SPATIAL ASPECTS OF MARKET STRUCTURE:

THE REAL ESTATE BROKERAGE INDUSTRY

DISSERTATION

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By

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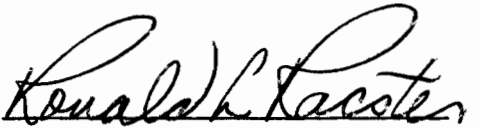
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INTRODUCTION

Purpose

The objective of this dissertation is to contribute to the understanding of the market structure of the real estate brokerage industry. The general topic of market structure has been of interest to economists for many years. Equally interesting have been the various topics which together define market structure. These include but are not limited to pricing, competition, concentration, cost structures and freedom of entry within a given industry or market. Each of these subjects has been studied extensively on both theoretical and empirical levels and the volume of previous research is an indication of the importance attached to the general subject area.

The interest in market structure research has not been limited to academics, but is shared by government regulators, jurists, and market participants. The government and the courts have used the results of various market structure studies as the basis for governmental regulation and influence in various industries. All industries are subject to certain forms of regulation, but some are more heavily regulated than others as a result of some aspect of market

structure; among these industries are public utilities, trucking, airlines, and the banking and thrift institutions.

The banking and thrift industries have been subject to extensive and ongoing regulation for half of a century as a result of the government's effort to protect the public. Regulation of this market includes limits on product lines, and limits on the geographical extent of firm activities. Each of these regulations is designed to protect the public from concentration, collusion and/or destructive competition among firms; and these regulations are administered by an elaborate array of government institutions. These industries have been the subject of more extensive studies of market structure than others, and large amounts of empirical evidence on the subject have been produced. Despite the large volume of empirical data, there are certain issues which remain unresolved, and which, until resolved, will continue to cloud the results of some of the previous research. These issues involve the spatial aspects of market structure.

The importance of the spatial aspects of market structure can vary substantially depending upon the industry in question. In any study of the subject, however, there must be an assumption, either explicit or implicit, as to the geographical extent of the market. Goods are produced by firms at spatially dispersed locations and are sold to customers

who are also spatially dispersed. The activities which comprise market structure such as pricing and competition occur within this spatially dispersed market area, and market structure must therefore be studied within the boundaries of the appropriate market.

In many cases an implicit assumption as to the appropriate market area is sufficient. The computer or pharmaceutical industries might have a world wide market area, while a public utility would have a much more narrowly defined scope. The spatial aspects of market structure are not as important for these industries as they are for firms with more localized geographical scope such as a bank branch or a real estate brokerage firm. For highly localized firms a study of market structure may not be complete without explicit consideration of the spatial aspects.

Empirical studies of banking and thrift markets have generally included an explicit assumption as to the market area under study. Usually these market areas have been defined by political boundaries such as a state, county or SMSA. The choice as to which area to choose is often a function of the data available for the study. These arbitrary definitions of market areas are the reason that the results of some of these prior studies are clouded. There is no assurance that the politically defined geographical

area coincides with the actual market. For example, a study
of banking concentration in a given SMSA would implicitly
assume that all banks located within that SMSA operated
throughout that region. The results of the study might show
very low concentration ratios for the SMSA, when in fact
concentration was high in certain markets within that SMSA.
Clearly, the conclusion of low concentration would not be
valid in this case.

The example just cited is highly simplified; however, it
demonstrates two of the key problems associated with certain
of the market structure studies. The first was already men-
tioned, that the political definition of a market may not
correspond to the actual market. The second is that a single
firm may have several separate and distinct market areas
each of which corresponds to a specific product or service
of the firm. A bank for example may offer its credit cards
throughout a state, mortgage loans only within certain coun-
ties of the state, and checking accounts only in a specific
city. The markets for each of these products would be dif-
ferent in terms of geography, customers, and competitors,
and a study which did not account for these differences
would lead to spurious results. Hence the clouded results
for some of the prior banking studies.

Since market structure is the basis for regulation in
these industries, the question of the validity of previous

research is not trivial. Regulation is costly to all concerned, and once the regulatory structure is established, it generally continues to grow and become even more costly. The recent efforts to deregulate banks and thrifts have demonstrated the difficulty of dismantling an established power structure.

The discussion thus far has centered upon the banking and thrift industries even though the subject of this research is the real estate brokerage industry. The reason the banks have been used as a model is because of both the similarities and differences between the industries. Banking and real estate brokerage are similar in that they are both service industries, firms in each industry offer standardized products, and each appears to have a localized geographic scope to its service area. Additionally, for both banks and brokers, implicit prices and advertising appear to be important aspects of performance.

The differences between the industries are equally as important. Firstly, banking has been studied extensively, and with the caveats mentioned earlier, much is known about the structure of the industry. The real estate brokerage industry has been the subject of only very limited research of any type, and very little is known about its market structure.

The second significant difference is that banking is
heavily regulated while real estate brokerage is not, though
there have been many voices calling for its regulation.
Those who seek to regulate the industry allege that brokers
have been guilty of collusion and other anti-competitive
activities which have injured the public. These groups and
individuals presume to know the structure of the industry
without the benefit of any supporting empirical evidence.
The decision to regulate should not be made until it is clear
that the structure of the industry calls for regulation, and
this decision can be made rationally only with supporting
evidence. To regulate an otherwise competitive market would
simply impose an economic burden upon firms and consumers
without any offsetting benefits.

The purpose of this research is to present empirical evi-
dence on the structure of the real estate brokerage industry.
In order to understand the structure of the industry, we
must first understand the economic choices of participants
in that market because it is the overall effect of those
choices which results in market structure. One of the key
variables over which such choices must be made by consumers
and suppliers in the real estate market is distance, and the
emphasis of the analysis here shall be upon the importance
of the spatial variable. The concepts of spatial economic

theory shall be applied first to the consumer's side of the market, and then to the supplier's side to understand the incentives of each participant. These individual results may then be aggregated to examine the spatial structure of the industry.

While the spatial structure of the industry is only one aspect of market structure, it is a very significant aspect because it provides the appropriate setting for further studies of other aspects of market structure. As mentioned earlier, a study of competition without an appropriate spatial market definition is subject to measurement error. Likewise, studies of pricing practices, collusion and other aspects of market structure should also be performed in an appropriate spatial context. This paper shall develop the spatial structure of the market and then present evidence on the competitive nature of the market. Other aspects of market structure will be left for the future.

Research Questions

The questions which shall be addressed in this paper deal with the spatial aspects of the real estate market, and fall into three general categories:

1. How does distance affect the consumer of brokerage services?

2. How does distance affect the suppliers of brokerage services?

3. What is the competitive nature of the market for residential real estate brokerage?

As indicated by the previous comments, the third question can be addressed only after the first two are examined.

The specific question of interest on the consumer's side of the market is whether or not a consumer's demand for brokerage services is affected by the distance from a given broker's office. This question shall be addressed by developing a model of the consumer's decision process, and then examining the economic impact of various choices upon the well being of the consumer. Each of the variables in the selling process which may be affected by the choice of a more distant broker are included in the model, and it is used to develop several testable hypotheses.

The second general question shall be addressed by examining the economics of a brokerage firm. A production function will be presented which will incorporate the spatial aspects of the business, and will then be used to examine the impact of distance on the firm's activities. The questions to be examined include the optimal size and characteristics of product markets for the firm. In a more general sense, this section will examine the supply curve of a firm, and

how it is affected by distance. The specific hypotheses which are developed will also be subject to empirical testing.

The questions to be answered with regard to market structure fall into two areas: first, what is the type of competition which prevails, and secondly, what is the level of competition. It would be very difficult to find a specific answer to the first question; however, by incorporating the spatial aspects of the market in the analysis, it is possible to reach a conclusion by inference. It will be shown that the level of competition is also dependent upon the spatial structure of the market. While specific hypotheses will not be developed with regard to these questions, they will both be examined empirically.

Organization

The remainder of the paper is organized in the following order. Chapter Two will review the work of authors who have written on related topics. Included in this review will be the literature of spatial economics as well as some of the work which has been done in the real estate industry specifically. Chapter Three will describe the real estate brokerage industry. Included therein will be a description of the products and/or services offered by brokers to buyers and

sellers of real estate, as well as a description of the demand for those services as a function of price, both explicit and implicit.

Chapter Four will present the economic model of a brokerage firm and develop a production function for a broker with distance as one of the decision variables. The model will then be used to generate several hypotheses about the market areas for brokers with differing inputs. Chapter Five will discuss the structure of the market which results from the choices of consumers and brokers, and demonstrates the importance of the spatial dimension in describing the market. Chapter Six will describe in detail the data to be used in the study and the methodology which will be employed to test the hypotheses. Chapter Seven will present the actual analysis of the data with empirical descriptions of the market areas for firms.

The final chapter will then summarize the research and indicate areas for further study. The chapter will also summarize the results of each of the hypotheses generated in the paper.

LITERATURE REVIEW

The purpose of this chapter is to review the literature which provides the basis for this paper. The subject of this paper draws upon a diverse body of literature which ranges from theoretical economics to the practical real estate literature. The central topic here is the impact of costly distance upon the market areas of real estate brokerage firms. This calls for a review of two general bodies of literature - spatial economics and real estate.

The logical first step is the spatial economics literature. This subject covers a broad range of topics all of which deal with the impact of spatial friction upon the firm. The particular aspects of spatial economics of interest here are the effects of transportation costs on the size and shape of the market area of a firm. This literature is primarily theoretical; however, it demonstrates the importance of transportation costs to the firm and it provides a useful background from which to build.

After presenting the classical model, several of the extensions of that model will be discussed. There have been numerous developments in spatial economics; however, the one which is most important for the subject at hand is the impact on market areas of different forms of competition. These

authors have shown how market structure may affect the spatial relationships of firms and how changes in the form of competition may change those relationships or market areas.

The review will then move to the real estate literature. The section will begin with a recent paper which was the first to deal with the economic aspects of real estate brokerage at a theoretical level. While the paper did not specifically include distance as a variable, it does provide valuable insights as to the importance of search as a production input. Aspects of the model provided by this paper will be utilized later along with the classical model to provide a basis for later analysis.

The final section of the paper shall review several other papers which deal with pertinent aspects of the real estate brokerage business. Hempel was one of the first researchers to examine the importance of the real estate broker in the home buying process. Later work by Miller & Atzenhoefer and Goulet et al. examined similar topics. Palm also looked at the broker's role, but with emphasis upon possible bias introduced into the process by the spatial limitations of brokers.

Among those researchers calling for more active governmental influence in the industry are Yinger and Owen & Grundfest. Yinger bases the need for regulation upon the

economics of the business, while Owen & Grundfest claim that regulation is necessary because of prevailing practices in the industry. Miller and Shedd agree that some of the prevailing customs appear to be anti-competitive, but in analyzing the economics of the business, they identify a plausible explanation for those customs. The authors also discuss the applicability of anti-trust legislation to the real estate industry.

Spatial Economics

The Classical Model

The basis of classical central-place theory lies primarily in the work of Christaller and Losch (1944)[1] both of whom considered the optimal spatial arrangement of firms for distribution of a single good. Losch's work is more pertinent to the current topic because it was he who made the theory mathematically explicit, and included consumer demand as a spatial variable. His work has been extended by other authors to encompass what we shall refer to as the theory of market areas.

The basic conclusions of Losch were that free entry of firms to a market would result in space-filling hexagonal

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[1]See Smith (1971) for an excellent review of work previous to Losch.

market areas with each firm located at the center of its
market area. In deriving this result, the following assump-
tions were critical:

1. Firms maximize profits.

2. Resources are distributed homogeneously.

3. Free entry prevails.

4. For equilibrium, market areas must be space filling.

Mills and Lav (1964) presented a rebuttal to Losch by
claiming that the fourth assumption was incorrect. They
agreed that firms would enter as long as greater than normal
profits prevailed, and that as firms entered or exited an
industry, market areas would change so the remaining firms
would continue to maximize profits. They noted two addi-
tional conditions necessary for long run equilibrium:

1. All firms earn zero economic profits.[2]

2. No new firms may enter without causing negative prof-
   its.

The analysis of Mills and Lav was based upon the f.o.b.
pricing system used by Losch with the additional assumptions
appended. The result of their analysis was that a circle
could be the equilibrium market shape since market areas

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[2]The zero profit condition has been questioned in the
literature and Eaton and Lipsey (1976) have shown that
positive profits may be earned in equilibrium in a spa-
tial economy.

would not necessarily be space-filling, and that the hexagon would be only one of several equilibrium configurations.

Several studies (Greenhut, 1974; Greenhut & Ohta, 1977; Hartwick, 1973) have since shown that Mills and Lav were incorrect since they disregarded the possibility of negative demand at the perimeter of the market area. When the appropriate non-negativity constraint is applied, the hexagon results as the most profitable shape since it is the space-filling geometric form which most closely approximates a circle.[3] The mathematics of this conclusion are presented later in this chapter. The Loschian model has been extended and refined over the years; however, the basic model provides the framework from which the extensions must begin. The classical model shall be the basis for the analysis in Chapter 3, and therefore the mathematics and assumptions of the model are presented here. The assumptions are:

1. There is a single good which is produced in two-dimensional space with the same cost function pertaining to each firm.

2. The cost function has constant marginal and fixed costs,

$$C = f + cX \tag{1}$$

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[3]For an intuitive explanation of the hexagonal result, see Berry (1967) pp. 62-63.

where X=output, C=production costs, f=fixed costs, and c=marginal cost.

3. Transport cost per mile is identical between any two points and is equal to t units per mile.

4. Consumers occupy a homogeneous unbounded plain at uniform density D.

5. All consumers are identical and have a demand curve that is negative in slope

$$x = a - b(p + tu) \tag{2}$$

where p=mill price, x=demand per consumer, u=distance to the firm and a,b >0. There is no price discrimination, firms set the mill price, and consumers pay the transportation costs.

6. Firms continue to enter until profits for all firms are driven to zero.

These assumptions are the basis for the model, and will now be utilized to derive the equilibrium size and shape of market areas with firms setting the profit maximizing prices. Total demand in a circular market of radius R is

$$X = D \int_0^R a - b(p + tu) \; 2\pi u \; du \tag{3C}$$

and in any regular polygon total demand is

$$X = 2sD \int_0^{\pi/s} \int_0^{R/\cos\theta} a - b(p + tu) \; u \; du \; d\theta \tag{3H}$$

where s is the number of sides of the polygon and θ is the angle formed by straight lines drawn through the center of the polygon, one to the midpoint of a side and the other to a corner.

The firm's total profits are

$$y = pX - f - cX \tag{4}$$

and after integration of the above functions and substitution for y and X, we have

$$y = \pi DR^2 \{a - bp - (2/3)btR\} (p - c) - f \tag{5C}$$

for the circle and

$$y = DR^2 \{a - bp - .9447\ btR\} (p - c) - f \tag{5H}$$

for the hexagon.[4]

The firm will set the profit maximizing price which may be found by taking the partial derivative of y with respect to p, setting it equal to zero and substituting in the above equations.   The   prices   found   by   this   procedure   are

$$p = a/2b + c/2 - 1/3tR \tag{6C}$$

for the circle, and

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[4]We consider only the hexagon since it has been proven to be the most profitable of the polygons, and consideration of other polygons would be redundant and would not add to the presentation.

$$p = a/2b + c/2 - .3509 \, tR \qquad\qquad\qquad (6H)$$

for the hexagon.

The demand constraint which was mentioned earlier must now be imposed on the model. This states that $u < a - p$. The farthest point from a seller in any market shape is the point where demand vanishes for a given p, therefore the following must hold,

$$R' = a - P_i \quad \text{(i = hexagon, circle)}$$

where R' is the longest distance from the seller to the perimeter of any market shape. The shortest distance to the perimeter is then

$$Ri = \gamma_i(a - p)$$

where $\gamma_h = \sqrt{3}/2$, and $\gamma_c = 1$.

The prices from equations 6 and the demand constraints above are substituted back into the profit function to solve for the equilibrium conditions. The solution involves quadratic equations in R which are rather involved, and since the complete derivation is available elsewhere (Greenhut, 1974; Greenhut & Ohta, 1977), the mathematics is discontinued at this point.

The values of interest are the profit maximizing R, and the maximum level of profit for each market shape. The

hexagon is the shape which yields the maximum level of pro-
fits for all values of R, and is therefore the shape which
will prevail in equilibrium. The absolute difference in the
level of profits between the circle and hexagon is not
large, and is the result of the constraint imposed earlier.
The optimal hexagon is in fact inscribed in the optimal
circle[5] and the difference in profits between the two is
the area within the circle which is not in the hexagon.

The analysis of market areas was extended by Stern (1972)
who examined the differences which arise when the price
assumption of the classical model is changed. Specifically,
he questioned the effect on market area size when the price
charged is the socially optimal price[6] rather than the pro-
fit maximizing price. He found that the Loschian model
would result in smaller market areas for a given level of
fixed costs, but that the market size is closely tied to the
level of fixed cost.

In two separate articles, Eaton and Lipsey (1976, 1978)
have disputed certain of the key results of the classical
model. They found that

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[5]That is Rc Rh, but R'c = R'h.

[6]i.e., marginal cost

1. The hexagonal network is only one of the large number of equilibruim configurations of market areas.

2. Zero profit is not a necessary condition of free entry equilibrium in a spatially extended market.

The first conclusion was achieved by numerical simulation of the decision making process of atomistic firms, and the second through assumptions regarding the location decision of entering firms.

Competition and Market Areas

The most recent theoretical work on the classical model has been by Capozza and Van Order (1977, 1978). They extend the basic model by examining the effects of alternate forms of competition and pricing. In the classical model, firms set the profit maximizing price thereby acting as monopolists within their market area. This is referred to as Loschian competition and several authors have shown that this competitive assumption results in conclusions which are the reverse of what we would expect from classical price theory. Among these perverse results are that cost increases may decrease equilibrium market prices, and that spatial competition will result in higher prices than spatial monopoly.

Capozza and Van Order examine two alternative models of market structure with different assumptions about price

competition. These are Hotelling-Smithies competition (HS) wherein the firm assumes that prices of competitors are fixed, and Greenhut-Ohta competition (GO) where the firm assumes that the price at the edge of the market area is fixed. The authors find that both the Loschian model and GO competition lead to extreme results, but that the HS assumption leads to a range of intermediate results. The perverse results of the classical model may still obtain, but only as extreme cases. They feel that the HS assumption is the way firms behave in the real world, and it leads to the analysis of monopolistic competition.

