Sale Price, Marketing Time, and Limited Service Listings: The Influence of Home Value and Market Conditions

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Abstract

Local markets for real estate brokerage services typically exhibit fairly strict pricing. Increased popularity of limited service brokerages provides an opportunity to study any loss in utility by sellers using these firms. Anecdotal evidence suggests that sellers experience a decreased selling price or an increased marketing time when utilizing limited service brokers, but there has been little prior empirical work. This study finds that limited service listings sell for significantly more and spend significantly less time on the market than traditional listings. The price and marketing time impacts vary by home value and local market conditions.

Real estate brokerage commissions typically cluster at 5%, 6%, or 7% in any particular geographic area, and few real estate brokerage firms deviate from the standard commission. However, limited service real estate brokers are an increasing national trend. These limited service brokers offer real estate brokerage services on an á la carte basis, in which the seller pays a flat fee for services. For example, a particular seller may wish only to have a property entered into the area multiple listing service (MLS). Or the seller may want the limited service broker to enter the property into the MLS and handle negotiations with the selling agent. A variety of possible service combinations are available.[1]

In analyzing the potential market effects of limited service contract utilization, this study makes four contributions to the existing literature. First, the existence of price and time-on-market impacts due to limited service utilization is confirmed. Transaction outcomes are important to sellers pondering which type of contracting arrangement to pursue and to agents wondering whether to offer á la carte services. Second, and arguably of more interest to academics, this work offers additional insights into the incentives provided by conventional versus non-conventional contracting arrangements in the real estate brokerage industry. There is a long line of literature examining the effects of real estate brokerage contracts and/or commission arrangements on transaction outcomes. However, only one prior study

has considered how the use of a limited service broker affects selling price or marketing time.

The third contribution to the existing literature is an attempt to isolate the factors driving limited service brokerage outcomes. Specifically, the study hypothesizes that limited service effects could be related to the price of homes offered for sale using limited service contracts or the state of the market at the time the homes are offered for sale. Separate analyses are conducted to test for limited service brokerage effects controlling for these factors. The fourth contribution is confirmation that the data chosen as the final sample have substantial bearing on the results obtained; that is, the observations that must be discarded due to incomplete data matter. This study includes a simple control for selection bias due to sample inclusion that, to the authors' knowledge, has not been utilized in prior brokerage studies.

Using comparable sold data from a medium-sized East Coast city, a hedonic pricing model is constructed to test for the effect of limited service broker utilization on property sales price. In addition, hazard modeling is employed to uncover the effect of limited service broker utilization on property time-on-market. The MLS from which the data are drawn provides an excellent laboratory in which to test for transaction outcomes due to limited service brokerage usage, since the MLS requires that limited service listings be identified by the words ''limited service'' or some close variation in the agent notes.

Somewhat surprisingly, robust results indicate that limited service listings actually sell at a higher price and experience a shorter time-on-market for the full sample. Differences exist in the limited service price and marketing time effects depending on property value and market conditions.

The remainder of the paper proceeds as follows: the next section reviews the relevant literature, the third section discusses the data and methodology, and the fourth section reports the empirical results. Concluding comments and directions for future research are provided in the final section.

Literature Review

Hedonic pricing models and hazard models of time-on-market are well understood and accepted methodologies in the real estate literature. Thus, this literature review does not focus on these topics. A line of literature dating at least to the early 1970s examines the impact of real estate brokerage contract and/or commission structures on transaction outcomes. Much of the early work dealing with real estate brokerage contracts and commission structures is theoretical. Crockett (1982) develops a model of profit maximization within the real estate brokerage industry and shows that current industry structure and practice lead to allocative and technical inefficiencies. The main solution this author suggests to address the problems of the real estate industry involves unbundling the services offered by real estate brokers into individual components, which can then be purchased by

consumers as needed. Essentially, the author suggests limited service brokerage as a way to eliminate inefficiencies.

Zorn and Larsen (1986) develop a search model to compare the standard percentage commission structure with a flat-fee system of real estate broker remuneration. They argue that the flat-fee system provides inferior incentive alignment between seller and agent in the absence of a minimum acceptable price set by the seller. Additionally, if there is a minimum acceptable price specified, the two systems offer equivalent incentive effects. Thus, the use of a percentage commission structure may not be purely a result of price discrimination. Schroeter (1987) presents an alternative model of the market for real estate brokerage in which ''value-of-service'' pricing, or fixed-percentage commission, is the optimal payment structure. Based on this model, he argues that charges of noncompetitive behavior by real estate brokers may be unfounded.

