The store types of food, toys, and games were stable over 1992-1996, but started to decline after 1996. Hardware, fabrics, office supplies, and pet supplies were found to have losses of varying size. Furniture and general merchandise/department stores experienced significant losses over 1992-1999. The only store types with continuous growth within shopping centers over 1992-1999 were electronics and sporting goods. According to Jones and Doucet (2001), department stores, retailers and shopping centers responded to the competition of big-box retailing by undertaking different types of restructuring. For example, both Sears Canada and the Hudson Bay Company established a chain of home stores. Canadian Tire started to develop large-format stores and opened a new specialty chain named Partsource.

Hernandez (2003) provided a descriptive analysis of the competitive impact of Home Depot Inc., a big box retailer, in Canada. For each big box location, Hernandez provides the closure ratios for non-big-box home improvement retailers located nearby and showed that the entry of Home Depot has negative impact on traditional street-front and mall-based home improvement retailers. Over the last decade of the 20th century, home improvement retailing is found to move from the traditional enclosed mall and street-front stores to big-box retailing in the Greater Toronto Area (GTA).

Lorch (2006) looked into the geographic location of big-box retailing in the retail sector of Winnipeg and found that big-box retailers are frequently built around enclosed regional centers. He thus concluded that the big box development reinforced the existing geographic pattern of business areas rather than changed it. In addition, Lorch found that strip malls exhibit high vacancy rates, whereas some planned regional shopping centers react by including some big-box stores on site after the "advent of power retailing".

The above descriptive studies explore the evolution of retail industries in the era when big-box retailing was expanding. However, a rigorous regression analysis that controls for the other factors that could lead to the changes in retail structure is missing. Hernandez (2003) focused on a particular type of big-box retailer (i.e., Home Depot). Whether the findings can be extended to the other types of store categories is uncertain. Jones and Doucet (2000) investigated the impact of big-box retailing on retail strips. There is no developer managing such retail strips, so entry and exit are not controlled. There are possible alternative explanations for the exit of stores from retail strips that may not be linked to the power center entry and expansion. For example, an unplanned retail strip could have "excess capacity" in the form of replication of certain store types for which comparison shopping is not important[62]. Jones and Doucet (2001) explored the changes within planned regional shopping centers, identifying the rise and decline of store categories after the emergence of big-box retailing. However, as a

[62] West (1993) finds that unplanned centers have "more replication of stores of types for which replication would represent excess capacity and fewer stores of types for which replication would reduce consumer search costs".

descriptive analysis, the influence from factors such as the characteristics of a regional center and the distance between the center and the big-box retailer were not controlled.

In a regression analysis, Haltiwanger, Jarmin, and Krizan (2010) studied the impact of big-box entry and growth in the Washington D.C. metro area on employment growth at retail establishments located nearby. They found the entry of big-box retailers poses substantial negative impact on the employment growth at independent and small chain stores that are in the same retail industry, and such effect decreases with geographic distance. Although they investigate the impact of big-box retailing on a different aspect, their empirical analysis does provide some indication of the possible competitive effect of big box retailers.

4.2.2 Empirical Literature on Entry of Walmart

In addition to the above studies, there is a stream of literature that focuses on the impact of a Walmart store's opening on local retailers. These studies are worth exploring because the econometric strategies adopted in these empirical analyses could be used in this part of the thesis. For example, Basker (2005) studied the effect of Walmart's entry on average city-level prices of ten frequently-purchased consumption goods (e.g. Aspirin, Cigarettes, Coke, detergent, etc.) in 165 US cities from 1982 to 2002. Negative price effects are identified for several products with varying magnitudes. Paruchuri, Baum, and Potere (2009) used a random-effect regression for the entry and exit of independent retailers of four types (i.e., home furnishings, photo studios, beauty

salons, and antique stores) in Florida from 1980 to 2004 (i.e. before and after the entry of Walmart stores). They found that the impact of Walmart varies with independent retailers' merchandise overlap with and distance to Walmart. Artz and Stone (2006) used a difference-in-differences estimation method to estimate the impact of Walmart Supercenter on the sales growth of existing grocery stores in Mississippi from 1990 to 2005. They found that Walmart's entry cause grocery store sales to decrease. Such a negative impact is about four times bigger in nonmetropolitan markets than in metropolitan markets.

4.2.3 Studies on Theory of Locations in Multiple-Dimensions and Empirical Evidence

In this section, the theory of locations in multiple dimensions will be reviewed, with a discussion of predictions that could be tested using the shopping center data, as power centres and regional centres are expected to compete in two dimensions: location and tenant mix. The theoretical literature on spatial economics has produced two groups of conflicting predictions regarding the equilibrium locational configuration of firms: clustering (e.g., Hotelling, 1929; and de Palma et al., 1985) and differentiation (e.g., Prescott and Visscher, 1977; Neven, 1987; Zhou and Vertinsky, 2001; and Gupta, 1992). This divergence can be explained by the various underlying assumptions made by these authors (Netz and Taylor, 2002), which include assumptions as to the distribution of consumers, the elasticity of demand, the structure of transportation costs, consumer heterogeneity, firm homogeneity or heterogeneity, and timing of entry (i.e., simultaneous vs. sequential). However, when the choice of differentiation is

considered in a multidimensional fashion, clustering and differentiation could be achieved.

Ben-Akiva et al. (1989) construct a model where *n* firms compete with each other in a non-cooperative fashion in two dimensions: location and brand specification. Each firm sells a product which is differentiated in terms of brand specification from other products. The degree of differentiation in the brand space is assumed to be exogenous. The market place is a bounded line segment. Consumers incur linear transportation costs in the geographic space and quadratic costs for not getting their most preferred product in the brand space. Facing inelastic demand, firms are assumed to choose both prices and locations in the geographic space. The authors show that firms will choose central location (i.e., agglomeration) when product differentiation is large enough, which means that firms choose minimum differentiation in one dimension and maximum differentiation in another dimension. In other words, when firms are located close to one another, the theory predicts that their products will be as different as possible in terms of brand specification. Such differences decrease when firms are located away from each other. The underlying rationale is that firms differentiate themselves to avoid direct competition and potential profit loss.