Real Estate Literature

An Economic Model

Recently, Yinger (1981) presented the first formal economic model of real estate broker behavior. There are three general topics in his paper: first, he develops the basic model which incorporates the essential features of a market with imperfect information; the second topic is to extend the basic model to a market with a multiple listing service (MLS); and finally, he discusses the potential need for government intervention in the market.

The most important contribution of this paper is that it was the first formal analysis of the real estate brokerage

business, and it provides a framework for further study. Yinger recognizes that the heart of the business is the search for buyers and sellers of real estate, and he includes search as an input to the production function of the firm. He then solves for the optimal levels of search by individual brokers and for the market, and demonstrates market outcomes both with and without an MLS.

Yinger includes many of the essential features of the brokerage business in his model; however, there are several omissions and assumptions which detract from the value of his presentation. Even though he included search as an input, he overlooked the spatial aspects of that activity. Search can only be carried on in a spatial context, and new units of search may logically by purchased only at a greater distance from the broker's office location. Yinger assumed that the marginal productivity of each unit of search was equal, and that the marginal cost of each unit was also equal. Clearly, in the real world, this cannot be the case, and this diminishing marginal productivity of search may have led to different conclusions. The discussion in later chapters will discuss this point in more detail and demonstrate the importance of this oversight.

The other more notable weaknesses of Yinger include his assumptions that brokers set the prices of housing and the

rate of commission at optimal levels, and the absence of explicit transportation costs from the model. These assumptions overlook the realities of the business, and may lead to incorrect conclusions. It does not appear reasonable to assume that brokers are able to optimize their own well-being at the expense of the home owner who has engaged their services.

Despite the weaknesses, Yinger arrives at some plausible conclusions, especially with regard to the value of an MLS. He finds that brokers' incomes will increase when they belong to an MLS because total search costs are lower and because they are able to arrange more matches. There is an important economic incentive for brokers to form MLS's and this is demonstrated in Yinger's analysis.

The final section of his paper deals with the potential need for government influence in the market. Discussion of this section shall be deferred to a later section of this chapter.

The model which will be developed in Chapter Four will draw upon both the classical model and the Yinger study, and will incorporate the salient features of each. In an attempt to make the model as useful as possible, it will also draw upon the opinions expressed by individuals in answer to various surveys about the real estate brokerage business. Several of these surveys are reviewed in the next section.

Empirical Surveys

Much of the research which has been conducted on the real estate brokerage industry has involved surveys of consumers of brokerage services. There have been many such studies; however, only a few are pertinent here. The results of these studies will be incorporated in the development of the broker model in Chapters Three and Four, and will be discussed there. In this section we shall simply indicate the general area of interest of each of the surveys.

Hempel (1969, 1970) conducted extensive studies of the home buying process with emphasis upon the buyer's side of the market. His interest was in the sources of information utilized by buyers and the importance of those sources, one of which was real estate brokers. Miller and Atzenhoefer (1981) conducted a survey of home owners who were attempting to sell their properties without the services of a broker. Their goal was to learn the reasons why these individuals chose to avoid the brokerage commission. The final survey which will be drawn upon was conducted by Goulet et al. (1981). It dealt with consumers' opinions about buying and selling real estate and the services provided by various intermediaries in the process.

The Spatial Bias of Real Estate Brokers

In two separate publications, Palm (1976a, 1976b) reported
the result of a survey undertaken to determine the existence
of spatial bias in the recommendations made to potential home
buyers by real estate brokers. She argues that the existence
of spatial bias would impede the home buying process and
present to the potential buyer a distorted view of the metro-
politan area in question. Her survey was conducted in two
separate cities with very different topography and geography.

Not surprisingly, Palm finds that individual realtors
over-recommended the areas in which their activities are
centered. She concludes that Realtors present a biased view
of the urban geography, and that buyers who rely upon brokers
for information are using a spatially limited information
source. She also infers that this situation may be related
to localized imbalances in supply and demand for housing.

The problem with Palm's study is that she does not discuss
the reasons behind the spatial bias of brokers. Her discus-
sion makes it sound as though the brokers conspire to limit
their spheres of knowledge in order to deprive potential
buyers of complete information. It is equally likely that
this territorialization results from the economics of the
brokerage business, and specifically because of the spatial
costs which must be incurred by brokers. This question shall

be investigated later in the paper when the model of a bro-
kerage firm is developed.

The Need for Government Intervention

There have been three recent papers which have dealt with
the economics of the brokerage business and the potential
role of the government therein. These papers summarize the
issues which have been raised in support of increased govern-
ment intervention and they will be reviewed here.

Owen and Grundfest (1977) discuss the real estate con-
veyancing industry in California, one member of which is the
brokerage industry. They find that there are two major
problems in the California market: first, brokers are guilty
of price fixing and collusion, and secondly, that the exist-
ence of MLS's has eliminated some of the competition in the
market. These conclusions are based upon a limited amount
of empirical evidence which showed that most brokers in the
state charged the same rate of commission. In order to
correct the less than competitive situation in the market,
the authors recommend the vigorous enforcement of existing
anti-trust laws, along with the passage of new laws against
price fixing by brokers.

The Owen and Grundfest analysis suffers from the same
weakness which has characterized some of the banking studies

discussed in Chapter One. They speak of the situation in the "California brokerage market" as if it were a monolith. They ignore the fact that there are probably hundreds of local markets within the state and that the competitive environments could be very different among these markets. The aggregate empirical data upon which the conclusions are based is not adequate to prove collusion and price-fixing in the industry. These allegations could only be supported by first identifying local markets, and then studying the competitive situation within those markets.

Miller and Shedd (1979) point out many of the issues raised by Owen and Grundfest; however, their interest is in the applicability of anti-trust laws to real estate brokers. The authors agree that commission rates are uniform throughout the country; however, they do not conclude that the uniformity is the result of collusion. Rather, they point out the economic importance of cooperative sales to brokers and how that may lead to econmic interdependence among brokers, especially smaller firms. These authors conclude that the uniform commission rates result from the economic interdependence rather than from collusion or price-fixing, and they note that the situation may be especially pronounced where many small firms belong to a local MLS.

Miller and Shedd do not call for new regulations to correct the uniformity of prices, but note that the evolution of the industry will likely correct the situation. As independent firms become larger and national franchises become more important, there will be less dependence among firms, and in fact less need for the local MLS. The decreased dependence will lead to more intense competition, and price cutting will likely result. The authors conclude that the market will outgrow uniform commission rates without the need for new government intervention.

Yinger (1981) is the latest author to call for new government activity in the real estate brokerage industry, and he sees a need for intervention at several levels. His conclusions are based upon his economic model of the industry which was discussed previously, and as mentioned there are several oversights and omissions in his model.

Yinger states that the market for real estate services is inefficient because the level of broker search is too high; he feels that this search is an inefficient use of the resources of society, and that the government should somehow limit the level of search by brokers.

He also states that brokers have considerable market power, and that market power drives commission rates and housing prices above the competitive level. This conclusion

is based upon two pieces of evidence: the existence of uniform commission rates, and the use of percentage fees rather than fees for services rendered in the industry. Yinger's solution to the alleged market power is for the government to require that brokers set a fee for services, or that the government regulate commission rates. As with the Owen paper, this call for regulation is based upon incomplete empirical data, and there has been no attempt to identify an appropriate local market.

Yinger suggests that the creation of an MLS is an unambiguous gain to society, and that government should encourage the development of such organizations even to the extent of providing loans and technical assistance. This is an interesting contrast to the conclusion of Miller and Shedd that membership in an MLS would naturally lead to uniform commission rates because of the economic interdependence which results.

There is general agreement that commission rates in the real estate brokerage industry are uniform; however, there is no such agreement as to why the situation exists. Each of the authors above has suggested different possible remedies for the situation, but there is insufficient evidence about the structure of the industry to know the proper solution. Without knowledge of the market structure, it is not

possible to know whether regulation is in the best interest of the public, and the divergence of opinion among these authors is indicative of the problem.

Conclusion

This review has drawn from two separate bodies of literature. The spatial economics literature provides understanding of how costly distance may affect the behavior of firms. This literature recognized the fact that firms operate in a spatial environment, and that it is costly to traverse that space. It also showed that firm actions in a spatial economy may be different than classical price theory would suggest. The size of a firm's market area is a function of the costs of spatial friction and the actions of its competitors, or the structure of its market. This literature provides the economic justification for the existence of local market areas, and provides the basis for the analysis to follow.

The real estate literature is diverse and we have reviewed only the pertinent contributions. It should be clear from this review that the real estate brokerage industry is not well understood by researchers and that there is a need for more research. Several of the articles reviewed here have been critical of the industry and have called for reform or regulation. There is general agreement that fees are uniform

throughout the industry; however, there is not agreement as to why this is the case. There is clearly a need for intensive research on the structure of the industry which will indicate the reasons for the existing practices. The structure of the industry will not be determined by regional or statewide studies because a real estate market is local in nature. A study of market structure must be based upon a local market if it is to be accurate. Hopefully, by combining the spatial economics literature with the economics of the real estate brokerage industry, this analysis will help define a local real estate market.

THE DEMAND FOR BROKERAGE SERVICES

The purpose of this chapter is to describe the real estate brokerage industry, and the demand for the services of the industry by both buyers and sellers of real estate. The chapter begins with a brief introduction to the industry, and then continues with a more detailed discussion of the economic motivations of buyers and sellers.

Throughout the following discussion, the assumption is made that the firm is an individual broker/owner. This assumption allows concentration on the incentives of the firm without the complication of multiple employees. Since the incentives of employees and the owner are very similar in a commission only business, this assumption should not detract from the utility of the model.

The Real Estate Brokerage Industry

The industry is composed of a large number of small firms each of which earns income by acting as an intermediary in a sales transaction of real property. The owner of the property engages the services of a broker to locate a buyer for the property, and agrees to pay a fee to the broker when the property is sold. The fee is generally a fixed percentage

of the sales price of the property, although other arrangements are possible. The process of engaging the broker's services is known as listing the property with that broker, and the listing agreement sets forth the term of the listing and the fee.

While entry to the industry is not free, it more closely approximates free entry than many other industries. The costs of entry include the state licensing requirements[7] and the expenses of opening an office, although an office is not a necessary prerequisite. The theoretical industrial location models include as a key assumption the free entry of firms, and this feature of the brokerage industry adds to its applicability for the testing of those models.

There are two types of licenses issued by states, the broker and the salesman license. The salesman license qualifies a person to handle transactions in real property for a fee, but only under the supervision of a licensed broker, the salesman may not open his own office. The broker license qualifies that person to act in his own behalf and to open his own office to transact business. The qualifications for

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[7]Normally this would include several college level courses in real estate, and an examination administered by the state.

the broker's license are more rigorous than for the salesman, and typically there is a requirement of some period of experience in the industry.

Collectively, brokers and salesmen are referred to as real estate agents, and in a legal sense they do act as agents for the property owner. Typically, a broker will open an office and employ persons holding salesmen licenses to solicit listings and/or sell existing listings. The employees are paid on a commission only basis, and when a property is sold, the broker receives the fee and splits it with the salesman involved in the sale. Expenses are absorbed by the broker and the salesman in a prearranged manner, but in no case does the property owner pay more than the preagreed fee.

Brokers have found it advantageous to cooperate on both a local and national level through several associations, the largest of which is the National Association of Realtors. At the local level, firms have formed multiple listing services (MLS) which combine all of the listings of each firm into a central data bank to be shared by all members. This allows one broker to sell the listings of other brokers and still be paid some portion of the fee which was set in the original listing agreement. The method in which the fee is split is set by the local board.

The MLS has expanded the income earning opportunities of most brokers because it has increased their inventory of saleable properties, but also because it has increased their inventory of information about the area, and it is information which the agent offers to potential buyers of property Since most firms in an area have access to MLS[8] and the price charged by brokers is uniform, firms attempt to differentiate their product and services by non-price means such as advertising, office location and appearance, community activities, etc. The firms are in business to provide information to potential buyers and the more information provided and the higher the quality of that information, the higher the probability of selling a listed property. These non-price forms of competition are information signals to potential buyers, and they also provide information to owners of property who are shopping for a broker.

Product and Price Redefined

In the classical model, the consumer buys from the firm which offers the lowest delivered price of a homogeneous product, and the firm's market boundaries are established by the choices of consumers. The decision is not as clear when

[8]Several studies (Becker, 1972; Miller & Atzenhoefer, 1981) have shown the MLS membership to be in the range of 85 to 95% of all brokers in a given area.

dealing with a service firm since the product or service may not be homogeneous and explicit price may not be the only decision variable. The purpose of this section is to discuss the differences between products in the two types of industries, and then to discuss pricing implications.

The Product of a Brokerage Firm

The product which is offered by a brokerage firm is a complex bundle of knowledge, experience, information and legal entitlement which we shall call brokerage services. Any licensed broker may represent others in real estate transactions and charge a fee for services. Since all brokers must have a certain level of knowledge and experience in order to become licensed, information is one of the primary ways in which one broker may distinguish his product from another; and in fact, the product brokerage services is largely informational.

Consumers expect a broker to have sufficient information on schools, neighborhoods, shopping, and relative prices of properties to answer questions and handle a sale effectively. As a broker increases his inventory of information, he is able to provide better and more efficient service to consumers, and therefore to provide a larger quantity of brokerage services, or a better product. If all brokers

charge the same price for their product, consumers will choose the broker which offers the better product.

It is in the best interest of the broker to have an optimal inventory of information to offer consumers. Information in this sense is a valuable commodity, and it is costly to acquire and to keep the inventory current. The costs of information include transportation costs incurred in seeking information, and the opportunity cost of the time spent in the search. As the broker moves further from his office each of these costs increase since more time and money is spent in travel, and therefore the cost of information is an increasing function of distance. The broker will seek that amount of information which is sufficient to differentiate his product, but which can be gathered at the lowest cost.

The product of brokerage firms is not homogeneous to the extent that the brokers' inventories differ, and since information is a function of distance, it is likely that a broker will serve a finite market area where his product may be successfully differentiated.

The Price of Brokerage Services

The consumers decision as to which broker to choose is complicated not only by the complex nature of the product,

but also by the pricing of the product. The price of bro-
kerage services is composed of both an explicit fee and
implicit costs which must be evaluated by the consumer; and
while the consumer will select the firm which offers the
lowest price, the lowest price is not always obvious.

The explicit fee for services is a percentage of the
sales price of the property. The actual percentage rate is
generally 6 or 7 percent, and the rate appears[9] to be fairly
consistent across metropolitan areas. The seller of the
property agrees to pay the fee to the broker when a buyer is
located, but the buyer pays no fee.

The seller's goal is to find a buyer for the property and
comsummate a sale as quickly and efficiently as possible.
He may accomplish that goal either by selling the property
himself, or by contracting with a brokerage firm to handle
the sale. The decision as to whether or not to use a broker
depends upon the explicit fee, the anticipated difficulty of
selling the property, the opportunity cost of the seller's
time, and the expected quality of the broker's service, or
synonymously, the product offered.

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[9]Several studies (Zerbst, 1977; Owen & Grundfest, 1977)
have shown that 80 - 95% of all transactions are at the
same commission rate.

The implicit price may be defined as the opportunity cost of doing business with a particular broker. Since the seller's goal is a quick and efficient sale of the property, any factor which impedes the achievement of that goal is an opportunity cost. From the seller's viewpoint, the ideal sale would be on the day the property is listed, at the asking price and with no complications in the paperwork; any diversion from this ideal would be an opportunity cost to the seller. The seller will choose the broker who offers the highest probability of achieving the ideal sale, and it appears that in most cases this will be a broker located in close proximity to the seller. Opportunity cost appears to be an increasing function of distance, and therefore a spatial cost which influences the consumer's choice of a broker.

This conclusion is based upon the earlier discussion of the broker's services and the implication of that discussion for a broker's service area. The probability of a broker selling a property is highest when that property is located in his service area because that is where he spends most of his time, and that is the area about which he has the largest amount of information. His ability to facilitate a sale is greatest in that area because he can answer the questions of buyers, he knows the relative prices and he knows buyers interested in that area. In a more distant location he

would be less likely to arrange a quick and efficient sale because of a lack of information about the area. He would have spent less time in the more distant area because of the costs of transportation, resulting in a lower inventory of information and therefore a lower probability of achieving the consumer's goal.

The total price of brokerage services to a seller is

$$p = rS + o(u)$$

where rS is the explicit fee, and o is the implicit opportunity cost which increases with distance, that is

$$do/du > 0$$

The next section of the paper will discuss the seller's decision.

The Seller's Decision

Once the owner of a property decides to sell, he must decide whether or not to engage the services of a broker, and then perhaps which broker to engage. The basis for making these decisions is the real net proceeds from the sale under each of the alternative methods of sale. This implies that the consumer considers the sale price, the value of his time,

and the time required to find a buyer for the property, as well as the explicit rate of commission, r, charged by the broker.

Let E(S) be the expected sale price of the property. If the owner decides to sell the property himself, the real proceeds will be

$$E(S_O) \ e^{-i_O t_O}$$

where (S_O) indicates that the sale was handled by the owner, t_O is the time required to consummate the sale, and i_O is the periodic discount rate which is appropriate to the value of the owner's time in handling the sale.

The ideal sale in the view of the owner would be one which occurred at the moment the property was offered for sale, in which case the real proceeds would be $E(S_O)$. The difference between the actual real proceeds and the idealized proceeds is the opportunity cost or implicit cost of selling the house in this manner,

$$E(S_O)(1-e^{-i_O t_O})$$

The variables which determine the implicit cost are i_O and t_O. i_O can vary substantially across owners and is a key determinant in the choice to sell with or without a broker. An owner who is highly paid and has little free time would

assign a much higher i_o than an owner who has much free time.[10]

Consider now the real proceeds from a sale handled by a broker. Using the subscript b to indicate the involvement of a broker, we have

$$E(S_b)(1-r)e^{-i_b t_b}$$

as the real proceeds where r is the rate of commission charged by the broker. The opportunity cost of selling with a broker is

$$E(S_b)(1-r)1-e^{-i_b t_b}$$

The consumer will therefore engage the services of a broker only if the opportunity cost of using a broker is less than the opportunity cost of selling the property personally, or

$$E(S_o)(1 - e^{-i_o t_o}) > E(S_b)(1-r)(1-e^{i_b t_b})$$

For many consumers, $i_b < i_o$ because of other demands on their time or simply because they do not want to deal with the problems associated with selling the property on their own. $E(S_o) < E(S_b)$ for many consumers also because they do not have the same knowledge of market conditions and buyers which brokers have. Finally, $E(t_o) > E(t_b)$ for some of the

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[10]The Miller & Atzenhoefer study lends support to this statement.

same reasons just mentioned, and also because brokers have a comparative advantage in selling property and should be expected to consummate a sale more quickly. The evidence indicates (Miller & Atzenhoefer, 1981; Becker, 1972) that about 70% of sellers use the services of brokers so that consumers apparently anticipate lower opportunity costs with a broker.

