J Real Estate Finance Econ (2006) 32: 391–408
DOI 10.1007/s11146-006-6959-4

Spatial Competition and Shopping Externalities: Evidence from the Housing Market

Geoffrey K. Turnbull · Jonathan Dombrow

Abstract In search markets, greater spatial concentration of sellers increases price competition. At the same time, though, a greater concentration of sellers can create a shopping externality by attracting more buyers to the site. Using housing sales data, we test for spatial competition and shopping externality effects on prices and marketing time. We find that they reflect both competitive and shopping externality effects from surrounding houses, although the relative strength varies with how fresh the house is in the market, the freshness of surrounding houses, and the phase of the market cycle. New listings have the strongest shopping externality effect on neighboring houses that have been on the market for some time. Vacant houses have their strongest competition effects in the declining market and externality effects in the rising market. Fresh houses on the market reap little benefit from shopping externalities in all phases of the market cycle.

Keywords Spatial competition · Shopping externalities · Housing

JEL Codes D83 · R21 · R31

Introduction

Increasing the number of sellers in a competitive market increases the competition for buyers, and if the number of buyers is exogenous then this competitive effect reduces selling prices. When sellers conduct their business from individual locations scattered throughout the market, however, the number of buyers attracted to each will generally be endogenous. In particular, buyers will be attracted to locations with

G.K. Turnbull (✉)
Department of Economics,
Georgia State University, P.O. Box 3992, Atlanta, GA 30302-3992, USA
e-mail: gturnbull@gsu.edu

J. Dombrow
DePaul University
Chicago, IL, USA

a greater concentration of sellers in order to reduce the search costs associated with contacting a wider variety of sellers. This means that increasing the concentration of sellers in a particular locale also creates a shopping externality, increasing the probability of a successful match between seller and buyer, which tends to increase selling prices. Spatial concentration of sellers, then, produces two countervailing forces—competition and the shopping externality—and the net effect of these forces on transaction prices is at root an empirical question.

This paper examines how the surrounding spatial concentration of houses for sale affects the sales price and marketing time for owner occupied houses. It presents the first empirical evidence of the spatial competition-shopping externality relationship in markets involving search over both the good's attributes and seller location.[1] This study offers novel empirical evidence on the nature of markets for search goods in general and housing markets in particular. As such, it adds to the empirical literature studying behavior in search markets. The estimates reveal the presence of both spatial competition and shopping externalities, the effects of which systematically vary across phases of the market cycle and across properties that are fresh or stale on the market.

The empirical issue resolves to a straightforward question: When comparing two otherwise identical properties, does a nearby concentration of houses listed for sale matter? We expect it to matter, although the net effect depends on which of the two countervailing forces predominates: a greater density of listings should increase price competition among sellers but should also increase the number of potential buyers searching that neighborhood. Housing markets therefore represent the type of situation that is conducive to shopping externalities. Given this observation, it is surprising that there are no rigorous empirical studies focusing on these externalities in the extensive housing market literature.[2]

The housing market presents an excellent opportunity for studying the effects of spatial competition and shopping externalities for several reasons. First, houses are not homogeneous commodities. They are sufficiently heterogeneous to require non-trivial buyer search effort. Differing maintenance histories or remodeling patterns can make houses with the same architectural features fundamentally different. As a result, very few buyers are willing to purchase houses without a physical examination of the property and neighborhood.[3] Thus, active buyer search—which opens the nexus for shopping externalities—is an essential aspect of transactions in this market.

Second, an analysis of shopping externalities in retail settings must allow for endogenous seller location. For example, a cluster of auto dealerships will attract

[1] Of course, in the case of housing, location itself is both the seller location and one of the attributes of the property.

[2] The theoretical models of buyer or seller search in housing markets also neglect shopping externalities. See, for examples, Turnbull and Sirmans (1993), Wheaton (1991), Wu and Colwell (1986), Yavas (1992), and Yinger (1981). On the other hand, spatial competition and shopping externalities have been long recognized as the centrifugal and centripetal forces driving retail store location decisions.

[3] Of course, intermediaries like inspectors can be used to reduce the number of visits a buyer makes to a given property. Nonetheless, few buyers use such agents to sort through their preliminary purchase options, even though buyers must sometimes travel great distances to examine houses when moving to a different city. This characteristic helps explain why house shopping on the internet has developed into an adjunct to rather than a replacement for physical visits by buyers.

additional dealers up to the point where the advantage of the location from shopping externalities is just offset by the disadvantage from greater spatial price competition. The presence of a shopping externality in this case will not necessarily lead to an observable price differential for autos sold at this location versus those sold by isolated dealers.[4] This notion leads to one main difference between the market retail goods like automobiles and the market for houses. While the empirical study of spatial competition-shopping externalities among retail businesses must take into account the endogeneity of seller location, our study of a housing market avoids this messy complication. Each family can sell only the house it occupies so that seller location is exogenous, thereby eliminating one potentially complicating factor from the empirical model.

The discussion is organized as follows. Section 2 summarizes the countervailing effects of competition and shopping externalities on prices and time on the market within the context of a simple search model. The empirical analysis is explained in Sections 3 and 4. Section 5 presents the conclusion.