Similar results are found in Tabuchi (1994) and Irmen and Thisse (1998). Using a two-stage two-dimensional spatial model where two firms choose location in the first stage, anticipating price competition in the second stage, Tabuchi (1994) showed that the firms maximize their distance in one dimension, but minimize their distance in the other dimension. In a subsequent study, Irmen

and Thisse (1998) found that "in the location game with *n* characteristics, firms choose to maximize differentiation in the dominant characteristic and to minimize differentiation in the others when the salience coefficient of the former is sufficiently large" (Irmen and Thisse, 1998, p. 76).

Allowing firms to differentiate in both the dimension of physical space and the dimension of product attributes, Netz and Taylor (2002) examined the locational patterns of gasoline stations in the Los Angeles basin. They show that gasoline stations prefer to spatially differentiate themselves as competition increases. Increased competition means price matching, which can be considered as minimum differentiation in the dimension of product price. Spatial dispersion means maximum differentiation in the dimension of location. The fact that gasoline stations spatially differentiate themselves as competition increases supports the theory of locations in multi-dimensions, which predicts that maximum differentiation in one dimension will lead to minimum differentiation in all other dimensions. However, their results also show that an increase in attribute differentiation will lead to an increase in spatial differentiation, which means maximum differentiation in both dimensions and is inconsistent with the prediction of the theory.

Using data on U.S. airline departure times in both regulated and unregulated periods, Borenstein and Netz (1999) estimated the effect of competition on product differentiation and showed that increased competition on a route leads to a reduction in departure-time differentiation in both periods. Since there is not much price differentiation in a regulated period, their findings show

that firms minimize differentiation in all dimensions, which is inconsistent with the theory of locations in multiple-dimensions. Their results also show that reductions in scheduling constraints increase differentiation in the unregulated period, an effect that is not evident in the regulated period. Therefore, firms may be differentiating their products to reduce price competition. The findings of Borenstein and Netz (1999) provide ambiguous support for the location theory in multiple dimensions.

Summarizing the total waiting time for all flights on a certain route, Salvanes et al. (1997) constructed a waiting cost index that measures the degree of clustering of departure times during a day. By observing both monopoly and duopoly routes during periods of regulation and deregulation in Norway, they found a tendency toward clustering between firms in duopoly, and even more so in the business travelers segment than in general.

Other empirical studies include Shaw (1982), Swann (1985), and Stavins (1995). Shaw (1982) examined the process of product competition in the UK agricultural fertilizer market and provided weak evidence that clustering in the choice of product location tends to develop in the process of competition. Swann (1985) focused on developments in microprocessors from 1971 to 1981 and showed two types of clustering: (1) clustering of producers in their own design and (2) clustering of second source production (i.e., copying established designs). Stavins (1995) investigated the personal computer industry and found that when more firms exist, entrants tend to locate their new computer models more closely to the existing models.

In short, empirical support is lacking for the theory of location in multiple dimensions. Most of the existing studies provide evidence that is not consistent with the theory of location in multiple dimensions, except for Borenstein and Netz (1999) and Netz and Taylor (2002), whose findings provide mixed support for the theory. This paper will provide some empirical investigation of the theory of location in multiple dimensions using the shopping centre data.

4.3 Shopping Center Hierarchy and Power centers

4.3.1 Theory of Central Places

In 1933, Walter Christaller proposed the theory of central places to explain/describe the size distribution of cities. Since then, this theory has been applied by many researchers in explaining the spatial patterns of retailing (e.g., Berry, 1961, 1963). However, Christaller's (1966)'s "brilliant conjectures" about the spatial structures of cities are based on "mechanistic, geometric arguments", not economic behavior (Eaton and Lipsey, 1982). Eaton and Lipsey (1982) try to re-build the central place theory on economic foundations, and propose that the clustering of heterogeneous retail firms facilitates multipurpose shopping. Their theoretical work shows that the formation of central places is the result of the interaction of consumers' multipurpose shopping behavior and firms' profit maximizing choice. The equilibrium of Eaton and Lipsey's model satisfies the hierarchical principle: a small number of large centers and a large number of small centers; and centers at each level contain all of the store types that can be found in lower level centers, plus additional ones. Using shopping center panel

data from Edmonton, West, Von Hohenbalken, and Kroner (1985) test the predictions of both Christaller's classic model and Eaton and Lipsey's model. The shopping center hierarchy they identified has characteristics that are consistent with the predictions of the Eaton and Lipsey model. In the next section, the characteristics of shopping centers at each level of the hierarchy will be described. Comparing the characteristics of power centers and hierarchical shopping centers will indicate whether power centers fit into the shopping center hierarchy.

4.3.2 Shopping center Hierarchy and Power Centers

To identify shopping centers at each level, West, Von Hohenbalken, and Kroner (1985, p.105) [63] start by classifying store types into different categories:

M_1 and M_2 store types are stores catering to multipurpose shoppers. For M1 and M2 stores selling goods, the products sold in stores of a particular type tend to be similar and are frequently purchased. Consumers are expected to engage in little search across stores of a given type. Examples of M_1 stores include drug stores and grocery. Examples of M_2 stores include book stores and music stores. Compared with M_1 stores, M_2 stores require a comparatively larger customer base. The reason is because goods offered in M1 stores are more

[63] In Golosinski and West (1995, 462-63), store types are grouped in a different way. They define two types of stores: "C" stores and "M" stores. "C" stores are those types of stores that cater to comparison shoppers on a multipurpose trip. Examples of C store types include ladies' wear and shoe stores. "M" stores are those types of stores that cater to multipurpose shoppers on multipurpose trips. They sell products that are more frequently purchased than are the goods from C stores, and consumers engage in little search across M stores of a given type. M stores tend to be the same or very similar, except for M stores that sell services, which vary in price and quality. Examples of M stores include book stores and grocery stores.

frequently purchased than goods provided in M2 stores. A larger customer base is required for M_2 stores to survive.

C stores are defined as stores catering to comparison shoppers on a comparison shopping trip. Examples include automobile dealerships and home appliance stores.

MC stores are stores catering to comparison shoppers on a multipurpose and comparison shopping trip, and include such store types as footwear stores and clothing stores.

S stores are defined as stores serving single purpose shoppers, e.g., movie theatres.