The consumer must now choose from among available brokers. He will attempt to find the broker which will provide the highest expected real proceeds from the sale. Consider the choice between two brokers, j and k. The consumer will choose broker j rather than broker k if

$$E(S_k)(1-r) \ e^{-i_k t_k} < E(S_j)(1-r) \ e^{-i_j t_j}$$

Since r is equal for each broker, this implies that the opportunity cost relationship is,

$$E(S_k)(1-r)(1 - e^{-i_k t_k}) > E(S_j)(1-r) \ (1 - e^{-i_j t_j})$$

This formulation allows the identification of both the explicit and implicit costs of brokerage services referred to earlier. With $S_j = S_k$, the explicit fee for each broker is equal at $rE(S)$. However, the implicit cost will be different. It will be the implicit cost which will cause the

consumer to choose one broker over another, and the implicit cost is determined by the terms i, t, and S.

The consumer must assign values to these parameters as part of the decision process, and it appears that distance from the broker's office may be important in assessing the values of $E(S)$, $E(t)$, and $E(i)$. The discount rate would be lower as a higher level of service is provided. A higher level of service is synonymous with the best bundle of brokerage services or the best product[12] and from the previous discussion, a local broker may offer the best product and thereby the lowest discount rate. $E(S_j)$ might exceed $E(S_k)$ if broker j were more knowledgeable about market conditions and properties in the area, although in a competitive market with a multiple listing service the consumer would likely assess $E(S_j) = E(S_k)$. $E(t)$ would be more closely related to the proximity to the property, because it would be related to the ability of the broker to bring large numbers of potential buyers to the subject property, and to his knowledge of the area. A broker who is located close to the property is able to make more trips in a given time period than a broker who is located at greater distance.

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[12]This could include personal comfort with the broker or previous satisfactory experience.

While many brokers may have the ability to sell the property, it seems that a broker who is located closer to the subject property will be the most likely to provide the maximum exposure. The implicit cost of brokerage services is determined by i, S, and t. However, of the three parameters, E(t) seems to be the most relevant. When considering similar brokers, it may be difficult to evaluate $E(i_j)$ and $E(i_k)$ unless the brokers offer clearly different levels of service. With similar brokers, it is also likely that $E(S_j) = E(S_k)$.

E(t) seems to be most closely related to the broker's knowledge of the local area, and since a broker's level of information is greatest within his local area, we expect sellers of property to associate a lower E(t) with a broker who is located closer to a property. Sellers could observe the time required to sell other properties in the area by various brokers and could form expectations based upon those observations. Empirically, we would expect to find a positive relationship between time on the market for a listed property (TOM) and the distance from the property to the listing broker (DLB).

The most important decision criteria for the seller of the house is the expected real net proceeds from the sale. The decision as to which broker to choose will rest on that

criteria. The discussion above leads us to expect a negative relationship between DLB and expected real proceeds; that is, a broker who is located further from the listing would be expected to produce lower real proceeds from the sale.

The empirical formulation will be slightly different than the original since an adjustment must be made for heterogeneous housing prices. The original relationship was

$$E(S_j)(1-r) \ e^{-i_j t_j} \ > E(S_k)(1-r) \ e^{-i_k t_k}$$

In order to standardize the empirical relationship to adjust for houses with different list prices and sale prices, we substitute the actual sale price for E(S) and divide each side by the list price L. If broker j is closer to the subject property than broker k, we expect

$$S/L \ (1-r) \ e^{-i_j t_j} > S/L \ (1-r) \ e^{-i_k t_k}$$

This once again is an ex post relationship. However, it seems reasonable that a consumer will form expectations based upon previous observations of performance. The consumer of brokerage services will therefore assume that the implicit cost of brokerage services will increase with distance to the listing broker, and will list with a nearby broker, ceteris parabis.

The consumer's demand curve for brokerage services can therefore be presented as a function of both explicit and implicit costs. The explicit cost is the commission rate, r, and the implicit cost is the expected loss in real proceeds associated with a given broker. This implicit cost is an opportunity cost and is a function of distance, u. For a given sale price S, the demand curve for a consumer is

$$x = a - b((r + o(u_j))$$

where x is the demand for the product of broker j, and u_j is the distance from the property to the office of j. As previously established $do/du_j > 0$, and the opportunity cost term o is defined as

$$E(S) (1 - r)(1 - e^{-it})$$

This indicates that price to the consumer and therefore demand is a function of distance and an analysis of the market must include distance as an important variable.

The Buyer's Decision

As discussed previously, the buyer's side of the real estate market has been the focus of most previous research, and therefore, more is known about the motivations of buyers. The buyer does not pay an explicit fee to the

broker, and therefore the analysis of buyers is somewhat different than the analysis of sellers.

Prior to the existence of an MLS, the buyer's task was substantially more complicated. The buyer might expend substantial amounts of money and time in the search process for an appropriate house. In many cases, the buyer would work with a number of real estate brokers, each of whom was located in a different part of the metropolitan area. Each broker had specific knowledge about some part of town, and the buyer would then decide which part of town was most desirable.

The existence of an MLS has greatly simplified the task of the buyer, and has substantially reduced the search costs involved. The buyer may now visit only a single broker and have access to all properties for sale in the MLS, since each broker will have the same inventory. The buyer must simply choose the broker with whom he would like to search. There is no explicit fee to the buyer, only the implicit cost of time involved in the search process.

It would seem that a buyer might be indifferent about the choice of a broker since the product is homogeneous and without explicit cost. We might expect to see buyers choosing to work with a broker in their own neighborhood even if they were planning to move across town. This does not appear to

be the case, however. Research has indicated that buyers still go to a broker or brokers who are located in the section of a city where the buyer would like to look at housing. Apparently buyers feel that by working with a broker in that area, the implicit costs of search will be lower, since there would be no difference in the explicit costs.

These implicit costs include the time involved in the search, and the quality of the product offered by the broker. Within that area, the local broker has the highest level of information and is able to provide a better product to the buyer. Search time may be minimized, and therefore the implicit cost of buying is lower.

While distance is not as important to the buyer's decision as it is to the seller's decision, it appears that buyers still value the localized knowledge of brokers. The MLS has not caused all brokers to be viewed equally by buyers, since they still place a lower implicit cost or higher value on brokers with more knowledge of a local area. From the broker's viewpoint, this would provide incentive to concentrate efforts within a specific part of town.

THE ECONOMICS OF THE BROKERAGE FIRM

The traditional industrial spatial model will be the basis from which to build an economic model of a real estate brokerage firm. The format of the classical model shall be followed wherever possible. However, the unique nature of this business requires some additions and redefinitions. The chapter begins with a description of the output of a brokerage firm and the revenues associated with each output. These outputs are the distinct products of the firm. The following section discusses the inputs which are required in the process of producing those products. The final section of the chapter shall return to the notion of optimal market radii from the classical model, and develop the idea for a brokerage firm. Optimal market radii for the different outputs and different firms will be examined and hypotheses presented.

The Basic Model

The analysis of the broker begins with a standard profit function for a firm operating in a spatially dispersed market. The necessary redefinitions shall then be added so that the model will represent the nature of a brokerage

firm.   In the standard model, the profit for some time period is

$$y = pX - tu - c - f$$

where p is the price of the product, X is the output of the firm, t is the transportation cost per unit of distance, u is one unit of distance, c is the marginal cost of production and f is the fixed cost of the firm. For a broker, p = rS, where as before, r is the rate of commission and S is the selling price of houses, which for the moment is assumed to be constant.

Implicit Prices

With all brokers charging the same rate of commission, r, and all houses being sold at the same price, S, consumers would appear to be indifferent among the various brokers located in this economy. This is a basic difference from the classical model where consumers paid transportation costs which thereby caused one producer to be less expensive than others. Consumers set the boundaries of firm market areas by choosing the lowest delivered price of the homogeneous good. It would appear from the above that consumers would have no role in defining the boundaries of market areas since the firm bears the costs of transportation.

Consumers of brokerage services do bear the implicit costs of brokerage services discussed in Chapter Three, and these implicit costs may be as important as transportation costs in defining the full cost of services of any given broker. While we shall not attempt to include implicit costs in the model to be developed in this chapter, it is possible to envision a demand function for a broker of the form,

$$x = a - b(r + Tu)$$

where T is the measure of these implicit costs which increase with distance. This demand function would again result in the situation wherein consumers would set the firm's market boundary by choosing the lowest cost provider of brokerage services, where cost includes both implicit and explicit costs.

A demand function of this type could also explain why some consumers choose a broker which charges the customary commission rate despite the existence of discount brokers within the area. Consider the following diagram wherein a consumer is located at location u* and is faced with a choice between broker a who charges commission rate r, and discount broker b who charges a lower commission r'. The total cost of brokerage services is

$$p = r + Tu$$

where r is the explicit cost and Tu is the implicit cost which increases with distance.
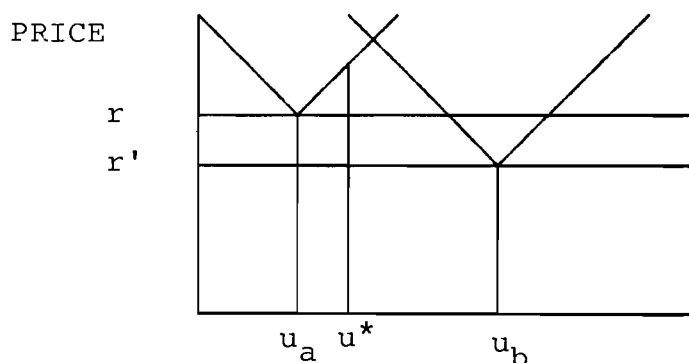
Figure 1: The Price of Brokerage Services

The consumer in this case will choose broker a because the total cost of services is lower even though the rate of commission is higher.

As mentioned, implicit costs will not be a specific addition to the model here although they will be mentioned again. It is difficult to model such costs since they would be assessed differently by various individuals, and since so many various types of costs could possibly be included. The necessary simplifications would cause the model to be less useful so we choose to use only explicit costs here.

The Output of a Brokerage Firm

Output, X, is a more complex variable for the broker than it is in the standard model because of the different types

of output of a brokerage firm. Output is defined as any transaction which generates revenue for the firm, and the broker receives no revenue until he is involved in the sale of a property. Even though listing a property is desirable for a broker, it is not a revenue generating action but rather an addition to the firm's inventory. No revenue is generated until the property sells.

There are several ways in which revenue may be earned so that the single term, X, alone does not adequately describe the output for a firm. In a market with an MLS, the broker may be involved as the selling broker, the listing broker or both, and the income received depends upon the type of involvement. In a coop transaction a broker may sell the listing of another broker in the MLS, or his listing may be sold by another broker. In these cases, the commission is split in a manner established by the MLS. In a non-coop sale, the broker sells one of his own listings and keeps the entire commission.

In order to define output more clearly, some new terms must be introduced. Let L_j be a listing by broker j, and B_j be a buyer represented by broker j; the subscript k will indicate a listing or buyer represented by broker k. The three types of output then are,

1. x1: when Lj is purchased by Bj. In this case j receives the entire commission on the sale which is rS.

2. x2: when L_k is purchased by Bj. Brokers j and k share the commission equally, so that the income from and x2 sale is .5rS.

3. x3: Lj is purchased by Bk. j and k each receive .5rS.

The total output for a broker is the sum of the three types of output during the time period or

$$X = x1 + x2 + x3$$

and the broker's gross income is

$$pX = rS[(x1 + .5(x2 + x3)]$$

This description of output indicates why coop sales are so important to brokers. Prior to the existence of an MLS the broker could earn income only by selling his own listings; but with the MLS his income earning potential is significantly enhanced, and in fact, the majority of transactions are coop sales. The tradeoff of a portion of the commission for access to a large inventory benefits all members of the MLS.

Inputs to the Production Function

The broker incurs several types of expenses in producing output. As noted by Yinger (1981), the two major inputs to the production function are the search for buyers and the search for listings, and the broker will seek the optimal combination of these costly inputs. The profit function here does not explicitly show search as an input but does show other types of expenses such as fixed, marginal and transportation costs which are incurred. This section will discuss the importance of these expenses, and how they may be transformed into units of search.

The Search for Buyers

The search for buyers is carried on at two levels. The broker first searches for potential buyers, and then given that flow of potential buyers he attempts to match them with suitable listings, either his own or those of other brokers in the MLS. The costs associated with the first level of search are primarily fixed costs. The broker attempts to attract buyers through institutional advertising, office appearance, office location, reputation or perhaps through association with a regional or national franchise. Previous research (Hempel, 1969; Goulet, et al., 1981) has shown that buyers choose brokers through ads, location, and reputation

and therefore the cost of this type of search are fixed. Rather than attempting to model the effectiveness of this type of search, we assume that each broker is given B potential buyers per period, and that the level of search for those buyers is indicated by f.

The second level of search for buyers is the type of search described by Yinger. This is the search by the broker for a listing which suits the needs of each of his B buyers. This type of search is costly and may not result in a unit of output.

Assume that each of the B potential buyers is shown b houses during the period. These b houses may be listed by this or other brokers, and they are spatially dispersed. This implies that the broker must incur transportation costs in order to show the houses to the buyers. These transportation costs include the capital costs and variable costs of transportation as well as the opportunity cost of the broker's time spent in travel. As the broker shows houses which are located further from his office, the total distance traveled increases, as does the time spent in search. The total distance traveled by the broker with potential buyers in the period is

$$Bbu_b$$

where u_b is the average distance traveled to each of the showings with the buyers. The transportation cost is t per unit distance. Therefore the transportation cost of showing properties to potential buyers is

$Bbtu_b$

The opportunity cost of time will not be modeled separately, but is an important element in the broker's decision process. The broker has a limited amount of productive time, and must make optimal use of the resource. The time involved in the search for buyers includes the time spent in looking at MLS listings, driving time with the prospective buyer and the time spent in showing each listing to each buyer. The opportunity cost of time may be far more significant than the out of pocket transportation costs, and we shall assume that they are included in t.

Not all of the B potential buyers will actually buy a property so that many of the costly trips will have generated no income. The number who actually do buy is some percentage of B, aB. From the previous definition of output we see that the following identity holds,

$x1 + x2 = aB.$

The Search for Listings

The second type of input is the search for listings. The broker will expend some amount of time and expense in the solicitation of listings for his firm. Those listings which are acquired by the broker will be entered in the MLS, and when sold, the broker will receive some portion of the commission. While a listing is not a unit of output, it is considered an asset by the broker since there is a high probability that it will be sold through the MLS.

In order to acquire a listing the broker must visit l houses, so that given some stock of listings, L, the broker would have been required to contact Ll property owners. Let u_l represent the average distance traveled per listing visit, so that a broker who contacts widely dispersed properties would have u_l greater than a broker who did not travel as far. The total distance traveled by a broker is

$$Llu_l$$

and with transportation and time costs of t the total cost of the search for listings is

$$Lltu_l$$

The broker receives no income until a listing sells, and not all listings will sell in a given period. The number of

listings which do sell is some percentage of the total inventory of listings, g or

$$x1 + x3 = gL$$

The next term in the profit function is the marginal cost, c, which is proportional to the number of listings, although it is not really part of the search for listings. These costs could be viewed as the cost of carrying inventory for a manufacturing firm. When a property is listed the broker must pay MLS fees, advertising fees for each listing, incur the expenses of open houses for other brokers, purchase signs, etc. There are no such marginal costs associated with buyers, but they are incurred for each listing. The total marginal costs then are Lc.

The Model of the Brokerage Firm

The discussion thus far may now be summarized by substituting the terms into the original profit function to obtain

$$y = rS((x1 + .5(x2 + x3)) - L(tlu_1 + c) - Btbu_b - f$$

A further simplification may be realized by substituting into the above for L and B to obtain the profit function for the broker,

$$y = rS[x1 + .5(x2+x3)] - \frac{(x1 + x3)}{g}(tlu_{l+c}) - \frac{(x1 + x2)}{a}(tbu_b) - f$$

This is a highly simplified market in which all participants are very much alike. We assume that all brokers are equal in their ability to sell and list property, so that a, g, l, and b are constant, and as mentioned, all brokers also charge the same rate of commission, r. Transportation costs include both the monetary cost and the opportunity cost of time spent in travel, and since all brokers are identical, t will also be constant. These simplifications result in a model wherein the only variables are S, X, and u_l and u_b, the market radii, for the search for listings and the search for buyers. These could be viewed as the market radii for the two products of the brokerage firm - listings and sales.

Optimal Market Radii

The profit function may now be utilized to examine some of the questions of market structure which were raised in Chapter One. The questions to be addressed in this section are whether or not there is an optimal area for a real estate firm; are the optimal market areas different for each of the products of the firm; and finally, how do those market areas differ?

The first two questions may be answered together, since it is clear that if there is an optimal market area for a product of the firm then there must be an optimal market area for the firm. The primary question is whether or not there is an optimal market radius for each of the outputs of the firm.

We begin by repeating the profit function for the broker,

$$y = rS[x1 + .5(x2 + x3)] - \frac{(x1 + x3)}{g}(tlu_{1+c}) - \frac{(x1 + x2)}{a}(tbu_b) - f$$

The three outputs of the firm are x1, x2, and x3, and the first order conditions with respect to those variables are,

$$\frac{dy}{dx_1} = rS - t(\frac{lu_1}{g} + \frac{bu_b}{a}) + \frac{c}{g}$$

$$\frac{dy}{dx_2} = .5rS - \frac{tbu_b}{a}$$

$$\frac{dy}{dx_3} = .5rS - \frac{(tlu_1 + c)}{g}$$

Even though the firm produces three types of output, there are really only two basic products, x2 and x3, since the x1 output results from the combination of the other two. The two market areas of immediate interest then are the listing market radius (ul) and the sales market radius (ub).