Competition, Shopping Externalities and Prices

This section presents a simple search model to illustrate the possibly countervailing effects of spatial competition and shopping externalities on seller behavior and the resultant selling price. We assume that buyers use a search strategy over a range of neighborhoods and houses within those neighborhoods. For example, each buyer first decides which locales within the broader urban area best suits her work commuting pattern, shopping and recreation preferences, etc. She then selects which neighborhoods to search based on the specific houses that attract her attention within these neighborhoods. If there are shopping externalities, she includes visits to other randomly selected houses that are listed for sale in the chosen neighborhoods. Alternatively, the buyer may base her choice of neighborhood to visit on the number of houses for sale, tending toward neighborhoods with more listings in order to visit the greatest number of houses at lowest search cost.[5]

Consider a particular house that is listed for sale. The probability of a potential buyer arriving to visit this house specifically is a. The potential shopping externality is introduced through visits to this house by buyers that have been either attracted to visit this neighborhood in general or some other specific house in the neighborhood. The probability of a potential buyer arriving to search the surrounding neighborhood is s. The probability that such a buyer includes this house in her search within this neighborhood is simply the arrival probability s divided by the number of houses for sale in this location, n. The probability of a visit by a potential buyer to a given house in the neighborhood is therefore

$$v = a + \frac{s}{n}$$

In general, s will be a function of the number of houses for sale in the neighborhood. If the number of buyers attracted to the neighborhood is unaffected

[4] It will, however, lead to spatial clustering of auto dealers.

[5] Similarly, the agent will also have an incentive to prefer neighborhoods with more listings in as much as search costs from his perspective will also be minimized.

by the number of houses for sale, then $s' = 0$. In this case, an increase in the number of houses for sale simply dilutes the number of potential buyers visiting each individual house in the neighborhood; this is the pure spatial competition effect of competing houses in the area in which case $v' < 0$. On the other hand, the arrival rate to the neighborhood might depend upon the number of houses for sale in the area. In this case we expect that each additional house for sale attracts additional potential buyers to the locale ($s' > 0$). But the critical question is how this affects the total number of buyers visiting other houses in the locale. If $v' = 0$ then an additional house for sale draws only enough additional potential buyers to the location to just offset the spatial competition effect; a neighborhood with twice as many houses for sale will have twice as many visits by potential buyers, leaving the number of potential buyers for each house unaffected. On the other hand, when an additional house for sale in the locale attracts enough additional potential buyers to also increase the number of visits to the surrounding houses that are also for sale, the existence of this shopping externality implies $v' > 0$. The sign of the derivative of the buyer arrival rate for a given house reflects the absence or presence of shopping externalities.

We cannot tell a priori which will be the case, $v' \gtrless 0$, nor can we observe the arrival rate directly. Therefore, we must infer the presence of shopping externalities from observed relationships between listing density and selling prices and time on the market for houses in different neighborhoods. To do so, it is useful to cast the competitive pricing and shopping externality effects within the context of a standard search framework for house sellers.

In order to do so, note that in this model buyers are ranked by their willingness-to-pay summarized in the distribution of bid prices $F(p)$ with density $f(p)$. As explained above, the effect of the number of surrounding listings of houses for sale on the number of buyers visiting a given house reflects the presence or absence of shopping externality effects. In addition, though, the number of houses for sale in the area also affects the offer distribution function describing buyers' behavior. We assume that buyers' potential offers for a particular house in the neighborhood reflects only local competition effects; each individual buyer is willing to offer a lower price for a given house as the number of competing listings in the immediate area rises. This is reflected in a leftward shift or translation in the offer distribution function, so that $F_n > 0$.

Now consider the seller's reservation price strategy. Given the probability of a buyer visit v at a given time, the probability of a sale in any given period is v times the probability that an arriving buyer is of the type whose bid p exceeds the seller's reservation price r:

$$\Pr(sale) = v(1 - F(r)) = v \int_{p \geq r} f(p)dp \tag{1}$$

Our point is most easily seen for the simplest search model with no time discounting and a stationary distribution of buyer types. The reservation price of a seller in this situation is implicitly defined by the equilibrium condition (Lippman and McCall, 1978)

$$v \int_{p \geq r} (p - r)f(p)dp = c$$

where c is the search or waiting cost for the seller. This is the familiar condition that the optimal reservation price equates the marginal cost of turning down a lower offer, the waiting or search cost, with the marginal benefit, the expected gain from an offer forthcoming in the next period.

A greater number of surrounding houses for sale has several effects. One is the competition effect felt through buyers' reducing their willingness-to-pay for a given house. This reduces the probability of selling the house to a given pool of searching buyers and lowers the expected sales price for a given reservation price of a seller: $F_n > 0$ and $\int_{p \geq r} pf_n(p)dp < 0$, respectively. Another is the competition and shopping externality effects felt through their impact on the number of potential buyers visiting the house. The net effect of more houses for sale in the neighborhood on the seller's reservation price depends upon the relative strengths of the price competition and shopping externality effects; differentiating the equilibrium condition for the seller's reservation price and simplifying yields

$$\frac{dr}{dn} = \frac{\left(cv'/v + v\int_{p \geq r}(p-r)f_n(p)dp\right)}{v[1-F(r)]} \tag{2}$$

As one would expect, by itself competition reduces a seller's reservation price; $v' \leq 0$ and the negative second term in the numerator together ensure $dr/dn < 0$: greater listing density reduces sellers' reservation prices. On the other hand, a shopping externality from additional houses for sale in the neighborhood is reflected in a greater number of potential buyers for each house in the neighborhood. In this case $v' > 0$ so that the first term in the numerator is positive and the net effect of additional neighborhood listings is ambiguous a priori, depending upon the relative strengths of competition and shopping externality. Additional listings can lead to higher seller reservation prices when the shopping externality is sufficiently strong. It is nonetheless possible that a greater listing density in the locale leads to lower reservation prices for sellers even when a shopping externality exists, provided the externality is sufficiently weak.