After defining the store categories, the authors classify shopping centers into four main levels, which are neighborhood centers, community centers, regional shopping centers, and central retail districts, listed in an ascending order. Neighborhood centers mainly contain M_1 stores. Community centers contain M_1, M_2, and a small number of MC stores. Planned regional centers are distinguished from unplanned regional centers. The former contain all of the MC store categories that could be found at community centers, with each in larger variety. C and S stores are seldom found in planned regional centers. Unplanned regional centers have a tenant mix that is similar to regional centers but they might also contain C and S stores. Central retail districts contain each store category in a wider variety. For completeness, in addition to the above shopping centers, the authors also defined highway strips, which mainly contain C and S stores, and

may include some M_1 stores. Such centers fall outside the shopping center hierarchy.

As discussed at the beginning of Section 4.2, in addition to the key characteristics that power centers are open air and contain mass merchandiser and big box category killers, the tenant list of power centers can vary. A power center could consist of a small number of large big box stores and a mass merchandiser, but it might also contain a number of conventional retailers as well. Based on the distinction between the characteristics of power centers and the hierarchical centers, power centers do not easily fit into the shopping center hierarchy.

4.3.3 Impact of the Entry of Power Centers

The central question of this paper is how the entry of power centers affects regional shopping centers. The theory of locations in multiple-dimensions provides a discussion of competition among firms at a general level. Assume power centres and regional centres compete in two dimensions: location and tenant mix. As discussed earlier, the differences between power centers and regional centers include the big box retailers contained in power centers, and possibly the number of store types and stores of a type in the power center. Therefore, the impact of a power center on regional centers located nearby is expected to vary based on the characteristics of both centers. Assume a power center contains a big box retailer of a type that might compete with one or more stores of the same type in a neighbouring regional center. This big box retailer in the power center could have an important impact on the sales of stores of the same

type in the regional center, depending on the extent to which consumers will continue to patronize stores in the regional center on a multipurpose trip and on the extent to which the regional center's stores differentiate themselves from stores of the same type in the power center. It could also be the case that the big box retailers in the power centers might cause stores of the same type in the regional center to exit, and this could result in greater differentiation between the power center and the regional center in terms of store counts in this store category and tenant mix. This prediction is consistent with the hypothesis of Ben-Akiva et al. (1989) that firms tend to differentiate themselves when being located close to each other.

On the other hand, if the big box retailer only carries a single brand of comparison shopping goods instead of multiple brands, or if it caters to multipurpose shoppers, the impact of the big box stores in the power center on stores in the regional center might be smaller than in the previous case, because customers may want to shop at the regional center to visit different stores of the same type. Based on the varying size and tenant mix of power centers, the impact of a power center on the tenant mix of a neighboring regional center is expected to vary.

Another factor that may influence the impact of a power center is the variety of store types contained in a power center. If a power center includes many store types that are similar to the regional center located nearby, the drawing power of the power center is expected to be strong, because the power center is more likely to satisfy the same customer shopping needs as the regional

center. In a different scenario, if the power center contains a small number of store types, consumers may have an incentive to shop at the regional center because it might better fulfill their comparison and multipurpose shopping needs. Furthermore, based on Ben-Akiva et al. (1989), we expect the impact of the power center to increase when the power center is located closer to the regional center when everything else (e.g. tenant mix) is held constant, because competition might be more intense in this case.

Based on the above discussions, the following predictions are generated: after the entry of a power center, the big box retailers will have an impact on the stores that are of the same type as the big box retailers within a nearby regional shopping center. Such an impact is expected to vary with the store types. In addition, such an impact is expected to decrease with the distance between the regional shopping center and the power center.

4.4 Data and Description of Regional Shopping Centers and Power Centers

4.4.1 Data Source

Data on the gross leasable area (GLA), year of entry, developer, and tenant lists of power centers and regional shopping centers were collected from the *Canadian Directory of Shopping centers, 2000-2010*[64]. Shopping centers located in the major cities of the Prairie Provinces in Canada (i.e., Calgary, Edmonton, Winnipeg, Regina, and Saskatoon) with the following characteristics are defined

[64] The year of 2004 is not included because the directory is not available.

as power centers and included in the dataset: (1) open air; (2) have a GLA of at least 250,000 square feet[65]; and (3) contains at least one of the following mass merchandisers as anchors: Canadian Tire, Walmart, Sears, the Bay, Zellers, Real Canadian Superstore, Costco, and Sam's Club.

Planned regional shopping centers located in the five major cities of Prairie Provinces in Canada are considered. For inclusion in the dataset as a planned regional center, the actual store count of a shopping center is required to be greater than 40[66].

Based on the above criteria, the sample consists of 26 power centers (with 9 from Calgary, 9 from Edmonton, 5 from Winnipeg, 2 from Regina, and 1 from Saskatoon), and 35 regional shopping centers (with 10 from Calgary, 11 from Edmonton, 5 from Winnipeg, 4 from Regina, and 5 from Saskatoon).

Stores in the sample were assigned a store type (both a subcategory, e.g. footwear, and a broad category, e.g., apparel), based on the *Canadian Directory of Shopping Centers*. The population and income served by a regional shopping center were calculated based on the 2001 and 2006 Census of Canada. The method of calculation is explained in detail in Section 4.5.

[65] 40 is set as the threshold for the following reasons: (1) the same threshold is adopted in Chapter 3. To be consistent, 40 is also adopted in this part of the thesis; (2) it is chosen to include more centers in the sample; and (3) the sample regional centers do not exhibit an apparent cut in their real store counts. Choosing 40 as the threshold does include small centers in the sample. Another threshold (i.e., 60) is used later as a robustness check.

[66] The year of 2004 is not included because the directory is not available.

4.4.2 Description of Regional Shopping Centers and Power Centers

Table 4.1 reports summary statistics of the sample regional shopping centers and power centers in 2010. The data on the characteristics of regional and power centers are obtained from the *2010 Canadian Directory of Shopping Centers*. The composition of the categories is illustrated in Table 4.5 in the appendix.

Table 4.1: Summary Statistics for Regional Centers and Power Centers in the Sample, 2010.