The first order conditions may be solved for these optimal radii by setting them equal to zero and then solving for ul and ub,

$$u_l = \frac{rS}{t} * \frac{a}{2b}$$

and

$$u_b = (\frac{rS}{t} * \frac{g}{2l}) - \frac{c}{tl}$$

If we assume that consumers are identical in their like-lihoods of buying or listing property, i.e. a=g and l=b, then we would expect ub to exceed ul by the distance c/tl. This implies that brokers will travel further with buyers than they will in soliciting listings, and that the two product markets will differ in size.

The market radius for non-coop sales should coincide with the listing market radius, since the broker does not have prior knowledge as to whether a listing will be sold by him-self or by another broker.

The discussion results in the following hypotheses which will be empirically examined later,

Ho(1) : $u_b = u_l$

Ho(2) : $u_l(x1) = u_l(x3)$

Thus far we have assumed that all properties in this market sell at a single price, S. The conclusions drawn above with regard to the optimal market radii would still hold if we assumed instead that S were the mean of a distribution of housing prices throughout the market, and that indvidual transactions were drawn randomly from that distribution. Let us now assume heterogeneous housing prices with those prices randomly distributed in the market, and examine the impact of differing prices on the broker's activity within his market area. The optimal radii of the listing and sales markets will not change. However the broker's activity within his listing market may be altered, and in fact, this change will serve to differentiate the characteristics of the broker's non-coop transaction market from those of his listing market.

If we return to the first order conditions for the profit function and solve for S*, the optimal selling price, we find

$$S^*(x1) = 1/r [tu(1/g + b/a) + c/g]$$

and

$$S^*(x3) = 2/r[tu(1/g) + c/g]$$

These conditions imply that the broker could earn the same equilibrium profit by selling houses with substantially different selling prices. To earn that given level of profit, the broker would choose to sell the lower priced houses as non-coop (x1) sales and the higher priced houses as coop sales. Likewise, if the broker were working with a buyer interested in housing at a price S', and the broker had a listing at price S''>S', the broker could increase his expected income from the transaction by convincing the seller to accept a price lower than S''.

This discussion does not presume that the broker has the power to dictate the decisions of his customers. However, the broker may develop sales strategies to capitalize on these incentives. Specifically, given a buyer interested in low priced housing, the broker may emphasize his own low priced listings as they travel through the market area; and given a buyer interested in $50,000 housing, the broker may emphasize his own listings at a slightly higher price, and then attempt to convince the seller to accept a lower price and/or the buyer to pay a slightly higher price.

This discussion leads to two testable hypotheses with respect to the broker's non-coop transaction market. First, the mean sales price in the non-coop market may receive a lower proportion of the list price when the property is sold.

Formally,

1. $S(x1) < S(x3)$

2. $\frac{SP}{LP}(x1) < \frac{SP}{LP}(x3)$

The discussion in this section has served to develop hypotheses regarding the market areas for the three specific products of a brokerage firm. We expect the sales market area to have the widest geographical extent, while the listing and non-coop markets should be smaller and approximately equal in size. The characteristics which should differentiate the listing and non-coop markets are the mean selling price and the proportion of list price received by sellers. Each of these hypotheses shall be tested in Chapter Seven.

Summary

In this chapter a profit function of a brokerage firm has been developed. The model represents a simplified version of the brokerage industry. However, it allows for the examination of questions pertinent to the subject at hand. The model is not suitable for predicting the actual size of market areas because no estimates were made as to the parameter values. However we are able to predict the relative sizes and certain characteristics of the markets for the basic products of the firm.

SPATIAL MARKET STRUCTURE

The discussion to this point has been concerned with the economics of individual brokerage firms, and the impact of economic incentives upon the spatial attributes of a firm. Comparative statics analysis has indicated that the size and/or characteristics of product markets are predictable and should be similar[14] for individual firms. The key predictions of the model are that market areas are finite and that the basic product markets[15] will differ in size. These predictions have significant implications with regard to the structure of the brokerage market, since market structure is the result of the aggregate decisions of individual firms who participate in the market. The remainder of this chapter shall discuss those implications.

As mentioned early in this paper, previous market structure studies have been characterized by inadequate definitions of the spatial extent of a market, and this oversight may have led to conclusions about the competitive

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[14]The market areas for individual firms would be identical in the case of a single uniform selling price and identical brokers.

[15]i.e. listing and sales markets

nature of markets which are not correct. The purpose of the following analysis is to demonstrate the importance of the spatial dimension in a market structure study, and then to discuss the appropriate variables for such a study of the real estate brokerage industry. Apart from demonstrating the general importance of the spatial dimension in this type of research, this exercise shall also be the first to present evidence, rather than speculation, on the competitive nature of the real estate brokerage industry.

This study of market structure will be concerned with two topics within the overall subject of market structure. First, it will examine the appropriate spatial definition of a real estate market, i.e., state, county, city, or a more narrowly defined area. This topic is not very interesting by itself. However, as pointed out earlier, it is crucially important when we attempt to measure the level of competition in the market, which is the second topic to be addressed herein. The level of competition refers to the amount of competition in the market, and is generally measured by the number of firms in the market, firm market shares, or concentration ratios.

The level of competition in a market is intimately related to another market structure concept, the type of competition; and, in fact, in the limiting cases of these concepts, they

are synonymous. That is, a concentration ratio of one implies that a single firm controls all of the business in the market, which is, by definition, a monopoly; and conversely, concentration rations approaching zero imply that there are many small competitors in the market, which is the epitome of a perfectly competitive market. In the following discussion we shall be dealing with intermediate cases where the translation between the level and type of competition is not so straightforward and reference shall be made to both concepts. The empirical focus shall remain on the level of competition, which is measurable, although we will make observations about the type of competition in the brokerage market, which is measurable only by inference.

Assumptions

Let us now demonstrate the importance of the previous discussion by examing the interrelationships between the type and level of competition, and space. Graphical examples should clarify the issues and indicate the importance of an appropriate spatial definition when one attempts to measure the competitive structure of a market. This discussion will incorporate the following simplifying assumptions:

1. The market is a straight line bounded by points U and U'.

2. There are n identical brokers, each of whom sells a uniform product at a uniform price.

3. Consumers are identical and are located at uniform density along UU'.

The final assumption to be included is drawn from the earlier analysis in this paper regarding the broker's market area. That is, we assume that each market area is finite, implying that the density function of a broker's market area declines as the distance from his office increases. The negative slope is the result of choices by both the broker and the consumer; the broker chooses to limit his market area geographically because the marginal productivity of search declines over space, and the consumer will prefer to buy from a more proximate broker because of the lower implicit costs of such a choice. The transaction density function could also be viewed as a probability density function since the choices of the broker and consumer result in a decreasing probability of a transaction as distance increases.

Spatial Competition

In the following discussion, various market scenarios shall be presented, and shall proceed from the simplest to the most complex. The focus of the discussion in each case will be upon changes in the number of brokers, and changes in

the spatial attributes of the brokers, and then the implica-
tions of such changes for market structure. It will be shown
that, in all but the most idealized scenarios, the spatial
attributes of the brokers are as important as their number
in correctly determining[16] market structure.

Perfect Spatial Market

Figure 2 presents the simplest spatial structure possible
since brokers are located at a single location in the market,
b. The level and type of competition in the market are
determined by n, the number of brokers at b. With n = 1,
the market is a perfect spatial monopoly, and as n becomes
large, the market becomes increasingly competitive, with the
limiting case being perfect spatial competition. Note that

| U | b | U' |
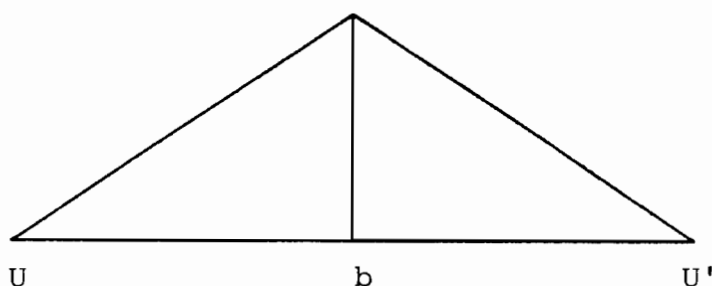
Figure 2: Simple Spatial Market

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[16]This discussion shall use a simple concentration ratio
as the empirical determinant of market structure. More
complete measures will be introduced when the subject
turns to the empirical study of market structure.

consumers in this case face the same competitive situation no matter where they are located along UU'. Therefore, distance is a matter of indifference, and the competitive structure is determined by the value of n. In this simple case only, the spatial definition of market boundaries is not important in determining the level of competition.

Spatial Monopoly

Now consider a case where brokers serve areas which are smaller than the entire market, and which are mutually exclusive. This situation is shown in Figure 3. With one broker at each b location, each broker is a monopolist within his service area, and therefore, the competitive situation facing each consumer in the market, regardless of location, is monopoly. Given the existence of multiple broker locations, however, the ability of a researcher to detect the existence of monopoly would depend upon the spatial definition utilized. Assume that there are d transactions within
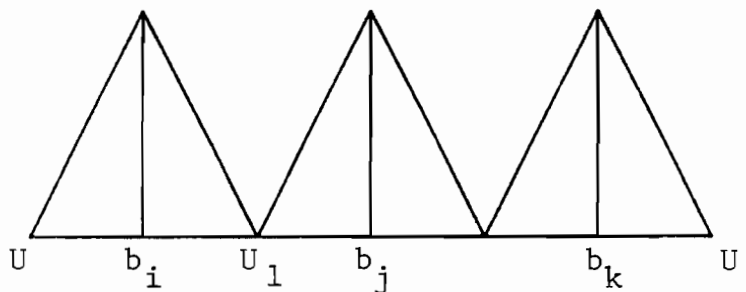
Figure 3: Spatial Monopoly

each broker's market and therefore nd total transactions. For broker i, those d transactions occur within the bounds defined by Uu1, and his market share or concentration ratio is $d/d = 1.0$, implying monopoly; however, the market share of broker i within the total market defined by UU' is $d/nd = 1/n$, and as n becomes larger, the value of the concentration ratio decreases, and might imply a competitive market. Hence, the likelihood of incorrect conclusions regarding market structure.

A similar situation would result if there were more than one broker at each location in Figure 3. Let there be n_i brokers located at b_i, n_j and b_j, and so on, with $n_i + n_j + n_k = n$. The competitive situation within the spatial boundaries of each of the k markets (e.g. Uu1) could range from oligopoly to perfect competition depending upon the values of n_i, n_j, etc. Yet the competitive situation within the more broadly defined market UU' would always appear to be highly competitive. As an example, assume there are three brokers at each of nine distinct locations such as b_i to b_k, and that d in each market segment is nine; with identical brokers, this implies that each of the 27 brokers in the market will handle three transacitons. Concentration ratios computed for the total market UU' would be $3/81 = .037$, implying a highly competitive situation, while the ratios

within any of the individual markets such as Uu1 would equal 3/9 = .333, which is indicative of oligopoly, or more correctly, spatial oligopoly.

Spatial Monopolistic Competition

The next scenario proceeds a step closer to reality by recognizing the fact that firms compete over space, and therefore have overlapping market areas. This results in a situation which is fundamentally different than those previous because now consumers will have a choice among broker groups, each of which is identical except for its location with respect to the consumer. The overall market structure which results is spatial monopolistic competition, because now consumers will differentiate among otherwise identical brokers on the basis of spatial attributes. In the standard case of monopolistic competition, identical firms attempt to differentiate their product on the basis of attributes such as product quality or advertising, and the notion of differentiation based upon the locations of spatially dispersed firms is consistent with that definition. This situation is shown in Figure 4, where once again brokers are located at points b_i to b_k along the line UU', but now certain segments of the market are served by more than one broker location.
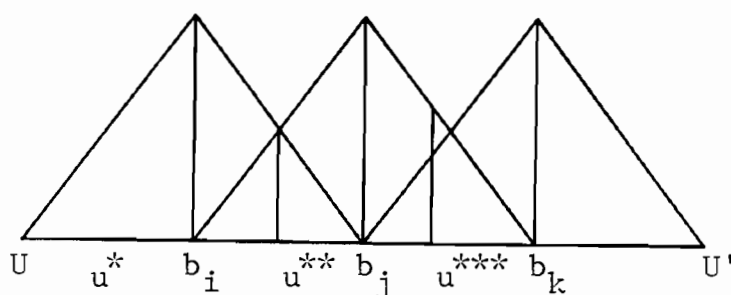
Figure 4: Spatial Monopolistic Competition

The consumer located at u^* faces a competitive situation
similar to those already discussed, and is not affected by
the existence of competing brokers. Those at u^{**} and u^{***}
though are affected by the new competitive situation. At u^{**}
the consumer will be indifferent between brokers located at
b_i and b_k; since each is equidistant and otherwise identical,
there is no way for the consumer to differentiate between
them. The result of this situation is that the consumer
faces a more competitive market structure than in the pre-
vious cases, because now a larger number of brokers are
competing for his business. The consumer at u^{***} will also
be the focus of increased competition between the brokers at
b_j and b_k. However, he will probably choose the broker at
b_j because of the spatial differentiation of the products
offered. In both of these cases, however, the consumer will
benefit from the existence of a higher level of competition
for his business.

This scenario might be labeled imperfect spatial monopolistic competition, because different competitive situations now exist at various locations along UU'. With one broker at each location, u^* faces a monopoly while u^{**} and u^{***} face oligopolies; with three brokers at each location, u^* is an oligopoly while the other two consumers are approaching competitive situations, and so on. This market structure is imperfect in that the broker locations are sufficiently dispersed to result in fairly distinct submarkets within the overall market area, with each submarket being distinguishable by location, and perhaps by competitive structure. In all cases though, the level of concentration will be higher within each of these submarkets than in the market as a whole, and therefore, the identification of such submarkets would be important in any study of market structure.

Perfect Spatial Monopolistic Competition. The difference between the imperfect and perfect cases of spatial monopolistic competition lies in the number of broker locations and the distribution of these locations in the market. As the number of locations increases, the market becomes more perfect because a higher degree of competition will exist

throughout the market. The decreased distances between brokers reduces the importance of the spatial differentiation attribute, and therefore causes the differences among broker groups to be less distinct[17]. The result is that any consumer in the market would view a wider group of brokers as being more nearly equal, and would thereby benefit from the increased level of competition. This scenario is shown in Figure 5.
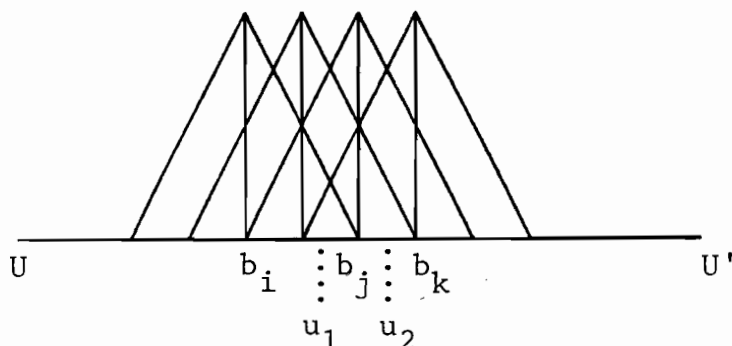
Figure 5: Spatial Monopolistic Competition

One of the immediately apparent results of this change is that the localized submarkets are no longer as distinct, and at every location, the submarkets are smaller. While the broker or brokers at b_j are still dominant within the segment

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[17]The limiting case of this process would be for brokers to be continuously distributed throughout the market, such that the monopoly advantage of the spatial attribute would no longer exist. The diagram presented here is therefore an example of a market which is approaching the ideal case, but is less than perfect.

u1, u2, there is still a positive probability that a consumer located within that segment might buy from broker i or broker k. If b_j is a single broker, his spatial monopoly is reduced, both in terms of area and power. Consumers throughout the market benefit from the higher level of competition, and the competitive distinctions which existed along UU' in the imperfect case are no longer so pronounced. Since competition is more uniform and at a higher level throughout the market, the potential measurement errors caused by an inadequate spatial definition are reduced, and in the limit, such errors would be eliminated.

This section has described the forms of spatial competition which may exist within simple markets. Given the assumptions above, we have found that the level of competition in the market depends upon the number of firms and their spatial distribution. The ability to correctly measure that level of competition, though, is dependent upon the definition of spatial submarkets in all but the most idealized cases. Attention to submarkets is not important when brokers are either all located at a single point, or when brokers are continuously distributed through the market, and the importance of the spatial definition increases as the actual market configuration moves away from these ideal end points.

The next section will draw upon this discussion, and attempt to locate where in the spectrum the real estate brokerage market is located.

Brokerage Market Structure

The market for brokerage services is composed of consumers and suppliers who are spatially dispersed, and the analysis to this point has indicated that the demand for and supply of brokerage services are affected by that spatial dispersion. It is therefore clear that this market fits the characteristics of spatial monopolistic competition as described above. It is also clear that this market is not representative of the limiting case of this form of competition since neither consumers nor brokers are continuously and uniformly distributed throughout a market area.

What is not so clear, however, is how closely the brokerage market approximates the ideal situation. This is a non-trivial matter because of the implications for an empirical study of market structure. If the market is close to the perfect case, a broadly defined market boundary is acceptable, because the level of competition throughout the market is equivalent. In the imperfect case, however, large submarkets exist, and varying levels of competition may exist within each submarket. Therefore, the spatial boundaries of the market must be more narrowly defined.

The essential difference between the perfect and imperfect cases is the existence of distinct submarkets, and we must therefore explore the question of whether such submarkets exist in a real estate market. The question can only be explored rather than answered because a definitive answer is not possible. An answer may be inferred though by examining the spatial characteristics of a real estate market, and identifying those characteristics which might indicate the existence of submarkets. Among the characteristics which might indicate the existence of submarkets are the density of housing, the locations of brokerage offices, and the size of broker market areas[18]. Each of these will be discussed separately, although the relationships among them will be obvious.

Housing Density

The discussion above assumed that housing was located at uniform density throughout the market. Relaxing this assumption might involve two changes in the spatial attributes of the market; first, housing could be located at non-uniform densities throughout the market, or secondly, it could be located at uniform density, discontinuously throughout the market. Either of these situations might be indicative of

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[18]Or equivalently, the slope of the broker's density functions.

the existence of broker submarkets. Brokers would find it advantageous to limit activities to the areas of high density, because they could arrange the same number of transactions within a smaller area. Likewise, the costs of search would be higher in less populated areas and there would be less incentive to search there. Therefore, in a market with non-uniform housing density, there might exist incentives for brokers to specialize in submarkets within the overall market area.