Nonetheless, we cannot directly observe the reservation prices of sellers. In our empirical model, though, we do observe the effect additional listings have on the expected sales price for a given time on the market. It is easier to examine the effects of listing concentrations on the expected sales price for a single period; since the reservation price is invariant across time in this model, the results generalize to any marketing period. The expected price for a house that sells is

$$E[p] = \frac{v\int_{p \geq r} pf(p)dp}{v[1-F(r)]}$$

so that

$$\frac{dE[p]}{dn} = \left(\int_{p \geq r} pf_n(p)dp \int_{p \geq r} f(p)dp + f(r)\int_{p \geq r}(p-r)f(p)dp\left(\frac{dr}{dn}\right)\right)[1-F(r)]^{-2} \tag{3}$$

The first right hand side term is negative; the greater the number of listings, the lower the willingness-to-pay of potential buyers, which translates into a lower expected sales price for a given reservation price. The second right hand side term picks up the effect of changes in the reservation prices of sellers. From (2) the sign of dr/dn reflects the presence of a net shopping externality effect on reservation price. Therefore, the effect of neighboring listings on expected selling price reveals information about the role of shopping externalities and spatial competition. A nonnegative effect of listing density on selling prices requires that $dr/dn > 0$ and therefore is evidence of net shopping externalities at work.[6]

There are two observable dimensions in our house sales data, sales price and time on the market, and their connection is straightforward in this simple model. Since the regression model depicts expected marketing time for a given selling price, the effect of neighboring listings on sales time is most easily inferred from the effect on the probability of selling the house within a given period for a given expected price: $d\Pr\{sale\}/dn$ subject to the constraint $dE[p]/dn = 0$. Differentiating (1) using (3) in the constraint yields after rearrangement

$$\begin{aligned} sgn\frac{dPr\{sale\}}{dn} &= sgn\left[v'\int_{p\geq r} f(p)dp + v\int_{p\geq r} f_n(p)dp - f(r)\left(\frac{dr}{dn}\right)\right] \\ &= sgn\left[\int_{p\geq r} pf_n(p)dp\int_{p\geq r} f(p)dp + c\left(\frac{v'}{v}\int_{p\geq r} f(p)dp + \int_{p\geq r} f_n(p)dp\right)\right] \end{aligned}$$

In the absence of a shopping externality, $v' \leq 0$ so that $dPr\{sale\}/dn < 0$ and it takes longer on average to sell the house at the given expected price. In order for $dPr\{sale\}/dn > 0$, that is, for the expected days on market to decrease with greater listing density, $v' > 0$ must hold and the shorter expected marketing time is sufficient to conclude the presence of a shopping externality.

Given our application to owner-occupied housing, we must recognize a complication that is not present for retail activity in general: equity constrained sellers. Some sellers may be constrained to sell only at or above a price that will allow them to satisfy their outstanding mortgages, equity loans, or other debt attached to the property (Case and Shiller, 1988; Genesove and Mayer, 1997, 2001; Meese and Wallace, 1993; Stein, 1995). Genesove and Mayer (1997) find evidence of equity constrained sellers for their sample of condominium sales in Boston. In our application, equity constrained sellers or sellers who are otherwise following a target equity strategy cannot or will not vary their reservation prices in the face of increased competition from additional local listings. In the context of our model, the equity constraint is expressed as $dr/dn = 0$. Using (3), the *expected* sales price will still decrease in the face of the competitive effects of greater local listing density on buyer willingness-to-pay. The expected price declines because of the declining probability of selling for the higher prices. In any event, the presence of the shopping externality can still be inferred from the observed gross effect of listing density on sales time. Further, if equity constraints exist, they are more likely to be binding in declining or stagnant markets than in a rising market. It is possible that equity constraints may also be binding in the initial phase of a rising market for those sellers who bought (and financed) their houses at higher prices during a previous upturn or have recently eliminated their equity by refinancing for repairs, remodeling, or other consumer spending. Our empirical approach allows for these various possibilities.

[6] This conclusion holds under the hypothesis that spatial competition effects are present. If we do not maintain this hypothesis, then $dE[p]/dn = 0$ is also consistent with zero competitive and externality effects. In this case $dE[p]/dn > 0$ is required to conclude the presence of shopping externalities. It turns out that marketing time effects can be used to ascertain the presence of competition effects when $dE[p]/dn = 0$, as explained below.

There is another complication to consider before moving on to the empirical evidence. It is widely believed in the real estate brokerage profession that newly listed or "fresh" houses generate more buyer traffic than do "stale" houses that have been on the market a while. If this is true then fresh listings generate stronger shopping externalities for other houses than do stale listings. In addition, the competition or externality effects of surrounding houses should have different impacts on fresh and stale houses. In particular, relatively fresh houses may not enjoy as much of the externality brought to the neighborhood by a newly listed house that stale houses enjoy. These possible asymmetric relationships also are addressed in the empirical analysis that follows.

The Data

We use a sample of single-family, owner occupied, broker-assisted housing transactions to examine the effects of competition and simultaneously test for the presence of shopping externalities. The data under investigation is drawn from the Multiple Listing Service (MLS) sales reports for Baton Rouge, Louisiana during the period beginning July 1985 through June 1997.

In order to enhance the comparability and homogeneity of the houses, we restricted our attention to a contiguous region within the urban area which accounts for roughly fifty percent of the broker-assisted single family house sales during the sample period. We required that the property must have been purchased for cash or financed with a conventional mortgage, thereby avoiding introducing bias from below market financing arrangements.[7] In addition, there is evidence that the prices of houses in new subdivisions diverge significantly from the broader market until the new development reaches a critical mass (Sirmans et al., 1997). Our sample avoids this pricing bias associated with new development by including only those houses that are at least two years old. Finally, in order to avoid outlier influence on selling time estimates, we exclude from the sample houses that take more than nine months to sell (which excludes approximately five percent of the total number of houses sold during the sample period). The sample comprises 4922 transactions.