	Regional Shopping Center			Power Center		
	Min	Max	Mean	Min[67]	Max	Mean
Tenant Count	40	576	111.7	3	83	35.5
GLA (1000 Sq. feet)	285.6	5,300	714.3	127	3,500	793.7
Number of Store Types	26	47	33	3	34	18
Number of Anchors	1	3	1.6	0	3	1.1
Apparel Stores (percent)	7.3	50.8	31.3	0.0	44.4	18.5
Food Stores (percent)	12.8	32.7	19.4	13.0	46.7	25.0
General Merchandise Stores (percent)	6.9	22.0	12.3	0.0	16.0	5.5
Home Stores (percent)	0.0	5.2	2.0	0.0	33.3	9.3
Leisure Stores (percent)	4.9	15.4	9.7	0.0	42.9	13.4
Services Stores (percent)	6.3	25.6	14.9	0.0	28.6	12.9
Non Retail Stores (percent)	0.8	25.4	8.7	0.0	33.3	11.5

From the table, the number of tenants contained in regional centers is on average about three times that of power centers, whereas the average GLA of the

[67] Table 4.1 shows the minimum number of anchors is zero in power centers in 2010, whereas the minimum GLA is 127,000 square feet for power centers. A power center needs to have a minimum of 250,000 square feet and one anchor by definition. The reason that these numbers are below the criteria is because anchors or big box retailers may withdraw from the power center. Once a center is defined as a power center, it is included in the sample and the characteristics of this power center are recorded over the entire sample period.

former is less than the latter. This discrepancy implies that the size of stores in power centers is on average much larger than the size of stores in regional centers. In addition, the average number of store types contained in regional centers is 33, which is about twice that of power centers. The fraction of stores selling apparel and general merchandise in regional centers is substantially bigger than their counterparts in power centers. Home stores, on the other hand, have a bigger share in power centers than regional centers.

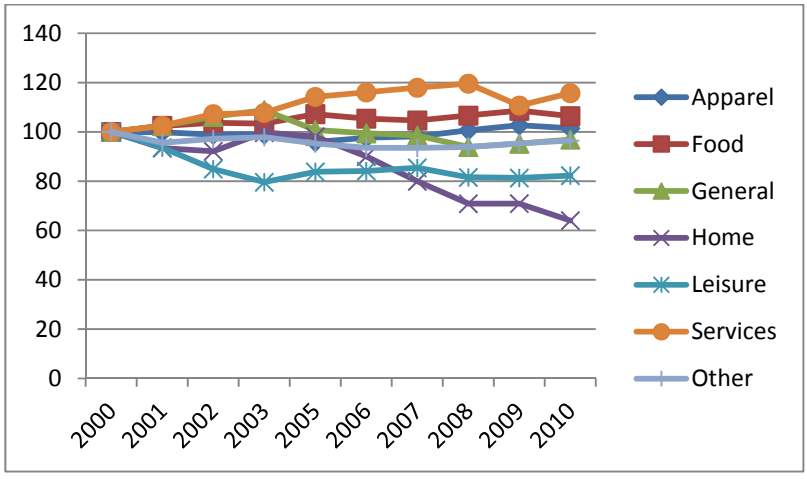
In addition, the evolution of store categories as a fraction of total retail stores in regional centers over time[68] is calculated. Over the past decade, the share of home stores in regional centers decreased from 3.4% to 2.2%, and the share of leisure stores decreased from 13.0% to 10.7%. On the other hand, the fractions of food stores and services stores seem to be on an upward trend. As to stores providing apparel and general merchandise, the shares fluctuate around 33.0% and 14.0%, respectively over time.

However, using the fraction of store types to illustrate the evolution of regional centers might be misleading. For example, regional centers usually contain a small number of home stores. Facing the competition of power centers, if the number of home stores contained in a center dropped from 4 to 1, the percentage change of the fraction of home stores in the regional center is estimated to be around 3%, given that the average store counts is 111. Such a change is small and is easily ignored. But the hidden fact may be that home stores

[68] Nonretail firms such as medical center, accountant, lawyers, etc. are excluded from the analysis. The reason is because the report of nonretail stores in the shopping center directory is not consistent over time. For example, in some year, medical center is reported as a single tenant, whereas in other years, each doctor is listed as a separate entry.

withdraw from regional centers. To unveil such an effect, it is useful to illustrate the growth rate of the share of stores. Figure 4.1 reports the growth rate of the fraction of store types for regional centers over the past decade. When calculating the growth rate, data in 2000 is used as the base and is normalized at 100. From this figure, it is clear that home stores and leisure stores are the two categories within regional shopping centers that experience the biggest change over the past ten years. Service stores exhibit an upward trend from 2000 to 2008. The fraction of service stores dropped slightly in 2009 and moved back to a level that is slightly below the level of 2008 in 2010.

Figure 4.1: Evolution of Store Types in Regional Centers, 2000 to 2010.



As to the power centers, six power centers were constructed from existing regional centers or retail strip plazas, and the rest were built from scratch. Twelve power centers contain Walmart as one of their anchors. Most of the power centers enter during the early 2000s. From 2000 to 2003, sixteen sample centers were

opened. Big box retailers were assigned a store type based on the *Canadian Directory of Shopping Centers*. On average, a sample power center contains 1.2 anchors, and 4.3 big box retailers[69]. Among the big box retailers, approximately 31% are apparel stores, 5% are general merchandisers, 35% are home stores, and 29% sell leisure goods[70].

4.5 Econometric Model and Definition of Variables

4.5.1 Econometric Models

Theory suggests that the change of tenant mix in a regional shopping center should be associated with the characteristics of power centers that are located nearby. To examine these relationships, the fraction of retail stores in a regional center that are a broad category is used to reflect the tenant mix of the centers. The broad store categories considered are apparel, general merchandise, home, and leisure[71]. The composition of these broad categories is presented in Table 4.5 in the appendix. For each regional center, power centers located within three distance bands from each regional center are considered: within 2 km, from 2 to 5km, and from 5 to 10 km[72], for the purpose of analyzing the competitive

[69] See Table 4.4 in the appendix for the list of big box retailers in the sample power centers.

[70] See Table 4.5 in the appendix for the list of store types.