Location of Brokers

The location of brokers was treated as an independent variable in the simple cases above. However, in reality, location is dependent upon a number of other factors. Given the economics of the business, one of those factors, and perhaps the most important, is the density of housing; others might include proximity to an important intersection, proximity to the center of a shopping area, or the reduction of search costs for consumers. The incentives of locating at such points are common to all brokers, and might result in the clustering of brokers at key locations in the area.

Such clustering of brokers might be indicative of the existence of spatial submarkets. The strength of the indication is, of course, a matter of degree. If all brokers in

a market were located in n spatially distinct clusters, sub-
markets would clearly exist; however, as more brokers are
located between such clusters, the distinction of those sub-
markets diminishes, and finally ceases to exist.

Size of Market Areas

The size of broker market areas is another attribute which
might indicate the existence of submarkets. It is not the
absolute size of the markets, but the size relative to the
overall market which is important in this regard. If bro-
kers, in general, serve markets which are small relative to
the overall market area, submarkets might exist. Conversely,
market areas which approximate the size of the broadly
defined market would indicate an absence of submarkets.

Small market areas alone would not indicate the existence
of submarkets but, when combined with other spatial charac-
teristics, might be strong evidence. Like the location of
brokers, size of market areas is probably related to the
density of housing, and we might expect to find smaller
market areas where high density exists. If this situation
were combined with the existence of clusters of brokers,
submarkets would be likely.

Summary

The degree of deviation of each of these characteristics from the ideal is an empirical question, and one for which there is not a clear answer. An empirical study of market structure must address these issues, however, if it is to achieve valid conclusions. In the next chapter, the empirical aspects of measuring these attributes will be discussed.

Conclusions

The two previous chapters examined the economics of the real estate brokerage market for both consumers and suppliers, and found that both the demand for and supply of brokerage services are decreasing functions of distance. This chapter considered the implications of those results for market structure which includes both the form and the level of competition. It was shown that the likely form of competition which exists in a real estate market is spatial monopolistic competition, and that various levels of competition may exist within this form. This situation presents empirical problems to a researcher studying market structure, and the extent of those problems and possible approaches were also discussed.

The level of competition which exists in a real estate market is an unanswered but important question, which can be answered only by empirical testing. In the following chapter, a test of the level of competition will be proposed, which will address the issues raised in this chapter.

DATA AND METHODOLOGY

The purpose of this chapter is to describe the data which
will be used for the study, and then to describe the methods
by which the data will be analyzed. The next chapter shall
report the results of the analysis.

The Data

In order to study the spatial structure of an industry,
it is necessary to study a sample of the transactions which
occur within that industry. For the real estate brokerage
industry these transactions include the listings and sales
of properties by brokers within some geographical area, the
appropriate extent of which is one of the topics of inquiry
here. The difficulty of gathering the appropriate type and
quantity of data has resulted in the dearth of empirical
studies in the area of spatial structure. Fortunately, such
data has been made available for this study.

Basic Data

The data which will be utilized consists of complete
transactions information for the Franklin County, Ohio Board
of Realtors for the month of August, 1978. This data is

particularly well suited for this type of study for several reasons. Firstly, August, 1978 was a peak period in the residential real estate market and there are a large number of transactions and brokers represented; the data includes not only the transactions which occurred during the month, but also a large number of transactions which occurred prior to that period but which had not yet been closed out.

Secondly, the geographical coverage of the Franklin County Board of Realtors matches very closely the areal extent of several of the important political boundaries which have been used in past market structure studies, namely the Columbus, Ohio SMSA, the City of Columbus and Franklin County. This coincidence will allow us to examine the question of the appropriate market area definition, and compare it to each of the political boundaries.

Finally, the data includes not only spatial information on the transactions, but descriptive information as well, which will allow for more depth of analysis.

Transactions

The two basic transactions of a brokerage firm are a listing and a sale of a property, and, as discussed earlier, these may be viewed as the products of a brokerage firm. The sales transaction may be further clarified as being either a coop or a non-coop sale. This clarification results from

the existence of a Multiple Listing Service which allows
brokers to sell the listings of other brokers. The data
includes information on the three basic transactions of
firms - listings, coop sales and non-coop sales.

In order to eliminate any questionable transactions from
the data, only sales which were actually closed during the
month were included. There were a large number of transac-
tions listed as pending sales which were therefore counted
as listings since there was no assurance that these transac-
tions would actually become sales. The listings which were
included in the final data set included only listings which
were active during the month of August. The majority of
these active listings were acquired by brokers in the months
previous to August, but had not yet been sold.

During the month, there were 1326 sales transactions and
10,000 active listings handled by the members of the Franklin
County Board. That total number of observations was then
reduced for the following reasons: first, our interest is
in the residential brokerage market, and since the motivation
for commercial transactions may not be the same as that for
residential, all farm and commercial transactions were elim-
inated. The second reduction in sample size resulted from
eliminating the transactions of brokers which were located
outside of Franklin County. There were few members of the

Franklin County Board who were located outside of the county, and each was in a county contiguous to Franklin. All of the transactions of Franklin County brokers were included whether or not the property location was in the county.

Of the 1326 sales included in the final sample, there are more than 700 coop transactions, each of which involved two selling brokers, so that the data set includes information on 2200 individual broker sales transactions.

Member Firms

During August, 1978, there were 485 member brokers in the Franklin County Board, several of whom had multiple offices, so the data includes the transactions generated by all of the 547 offices of these brokers. There were 27 multiple office firms which collectively accounted for 89 offices in the county. Seventeen of these firms had only two offices, and there were only five firms with more than five offices.

There were many member firms with no listings or sales during the month, and an equally large number with only a single transaction. In order to eliminate non-representative data, the final data set was limited to brokers which accounted for at least two listings or one sale during the month. The elimination of the smallest brokers and those located outside of the county reduced the number of brokers

from 485 to 302, and it reduced the number of brokers offices from 547 to 359.

Final Data Set

Despite the eliminations of brokers mentioned above, the final data sample has been reduced very little from the original. Of the 10,000 original listings, only 505 were eliminated, and only 92 of the original sales transactions were not included. The final data set includes information on 9495 active listings and 1234 sales of which approximately one third were non-coop.

Centrographic Data

Data Handling

In order to investigate the spatial structure of the market, it was necessary to create from the raw data a new data set with the spatial characteristics included. The initial phase of data handling was concerned with this transformation.

A datagrid digitizer was used to plot each transaction of each broker on a map of the county which had been annotated as a cartesian grid. The function of the digitizer is to allow for the precise measurement of such distances with respect to any selected reference node. The process of

digitizing the data involved several steps; first, the broker's office was located and its coordinates recorded; secondly, each property within that broker's transaction set was located on the map, and its coordinates on the grid were recorded; and finally, each of the locations were plotted on the map with the digitizer which then generated the x, y coordinate distance measurements in computer readable form.

The goal of this process was to identify the geographic market area for each broker in Franklin County, with the market area defined as the area wherein the broker generates income. As discussed earlier, each broker has two basic products, and therefore a separate market area was plotted for each of those products (listings and sales) wherever possible. A broker's listing market included each of the active listings for the broker along with each of the coop sales where that broker was the listing broker. The listing market area for a broker is therefore the area where a broker lists property for sale. The sales market area includes every sales transaction in which the broker participated during the month. In the case of a non-coop sale, a single point was plotted both in the listing and sales market areas for the broker, and for coop sales, a single sale was part of the listing market for one broker and the sales market for the other broker.

Not all of the listing locations were plotted. Brokers
with less than three listing locations were not plotted, and
the listings of larger brokers were sampled, so that approx-
imately one-third of the total listings were plotted. This
resulted in a final sample of 348 listing markets made up of
2915 listings. This reduction did not seem to be costly in
terms of information because of the large number of points
left, and also because of the greater importance of the sales
transaction to the broker. The only sales transactions
which were not plotted were those which were the solitary
sale of a broker, since the notion of a market area is not
consistent with a single point. Every other sale was
plotted for each broker, and the final sample includes 244
sales market areas with 1719 points.

After the plotting procedure, this data set contained the
locations of the office(s) of each broker and the locations
of each of their transactions with respect to the office
location. These data alone were not sufficient to describe
the market areas so a set of descriptive statistics were
calculated which would statistically describe each market
area. These statistics will be described later in the
chapter.

Centrographic Statistics

This section will describe the centrographic statistics which will be utilized in this study. In describing the point distributions of transactions by brokers we are concerned with such things as the clustering or dispersion of points, the orientation of the point set, and perhaps, its center of gravity. These properties may be viewed as the bivariate equivalents of the standard deviation, skewness, and mean of a univariate distribution[18].

Mean Center

The mean center is the equivalent of the mean of a univariate distribution. It is the center of gravity of the distribution and is defined by the intersection of the mean of the distribution projected on the x-axis, and the mean of the distribution projected on the y-axis. The coordinates on the cartesian grid are x in the east-west direction, and y in the north-south. Formally,

$$E(x) = \sum_{i=1}^{n} xi/n$$

$$E(y) = \sum_{i=1}^{n} yi/n$$

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[19]Much of the following discussion is adapted from Hultquist et al. (1971).

with the mean center at (x,y), where xi and yi are the coor-
dinates of point i.

Standard Distance

This is a measure of dispersion along a line passing
through the mean center of distribution. Standard distances
are measured for lines passing through the mean center,
parallel to the original x and y axes,

$$SD_x = \sum_{i=1}^{n} (xi - \bar{x})^2/n$$
$$SD_y = \sum_{i=1}^{n} (yi - \bar{y})^2/n$$

however, the more useful statistic is the SD measured about
the principal axes of the distribution. Unless the distri-
bution is perfectly circular, there will be some correlation
between the projections of the x and y values onto their
respective axes. In order to eliminate the correlation,
rotation of the original axes is required to the point where
$R_{xy}=0$. The rotation results in a major axis and a minor axis
of the distribution, where the major axis is that about which
standard distance is a minimum, and the minor axis is that
about which the standard distance is maximized. The standard
distance about the major axis is labeled SMJ, while its
counterpart about the minor axis is SMN.

Standard Radius. This statistic is analagous to the standard deviation of a univariate distribution, in that it is a single number which describes the dispersion in the distribution from a point. When measured from the mean center of the distribution,

$$SR = \sqrt{[\Sigma(xi-\overline{x})^2 + \Sigma(yi-\overline{y})^2]/n}$$

The standard radius may also be computed from any other point in the distribution, known as an orientation node. For this analysis, the standard radius was measured as above, and also from the broker's office,

$$SRO - \sqrt{[\Sigma(xi-xj)^2 + \Sigma(yi - yj)^2]/n}$$

where xj and yj are the coordinates of the broker's office.

Coefficient of Circularity.

This is a measure of the circularity of the distribution and is defined as

$$CC = SMJ/SMN$$

The values of the ratio vary from 0 for a market area which is a straight line or a single point, to 1.0 for a perfectly circular market area.

Distance of Displacement.

The distance of displacement (DD) is simply the distance between the mean center of the distribution, and a selected reference node. For this study the reference node is the broker's office location, and DD will indicate whether or not the office is located at or near the center of the appropriate market area.

Data Cleaning Option.

The computer program which was used to compute these statistics, CENTRO[19], also provides a data filtering option. There may be cases where a transaction occurs which lies far outside of the broker's normal market area, and which point may distort the centrographic statistics. These outliers may be eliminated with this option which removes observations which are either those n points which lie furthest from the mean center, or those which deviate from the mean center by more than t * SR, where both t and n are chosen by the researcher.

These statistics shall be used to describe both a listing market and a sales market for each broker in the sample. The empirically computed market areas may then be compared

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[19]Described in Hultquist et al. (1971).

to the theoretical predictions, and the appropriate hypotheses tested.

Transactions Data

An additional set of information was gathered from the raw data which includes descriptive information on each sales transaction which occurred during the month. There were two reasons for gathering this added data: first, the centrographic statistics do not provide a measure of the actual distances involved in the home buying process, and since distances are an integral part of the brokerage firm model such measures were needed; and secondly, since a sale is the most important transaction for a broker, it is desirable to have more complete descriptive information on those transactions.

The information which was gathered on each of the 1234 sales includes: the identification of both the listing and selling broker, the list price of the property, the selling price of the property, and the time the property was on the market prior to sale. Unlike the centrographic data, this set includes every sale which occurred during the month, so that even the activities of the smallest brokers are included.

The basic data was extended by adding location of the property, and the locations of both the listing and selling

brokers. This allowed for the measurement of distances involved in the selling process, and two distance variables were calculated - the distance from the property to the listing broker (DLB), and the distance from the property to the selling broker (DSB). These additions also allowed for the identification of coop and non-coop sales, so that various propositions developed earlier with regard to optimal market radii could be tested.

The spatial information included in this data is more explicit than that developed in the centrographic data, and will allow for the measurement of the distances involved in listing vs. sales markets and in coop vs. non-coop markets. Likewise, the data can be examined on the basis of individual brokers, or in aggregate, across all brokers. Given the added flexibility and specificity of the transactions data, it will be relied upon more heavily in the analysis which follows.

Methodology

The issue of central concern in this analysis is the spatial structure of the real estate brokerage industry; where the spatial structure is determined by the size, shape, and location of market areas of brokerage firms. We wish to

examine empirically some of the issues which were raised earlier in the paper with regard to spatial structure.

These issues fall into two general categories; the first deals with the market areas of individual brokerage firms. We wish to examine the evidence to determine if those market areas follow the predictions of both theoretical spatial economic theory and the brokerage firm model developed in this paper. These findings will be of interest in their own right, and also because of the potential implications of the findings.

Those implications deal with the market structure of the real estate brokerage industry, which is the second general category of issues to be investigated. The questions to be addressed here regard the aggregate effects of the choices of individual firms, and the impact of those aggregate choices upon the overall market structure.

The remainder of this chapter will discuss the methods which will be used to analyze the data, and the discussion will be divided according to the two general categories just mentioned - individual firm market areas, and market structure.

Individual Firm Analysis

The most important aspect of the analysis of individual firms to be performed in the next chapter concerns the predictions of the brokerage firm model developed in Chapter Four. Before discussing that analysis, however, it will be useful to examine several of the other propositions which were discussed earlier in the paper, but which heretofore, have not been the subject of empirical analysis. These propositions were discussed in Chapters Two and Three, and deal with the classical model and with implicit prices.

The Classical Spatial Model.

As discussed in Chapter Two, two of the basic results of the classical central place model are that the market areas of firms are hexagonal and that the firm will be located at the center of its market area. Research in this area has generally agreed upon these two conclusions, although there have been no empirical tests of the conclusions. The reasons for the absence of tests are twofold: the conclusions are derived from a highly simplified model which is very different from the world in which firms operate; and secondly, there has not been appropriate data available to perform such tests. The data which was described earlier is, however, appropriate; and while we agree that the world is

more complicated than the simplified models, it will be interesting to see if the actual market areas of firms approximate the predictions of the classical model.

We do not expect to find that real estate firms operate in the optimal hexagonal markets, nor do we expect their office locations to be at the precise center of the market area. It may be reasonable to expect though that the firm's market areas are circular[20] and that the office location will be close to the market center.

Two of the centrographic statistics described earlier may be utilized to test these propositions since one is a measure of the circularity of an area, and the other is a measure of the displacement of a reference node from the mean center of an area. The coefficient of circularity (CC) approaches one as the area approaches circularity, and the distance of displacement (DD) is the distance from a reference node to the mean center.

These statistics were computed for each of the broker's market areas in the centrographic data sample, so that we have values of CC and DD for both listing markets and sales markets for each broker in the sample. The values of these

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[20]The circle is a reasonable approximation to the hexagon, and, in fact, the optimal hexagon is inscribed within a circle, as discussed in Chapter Two.

statistics will be aggregated over listing and sales markets, and then compared to the predictions of the classical model. Those predictions may be stated as null hypotheses to be tested:

$$CC = 1.0$$

and,

$$DD = 0$$

As mentioned, we do not expect to accept these null hypotheses given the complications[21] faced by brokers; however, the proximity of the computed values to the hypothesized values will be of interest.

An added complication in the analysis is that the centrographic sample includes a number of brokers with only one or two data points, and these small brokers may not be representative of the true population values[22] for the statistics. It seems reasonable to assume that the brokers

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[21]These might include suboptimal transportation systems, differing housing densities and prices, zoning restrictions, etc.

[22]Especially for CC which is not defined for a single point, and is not meaningful when the market area is a straight line, as when the market area is made up of two non-coincident points.

with more observations in their market areas may be more representative of the true sample statistics[23] and this supposition shall also be examined. The implication of the previous statement is that as the number of observations increases, the values of CC and DD will approach their hypothesized values. Stated differently, we expect to find a positive relationship between N and CC, and a negative relationship between N and DD.

These relationships will be tested with simple correlation analysis, since there is no causal relationship inferred. Acceptance of the null hypotheses would imply that the empirical market areas do approach the classical predictions as the sample size is increased.

Implicit Prices. The discussion of the seller's decision in Chapter Three indicated the importance of implicit prices in that decision, and proposed that distance may be a determinant of implicit prices. Specifically, the discussion stated that a seller may be less likely to list with a more distant broker because of that broker's higher implicit costs. Those costs were measured by the lower expected real proceeds from the sale caused by a longer selling period, and

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[23]i.e., Central Limit Theorem

a lower realized proportion of list price upon sale. These propositions shall also be examined empirically.

Obviously, the consumer's decision as to a specific broker is quite complicated and involves numerous variables in addition to distance; therefore, any empirical analysis of the importance of the distance variable will be clouded by these unconsidered variables. Since it would not be possible to specify a complete model which would hold for all sellers, we chose to proceed with the analysis of this single variable, while recognizing that we are only considering part of the situation. It seemed that the potential insights would outweigh the limitations of the analysis.

In order to examine the hypothesized relationship between distance and implicit costs, variables from the sales transaction data were used. The distance from the listing broker's office to the property (DLB), and the time the property was on the market (TOM), were discussed earlier; and in addition, two new variables were created for each of the 1234 sales.