Arnold (1992) models the search process and investigates three possible real estate broker payment structures: fixed-percentage commission, flat fee, and net listing. Of the three, only fixed-percentage commission results in the first-best solution to the incentive problem. Numerical analysis of the model supports the Crockett (1982) results predicting overproduction of broker search effort, rather than the Schroeter (1987) ''value-of-service'' argument. These theoretical arguments for the existence of fixed-percentage commissions in real estate brokerage received substantial empirical support from Goolsby and Childs (1988), whose results show that the use of a fixed-percentage commission structure does not necessarily lead to the non-competitive pricing feared by many outside observers and predicted by some early models.

The early literature analyzing brokerage contract and commission structure impacts is summarized in three comprehensive literature reviews: Megbolugbe, Marks, and Schwartz (1991), Yavas (1994), and Benjamin, Jud, and Sirmans (2000a, 2000b). Too many works have appeared since the publication of the latest review on this topic to allow for an in-depth discussion of each. Three of the more common topics are buyer brokerage (e.g., Zietz and Newsome, 2002), pricing strategies (e.g., Benjamin and Chinloy, 2000), and dual agency (e.g., Evans and Kolbe, 2005). In addition, Munneke and Yavas (2001) consider price and marketing time impacts of commission splits at the brokerage level. Many of the brokerage contract and commission structure topics explored in a residential context are beginning to be examined in a commercial brokerage setting, as seen in Hardin, Johnson, and Wu (2009).

The work most closely related to the current study is Wiley, Zumpano, and Benefield (2011). In that study, the authors develop a model of the seller's choice to utilize a limited service contract, and then empirically test the model's implications. They find that sellers with more available effort to devote to selling their own property and sellers of older homes are more likely to choose limited service. They also find that an increase in housing demand increases the probability that sellers utilize limited service contracts, as increased housing

demand will tend to increase prices and decrease marketing times in the short run. This would, in turn, increase the total dollar cost of traditional brokerage services and decrease the cost of seller effort to sell the home, both of which would make limited service listings more attractive. In their empirical section, Wiley, Zumpano, and Benefield report that limited service properties sell for more and sell faster than traditionally marketed properties. They attribute the price finding to mispricing in the market for full-service brokerage due to price appreciation and the time-on-market impact, at least in part, to the sample time period.

The current study differs from Wiley, Zumpano, and Benefield (2011) in that the market effects are investigated more thoroughly, using a clustered standard error model, a matched sample model, and a Weibull model for marketing time. The current study also takes the empirical investigation a step further, with the analysis of differential impacts on high-and low-priced homes and the separate analysis of time periods before and after the latest market peak. The current study also introduces a control for selection bias due to failure to be included in the final sample. Given the number of observations with incomplete information that are routinely discarded in studies using MLS data, some control for a potential record completion bias seems necessary.

Data and Methodology

Data

Variable names and definitions are provided in Exhibit 1. To conserve space, the variable names are often used in the sections that follow. To avoid unnecessary repetition, only variables requiring further explanation than is provided by Exhibit 1 are discussed. Also, the 13 high school attendance zones and the 12 time control variables are not detailed in Exhibit 1, since their inclusion offers little, if any, necessary information and they are not detailed in the results due to space limitations.

Employing comparable sold data from Charleston, South Carolina, a medium-sized East Coast metropolitan statistical area (MSA), this work empirically tests the hypothesis that using a limited service real estate broker results in a lower selling price and/or a longer time-on-market than could otherwise have been obtained. The dataset contains information on property-specific characteristics, lot features, geographic controls for location within the MSA, seller attributes, and brokerage/agent attributes. The brokerage attributes include whether the listing is identified as a limited service listing in the agent notes. This unique requirement of the local MLS allows limited service brokerage listings to be identified with certainty, rather than assuming any listing offering less than a ''normal'' commission split to the cooperating agent must be limited service.

Butler (1980) and Bajic (1985) suggest the selection of a reasonably homogeneous sample as a way to avoid excessive variability in the sampled housing stock, which