Table 1 summarizes the means and standard deviations of the variables included in the data set. Information on the sales price (*Price*), number of days on the market prior to sale (*DOM*),[8] and square footage of living area (*Living Area*) are drawn directly from the MLS report for each sale. We transformed the transaction date into a continuous monthly series (*Month*) and calculated the *Age* of the dwelling at the date of sale from information regarding the year built. The *Net Area* variable is calculated as the difference between the total square footage under roof less the square footage of living area, and captures the size of utility rooms, garages, covered

[7] As a practical matter, our data source does not reveal the specific terms of alternative financing methods (other than their presence), so we cannot adequately measure their influence on prices in any event.

[8] The point of sale is measured by the date of an accepted sales contract. Recalling that our data pertains only to those house sales that successfully close, the date of contract is the time at which the (eventually closed) house is effectively removed from market exposure. Further, like all MLS based data, our DOM measure does not take into account houses that have been relisted with new brokers.

Table 1 Descriptive statistics for housing transactions in sample

Variable	Mean	Std. dev.	Minimum	Maximum
Price	100724	35105	25000	255000
DOM	59.8	56.9	1	270
Living area	1943.7	467.0	1003	2997
Net area	735.0	261.8	102	1979
Age	13.6	8.4	2	50
Month	95.0	39.0		
Location 1	.22			
Location 2	.48			
Location 3	.14			
Location 4	.16			
Discount	.03	.03	−.10	.20
Competition	253.1	409.5	0	4289.8
New competition	65.8	78.6	0	648.8
Vacant competition	84.0	168.9	0	2110.0
Listing density	2.81	2.39	0	18.51
New density	0.98	0.65	0	4.54
Vacant density	0.84	1.03	0	9.50
Observations	4922			

porches, carports, etc. The binary *Location* variables indicate the MLS area in which the house is situated. The *Discount* variable is calculated as one minus the ratio of the selling price divided by the initial listing price.

The variables of central interest to this study are those measuring the concentration in neighboring listings. The variables that we use to measure the number of competing houses for sale in the surrounding area take into account both the number of days that competing houses overlap on the market as well as the distance between them. Competing houses are defined as those within $\pm$ 20% of the living area of the subject house. Let $L(i)$ and $S(i)$ denote the listing date and sales date for house i, respectively, so that the days on the market for house i is, $S(i) - L(i) + 1$, and the overlapping days on the market for contemporaneously listed houses j and i is defined as

$$O(i,j) = \min[S(i), S(j)] - \max[L(i), L(j)] + 1$$

After mapping all of the houses in the sample into geographic coordinates, we calculate $D(i,j)$ as the distance in miles between houses i and j. The set of competing listed houses within one mile of house i is $I \equiv \{j | D(i,j) \leq 1\}$. The variables measuring competing listings for house i are defined as

$$\begin{aligned} Competition_i &= \sum_{j \in I} (1 - D(i,j))^2 O(i,j) \\ Listing\ Density_i &= \sum_{j \in I} \frac{(1 - D(i,j))^2 O(i,j)}{S(i) - L(i) + 1} \end{aligned}$$

These variables control for the window of opportunity open to buyers potentially interested in the competing houses and avoids counting other houses that sell early in the marketing period of this house as competing listings throughout the entire

Table 2 Pooled sample 3SLS estimates

Variable	Base model		Comp model	
	Coefficient estimate	T-statistic	Coefficient estimate	T-statistic
Price equation				
Intercept	10.30805	215.84	10.10126	295.85
DOM	−0.00230	−8.76	−0.00019	−2.73
Living area squared	0.000867	24.73	0.000876	25.34
Living area squared	−7.58E–8	−8.72	−8.09E–8	−9.45
Net area	0.000347	10.92	0.000345	11.02
Net area	−1.22E–7	−6.68	−1.24E–7	−6.85
Age	−0.02569	−33.57	−0.02562	−36.59
Age squared	0.000520	28.12	0.000516	30.45
Month	−0.00301	−8.21	−0.00161	−7.16
Month squared	0.000030	16.81	0.000025	20.12
Location 1	−0.09879	−12.02	−0.09661	−14.73
Location 2	−0.09612	−12.47	−0.08198	−13.06
Location 3	−0.06396	−7.08	−0.07111	−9.86
Listing density			0.001373	0.53
New density			0.007669	1.42
Vacant density			−0.01865	−5.06
Observations	4922		4922	
DOM equation				
Intercept	14.98339	0.48	64.54401	3.72
Ln(price)	7.205806	2.70	−1.33090	−0.90
Month	−0.83351	−9.59	−0.36021	−7.18
Month squared	0.003033	6.13	0.001906	6.79
Location 1	3.029726	1.14	−10.3004	−6.99
Location 2	−2.70576	−1.17	−18.5843	−14.40
Location 3	7.019954	2.47	−7.03838	−4.45
Discount	253.9218	6.03	85.06916	3.03
Discount squared	700.5422	1.89	541.3740	2.09
Listings			0.096771	19.34
New listings			0.203360	12.09
Vacant listings			−0.05261	−7.07

days on the market. Further, the distance weighting reduces the strength of the competitive or shopping externality effect on house *i*, with the marginal effect decreasing at an increasing rate. The *Competition* variable measures the cumulative competition from other houses (in house-days) over the entire marketing time for a given house. The *Listing Density* variable measures the average intensity of competition, as an average of competing houses per day of time on the market.