The first, RATIO, is the ratio of the selling price to the list price of each property, and measures the gross proceeds realized by the owner upon the sale of the property. As mentioned, the seller might associate a more distant broker with lower gross proceeds since that broker may not

be as knowledgeable of local market conditions. The second new variable, WGTRATIO, is the empirical proxy for the real proceeds from the sale which was discussed in Chapter Three. This is the present value of the ratio of sales to list price, with the present value calculated at some discount rate, i, over a period of TOM days, or

$$WGTRATIO = (S/L) * exp(-i * TOM)$$

and in this case i was chosen as 15%.

For the reasons stated in Chapter Three, we expect to find a positive relationship between TOM and DLB, and negative relationships between DLB and RATIO, and between DLB and WGTRATIO, although the results for the weighted variable may be affected by a possible relationship between TOM and RATIO. The relationships will be computed using ex-post data, while the consumer would be more interested in the ex-ante relationships; however, it is likely that the consumer forms his ex-ante expectations by observing the ex-post performance of brokers active in his area, and therefore, this is not a dissimilar exercise.

The method of analysis to be used for tests of these proposition will be simple regression analysis. We have proposed that DLB has explanatory power with respect to TOM, RATIO, and (with the caveat mentioned above) WGTRATIO;

therefore, the following regression equations will be computed,

$$TOM = a1 + b1 \ (DLB)$$

$$RATIO = a2 + b2 \ (DLB)$$

and,

$$WGTRATIO = a3 + b3 \ (DLB).$$

The null hypotheses to be tested with the equations are that b1 > 0, and that b2 and b3 are less than 0.

The Brokerage Firm Model.

In Chapter Four, an economic model of a brokerage firm was developed, and utilized to generate hypotheses regarding the market areas for a brokerage firm. In this section, the methodology for testing those hypotheses shall be discussed.

The first two hypotheses dealt with the optimal market radii for the products of the firm. The model predicts that the radius of the sales market will exceed that of the listing market, and that the radius of the listing market will be coincident with that of the non-coop market. In order to test these propositions, it was necessary to develop a proxy for the market radius. Since the activities of a broker change from day to day, it is likely that his area of activities also changes, and since the data in this study is

cross-sectional it is not amenable to the examination of such changes over time. Therefore, any proxy chosen will be only an approximation to the actual market radius, and less than ideal. Given a sub-optimal proxy variable, we shall examine the data in several ways before drawing any conclusions.

The variables which will be used to test the hypotheses are the distance from each broker's office to each of his listings (DLB), and the distance from the office to each of his sales (DSB). These values were computed for each transaction and then further identified as being either a coop or a non-coop sale. This allows for differentiation between coop and non-coop markets, listing and sales markets, and combinations thereof.

The two hypotheses regarding optimal market radii shall be examined in three ways. First, the mean values of DLB and DSB shall be computed by individual broker and then averaged over all brokers to come up with the aggregate mean size for both listing and sales markets. While the mean values will not indicate the actual radial extent of the market areas, they will provide sufficient information to test for significant differences in the relative sizes of the product markets; and it is the relative size, not the actual size which has been predicted by the model.

The second method of analysis to be used is based upon the frequency distributions of all values for both DLB and DSB. The frequency distribution will provide an additional measure of central tendency, the median, which will be compared for each of the hypotheses. The median may be more indicative of the true market radii than the mean values since it is not unduly affected by outliers in the distribution.

The final test is also based upon the frequency distribution, but in this case, the frequency will be measured as the percent of total transactions occurring at each unit of distance as measured from the broker's office. In essence, this frequency distribution produces a density function for each of the product markets, and the slope of the density function is defined by the relationship between the percent of transactions, and the distance variable.

The hypothesis tests of market radii using the density functions will involve estimating regression equations of the following form,

$$Percent = a + b \text{ (Distance)}$$

for each of the relevant market areas. The regression coefficient on the distance variable will produce an estimate of the slope of the density function, and that slope will be

the focus of the hypothesis tests, since it will indicate the relative size of each product market. The slope coefficient will also indicate whether or not the market areas are finite $(b < 0)$, or infinite $(b = 0)$.

The hypotheses to be tested using these methods are concerned with the optimal radii for the various product markets of the broker. The first is that the radius for the listing market is smaller than that for the sales market,

$$U(\text{listing}) < U(\text{sales})$$

and given the proxy variables, its empirical counterpart is

$$DLB < DSB$$

The three tests of this hypothesis to be performed in Chapter Six are first to compute the mean values of DLB and DSB and test for a difference in group means; secondly, to compute median values for DLB and DSB; and finally to estimate the following regression equations,

$$\text{Percent } (L) = a1 + b1 \ (DLB)$$
$$\text{Percent } (S) = a2 + b2 \ (DSB)$$

and then to compare b1 and b2. We expect both b1 and b2 to be negative, and b1 to be larger in absolute terms than b2.

The second hypothesis to be tested with these methods is that there is no difference between the listing market radius and the non-coop market radius,

$$U(\text{listing}) = U(\text{non-coop}).$$

The distance variable for the non-coop markets is labeled DB, and the empirical hypothesis is,

$$DB = DLB.$$

These results will also be reported in the following chapter.

The final hypotheses to be tested concern the differences in characteristics between the non-coop market and the coop listing market. The hypotheses which were developed in Chapter Four are:

$$S(x1) < S(x3)$$
$$S/L(x1) < S/L(x3)$$

where S is the actual sales price and L is the listing price of the subject property.

The sample was divided into coop and non-coop trans-actions, and the mean values for list price (LP) and sales price (SP) were computed across brokers. The ratio of these two values, RATIO, was computed and then aggregated over coop and non-coop sales.

The empirical relationships to be tested are,

$$SP(non\text{-}coop) < SP(coop)$$

and,

$$RATIO(non\text{-}coop) < RATIO(coop)$$

The tests of these hypotheses are straightforward, and involve separating the variables into coop and non-coop groups, and then testing for the hypothesized differences in group means.

Market Structure Analysis

The final analysis to be performed is to study the level of competition which exists in a real estate market. As shown in Chapter Five, such a study must consider the spatial aspects of the market before measuring the level of competition. This section shall discuss the methodology which will be applied to the Franklin County data, and will address two specific topics: first, how is the level of competition measured, and second, within what geographical area should that measurement be made.

Level of Competition. The level of competition existing in markets has been a topic of interest to economists for many years, and as a result, a number of empirical measures

of competition have been devised. This study shall use the indices of market power which seem to be the most widely accepted. For each of these indices there are guidelines which have been proposed by economists or regulators to relate levels of each index with various levels of market power. While these relationships do not provide a sufficient basis for formal hypothesis tests, they do provide evidence as to the existing competitive nature of a market. Each of the indices will be discussed along with its heuristic guidelines.

A market concentration ratio measures the percentage of industry output contributed by the largest firm or firms in that industry. The most common forms of this index measure the percentage of total industry output controlled by the few largest firms in the industry, although concentration ratios have been reported with the 20 or 50 largest firms included. The variation which appears most often in the literature is the four-firm concentration ratio (CR4).

The CR4 is the percent of total transactions handled by the four largest firms in each market, and it shall be computed from the transactions data described earlier. The markets within which the ratio will be computed will be distinguished by product, since brokers may serve distinct product markets; and the markets may also be distinguished

geographically for reasons to be discussed. The level of competition existing within those markets shall be evaluated with the guidelines discussed in Scherer (1971, p. 60).

Scherer states that oligopoly begins to exist when the CR4 is equal to 40%, and that the market is competitive at lower levels of the index. An alternative rule which allows for a more sophisticated distinction is reported in the same source, and is based upon the eight-firm concentration ratio (CR8). The rule divides markets into one of three levels of competition: Type I oligopoly, wherein CR8 is at least 50%, and CR20 75%; Type II oligopoly, wherein CR8 is between 33 and 49% and CR20 is 75%; and finally, unconcentrated markets with lower values for the indices. Each of these ratios will be computed for the real estate markets, and reported in the following chapter.

The Herfindahl Index (H) is a summary measure of market structure since it includes the market shares of all firms active in the market. The index is defined by

$$H = \Sigma S_i^2$$

where S_i is the market share of firm i. The index ranges in value from 0 to 10000[24] with the maximum value attainable

[24]The scale of the index depends upon the definition of S_i. Here, S_i is defined as market share x 100 to be consistent with the guidelines to be discussed.

only when pure monopoly exists. The value of H increases as fewer firms in the market control larger market shares, and it approaches 0 as there are more firms in the market, each accounting for more nearly equal market shares. It is a desirable index of market structure since it incorporates both the number of firms and their market shares, and it has been used as the only index in many studies.

Once again, there are no clear-cut rules which could be used for statistical testing of the level of market structure; however, guidelines have been issued by the Justice Department which are used in evaluating banking markets,[25] and given the similarities of banking and real estate, those guidelines shall be used here. According to the Justice Department, a market is highly concentrated when H is greater than 1800, moderately concentrated when H is between 1000 and 1800, and not concentrated when H is less than 1000. The values of the Herfindahl index for each of the real estate markets will also be reported in the next chapter.

These concentration ratios are widely used and offer the most direct empirical measurement of the vigor of competition in a market. For the reasons show in the previous chapter,

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[25]The guidelines, as well as an excellent discussion of the Herfindahl index are included in Dunham (1982).

however, these ratios may not accurately reflect the true competitive nature of a market when spatial submarkets exist. It is important therefore, to determine if such submarkets exist, and if so, to measure the level of competition within those submarkets as well as within the entire market, before drawing conclusions from the concentration ratios. The following section discusses the empirical approach to be used to attempt to identify submarkets.

Spatial Submarkets. In the previous chapter, several spatial characteristics of real estate markets were discussed which might indicate the existence of spatial submarkets. This section will discuss those characteristics again, and indicate the empirical approach to be used to identify geographic submarkets with the Franklin County data. The purpose of this exercise is not to provide proof of the existence of submarkets, nor do we expect to provide a definition of the geographic boundaries of such submarkets, because it is not statistically possible to do either. The intent here is to simply infer from the data whether such submarkets might exist, and if they do, what their extent might be. The empirical approach to be described here is therefore of the casual rather than the formal variety, but should nevertheless provide useful insights.

The three spatial characteristics to be examined empiri-
cally are the density of housing, the location of broker's
offices, and the size of broker's market areas. The reasons
why these are the characteristics of interest were discussed
in the last chapter, so the following discussion will be
limited to the empirical approach to each.

For each of the first two characteristics, it seemed that
visual or graphical analysis of the data would be the most
effective means. Housing density will be examined by
plotting the locations of all of the transactions[26] on a map
of the county, and then examining the plot. If the plot
shows that housing is uniformly distributed throughout the
county, the existence of submarkets is not likely; however,
if the plot shows varying levels of density, and discon-
tinuities in housing, the existence of submarkets would be
more likely.

The location of broker offices will be examined in the
same way as housing density. The location of the offices of
each broker in Franklin County will be plotted on a map of
the county, and then visually examined. If offices are uni-
formly distributed throughout the market, the existence of

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[26]There is an implicit assumption here that all housing
in the market is disbributed in the same way as the
housing which was sold during the sample period. This
does not seem to be an unrealistic assumption.

submarkets is unlikely; but if offices are clustered at specific locations, that might be evidence of submarkets. The evidence would be even stronger if the clustering of brokers occurred at or near the center of high housing density areas, so the two plots will be compared to look for these coincident points.

The size of broker market areas is the final spatial characteristic to be examined. The empirical task is to measure the general size of broker market areas in Franklin County, and then to compare that size to the overall dimensions of the market. Small market areas might indicate that submarkets exist, especially if they exist along with the clustering of broker offices at high housing density locations. Unfortunately, the notion of a general market area size which would apply to all brokers is not meaningful except in the simplified world of the models presented earlier. The brokers in Franklin County lack the uniformity applied to the brokers in the models, and consequently, the size of their market areas will also lack uniformity. Any attempt to infer a general market area size will therefore be hampered by this empirical reality.

The tool which will be used to examine this question here will be the frequency distributions of transactions described earlier. These distributions are aggregated over all brokers

in each product market, and show where each transaction occurred with respect to the broker's office. The distributions may then be used to determine the approximate size of market areas served by brokers in general, and this approach will provide more information than simple summary statistics which might also be used.

Since brokers may occasionally handle a sale or listing outside of their normal market areas, there will exist some points in the distribution which are not representative of the broker's primary market areas, and which, therefore, should not be included in the analysis. The interest here is in the primary market area, or the area where brokers do the majority of their business. While there is no clear definition of what constitutes a primary market area, there is a generally accepted heuristic in the field of marketing which defines the primary market area as that area within which the firm does 75% of its business. This seems to be a reasonable definition, and shall be used here.

The frequency distributions will be examined, and the size of the primary market areas will be defined as the distance within which 75% of the transactions occur. This distance will then be compared to the overall size of Franklin County, and inferences regarding the existence of submarkets may be drawn.

Summary. The purpose of the market structure analysis is to measure the level of competition which exists in a real estate market, and to demonstrate the importance of considering spatial submarkets as part of the process. If it appears that submarkets exist, an attempt will be made to identify them based on these same characteristics, and concentration ratios will be calculated within those submarkets. Whether or not submarkets exist, the results of this analysis will be significant because it will be the first to provide empirical evidence on the competitive nature of the brokerage market, and also because it will be the first such study to consider the impact of spatial attributes upon market structure.

Conclusions

This chapter has discussed the data which will be used, and the methodologies which will be applied to the analysis of that data. A number of theoretical propositions were developed early in the paper, and empirical proxies and hypothesis tests of many of those propositions were provided here. Several of the propositions were found to be not amenable to hypothesis tests, and a more casual approach to those propositions was presented. The results of the analysis will be reported in the following chapter.

DATA ANALYSIS

This chapter shall report the reults of the tests of the hypotheses developed earlier in the paper. The first section of this chapter will deal with tests of the predictions of the classical model. The next two sections will present the empirical evidence regarding the buyers and sellers of brokerage services, and the final section will be concerned with the analysis of the competitive nature of the Franklin County real estate market.

The Classical Model

The literature of classical spatial economics predicts that market areas will be circular or hexagonal, and that the firm will be located at the center of its market area. As shown in the previous chapter, these predictions are consonant with the following empirical hypotheses,

$$CC = 1.0$$
$$DD = 0.$$

The values of these statistics were computed for both the listing and sales markets for each of the brokers in the sample, and the values for individual brokers were then aggregated to produce mean values for each product market.

The mean values for each of these statistics are reported in Table 1.

TABLE 1

Mean Values of Proxies

	CC	DD
Listing Markets	.440	3.697
Sales Markets	.355	3.776

As expected, the values for both CC and DD are substantially different than their hypothesized values, and each of the null hypotheses is rejected at a significance level of .01.

The data cleaning option was utilized to compute the statistics with varying levels of outlying points eliminated, but, in no case did the empirical values approach the theoretical values. At each filter level there was a consistent relationship between the statistics for listing markets and sales markets: listing markets were more round than sales markets,[27] and the DD was smaller for listing markets than for sales markets.[28]

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[27]Significant at .01.

[28]Not statistically significant.

The next step in the analysis is to report the results of the correlation analysis among the proxy variables, CC and DD, and N, the number of points in a given market area. For the reasons stated in the previous chapter, we expect the values of the empirical proxies to approach the hypothesized values as the number of points increases. Simple correlations among the variables were computed; the results for sales markets are shown in Table 2, and those for listing markets follow in Table 3.

TABLE 2

Sales Markets

	N	DD	CC
N	1.000	-.2162(a)	.5241(a)
DD	-.2162	1.000	-.2291(a)
CC	.5241	-.2291	1.000

a - significant at .01
b - significant at .05

TABLE 3

Listing Markets

	N	DD	CC
N	1.000	-.1146	.3839(a)
DD	.1146	1.000	-.0623
CC	.3839	-.0623	1.000

The expected negative correlation between N and DD exists and is significant in each market, and the expected positive correlation between N and CC exists and is significant in each. The larger market areas therefore appear to more closely approximate the theoretical market areas.

Finally, to evaluate the significance of the changes in these statistics as N increases, the values of CC and DD were computed for markets with at least five observations, and for those with less than five observations, and the differences in values computed. The results are shown in Table 4.

TABLE 4

Large and Small Brokers

	CC	DD
Five or more	.5079	3.544
Less than five	.2154	4.074
Difference	.2925(a)	.530(b)

The t-test for differences in group means shows that both of these differences are statistically significant, and as expected, the areas with a larger number of observations more closely approximate the theoretical values.

Clearly, even the values for the larger market areas are quite different than the originally hypothesized theoretical

values; however, we would not expect the actual market areas
to be perfectly circular, nor would we expect the market
center to be located precisely at the broker's office loca-
tion. The theoretical propositions are derived for a highly
simplified world with consumers evenly distributed throughout
the market, and with the costs of transportation also
constant. Brokers in the real world are faced with varying
housing densities, competitors in close proximity, and a
road system which causes certain areas to be more accessible
than others. These empirical realities cause necessary
changes in the shape and location of a broker's market area,
and it is interesting to see that even with these complica-
tions, the actual markets do exhibit some of the theoretical
properties.

The Seller's Decision

In Chapter Three, there was a general discussion of the
way in which a property owner chooses a broker when listing a
property for sale. That decision centered on the importance
of the implicit costs associated with a given broker and how
the consumer assessed those implicit costs. The discussion
indicated that the distance from the property to the broker's
office might be an important variable in the decision. In
this section, the evidence with respect to several of the

relationships proposed in that discussion is examined. As stated in the previous chapter, the method of analysis to be used here is simple regression analysis, since a causal relationship has been proposed between distance (DLB) and several sales characteristics. If distance from the pro-perty to the listing broker is important, we would expect to find a positive relationship between DLB and time on the market (TOM), and negative relationships between DLB and both RATIO and WGRATIO. The results of these regressions are shown in Table 5.

TABLE 5

Regression Results

$$TOM = 71.3 + 1.197 \ DLB$$
$$RATIO = .967 - .0002 \ DLB$$
$$WGTRATIO = .948 - .0006 \ DLB$$

While the direction of the relationship is as predicted for each of the three equations, only the equation for TOM is statistically significant with a t statistic for the coef-ficent of 2.95. This indicates that DLB does explain some of the variation in TOM[29], and should be included as one of

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[29]Previous empirical studies of time on the market have focused on variables such as list price, sales price, housing characteristics, and financing, but have not looked at the impact of the broker.

the explanatory variables in a more complete model of the seller's decision. Other potential variables might include the broker's reputation, level of advertising, franchise affiliation, etc., each of which is outside of the scope of this paper.