[71] Broad categories are used instead of specific categories because if we consider each specific category, a value of zero will be generated for power centers that do not contain the big box retailer of a particular type. Considering the fact that each power center contains a limited number of big box retailers, many zeros will be generated, and tenant variables might not have enough variation.

[72] Haltiwanger, Jarmin, and Krizan (2010) considered big-box stores that are located less than 1 mile, 1 to 5 miles, and 5 to 10 miles from an independent Mom-and-Pop store or a small chain store.

impact of power centers on regional shopping centers. To test for robustness, other distance bands are considered as well.

Equation (1) presents the regression function:

$$S_{kit} = a_k + b_{k2}BigBox\_sametype\_2km_{i(t-1)} + b_{k2\_5}BigBox\_sametype\_2\_5km_{i(t-1)} + b_{k5\_10}BigBox\_sametype\_5\_10km_{i(t-1)} + c_i PurchasingPower_{it} + d_i Mall_i + f_t Year_t + e_{kit} \quad (1)$$

where *k* represents the store category, *i* indexes the regional center, and *t* denotes the time period. A power center's entry date is defined as the year when the center started to meet the criteria for power centers (i.e. unenclosed, has a GLA greater than 250,000 square feet, and contains the desired anchors).

$Bigbox\_sametype_{id(t-1)}$ measures the average number of big box retailers in power centers that are of the same category as the dependent variable, and are located within distance band *d* from regional center *i* in year *t-1* (i.e., *d* = 2 km, 2 to 5km, and 5 to 10 km). When the average number of big box retailers of a particular type increases in power centers located nearby, holding everything else constant, the hypothesis is that the regional center will differentiate itself by decreasing the fraction of stores of the same type to avoid direct competition. $Bigbox\_sametype_{id(t-1)}$ is used instead of a simple dummy variable indicating the entry of a new power center because $bigbox\_sametype_{id(t-1)}$ contains richer information: it captures not only the impact of the entry of new power center but also the impact of the changes in the number of big box retailers in the existing power centers (i.e., centers that entered in the past) on the tenant mix of a regional center. Furthermore, after the number of big box retailers in the nearby power

centers changes, it takes time for the developer of the regional center to respond and adjust the tenant mix. Therefore, lagged variables $bigbox\_sametype_{id(t-1)}$ is used[73].

A concern is that power centers do not make entry decisions randomly, but rather strategically. If power centers intentionally choose sites where the surrounding area experiences growth in population or its population's income, the estimates of coefficients will be biased because such factors are expected to influence the store composition in a regional center as well. The endogeneity of market structure is widely recognized (see for example Basker, 2005; Artz and Stone, 2006; and Manuszak and Moul, 2008). It is difficult to address the endogeneity issue because it is usually hard to find suitable variables that are correlated with the market structure but uncorrelated with the unobserved factors (Manuszak and Moul, 2008). Manuszak and Moul (2008) reviewed the methods that are used to address this issue[74]. Using panel data to estimate the market fixed effects is a common practice. In this paper, a variable that measures the purchasing power of the population within a center's trade area (i.e.,

[73] Variables measuring the average number of store types in power centers are expected to have an impact on the tenant mix of nearby regional centers. The reason is because the bigger the number of store types contained in a power center, the more the drawing power of the power centers. However, such variables are highly correlated to the variables measuring the average number of big box retailers. Hence, they are excluded from the analysis to avoid the multicollinearity issue.

[74] Manuszak and Moul (2008) analyzed the relationship between prices and market structure for office supply superstores in the U.S., using a cross-sectional dataset. To address the endogenous market structure problem, they adopted a two-stage approach. They began by constructing a model that characterizes the market structures across different markets. Then, they followed the model of Mazzeo (2002) to generate a correction term for the second stage price regression. A drawback of this approach is that it requires substantial distributional assumptions for deriving the correction term. In addition, the specification of the market structure model is critical for the correction term to be valid.

$purchasingpower_{it}$) is included. This variable is expected to account for the endogenous market structure that affects the internal composition of a regional center.

To calculate $purchasingpower_{it}$, the methodology of Von Hohenbalken and West (1986) is followed to calculate the Voronoi diagram. Firstly, regional centers are plotted on a map of the sample city where these centers locate. Then the nearest point set of each regional center is calculated. Such calculation is based on the assumptions that all regional centers are identical and have the same price level, distances are Euclidean, and utility-maximizing customers visit the nearest regional centers to economize on time and transport cost of shopping. Once the regional shopping center's trade areas are calculated, they are overlapped with the census tracts. The population of a shopping center's trade area consists of the pieces of census tracts that fall into this area.

The total population and the median income of individuals for each regional center's trade area are calculated based on the 2001 and 2006 Census of Canada. The data for the other sample years were approximated by assuming constant annual growth rate. Once the population and median income of individuals for each regional center's trade area are estimated, $purchasingpower_{it}$ is defined as $population \times income$.

In addition, dummy variables $Mall_i$ and $Year_t$ are included as control variables. $Mall_i$ represent mall fixed effects, which are expected to capture the heterogeneity in the share of a store category in a regional center, such as demographic factors for the population served by the regional center. The year

fixed effects are intended to capture the influence of the fluctuations in the outside macroeconomic and social environment that are common across all regional centers.

4.5.2 Summary Statistics

Table 4.2 reports the summary statistics for dependent variables and explanatory variables.