The *New Competition* variable is defined the same as *Competition*, except that only newly listed houses are included in the set *I*, where "newly listed" is defined as any house that has been listed for 14 days or less.[9] *New Density* is defined following

[9] The 14 day window definition for a new listing corresponds with the time frame used for the separate new listings section of the bi-monthly MLS books that are used by the local Realtors. Similar results were also obtained from both modestly shorter and longer time frames.

Table 3 3SLS selected parameter estimates by market cycle

Variable	Declining market estimates	Market trough estimates	Rising market estimates	Pooled estimates
Price equation				
Listing density	0.002322	0.004542	0.008945 *	0.001373
New density	0.043037	0.115685	0.057223	0.007669
Vacant density	−0.00950	−0.01130 *	−0.03528 *	−0.01865 *
Observations	1042	1483	2397	4922
DOM equation				
Listings	0.077548 *	0.110320 *	0.144530 *	0.096771 *
New listings	−0.13011 *	0.073771 *	0.072799 *	0.203360 *
Vacant listings	0.068865 *	−0.05123 *	0.040499 *	−0.05261 *

Listing Density, but only including newly listed houses in *I*. Similarly, competing vacant houses are measured by the variables *Vacant Competition* and *Vacant Density*. The construction of these variables follows that for *Competition* and *Listing Density*, respectively, but only includes the exposure to competing vacant houses in *I*.[10]

Empirical Results

The theoretical model depicts house selling price and marketing time as simultaneously determined by seller and buyer search behavior. We estimate the effects of competing neighborhood listings on prices and marketing time using a simultaneous system of an hedonic price model and a days-on-market equation, the specifications of which are reported in Table 2. In all models, the log of sales price is explained by the marketing time (*DOM*), house characteristics (*Living Area, Net Area, Age*), location, housing market condition (*Month*), season (*Summer, Fall, Winter*), and the concentration of competing listings in the neighborhood (*Listing Density, New Density, Vacant Density*). The days on the market (*DOM*) is a function of the sales price (*lnPrice*), location, variables reflecting housing market condition (*Month, Discount*), season (*Summer, Fall, Winter*), and the competition of other listings in the neighborhood (*Competition, New Competition, Vacant Competition*).[11] The 3SLS estimates reported in Tables 2, 3, 4 take into account anticipated cross-equation correlations. Table 2 reports the complete model estimates for the pooled sample (1985–1997). Table 3 reports the estimates of key parameters for each phase of the market cycle covered by our sample (declining market, 1985–1987; trough, 1988–1991; rising market, 1992–1997). Table 4 reports the estimates of key parameters further broken down for different types of houses in the various market phases.

[10] The calculations for all of the density and competition variables include all sales for the entire metropolitan area over the period October 1984 through March 1998. Therefore, these variables include all relevant out-of-sample sales, that is, houses in areas bordering on our sample geographic areas and houses listed before the sample time period that overlap with our sample period.

[11] Alternative specifications using logarithmic transformations in lieu of quadratic terms yield the same conclusions regarding spatial competition and shopping externality effects.

Table 4 3SLS selected parameter estimates by market cycle and staleness

	Fresh	Average	Stale
Price equation			
Declining market			
Listing density	0.004715	−0.00729	−0.01324
New density	−0.01418	0.057770	0.080867
Vacant density	−0.01391	−0.00480	−0.00472
Market trough			
Listing density	0.006285	0.020571 *	−0.00239
New density	−0.00497	−0.02283	0.061114 *
Vacant density	−0.00837	−0.01340	−0.01102
Increasing market			
Listing density	0.013387	−0.00272	−0.00072
New density	−0.01103	0.025909 *	0.050812 *
Vacant density	−0.03014 *	−0.02528 *	−0.03816 *
DOM equation			
Declining market			
Listings	0.075562 *	0.063062 *	0.096463 *
New listings	0.062295	−0.19396 *	−0.46152 *
Vacant listings	0.063871	0.055992 *	0.020016
Market trough			
Listings	0.098174 *	0.108371 *	0.113189 *
New listings	0.131693 *	−0.15376 *	−0.21078 *
Vacant listings	−0.00606	0.002233	−0.05080 *
Increasing market			
Listings	0.120597 *	0.127109 *	0.156917 *
New listings	0.179537 *	−0.09439 *	−0.21326 *
Vacant listings	0.082654 *	0.057354 *	0.019919

Pooled Sample Estimates

Looking first at the results in Table 2, none of the house attributes or location variable coefficients are surprising. The price equation estimates reveal that the market values *Living Area* more highly than *Net Area* and that *Age* reduces house value over most of the sample. The coefficients on the *Area* dummy variables show the relative accessibility of each of the contiguous MLS areas to the major employment and shopping centers in the metropolitan area: Location 4 is closest to the major employment centers in the urban area, with locations 3, 2, and 1 exhibiting decreasing accessibility.

The effect of surrounding houses for sale is revealed by the *Listing Density* variable.[12] Competition by itself puts downward pressure on selling price while a

[12] In general, it is possible that a relatively greater density of listings may indicate an emerging negative neighborhood effect or tipping socio-economic composition. Interviews with local professionals and the 1990 and 2000 census data both indicate that this is not the case for our sample, however. The neighborhoods in our sample have exhibited continuing stable racial composition over time. Home ownership rates and household incomes have both remained relatively high relative to the rest of the Baton Rouge metropolitan area.

shopping externality puts upward pressure on selling price. A negative coefficient indicates dominant competitive pricing effects from surrounding listings. A coefficient of zero indicates either the complete absence of both competitive pricing and shopping externality or mutually offsetting effects. A positive coefficient on *Listing Density* implies a net shopping externality regardless of whether or not competitive pricing effects are present.