This result does imply, however, that a consumer may associate a more distant broker with a longer expected selling period. Since such longer selling period would result in lower real proceeds or more inconvenience[30] in the selling process, the consumer may be more likely to select a local broker over a more distant broker if all other considerations are equal. In the context of the previous discussion, the implicit costs of a local broker may be lower than the implicit costs of a more distant broker, at least with respect to the expected time on the market.

The Brokerage Firm

The analysis in this section deals with the predictions of the brokerage firm model. Those predictions fall in two general categories: the optimal market radii for each of the product markets of the firm, and optimal characteristics of those markets. The hypotheses and empirical proxies, as

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[30]For instance, when the seller has already purchased a new home, or has been relocated by an employer.

well as the methodology were discussed in the previous chapter, so this section shall present only the results.

Optimal Market Radii

Listing vs. Sales Markets. The analysis of the brokerage firm led to the conclusion that the optimal radius of the broker's listing market is smaller than that of the optimal sales market. The theoretical hypothesis is,

$$U^*(listing) < U^*(sales),$$

and the empirical equivalent is

$$DLB < DSB.$$

This is the relationship which will be the focus of the following analysis. The first test of this hypothesis involved computing the mean and median values for both DLB and DSB across all brokers, and determining whether the expected relationship exists. The median values were derived from frequency distributions of all values of DLB and DSB. The results of these calculations are presented in Table 6.

TABLE 6

Listing and Sales Markets

	Mean	Median
DLB	4.594	3.162
DSB	5.270	4.243

The difference in group means is significant at .01, and this result supports the null hypothesis.

The final method used to examine this hypothesis was to compute a regression equation for each variable using the percent of total observations at each unit of distance as the dependent variable, and DLB or DSB as the independent variable. In essence, this procedure produces a density function for both the listing market and the sales market, with the regression coefficient on the distance variable indicating the slope of the density function. The resulting regression equations are shown in Table 7.

TABLE 7

Regression Results

$$y = 3.8685 - .2695 \text{ DLB}$$
$$y = 3.5610 - .2452 \text{ DSB}$$

The slope coefficient in each equation is significantly different than zero, indicating that these market areas are, in fact, finite; and the steeper slope of the first equation indicates that the radius for the listing market is smaller than that for the sales market. The difference between the two slope coefficients, however, is not statistically significant, and we are not able to accept the null hypothesis based upon this result.

Listing Market vs. Non-Coop Market. The next theoretical hypothesis was that the optimal market radii of listing markets and non-coop markets would be equal. Theoretically, this can be stated as,

$$U^*(\text{listing}) = U^*(\text{non-coop})$$

and the empirical proxy is

$$DB = DLB.$$

The same methods of analysis were used to test this hypothesis as were described in the previous section. The mean and median values for these variables are reported in Table 8.

TABLE 8

Listing and Non-Coop Markets

	Mean	Median
DB	4.679	3.162
DLB	4.725	3.605

The t-test for difference of group means indicates that the difference between the variables is not statistically significant. This test allows us to accept the null hypothesis of no difference. The difference in median values, while wider than the difference in means, is smaller than the difference reported in Table 6.

The regression equations for the density functions of the two variables are shown in Table 9.

TABLE 9

Regression Equations

$$y = 3.295 - .211 \text{ DLB}$$
$$y = 4.671 - .3659 \text{ DB}.$$

Once again, each of the individual slope coefficients is significantly different than zero, implying finite market areas. In this case though the slope coefficients are substantially different, implying that the non-coop market

areas are smaller than the listing market areas. The difference in the values is statistically significant, and we therefore reject the null hypothesis of no difference.

This result conflicts with the result of the first test, therefore we are not able to conclusively state whether the hypothesized relationship holds. This conflict in results may be due to the less than optimal properties of the proxy variables. While we are not able to accept or reject the null hypothesis, it is clear from the results that the listing and non-coop markets are similar in size, and that they are both smaller than the sales market.

<u>Large</u> <u>vs.</u> <u>Small</u> <u>Brokers</u>. There are a number of brokerage firms in the sample which accounted for only one or two transactions, and it was felt that these few transactions may not be representative of their true market areas, and that their presence might bias the empirical results. The sample was therefore divided into large brokers and small brokers and the above tests were run again. Large brokers were defined as those with five or more transactions on one run, and ten or more on a subsequent run.

The results of these additional tests were not significantly different from the aggregate results on a statistical basis. The differences, however, were interesting enough to mention. In general, the large brokers had smaller indicated

market radii and steeper density functions for each of the product market areas, and this trend was more pronounced as the brokers were larger. This implies that the small brokers cover more geography in search of business, and may account for the outlying points mentioned earlier. The determination as to whether this fact is a statistical anomaly or the result of economic decisions is beyond the scope of this paper.

Non-Coop Sales vs. Coop Listings. Finally, the model of the brokerage firm produced two hypotheses regarding the optimal characteristics of properties of products sold in the two product markets just discussed. These empirical hypotheses are,

$$SP(non\text{-}coop) \ < \ SP(coop)$$
$$RATIO(non\text{-}coop) \ < \ RATIO(coop)$$

and the results of the analysis are shown in Table 10 and Table 11.

TABLE 10

Prices of Properties Sold

	LP	SP
COOP	$51323	$49749
NON-COOP	45250	43658

The values for both LP and SP are shown in the table, and in each case the differences between the two groups are highly significant. The value of the t statistic is 3.8 for the LP groups, and 4.0 for the SP groups. The evidence strongly supports the hypothesized relationship, and the null hypothesis is accepted.

TABLE 11

Ratio of Sale to List Price

RATIO

COOP   .9694
NON-COOP .9614

The second hypothesis is also supported by the data. The value of the t-statistic in this case is 2.62, which is significant at .01. Once again the null hypothesis is accepted.

These differences between the coop and non-coop markets are striking, and raise some interesting questions regarding the performance of brokers on coop and non-coop sales. A logical question is whether the broker sells his own listings faster than those of other brokers. This was examined using the TOM variable discussed earlier, with the results shown in Table 12.

TABLE 12

Time on the Market

TOM

COOP	77.44
NON-COOP	75.79

Even though TOM is slightly lower for the non-coop markets, the difference is not statistically significant. It is not possible to conclude that brokers sell their own listings faster than other listings.

In this section, we have examined the differences between the three product markets of a brokerage firm, and found them to be fairly distinct, much as predicted by the brokerage firm model. The results indicate that the sales market is the largest, the listing and non-coop markets are similar in size, and both are smaller than the sales market. The most interesting differences, however, are between the transaction characteristics in the coop and non-coop markets. In the non-coop market, where the commission rate is highest,[31] the broker sells his less expensive listings, and the sellers on those transactions receive a lower proportion of the list price than do sellers in the coop market. While this result

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[31]The commission on a non-coop sale is approximately twice that on a coop sale.

was expected, given the economic incentives of a broker, it is nonetheless surprising. The broker is the agent for the property owner who engaged his services, and should act in the best interests of his principal. The result reported here indicates that there may be some deviation from that ideal in practice; and would be an interesting topic for future inquiry.

Market Structure Analysis

The final empirical issue to be examined is the competitive nature of the Franklin County, Ohio market. The data will be examined to determine if spatial submarkets exist within Franklin County, and then indices of market concentration will be computed for various spatial and product markets.

Spatial Submarkets

The three spatial characteristics which will provide evidence of the existence of submarkets are the density of housing, the locations of broker offices, and the size of broker market areas. Housing density is plotted in Figure 6, and broker office locations are shown in Figure 7. In each

of the figures, the letter indicates the number of obser-
vations at each location. The size of broker market areas
will be evaluated following the discussion of those plots.

Figure 6 shows that housing is located discontinuously,
and at varying density throughout the county. There is
substantial clustering of housing at certain locations, and
in many areas, those clusters are surrounded by rapidly
declining numbers of houses. Most of these central clusters
are locationally coincident with communities which exist
within Franklin County. The density of housing is more con-
sistent throughout the central portions of Columbus. For
the reasons mentioned earlier, the discontinuities and
clustering might indicate the existence of spatial sub-
markets in housing.

```
Y |

  |
 1 +               A     I     A      B  E  B  A  H           A
 2 +             A  B  A  F  C       A  D  B  N  R  A           A  A
 3 +         A        A  D  H  D     J  E  F  K  E
 4 +            B  B  A     A  E     G  G  A  C  M  C        A  A
 5 +            B        G  A  F  H  K  R  I  D  C  B  B
 6 +         A  B  B  D  G     M  B  C  D  G  B     A  B     A
 7 +      A     B  B  C  F  A  K  E  E  K  F  A  A  A  C
 8 +       B  B  C  C  E  C  E  L  I  E  O  H  A     Q  B
 9 +    A  A  F  B  B  A  J  C  G  A  Q  I  I  D     A  B  F  D
10 +    A           C  F  A     H  E  A  A  A
11 +                I  E     B  A  A  A
12 +            A  A  E  J  A     A  C  I  G     I     B  C  H  B
13 +         B     A  C  A     A  A  A  C     H  E  C  G  K  B  K  E  F
14 +  D  A     C     C  J  M  D  G     D  H  C  H  I  L  O  G  B  C  D
15 +  A        C  I     D  J  G  D     A  G  I  D  B  D  G     G  A
16 +  A  A     A  A     D  H  A  C  B     A     B  A  B  C  A  O
17 +              D     A  B  B     A  C     A     E     A  P  A
18 +                B  B           A     B  A  A  B
19 +            A  L  F           C  C     C
20 +      A           B              A        B  B        A
21 +      A        A        A  A           B
22 +                  B
23 +      A
24 +      A
25
26 +                                                              A
   --+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+--
     1  2  3  4  5  6  7  8  910111213141516171819202122232425 26
```