Table 4.2: Summary Statistics (obs.=350)

Variable	Mean	Std. Dev.	Min	Max
$S_{apparel}$	0.33	0.11	0.09	0.52
$S_{general}$	0.14	0.03	0.05	0.25
S_{home}	0.03	0.02	0.00	0.10
$S_{leisure}$	0.11	0.03	0.04	0.23
$BigBox\_2km_{apparel}$	0.19	0.52	0	3
$BigBox\_2\_5km_{apparel}$	0.50	0.86	0	3.5
$BigBox\_5\_10km_{apparel}$	1.10	1.03	0	5
$BigBox\_2km_{general}$	0.05	0.22	0	1
$BigBox\_2\_5km_{general}$	0.09	0.25	0	1
$BigBox\_5\_10km_{general}$	0.27	0.37	0	1
$BigBox\_2km_{home}$	0.24	0.64	0	3
$BigBox\_2\_5km_{home}$	0.51	0.86	0	4
$BigBox\_5\_10km_{home}$	0.93	0.91	0	4
$BigBox\_2km_{leisure}$	0.23	0.71	0	4
$BigBox\_2\_5km_{leisure}$	0.57	1.19	0	8
$BigBox\_5\_10km_{leisure}$	1.43	1.44	0	8
*PurchasingPower**	219,857	176,773	27,006	1,241,518

**PurchasingPower* is measured in 10,000.

With 35 regional centers and 10 years, there are 350 observations. Over the sample years, the fraction of retail stores that are apparel stores is on average

33 percent for a sample regional center. The fraction of stores that are general merchandise, home, and leisure stores are 14 percent, 3 percent, and 11 percent, respectively. According to Table 4.2, the average number of big box retailers of a certain category contained in a power center increases with the distance between the power center and regional center. There are no big box retailers that sell food or provide services. For the other store category and different distance bands, the number of big box retailers range from 0 to 8. The purchasing power of the population within a regional center's trade area varies dramatically across centers, with the maximum being $1,241,518 (measured in10, 000) and the minimum being $27, 006 (measured in 10, 000).

4.6 Econometric Results

One concern with the model is the potential serial correlation. Wooldridge (2002, p282-283) proposes a simple test for serial correlation in linear panel-data model. This method starts by first-differencing the data to remove the individual-level effect and other time-invariant terms. Then, it uses the residuals from the regression in first-differences and regresses these residuals on their lags (Drukker, 2003). This test is attractive because of its flexibility. According to Drukker (2003), it fits the following conditions: (1) fixed and random-effects models, (2) models with or without homoskedasticity, (3) models with or without balanced data, and (4) models with or without gaps in the individual series. In this paper, the panel has gap in the time variable, because the data on 2004 is missing. The test proposed by Wooldridge (2002) will fit this condition.

We test the AR(1) serial correlation and the results show that F (1, 34) is 18.86, 56.01, 41.45, and 22.71for the regression functions where $S_{apparel}$, $S_{general}$, S_{home}, and $S_{leisure}$ are used as the dependent variable for calculating the estimated residuals, respectively. The test statistic detects strong serial correlation in the residuals in all four regression equations. When the error term from one time period depends on error terms from the previous time period, it increases the variances of the distribution of the estimated coefficients and makes OLS underestimate the standard errors of the coefficients (Studenmund, 2006, p.338). To deal with this issue, the Generalized Least Squares (GLS) estimator (Greene, 2008) is applied to estimate the regression functions, and each regional center is assumed to have errors that follow the same AR(1) process. Coefficients estimates of the regression models are presented in Table 4.3[75].

Table 4.3: Estimates of GLS

Y_{kit} / X_{kit}	***Sapparel***	***Sgeneral***	***Shome***	***Sleisure***
Bigbox_sametype2km$_{(t-1)}$	-0.002 (0.006)	-0.004 (0.015)	0.003 (0.002)	0.003 (0.004)
BigBox _ sametype2_5km$_{(t-1)}$	0.004 (0.004)	0.023** (0.010)	0.000 (0.001)	-0.002 (0.002)
BigBox _ sametype5_10km$_{(t-1)}$	-0.006** (0.003)	-0.002 (0.007)	-0.002** (0.001)	-0.001 (0.001)
PurchasingPower$_t$	9.87e-08** (4.90e-08)	-4.70e-08** (2.01e-08)	1.74e-08** (8.84e-09)	-4.36e-09 (1.65e-08)
Constant	0.315*** (0.017)	0.149*** (0.006)	0.025*** (0.003)	0.114*** (0.005)

[75] Service stores and food stores are not included in the analysis because there are no big box retailers for these two categories.

The regression models are statistically significant at the 10% level, 5% level, and 5% level with $S_{apparel}$, $S_{general}$ and S_{home} being the dependent variable, respectively. As to the model where $S_{leisure}$ is the dependent variable, the regression model is not statistically significant at any traditional level.

When $S_{apparel}$ is the dependent variable, the estimation results show that the coefficient on $bigbox\_sametype\_5\_10km_{(t-1)}$ is -0.006, which means that the fraction of apparel stores in a regional center is expected to decrease by 0.006 percentage points one year after the average number of big box apparel retailers in power centers that are located from 5 to 10 kilometres from the regional center increases by one. The negative impact of $bigbox\_sametype\_5\_10km_{(t-1)}$ on $S_{apparel}$ is statistically significant at the 5 percent level. This finding implies that, facing the competition of neighbouring power centers, regional centers respond by decreasing the fraction of apparel stores in center. Such a reaction implies a change toward a greater extent of differentiation. The coefficients on $bigbox\_sametype2km_{(t-1)}$ and $bigbox\_sametype2\_5km_{(t-1)}$ are not statistically significant at any traditional significance level, showing that the impact of the average number of big box apparel retailers in power centers that are closer to the regional center on $S_{apparel}$ is not identified. In addition, the coefficient on $purchasingpower_t$ is positive and statistically significant at the 5% level, which indicates that the market condition has an influence on the tenant mix of regional centers. Centers located in areas where the population has more purchasing power will contain a bigger proportion of apparel stores, when everything else is held constant.

As to the regression function where $S_{general}$ is the dependent variable, the coefficient is estimated to be 0.023 on $bigbox\_sametype2\_5km_{(t-1)}$. The results indicate that when power centers located within 2 to 5 kilometers from a regional center contain, on average, an extra big box retailer that sells general merchandise in year t, the fraction of such type of stores in the regional center will increase by 0.023 percentage points in the next year. Such an impact is statistically significant at the 5% level. This finding provides evidence that support the minimum differentiation rather than the maximum differentiation. In addition, the results show that the coefficient on $purchasingpower_t$ is negative and statistically significant at the 5% level, which indicates that regional centers located in areas where the population has more purchasing power will contain a smaller proportion of general merchandise stores.