Earlier we pointed out the widely-held belief of real estate brokers that fresh houses on the market attract more visits than do their stale counterparts. We argued that this could lead to stronger shopping externality effects for competing new listings than for stale listings. The price equation includes the *New Density* variable to pick up any differential price effect of newly listed versus stale competing listings. A positive coefficient on this variable captures the effect of any additional shopping externality associated with a new listing over and above that of a stale competing listing. An insignificant coefficient indicates that the competitive-externality effects of fresh and stale listings are indistinguishable while a negative coefficient indicates that new listings have stronger competitive pricing effects than do stale listings. Our expectation is that surrounding new listings will yield a stronger shopping externality than stale listings do.

Similarly, we allow for a differential pricing effect from competing vacant houses in the neighborhood by including the variable *Vacant Density*. We expect that owners of vacant houses in this sample are highly motivated to sell their property and therefore anticipate a negative coefficient on this variable in the price equation consistent with stronger competitive effects relative to occupied houses.

According to Table 2, only the *Vacant Density* variable has a significant effect on sales price, and that effect is negative. This is consistent with our intuition; vacant houses have a strong competitive price effect on neighboring houses. Interestingly, the coefficients on the *Listing Density* and *New Density* are not significantly different from zero for the pooled sample. Whether this means that there are no pervasive competitive price and shopping externality effects or that these effects are mutually offsetting on sales price depends upon the evidence revealed by the marketing time equation estimates.

Now look at the *DOM* equation estimates for the pooled sample in Table 2. The selling price is insignificant. The time trend variables show a surprising trend decline in marketing time in the early years of the sample during the declining market cycle. Given the nature of our sample, we expected to find a counter-cyclical relationship between *DOM* and the market phase, with increasing *DOM* during the declining market and decreasing *DOM* during the rising market. The strong positive relationship between selling price discount and days on market is consistent with marketing time estimates of others (Belkin et al., 1976) and suggests that sellers follow a strategy of decreasing their reservation prices over time. Nonetheless, it is possible that the selling price discount is endogenous with days on the market and what we are observing is that houses on the market for a long time induce their sellers to take a larger discount than originally planned. We also estimate the model without these discount variables to ascertain the extent to which any possible endogeneity biases other coefficient estimates. Our conclusions are unaffected by the inclusion or exclusion of the discount variables in the *DOM* equation.

The variables of central interest in the *DOM* equation are *Competition*, *New Competition*, and *Vacant Competition*. These variables are constructed like their counterparts in the price equation, except that they are not deflated by the number of days on the market. So, for example, *Competition* measures the number of surrounding house-days of listed properties overlapping with the sample transaction. *New Competition* and *Vacant Competition* are similarly constructed for new listings and vacant houses.

The significant positive coefficient on the *Competition* variable is consistent with strong competitive effects; the greater the number of surrounding listings, the longer it takes to sell a given house on average. The *New Competition* coefficient is also positive, revealing that new listings have stronger competition effects than do surrounding stale properties. The significant negative coefficient on *Vacant Competition*, however, is surprising, since it suggests that surrounding vacant houses have a stronger externality effect than do stale occupied listings. This is not what we expect to find and seems at odds with the vacant listings effect in the price equation. Still, note that the net effect an additional vacant listing, measured by the sum of the *Competition* and *Vacant Competition* coefficients, is significantly positive.

Taken together, the price and marketing time equation estimates for surrounding listings and new listings indicate the presence of the both competition and shopping externalities in this market. The evidence for competitive effects is revealed through the *DOM* equation, in which case the insignificant coefficients on these variables in the price equation implies a shopping externality.

Market Cycles and House Freshness

One of the advantages of this particular sample is that data is available through all phases of a housing market cycle. The local energy-based economy was driven into recession with the oil market collapse of 1983. House prices fell 9.2 percent in the last two years of the declining phase of the market, 1986–1987.[13] The precipitous decline ended in 1987, after which the housing market remained fairly stable through 1991 (with price changes of less than two percent per year and the level in 1991 roughly the same as it was in 1987). The recovery, as evidenced by increasing housing prices, has been steady from 1992 on, with prices increasing an average of 6.3 percent each year. In terms of our sample, 1985–1987 represents a declining market, 1988–1991 represents the trough, and 1992–1997 represents a rising market. These three subsamples allow us to examine potential variations in the effects of competition and externalities over the different market phases.

The broader urban area housing market conditions affect buyer and seller expectations, hence their potential offers and reservation prices. Therefore, it is reasonable to expect that the competitive price effects and shopping externalities from surrounding houses will differ across the phases of the market cycle. Table 3 reports the 3SLS estimates for the main parameters of interest, disaggregated by phase of the market cycle. The pooled sample estimates are included in the table to make comparisons easier.

The first thing that becomes clear from Table 3 is that, as expected, the competition and externality effects vary across the different phases of the market cycle. The *DOM* equation coefficients for *Competition* shows competitive effects in all phases of the market cycle. The price equation *Listing Density* coefficients for the

[13] This market summary is based on a constant quality housing price index supplied by the LSU Real Estate Research Institute.

declining and trough phases yield little evidence for shopping externalities. The significantly positive coefficient in the rising market indicates a stronger externality effect on price. The differential effects of surrounding new listings, however, show more variation across the market cycle. Based on the *DOM* equation, newly listed houses exhibit a strong externality effect on marketing time in the falling market and an opposite significant competition effect lengthening marketing time in the trough and rising market. Vacant houses in the neighborhood also have highly variable effects across the market cycle: competitive price effects in the trough and rising market, reinforced by competitive effects on marketing time in the rising market; significant shopping externality effects are evident in the falling market and in the trough.