x

Figure 6: Plot of Housing Locations

```
Y |

  |

 1 +      A A              A            C A
 2 +        A          B   A          A G B              A
 3 +          A        A   H   A D       B A                A
 4 +        A B        B A B A D D C D            A
 5 +                     E A A D A
 6 +            G     B C B C     B A
 7 +            C A A C   B B B A              A
 8 +          A C   B F   A C     A       A
 9 +      B       G     A       A     A F
10 +          A C F A       B           A
11 +              D A A B     A A     A A A
12 +        A       A A D   A   A B A D A     A
13 +            A     G F E C A L B C A   B D C
14 +      D A B A     B   E A B A C B A A D C A
15 +      B A A C A       C       A       A
16 +      A   A A B         A       A             A
17 +                                A
18 +          A         A     A
19 +        A B B
20 +        A               A   B     A
21 +                        A         B
22
23
24 +                    A
25
26
   --+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+--
    1 2 3 4 5 6 7 8 910111213141516171819202122232425 26

                         x
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Figure 7: Plot of Broker Office Locations

In Figure 7, the locations of broker offices are plotted. The discontinuities and clustering are even more pronounced, and once again, much of the clustering occurs at locations which are coincident with clearly defined communities. For example, at x=18,y=13, there are 12 broker offices, and that location is the center of Bexley. There are similar clusters at Westerville, Worthington, and Arlington. Once again, the clustering is less pronounced in the central portions of Columbus. This plot also is consistent with the existence of spatial submarkets. The brokers appear to locate near the centers of high density housing, and in so doing, also locate in close proximity to other brokers. Given the discussion of the economics of the brokerage business, this result is not surprising; nor would it be surprising if those brokers in a location attempted to specialize in selling local houses.

The frequency distributions of distances from each broker's office to each transaction will be used to estimate the size of broker market areas. These distributions were computed for each of the product markets served by brokers, and were also computed separately for large and small brokers. Each of the distributions was plotted and examined visually, and in each case, the shape of the density function was very similar - the number of transactions decreased

rapidly as the distance from the office increased, but then began to level off at greater distances. The existence of a number of outlying points indicated that the analysis of the slopes of these functions would be less helpful than the cumulative frequency of transactions across distance, because the outlying points might not be typical for all brokers. We wish to focus on the broker's primary market area, or the area where the majority of transactions occur. The heuristic rule mentioned in the previous chapter is that the primary market area is the area wherein 75% of transactions occur. The following table shows the results for the various market types, and reports the distances at which 50, 66, and 75% of transactions occurred for the brokers in the sample.

TABLE 13

Frequency and Distance from Office

Cumulative Frequency	50%	66%	75%
Listing Markets	3.6	5.1	6.3
Sales Markets	5.0	7.0	8.5
Non-Coop Markets	3.2	5.0	6.0
Large Brokers	3.0	4.5	5.8
Small Brokers	4.0	5.8	7.2

These primary market areas are small relative to the geographical dimensions of Franklin County,[32] and indicate that brokers derive most of their business from localized areas around their offices, rather than from throughout the overall Franklin County market area. This is consistent with the previous results, and provides further evidence that spatial submarkets exist.

The analysis of housing density, office locations, and size of broker market areas all indicate that submarkets do exist. In fact, the spatial market configuration of Franklin County closely resembles that of the spatial monopolistic competition models shown in Chapter Five. Throughout the county, the density functions[33] for brokers decline rapidly as distance from the office increases. At certain locations, brokers and housing are clustered; this, combined with the declining density functions produces a situation like that shown in Figure 4, imperfect spatial monopolistic competition. In other parts of the county,[34] clustering is not

[32]The county is roughly square, with an east-west distance of 25 miles, and north-south distance of 23 miles.

[33]These density functions could also be viewed as demand curves.

[34]Primarily the more central parts of Columbus.

obvious, and the result is a configuration more like Figure 5.

The analysis of submarkets to follow will focus on the areas which resemble Figure 4, since those are the areas where higher levels of concentration might exist. We have found that housing and broker offices are clustered at several of the communities which exist within Franklin County, and that broker transactions occur near his office. It is plausible then that each of these communities is a spatial submarket for real estate brokers,[35] and that each might have a distinct competitive structure. The identification of individual submarkets was based upon the clustering of housing, the clustering of brokers, and the homogeneity of housing in an area.[36] Given those considerations, the following were identified as submarkets for the purposes of this

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[35]Possible additional evidence of the spatial distinction of these communities is that the multiple office firms have branch offices located in these communities.

[36]These factors seemed most reasonable for this study, although it is clear that numerous alternative definitions are available.

study: Reynoldsburg, Whitehall, Bexley,[37]   Westerville,

Worthington, Upper Arlington, and Old Arlington.[38] It is

more difficult to identify submarkets within the city of

Columbus; however, in the Southwestern part of the city there

is a spatially distinct cluster of housing which is homoge-

neous with respect to price, and which is coincident with a

cluster of broker offices. This area shall also be included

in the study.   In the following section, the competitive

nature of these eight submarkets will be analyzed along with

that of the county as a whole.

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[37]The first three communities are contiguous, and the
spatial distinction is not as clear as it is for other
areas.   These areas are quite distinct, however, in
terms of types and prices of housing available; Bexley
is high priced, Whitehall mostly low priced, and
Reynoldsburg is mid-priced.   Given the wide disparity
in housing in these communities, it seemed that each
might attract disinct clienteles of buyers and brokers,
and that each might therefore be a distinct brokerage
submarket.

[38]Upper Arlington is a single community, but it was
divided into two submarkets based upon the clustering
of brokers and housing prices.   There were two distinct
clusters of brokers within Arlington, and each of those
clusters is associated with a specific type of housing.
Once again, it appears that brokers specialize in a
segment of the area, and Arlington was therefore
divided into two submarkets.

Market Concentration

The following tables report the various indices of market concentration discussed in the previous chapter, for each of the submarkets, as well as for the county in total. There is a separate table for each of the product markets, as well as one for total transactions. The guidelines as to the competitive nature of the market are repeated here from the previous chapter:

1. If CR4 > 40%, then oligopoly begins to exist.
2. If CR8 > 50% and CR20 > 75%, then Type I oligopoly, and
   if 33% < CR8 < 49% and CR20 > 75%, then Type II oligopoly.
3. H > 1800, highly concentrated.
   1000 < H < 1800, moderately concentrated.
   H < 1000, not concentrated.

Before discussing the results, it should be mentioned that the concentration ratios are not precise statistics, and should not be interpreted as such. The indices are subject to measurement error and bias from two sources, one systematic, the other specific to a particular market. The systematic bias results from the fact that the indices will have higher values in those markets which are most narrowly

defined, and lower values in less narrowly defined markets.[39] The indices for a particular market would be subject to additional bias if that submarket were defined incorrectly,[40] for the same reasons. The purpose of this section is not to provide precise measurement of the level of competition in an area, but simply to examine the relative competitive structures which exist. For this purpose, the indices presented in the tables are acceptable.

Consider first the most broadly defined geographical area in the table, the county. One would conclude that the real estate brokerage market in Franklin County is highly competitive, whether in terms of total transactions or individual product markets. This result is consistent with the a priori expectations of those who have described this as an atomistic competitive market. It is interesting to note that the market for listings is more competitive than the markets for sales and non-coop transactions. The four largest offices in the county handle 20% of the sales, but only 10% of the listings.

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[39]The values of the indices are dependent upon the market definition since that determines the number of firms and the number of transactions included in the calculation of the index.

[40]Only those submarkets which were most clearly identifiable have been included here, in an effort to minimize this source of bias.

A possible explanation of this result is that smaller brokers can compete more effectively for listings because of the spatial monopolistic advantage they own within their primary market area and that such an advantage does not necessarily exist in sales markets, where it appears that potential buyers are attracted to the larger brokers.

TABLE 14

Total Transactions

	AREA	CR4	CR8	CR20	HERF
1	COUNTY	14.032	20.861	31.529	110.090
2	REYNOLDS	31.633	47.959	76.530	476.880
3	WHITEHAL	23.786	37.379	58.738	476.880
4	BEXLEY	51.852	74.074	100.000	994.513
5	WESTRVIL	24.265	41.177	72.059	337.370
6	UPRARL	43.056	58.333	81.945	717.590
7	OLDARL	45.833	62.500	93.750	876.740
8	WORTHING	27.273	39.773	65.909	330.580
9	SWCOL	38.333	53.333	79.167	701.390

TABLE 15

Listing Transactions

	AREA	CR4	CR8	CR20	HERF
1	COUNTY	10.976	18.902	33.994	99.46
2	REYNOLDS	45.946	64.865	97.297	796.20
3	WHITEHAL	28.986	43.479	66.667	371.77
4	BEXLEY	72.727	100.000	100.000	1735.54
5	WESTRVIL	33.333	53.333	84.444	508.64
6	UPRARL	46.429	71.429	100.000	1045.92
7	OLDARL	53.846	84.615	100.000	1124.26
8	WORTHING	29.412	52.941	88.236	501.73
9	SWCOL	31.250	56.250	93.750	566.41

TABLE 16

Sales Transactions

	AREA	CR4	CR8	CR20	HERF
1	COUNTY	20.274	25.677	40.549	213.80
2	REYNOLDS	32.432	45.946	100.000	474.80
3	WHITEHAL	26.087	39.131	62.319	354.97
4	BEXLEY	72.727	100.000	100.000	1735.54
5	WESTRVIL	31.111	44.444	71.111	419.75
6	UPRARL	35.714	50.000	92.857	561.22
7	OLDARL	46.154	76.923	100.000	1005.92
8	WORTHING	35.294	50.000	85.295	622.84
9	SWCOL	31.250	43.750	81.250	468.75

TABLE 17

Non-Coop Transactions

	AREA	CR4	CR8	CR20	HERF
1	COUNTY	17.634	26.329	41.063	149.25
2	REYNOLDS	58.333	91.667	100.000	1388.89
3	WHITEHAL	44.118	58.824	94.118	726.64
4	BEXLEY	68.750	93.750	100.000	1640.63
5	WESTRVIL	47.827	65.217	100.000	850.66
6	UPRARL	87.500	100.000	100.000	2500.00
7	OLDARL	66.667	100.000	100.000	1666.67
8	WORTHING	60.000	100.000	100.000	1600.00
9	SWCOL	57.143	71.429	100.000	1811.22

As mentioned earlier in the paper, most traditional market structure studies have used a broad geographical definition of the market such as an SMSA, county or city. In this case, each of those definitions is similar, and a traditional study would conclude that this is a highly competitive market.

This conclusion will not necessarily hold when the competitive nature of the spatial submarkets is considered.

The concentration indices for each of the submarkets are higher than those for the county, and there is substantial variation among the submarkets. Throughout the tables, areas 4, 6 and 7 have the highest values for the indices, and these are the areas with the lowest numbers of transactions. Conversely, areas 3 and 5 have the lowest levels of concentration, and also the largest number of transactions. This relationship between the number of transactions (n) and the value of the index implies that it is not possible to compare indices across submarkets without adjusting for the effect of n. Even after making that adjustment, it is not possible to prove that oligopoly exists in a given submarket; however, it will be possible to compare the relative levels of competition.

The Herfindahl Index (H) was chosen as the basis for comparison since it is the most complete[41] index of market concentration. The adjustment for the impact of n on H was

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[41]The correlation of H with CR4 is close to 1.0; it therefore includes the information from CR4 along with the desirable features discussed in the previous chapter.

made by regressing the index[42] on n, thereby producing an expected level of concentration for any number of transactions. Comparisons among submarkets were then made by evaluating the actual and expected values of H. Those submarkets with an actual value much higher than expected are those which are more concentrated, and those with low actual values relative to expected are less concentrated. This procedure was performed for each of the four product markets, and for all markets in aggregate.

The values of H in Table 14 are all below 1000, indicating that none of the submarkets are concentrated. Several of the areas do exhibit values of CR4 which exceed the 40% guideline; however, these are also the areas with the lowest number of transactions. In terms of total transactions, each of the submarkets appears to be competitive.

Tables 15 and 16 present the indices for coop listing and coop sales markets, and unlike Table 14, there is some evidence of concentration in these markets. Bexley has the highest value of the indices,[43] with the four largest firms

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[42]Since the relationship is non-linear, the regression was run with both the actual value of H, and with its natural logarithm. The log regression resulted in a better fit, but the results for individual submarkets were consistent in both.

[43]Coincidentally the values for Bexley are equal in two tables.

accounting for 72% of the transactions in each market. The value of H exceeds the expected value by a wide margin as well.[44]   Old Arlington also has high levels for the indices, although the values for H are just above the guideline value of 1000.   The actual H values for Old Arlington are below those expected for the number of transactions, and therefore the evidence of concentration is not strong.   In general, the submarkets demonstrated similar concentration levels in both Tables 15 and 16.   The only exception to this is Upper Arlington which is substantially more concentrated in listings than sales.   This relationship also holds after adjustment for the effect of n.   Concentration in the coop listing market is slightly higher than expected, and concentration in the coop sales market is lower than expected. The only area which exhibits possible concentration in coop markets seems to be Bexley.

In Table 17, the evidence of concentration is more pronounced.   Six of the eight submarkets have H values in excess of 1000, with two of those values exceeding 1800.   In addition, none of the areas has a value for CR4 of less than 40%.   Most of these results may be explained by the fact

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[44]Bexley has the fewest number of transactions and this divergence may result from the non-linearity in the function, especially at the extremely low values.

that there are fewer non-coop transactions than there are
coops. In Upper Arlington, for example, there were only 8
non-coop sales, and this resulted in the very high values
for the indices. It would be difficult to conclude that the
market is highly concentrated based on only 8 observations.
That is not the case for area 9, however. This area had the
second highest number of non-coop transactions, but still
has indices which indicate a high level of concentration.
The actual value for H exceeds the expected value by a wider
margin than even Upper Arlington. This evidence of concen-
tration in the non-coop market is especially surprising when
compared to the results for the same area in Tables 15 and
16, where it seems to be very competitive. An interesting
characteristic of this submarket is that it has the lowest
mean sales price[45] of the eight areas. While it is not
possible to demonstrate a causal relationship between price
and concentration, it is notable that this result is con-
sistent with the earlier analysis of the broker's incentives.
The H indices in the remaining submarkets are close to their
expected values, and it appears that the high values result
from insufficient observations, rather than insufficient
competition.

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[45]The mean price for southwest Columbus is $33,600; the
next lowest was Whitehall at $39,200.

Summary

In general, we find that each of the product markets is characterized by concentration levels which are higher than would be expected in atomistic highly competitive markets. This is partly the result of the narrow definition of the markets, but even in the total transactions market, there is some evidence of market power. In individual product markets, there are several areas with concentration indices uncomfortably close to oligopoly levels, and one area which appears to be highly concentrated - both in absolute and relative terms.

The localized nature of these spatial submarkets is further indicated by an analysis of the firms which control most of the business in each. The top four firms in each area were identified while computing CR4, and their locations recorded. In five of the submarkets, all of the four firms were located within or immediately adjacent to the sub-market. In the other three areas, three of the four were located within the same bounds. In each of the submarkets, at least one, and most often two of the top four firms were local branches of multiple office firms. Each of these findings is consistent with the earlier discussion of the importance of implicit costs to consumers, and explicit costs to brokers. The dominance of local firms within submarkets

indicates that such firms own a locational advantage over more distant firms, and is further evidence that the structure of this market is spatial monopolistic competition.

CONCLUSIONS

This paper has examined the structure of the real estate brokerage industry. This study was different from previous work in that the market was studied within the context of spatial economics rather than the more traditional approach. In previous studies, the spatial attributes of markets have been treated implicitly or, most often, ignored. The focus on the spatial aspects of market structure was especially appropriate for the real estate brokerage industry because it has a localized scope. This research has yielded results and insights in two areas, one specific and the other more general. First, the consideration of spatial variables augments and extends the existing studies of the real estate brokerage industry; and secondly, it appears that a market structure study which does not consider the spatial dimension of the market may produce biased results. Given the importance placed on certain of these results, this is not a trivial matter.

The paper began by reviewing the pertinent spatial economic and real estate literature, and found that there was little common ground between the two. The spatial economics literature is highly theoretical and quite general; however, it demonstrates the importance of transportation costs to

firms and consumers. The real estate literature is limited as to content and scope, and only recently has an economic model of a brokerage firm been published. That model, while dealing with the search aspects of brokerage, failed to recognize that search is carried out in a spatial context. Several other real estate papers dealing with other aspects of competition and market structure were also reviewed.

While the ultimate objective of this paper was to examine the structure of the industry, it was equally important to consider the spatial economic decisions of the participants in the industry. This began by examining the economic incentives of a homeowner who has decided to sell his property. The notions of an explicit fee and implicit costs of brokerage services were explored, and it was hypothesized that under reasonable conditions, a consumer of brokerage services would associate a higher price with more distant brokers. This implies that the consumer's demand for brokerage services decreases over space, and that he will be most likely to list with a local broker. The hypothesized relationship between distance and implicit cost was empirically tested and supported by the data.

The next section of the paper drew from both the spatial economics and real estate literature, and developed a model of a brokerage firm with distance as a decision variable.

Transportation costs are a significant input to the broker's production function, and as he travels further from his office in search of listings those costs increase. It is logical therefore to assume that the broker will attempt to optimize his utilization of this resource. The production function for the broker includes the various types of output and the costs of each of those outputs (including search costs over distance). The model was then used to determine the optimal market area for each type of output, as well as the optimal characteristics of transactions within those market areas. A number of hypotheses were developed from the model and then tested empirically, and, in general, those hypotheses were supported.

The data indicate that the number of transactions handled by a broker dropped rapidly as the distance from his office increased, and that the rate of demand decay was a function of the type of output. These demand cones result from the joint preferences of consumers and brokers over distance. Consumers prefer to deal with a local broker because of the lower implicit costs, while brokers prefer to search for business in a local area because of the lower costs of time and travel. Brokers may also recognize that the marginal productivity of search will decrease as they move further from their offices. The sizes of broker market areas were

estimated, and found to be small relative to the geographic scope of Franklin County. The existence of these demand cones for brokerage services within the county indicates that individual brokers do not supply services throughout the broadly defined area, and that consumers in various parts of the county face a different array of suppliers, and perhaps different competitive situations.

The next section of the paper discussed the various types of spatial market structures which might exist, and the implications for competition within each of those structures. The model which seemed to fit the brokerage industry is spatial monopolistic competition because each firm has a spatial monopoly over firms which are located at greater distances. We found, however, that even within that market structure, various levels of competition might exist, and that the ability to measure that level of competition was dependent upon the appropriate definition of the spatial boundaries. The characteristics of the housing market in Columbus were examined, and based upon the clustering of broker offices and the discontinuities in housing density, eight brokerage submarkets were identified. Despite the existence of the county-wide MLS, we found that there was little overlap of suppliers across submarkets, and that firms located within each submarket handled the majority of transactions therein.

Measures of competition were then computed for each of the eight submarkets and for the county in total, and within each geographic area separate ratios were computed for each of the product market areas. Each of the concentration ratios indicated that the market structure in the county as a whole was highly competitive; however, certain submarkets within the county showed evidence of market concentration. The concentration ratios were reevaluated after adjusting for the effect of the number of observations on the ratios, and even then two of the submarkets exhibited evidence of concentration. It is interesting that the demographic and housing characteristics of these two areas are at opposite ends of the spectrum.

Implications

The results of this study have implications for both the real estate and the market structure literature. We find that the spatial bias discussed by Palm is not a conspiracy by brokers, but rather it is the result of spatial economic choices. Brokers do have a biased view of the market, and that bias results in a superior knowledge of the local sub-market and limited knowledge of other areas. The potential buyer of real estate should recognize this fact and visit

brokers located in various parts of the area to get an optimal view of the entire market.

Several authors have expressed the opinion that the real estate brokerage industry is highly competitive, but that brokers are guilty of price-fixing and collusion. We have found that both of these opinions are open to question. The market appears to be competitive from a broad viewpoint; however, when spatial submarkets are considered, the competitive situation may be quite different. The evidence in this study indicates that the majority of submarkets are competitive, but that market power may exist in some.

The previous discussions of price-fixing have focused on the existence of a uniform commission rate across markets. We have found that the explicit fee for services is only part of the total price, and that the implicit cost of brokerage services may be as important as the explicit fee. The situation here is similar to that which has existed in the banking industry for many years. Banks have been limited as to the explicit rate of interest they could offer for deposits, so they turned to implicit payments to attract business. Consumers allocated their deposits based upon the total return which was composed of both the implicit and explicit returns. The net effect was that banks offered varying rates of return despite the existence of a fixed and

uniform explicit fee. Consumers of brokerage services likewise choose their supplier based upon the total price of that service; the regulation of the explicit fee would not affect the total cost of the service but only the allocation between the explicit and implicit portions.

With regard to market structure studies in general, this research indicates that consideration of the spatial attributes of a market may lead to results which are quite different than those from the standard approach. It is likely that spatial submarkets exist in other industries, and if so, a market structure study based upon a more broadly defined area would lead to incorrect results. As mentioned early in the paper, the banking and thrift industries have been studied extensively, yet the market area has always been broadly defined. A study of these industries based upon spatial submarkets may lead to new insights about their competitive structures.

Future Research

This paper has extended the existing literature by considering the spatial economic aspects of real estate brokerage. This approach has been fruitful and has yielded new insights about the industry and its structure; however, a number of issues have arisen which require further analysis. While we

have considered the decisions of consumers and suppliers separately, a spatial equilibrium model would extend this approach and would yield supply and demand curves for brokerage services over space. This paper has taken the commission rate as given and has speculated about the pricing of brokerage services; it would be useful to study the implicit pricing of brokerage services in the context of information costs. Finally, it would be desirable to extend the market structure aspects of this work by examining the competitive situations in each submarket over a longer time period. Only then could we draw conclusions about the actual competitive situations which exist in submarkets. There is a substantial void in our knowledge of this industry, and this implies that there are unlimited topics for future research. Before subjecting this industry to costly regulation, it is important that we begin to fill this void.

BIBLIOGRAPHY

Becker, B. W. Economic Aspects of Real Estate Brokerage. Research Report #36, The Center for Real Estate and Urban Economics, University of California, Berkeley, 1972.

Berry, B. J. L. Geography of Market Centers and Retail Distribution. Englewood Cliffs: Prentice Hall, 1967.

Brown, L. & Holmes, J. Intra-Urban Migrant Lifelines: A Spatial View. Demography, 1971, 8, 103-122.

Capozza, D. & Van Order, R. Pricing Under Spatial Competition and Spatial Monopoly, Econometrica, 1977, 43, 1329-1338.

Capozza, D. & Van Order, R. A Generalized Model of Spatial Competition. The American Economic Review. 1978, 68, 896-907.

Dunham, C. Thrift Institutions and Commercial Bank Mergers. New England Economic Review, November/December 1982, 45-62.

Eaton, B. C. Free Entry in One-Dimensional Models: Pure Profits and Multiple Equilibria. The Journal of Regional Science, 1976, 16, 21-33.

Eaton, B. C. & Lipsey, R. The Non-Uniqueness of Equilibrium in the Loschian Location Model. The American Economic Review, 1976, 66, 77-93.

Eaton, B. C. & Lipsey, R. Freedom of Entry and the Existence of Pure Profit. The Economic Journal, 1978, 88, 455-469.

Goulet, W. M., Goulet, J. C., & Karns, D. A. Buying and Selling Real Estate: Consumer Opinions About Services and Financing. Research Report #23, Center for Real Estate Education and Research, The Ohio State University, 1981.

Greenhut, M. L. A Theory of the Firm in Economic Space. Austin: Lone Star Publishing Co., 1974.

Greenhut, M. L. & Ohta, H. Spatial Configurations and Competitive Equilibrium. Weltwirtschaftlliches Archiv, 1973, 109, 87-104.

Greenhut, M. L., Hwang, M. & Ohta, H. An Empirical Evaluation of the Equilibrium Size and Shapes of Market Areas. International Economic Review, 1976, 17, 172-190.

Hartwick, J. Losch's Theorem on Hexagonal Market Areas. Journal of Regional Science, 1973, 13, 213-222.

Hempel, D. J. Search Behavior and Information Utilization in the Home Buying Process. Center for Real Estate and Urban Economic Studies, University of Connecticut, 1969.

Hempel, D. J. A Comparative Study of the Home Buying Process in Two Connecticut Housing Markets. Center for Real Estate and Urban Economic Studies, University of Connecticut, 1970.

Hultquist, J., Holmes, J. & Brown, L. Centro: A Program for Centrographic Measures. Discussion Paper #21, Department of Geography, The Ohio State University, 1971.

Losch, A. Die Raumliche Ordnung Der Wirtschaft. Jena: Gustav Fisher, 1944.

Miller, N. & Atzenhoefer, E. An Analysis of the For Sale by Owner Market in Ohio. Research Report #21, Center for Real Estate Education and Research, The Ohio State University, 1981.

Miller, N. & Shedd, P. Do Anti-Trust Laws Apply to the Real Estate Brokerage Industry? American Business Law Journal, 1979, 17, 313-339.

Mills, E. & Lav, M. A Model of Market Areas with Free Entry. The Journal of Political Economy, 1964, 72, 278-288.

Nelson, P. Information and Consumer Behavior. The Journal of Political Economy, 1970, 78, 311-329.

Owen, B. & Grundfest, J. Kickbacks, Specialization, Price Fixing and Efficiency in Residential Real Estate Markets. The Stanford Law Review, 1977, 29, 931-967.

Palm, R.   The Role of Real Estate Agents as Information Mediators in Two American Cities. Geografiska Annaler, 1976, 58, 28-41.

Palm, R. Urban Social Geography from the Perspective of the Real Estate Salesman. Research Report #38, The Center for Real Estate and Urban Economics, University of California, Berkeley, 1976.

Phillips, C. F., Jr. The Economics of Regulation. Homewood: Irwin. 1969.

Rothschild, M. Models of Market Organization with Imperfect Information: A Survey. The Journal of Political Economy, 1973, 81, 1283-1308.

Salop, S. Information and Monopolistic Competition. Papers and Proceedings of the American Economic Association, 1976, 66, 240-245.

Satterwaite, M. Consumer Information, Equilibrium Industry Price, and the Number of Sellers. The Bell Journal of Economics, 1979, 10, 483-502.

Scherer, F. M. Industrial Market Structure and Economic Performance. Chicago: Rand McNally and Co., 1971.

Smith, D. M. Industrial Location. New York: John Wiley and Sons, 1971.

Stigler, G. The Economics of Information. The Journal of Political Economy, 1961, 69, 213-225.

Stern, N. The Optimal Size of Market Areas. The Journal of Economic Theory, 1972, 4, 154-173.

Weiss, L. W. The Geographic Size of Markets in Manufacturing. The Review of Economics and Statistics, 1972, LIV, 245-254.

Yinger, J. A Search Model of Real Estate Broker Behavior. The American Economic Review, 1981, 71, 591-605.

Zerbst, R. The Determinants of Single Family Residential Property Values with Special Reference to the Measurement of Housing Quality and Environmental Factors. Unpublished doctoral dissertation, The Ohio State University, 1974.