When S_{home} is the dependent variable, the estimation results show that the fraction of home stores in a regional center will decrease by 0.002 percentage points one year after the average number of big box home retailers in power centers that are located within 5 to 10 kilometres from the regional center increases by one. The negative impact of $bigbox\_sametype\_5\_10km_{(t-1)}$ on S_{home} is statistically significant at the 5 percent level. In addition, the results indicate that regional centers located in areas where the population has more purchasing power will contain a bigger proportion of home stores. As to the regression where $S_{leisure}$ is the dependent variable, the estimation results show that the impact of the average number of big box retailers on a regional center from neighbouring power centers are not identified in the sample centers.

To test the robustness of the setting of distance bands, we combined the distance bands, re-estimate the regression functions and considered the impact of power centers located within 5 kilometers from a regional center, and within 10 kilometers from a regional center. In addition, seemingly unrelated regression (SUR) methods are used to estimate the linear equations, as the error terms in the regression equations could be correlated across equations. The coefficients estimates from the alternative regressions exhibit minor changes from the GLS estimation, which means that the findings described above are robust.

In addition, a simple two-period model that uses only the first and last year of the sample is estimated to investigate how the changes in a regional center's tenant mix is related to changes in the nearby presence of power centers. When $S_{leisure}$ is the dependent variable, the estimation results show that the coefficient on *bigbox_sametype_5_10km* is -0.013, indicating that the fraction of leisure stores in a regional center will decrease by 0.013 percentage points from 2000 to 2010 after the average number of big box leisure retailers in power centers that are located within 5 to 10 kilometres from the regional center increases by one. This finding is statistically significant at the 1 percent level. The relationship between changes in the nearby presence of power centers and the fraction of stores selling apparel, general merchandise, and home goods in a regional center is not identified.

Another attempt is made by adding a lagged dependent variable to the original regression functions. We test the AR(1) serial correlation and the test statistic still detects strong serial correlation in the residuals in all four regression

equations. The lagged dependent variables are positive and statistically significant at the 1 percent level in the four regression functions. When $S_{general}$ is the dependent variable, the estimation results show that the coefficient on *bigbox_sametype_2_5km(t-1)* is positive and statistically significant at the 5 percent level. When S_{home} is the dependent variable, the results show that the coefficient on *bigbox_sametype_2km(t-1)* is positive and statistically significant at the 5 percent level, and the coefficient on *bigbox_sametype_5_10km(t-1)* is negative and statistically significant only at the 10 percent level. The coefficients on the other variables are not significant at any traditional significance level.

The regression results of the alternative models do not affect the conclusion of the previous estimation. The relationship between the changes in a regional center's tenant mix and the changes in the nearby presence of power centers is not clear, which implies that regional centers and power centers might not directly compete with each other.

4.7 Conclusion

The emergence of power centers has sparked research interest. However, the issues regarding post-entry competition among power centers and traditional shopping centers in the same geographic area have not been fully addressed. This paper uses a data set on the evolution of regional shopping centers' tenant mix and the characteristics of power centers in the five major cities of Prairie Provinces over the time period 2000 to 2010 to provide an examination of whether and how power centers' emergence affects regional shopping centers.

In this paper, regression functions that contain lagged variables measuring the average number of big box retailers of different categories contained in power centers that are located within varying distance bands from a regional center (i.e., 2 km, 2 to 5km, and 5 to 10 km) in year t-1 are estimated. These variables capture the lagged impact of both new power center and existing power centers on the tenant mix of a regional center. A variable measuring the purchasing power of the population served by a regional center is included to reflect the demographic and socio-economic factors that could be related to the entry decision of power centers and could lead to an endogeneity bias. Following the test proposed by Wooldridge (2002) for autocorrelation in panel data, AR(1) serial correlation is tested. The test statistic detects strong serial correlation in the residuals of all four regression equations. To deal with this issue, the GLS estimator is used to estimate the regression functions.

The estimation results identified a significant negative impact of $bigbox\_sametype\_5\_10km_{(t-1)}$ on $S_{apparel}$ and S_{home}. However, the results also show that $bigbox\_sametype\_2\_5km_{(t-1)}$ is positively related to $S_{general}$. Based on the above findings, this paper provides mixed support of the theory of locations in multiple dimensions. The results also indicate that the market condition has an impact on the tenant mix of regional centers. Centers located in areas where the population has more purchasing power will contain a bigger proportion of apparel stores and home stores, but a smaller proportion of general merchandise stores, when everything else is held constant. To explore the robustness of the empirical findings, the models were estimated by using alternative variables that reflect

characteristics of power centers and by considering alternative distance bands. Seemingly unrelated regression (SUR) methods are also used to estimate the linear equations. The changes in the results were minor, which means that the findings are robust.

This empirical analysis examines whether and how power centers' emergence affects regional shopping centers. The investigation of the competition between power centers and regional centers contributes to the literature in the empirical investigation of shopping centers. In addition, this study discusses the definition of power centers and their competitive impact on regional centers.

One should notice that a power center that enters with a variety similar to the regional center could have different possible impacts. It could lead the regional center to increase the quality of its stores without changing proportions or tenant mix. Or, it could choose to specialize more, reducing the number of store types in the regional center, but covering some (e.g, ladies' wear) more intensively. In addition, this paper focuses on planned regional shopping center. To better understand the impact of the power centers on traditional shopping centers, it would be useful to expand the dataset and include centers at other levels of the shopping center hierarchy, such as community shopping center.

4.8 References

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4.9 Appendix

Table 4.4: Big Box Retail Chains[76]

Best Buy	Old Navy
Chapters	Pacific Linen
Coast Mountain Sports	Pennington's
Designer Depot	Petcetera
Future Shop	Petland
Globo Shoes	PETsMART
Golf Town	Pier 1 Imports
Home Depot	Rona Warehouse
Home Outfitters	Sport Chek
Home Sense	Sport Mart
House of Tools	Staples
IKEA	Storage Works
Indigo Books	Super Pet
Jay Set	The Shoe Company
Linen'N Things	Totem Building Supplies
Mark's Work Wear House	Toys-R-Us
Michaels	Visions Electronics
Nevada Bob's Golf	Winners
Office Depot	

[76] This list of big box retailers is a revision of the list proposed by Hernandez and Simmons (2006). Big box retailers suggested by Hernandez and Simmons but not included in sample centers are excluded. In addition, several big box retailers are added to their list.