Table 4 further disaggregates the samples for each phase of the market into houses that sold while fresh, houses that sold while "average" stale, and those that sold while very stale. These marketing time criteria, of course, vary by market phase. In all cases, we define as "fresh" houses that sold within the lowest one third of days on market for the relevant market cycle subsample. "Average" houses are those that sold during the middle third of days on market for the relevant subsample and "stale" houses are defined as those whose marketing time fell within the highest one third of days on the market. In the declining market, the average days on market for houses in these four MLS areas is 90 days and the break points for staleness are 45 and 113 days. During the trough period the average days on market is 74 days and the break points for the degree of staleness occur at 32 and 86 days. The average days on market is only 48 days in the rising market and the break points for the staleness categories are 18 and 53 days.

Looking first at the sales price equation, the coefficient estimates for the *Listings Density* variable are never significantly negative, regardless of how fresh or stale the house is and regardless of the phase of the market cycle being examined. The presence of surrounding competing houses does not put downward pressure on sales prices. In fact, for average houses in the market trough and fresh houses in the increasing market, the significantly positive coefficient on this variable is consistent with shopping externalities: the greater the density of competing houses listed in the neighborhood, the higher the sales price.

The *Competition* variable in the *DOM* equation tells more of the story. The coefficient estimate is significantly positive at the ten percent level for all types of houses and all market phases in Table 4—evidence of a stronger competition than shopping externality effect. For all three measures of staleness, the effect of competing surrounding houses on marketing time tends to strengthen as the market progresses from its declining phase through its rising phase. This indicates that the competition effect is stronger (or shopping externality effect weaker) in the rising market than in the declining market. Further, within each phase of the market cycle, the competition effect of surrounding listings is stronger for stale houses than for fresh houses. The pattern of coefficients is consistent with the notion that stale houses are penalized relatively more from neighboring competition than are fresh houses. This is intuitively appealing in that the fresh house itself is at its peak period of drawing potential buyers.

Before examining the differential effects of new listings and vacant houses, it is important to note the clear implication of the *DOM* equation estimates for the results thus far: there is evidence of competitive pricing effect for all types of houses in all market phases. Thus, the insignificant *Listing Density* coefficient in the price equation reveals the presence of shopping externalities as well—shopping externalities that are just strong enough to offset the pricing effects of competition.

The pooled sample revealed that new listings have a greater shopping externality effect than stale listings. Looking at the *New Density* coefficient estimates in Table 4, several interesting patterns emerge. New listings have no net effect on the sales prices of fresh houses in all of the market phases. Nor do new listings have a significant differential effect on the marketing time for fresh houses in the falling market. The picture for the market trough and the rising market is different, though. In both of these market situations, surrounding new listings significantly increase the time on the market for a fresh house to sell at a given price. Coupled with the insignificant price effect, this indicates that new listings are relatively stronger substitutes for fresh houses than they are generators of additional buyer traffic. A fresh house in a neighborhood (a newer listing itself) has already increased buyer traffic as much as will occur. Because part of the greater traffic to a new listing is drawn from the same pool as the fresh house traffic flow, additional new listings will simply prompt buyers to also visit those properties as well as the fresh house, and the alternative new listings draw off enough traffic from the fresh house to reduce the likelihood of it selling at a given price while still fresh. Put somewhat differently, new listings in the neighborhood are close substitutes for fresh houses, an intuitively appealing result.

Stale houses, in contrast, reveal evidence of strong shopping externalities from having more new listings in the neighborhood; it is important to remember that a greater *New Density* value does not indicate more new listings in total, but rather that new listings represent a greater percentage of the surrounding listings. The coefficients in the price equations are either insignificant (e.g., declining market) or significantly positive (e.g., market trough and rising market). The pattern across fresh and stale houses shows that the additional buyer traffic from a new listing in a neighborhood is fully offset by the additional competition facing a fresh house during its most attractive marketing period, while stale houses that are past their most attractive marketing periods generally benefit from the traffic generated by new listings in the area. The *DOM* equation estimates reinforce these conclusions. Competition from new listings reduces the time on the market for houses in the average and stale categories in each market phase, with the strongest shopping externality effects being observed for the most stale houses. Fresh houses in the trough and rising market phases experience significant competition from newly listed houses.

Recall that the coefficients on the *Vacant Density* and *Vacant Competition* variables show the differential price and selling time effects of surrounding vacant houses over and above those of occupied listings. The pattern of coefficient estimates are harder to sort out. At the five percent level of significance or less, surrounding vacant houses for sale have no differential effects on prices or market time on fresh or average stale houses in declining or trough markets. In the rising market, though, surrounding vacant houses tend to both decrease selling price and increase time on the market for fresh and average stale houses. This pattern leads us to conclude that the competition effect of surrounding vacant houses on fresh and average houses arises only in the rising market phase.

For stale houses, none of the vacant house coefficients is significant in the declining market. And the negative coefficient in the price equation for the rising market subsample indicates a stronger spatial competition effect for vacant houses than for occupied houses. This much is consistent with fresh and average houses.

However, the negative coefficient in the *DOM* equation for the market trough indicates a stronger shopping externality from surrounding vacant houses than from occupied houses. This last result is puzzling. We expected to find competition effects for stale houses that are at least as strong as for fresh or average houses, yet we do not see this pattern for the market trough subsample.

Conclusion

This paper studied the relationship between spatial concentrations in houses for sale, selling prices and marketing times. We found that surrounding listings consistently exhibit competitive effects on sellers. As expected, though, neighboring new listings also create additional buyer traffic, the source of shopping externalities for neighboring average and very stale houses. Not surprisingly, the strength of the competition and externality effects on seller behavior varies over phases of the housing market cycle.

There is one potentially important difference between housing and other search goods that may be subject to shopping externalities. Unlike automobiles or other consumer goods requiring some degree of buyer search, agents play a key role in the sales process for real estate. There is, however, little consensus on how the real estate brokerage industry affects the housing market (Benjamin et al., 2000). For example, empirical studies by Turnbull et al. (1990) and Turnbull and Sirmans (1993) show that brokerage and financing institutions in the housing market help to diminish systematic price differentials that would otherwise arise from asymmetric information or bargaining abilities across types of buyers or sellers. Simply put, their rationale is: If a certain type of seller normally sells at a discount, then brokers will steer potential buyers to them, thereby increasing demand and diminishing the discount. At the same time, the role of financing institutions in the transactions process introduces monitoring in the form of third party appraisals, which provides brokers with the motivation to keep buyers from mistakenly overpaying relative to the market. Thus, it is argued, these institutions tend to eliminate systematic underpricing by uninformed sellers or overpricing by uninformed buyers. On the other hand, Harding et al. (2003) recently find persistent price differentials across types of buyers and attributes them to differences in bargaining power or skills for different buyers and sellers.

Like Harding, Rosenthal, and Sirmans, we find systematic price and selling time differentials, although ours are consistent with what we expect to see from shopping externalities. Still, our results are relevant to the debate over the role of brokers or agents in search markets. While earlier studies argue that real estate agents drive the process that eliminates systematic price differentials in the market, we argue that the real estate brokerage industry itself plays a role that reinforces shopping externalities and the ensuing effects on price. The story is simple: Competition from neighboring houses tends to lower the selling price of a house. Knowing this, agents who are eager to match their potential buyers with sellers find it profitable to steer buyers to locations with larger concentrations of houses listed for sale in order to increase the probability of a successful sale to "their" buyer.[14] This extra buyer

[14] Assume, as is the case for our study, that spatial concentrations in houses for sale is not a signal of imminent neighborhood decline.

search traffic, of course, is a shopping externality generated by the concentration of listings in the area. More importantly, the extra buyer traffic puts upward pressure on the prices of houses in the neighborhood, thereby offsetting the price effect of seller competition. Therefore, in our view, whatever the role of real estate agents in the housing market, their presence does not vitiate shopping externality effects, but instead reinforces them.

In a different vein, while Case and Shiller (1988), Genesove and Mayer (1997, 2001), and Meese and Wallace (1993) suggest that many house sellers use rules of thumb like equity targets in their pricing decisions, this view need not push spatial competition or shopping externalities out of the picture. There are, after all, two margins on which sellers operate: price and marketing time. As our study and Genesove and Mayer (1997) show, time on the market is always an important dimension when sorting out the market forces at work. For example, we find that while a greater density of surrounding stale house listings does not affect selling price, it does increase marketing time. Thus, even sellers who insist on immutable target prices without taking surrounding market conditions into account are balancing the benefits of holding the line on price against the greater opportunity cost of waiting to sell when the competition for buyers increases. For these sellers the effects of spatial competition and shopping externalities are revealed in the marketing time for their properties.

Acknowledgments The authors thank two referees for their helpful comments and suggestions. All errors remain the responsibility of the authors.

References

Belkin J, Hempel DJ, McLeavy DW (1976) An empirical study of time on market using multidimensional segmentation of housing markets. AREUEA J 4:57–75

Benjamin JD, Jud GD, Sirmans GS (2000) What do we know about real estate brokerage? J Real Estate Res 20:5–30

Case KE, Shiller RJ (1988) The behavior of home buyers in boom and post-boom markets. N Engl Econ Rev November/December 29–46

Genesove D, Mayer CJ (1997) Equity and time to sale in the real estate market. Am Econ Rev 87:255–269

Genesove D, Mayer CJ (2001) Loss aversion and seller behavior: evidence from the housing market. Q J Econ 116:1233–1260

Harding JP, Rosenthal SS, Sirmans CF (2003) Estimating bargaining power in the market for existing homes. Rev Econ Stat 85:178–188

Lippman SA, McCall JJ (1978) The economics of job search: a survey. Econ Inq 14:155–189

Meese R, Wallace N (1993) Testing the present value relation for housing prices: should I leave my house in San Francisco? J Urban Econ 35:245–266

Sirmans CF, Turnbull GK, Dombrow J (1997) Residential development, risk, and land prices. J Reg Sci 37:613–628

Stein JC (1995) Prices and trading volume: a model with downpayment constraints. Q J Econ 110:379–406

Turnbull GK, Sirmans CF (1993) Information, search, and house prices. Reg Sci Urban Econ 23:545–557

Turnbull GK, Sirmans CF, Benjamin JD (1990) Do corporations sell houses for less?: A test of housing market efficiency. Appl Econ 23:1389–1399

Wheaton WC (1991) Vacancy, search, and prices in a housing market matching model. J Polit Econ 2:1270–1292

Wu C, Colwell PF (1986) Equilibrium of housing and real estate brokerage markets under uncertainty. AREUEA J 14:1–23

Yavas A (1992) A simple search and bargaining model of real estate markets. AREUEA J 20:533–548

Yinger J (1981) A search model of real estate broker behavior. Am Econ Rev 71:591–605