Table 4.5: Classification of Store Types

Apparel	Food	General
Children's Wear	Grocery	Beauty Supply
Family Wear	Restaurant & Fast Food	Card/Stationery
Footwear	Specialty Food & Drink	Computers/Office Supply
Jewelry/Fashion Access.		Department/Mass Merchandiser
Ladies' Wear		Drug/Health & Beauty Aids
Menswear		Gift
Unisex		Leather Access. & Luggage
		Specialty Merchandise
		Variety/Convenience
		Second Hand Merchandise

Home	Leisure	Services
Fabric/Sewing Access.	Athletic Apparel	Automotive
Furniture & Home Décor	Book/Newsstand	Business Services
Hardware/Paint & Paper	Camera	Car & Truck Rental
Home Appliance	Electronics	Dry Cleaner
Home Improvement	Fitness/Recreation Place	Florist/Nursery
Housewares	Hobby/Craft	Hairstyling/Esthetic
Window Coverings	Music/Video	Laundromat
	Pet	Optical
	Sporting Goods	Other Services
	Theatre/Entertainment	Photo
	Ticket/Lotto Sales	Printing
	Toy/Games	Rental Equipment/Furniture
		Shoe Repair
		Tailoring/Alterations
		Travel
		Wireless/Telecommunication

5. General Discussion and Conclusions

The papers that comprise this thesis study the internal composition of shopping centers empirically from three different aspects. They examine several interesting economic issues, help to fill the gap in knowledge about shopping center internal configurations, and contribute to the literature on empirical investigations of shopping centers.

First, it was found in Chapter 2 that there was clustering of service stores near mall entrances, and clustering of comparison shopping stores near corridor intersections and on the second floor of two-story malls. Clustering tends to occur in the ladies' wear, jewelry/fashion accessory, and unisex clothing store categories, facilitating comparison shopping. Clustering also occurred in the service category, facilitating multipurpose shopping. There was also some evidence of clustering among ladies' wear and complementary store types. A join count test showed that there was statistically significant clustering among ladies' wear stores and service stores in a subset of malls in the sample. Results of a regression analysis indicate that clustering may depend upon the size, age, and type of the mall in question, with more clustering observed in larger and more upscale centers.

Second, it was demonstrated in Chapter 3 that, relative to the center level, more stores selling comparison shopping goods are located within 100 foot radius of a department store's entrance in centers that are older, have a larger gross leasable area, or contain fewer number of department stores. Because these mall characteristics are expected to reflect a developer's bargaining power, the above

findings are consistent with the hypothesis that the store location patterns near department stores depend on the relative bargaining power of the developer and the department stores.

Finally, Chapter 4 provided mixed support of the theory of locations in multiple dimensions. The results also indicate that the market condition has an impact on the tenant mix of regional centers. Centers located in areas where the population has more purchasing power will contain a bigger proportion of apparel stores and home stores, but a smaller proportion of general merchandise stores, when everything else is held constant.

In general, the results of this thesis suggest that the internal compositions of shopping centers are not random. A variety of factors may have an impact on a developer's tenant mix choices and store location decisions. Among these factors, a key factor is the type of demand externalities that a store can impose on other stores in a center. A profit-maximizing developer would set a center's internal configuration in such a way that the demand externalities among stores are internalized and the profits of the entire center are maximized. Other factors that influence a shopping center's internal composition include the physical feature of a shopping center, the relative developer/department bargaining power, the competition that a center faces from its neighboring centers, and the market condition in a shopping center's trade area.

There is a significant literature in economics on both the location and tenant mix of shopping centers. However, the determinants of store locations within a planned shopping center have received surprisingly little recent academic

attention. Even basic empirical evidence on clustering patterns within modern planned shopping centers is lacking. Only a few studies could be identified that quantify location patterns in planned shopping centers and test theories about such patterns. One possible explanation is that there is very little theoretical work on this topic. In choosing the tenant mix of a shopping center and the locations of specific stores within the center, a developer that wants to maximize rent or profit for the entire center must take into account all of the demand interrelationships among stores. Developing a theory that would allow one to carefully articulate the balancing act that a developer faces is a formidable task. This is a void in this field that needs to be filled by future work.

Another possible explanation is the data limitation: it is difficult to quantify store locations in shopping centers and find a suitable statistic method to test the location pattern of stores. Given the large number of stores within a shopping center, extensive data work is required. In addition, the number of stores of a particular category may not be large enough to satisfy the requirement of a statistic test. The sign test adopted in Chapter 2 simply tests whether there tends to be greater or fewer stores in a particular place (e.g. mall entrance) than elsewhere in the mall. This test does not say anything about the size of the difference. Therefore, the statistical significance in terms of the sign test need not equate with economic significance: the clustering may be statistically significant, but not large in magnitude. Future work in this area could utilize other measures of clustering, other measures of nearness, other store categories, other statistic tests and additional mall characteristics.

As an extension of Chapter 3, future work could study how widespread these restrictive clauses are, how they are used, and what radius is adopted. In addition, Chapter 3 examines how the store location patterns near department stores vary with the relative bargaining power of developers and department stores. Instead of bargaining over store locations, developers might choose the location configuration within the regional shopping center that maximizes overall center profit, and then compensate department stores through other ways (e.g. rents) for having less than ideal stores located near them. Such alternatives should be considered in future extension. Furthermore, there are other types of restrictive clauses (e.g. exclusive dealing, restrictive clauses, etc.) in shopping center leases. Investigation of these clauses could enrich the empirical evidences for the related economic theories and have implications for competition policies as well.

For Chapter 4, one should notice that a power center that enters with a variety similar to the regional center could have different possible impacts. It could lead the regional center to increase the quality of its stores without changing proportions or tenant mix. Or, it could choose to specialize more, reducing the number of store types in the regional center, but covering some (e.g, ladies' wear) more intensively. This factor could be a relevant extension of Chapter 4. In addition, this paper focuses on planned regional shopping center. To better understand the impact of power centers on traditional shopping centers, it would be useful to expand the dataset and include centers at other levels of the shopping center hierarchy, such as community shopping center. Furthermore, stand-alone big box retailers that are located near a regional center may have an impact on the

tenant mix of the regional center. Such an impact is not taken into account in Chapter 4 and should be controlled in future work.