Exhibit 1 | Variable Legend

Variable	Definition
SP	Contract sales price of the property.
ORIGLP	The original list price of the property.
DOM	Days on market, from listing date to pending contract date.
SF	Total heated square footage of the property.
AGE	Age of the property.
BED2	One if the property has 2 bedrooms, zero otherwise.
BED3	One if the property has 3 bedrooms, zero otherwise.
BED4	One if the property has 4 bedrooms, zero otherwise.
BATH2	One if the property has 2 bathrooms, zero otherwise.
BATH3	One if the property has 3 bathrooms, zero otherwise.
HBATH	One if the property has a half-bathroom, zero otherwise.
NC	One if the property is newly constructed, zero otherwise.
FP	One if the property has a fireplace, zero otherwise.
KITCHEN ISLAND	One if the property has a kitchen island, zero otherwise.
SPECIALTY CEILING	One if the property has a tray, cathedral, or higher-than-average ceiling, zero otherwise.
SUN	One if the property has a sun room, zero otherwise.
STUDY	One if the property has a formal study, zero otherwise.
LIVING ROOM	One if the property has a formal living room, zero otherwise.
SITTING ROOM	One if there is a sitting room in the master suite, zero otherwise.
WALK IN	One if there is a walk-in closet in the master suite, zero otherwise.
MULTI-STORY	One if the property is more than one story, zero otherwise.
BRICK	One if the property has any type of brick siding, zero otherwise.
DR_ST	One if the best available parking is the driveway or street, zero otherwise.
CPORT	One if the best available parking is a carport, zero otherwise.
GAR1	One if the best available parking is a one-car garage, zero otherwise.
GAR≥2	One if the best available parking is a two-or-more-car garage, zero otherwise.
SLAB	One if the property is built on a slab, zero otherwise.
ELEV_BASE	One if the property is elevated or has a basement, zero otherwise.
CRAWL	One if the property has a crawlspace underneath, zero otherwise.
IRRIG	One if the property has an in-ground irrigation system, zero otherwise.
FENCING	One if the property has a privacy fence, zero otherwise.
POOL	One if the property has a pool, zero otherwise.
GOLF	One if the property is located on a golf course, zero otherwise.

Exhibit 1 | (continued)
Variable Legend

Variable	Definition
CUL-DE-SAC	One if the property is located on a cul-de-sac, zero otherwise.
FOREST	One if the property is located on a lot bordering a wooded area, zero otherwise.
WATER	One if the property is located on the water or has a water view, zero otherwise.
DOCK	One if the property has an existing dock or a dock permit in place, zero otherwise.
C and R	One if the neighborhood in which the property is located has covenants and restrictions, zero otherwise.
HOA	One if the neighborhood in which the property is located has a Homeowners' Association, zero otherwise.
LON	Longitudinal coordinate of the midpoint of the ZIP Code containing the home.
LAT	Latitudinal coordinate of the midpoint of the ZIP Code containing the home.
AGENT-OWNED	One if the property is owned by a licensed real estate agent, zero otherwise.
VACANT	One if the property is noted as being vacant, zero otherwise.
BONUS	One if the seller offers a bonus of some type to the selling agent, zero otherwise.
MOTIVATED	One if there is wording to indicate a motivated seller in the Agent Notes, zero otherwise.
REDUCED	One if there was a price reduction during the marketing period, zero otherwise.
DOP	The Anglin, Rutherford and Springer (2003) degree of overpricing measure.
ATYP	The Haurin (1988) atypicality measure.
NOMKT	The Johnson, Springer, and Brockman (2005) non-traditionally marketed measure.
MONTHLY SALES	The number of sales that took place in the same month as the property.
SAMPLE	One if an original sample property is included in the final sample, zero otherwise.
IMR-SAMPLE	Inverse Mills' Ratio controlling for whether the property is included in the final sample.
IMR-LIM_SERVICE	Inverse Mills' Ratio controlling for whether the property is a *limited service* listing.
LIM_SERVICE	One if the property is marked as limited service, zero otherwise.

could lead to erroneous coefficient and significance estimations in the price and time-on-market models. Thus, the data search includes only properties outside the city center. In addition, the search is limited to properties with 2-to-4 bedrooms, 2 or 3 full baths, and 1,000 to 4,000 square feet of heated space. By eliminating housing irregularities such as single bathrooms or extraordinarily large homes during the initial search, this work seeks to avoid highly influential and high leverage observations, allowing the hedonic price models and the time-on-market models to more correctly assign variability.

The necessary data are readily available from the MLS. A total of 15,038 observations on sold properties were collected from September 1, 2005 through August 31, 2007. Of the total observations, 6,210 include either a necessary field that is incomplete or an obviously erroneous entry. Thus, the final sample contains information on 8,828 properties.

While comparing MLS-reported days on market (DOM) figures to the listing dates, pending contract dates, and closing dates reported, a potentially important incongruity was noticed. Some real estate brokerage firms report DOM as the number of days from listing date to pending contract date, while other firms report the number of days from listing to closing date. To prevent estimation errors caused by conflicting calculations of this variable, DOM is recalculated for each sample property as the difference between listing date and pending contract date. *WATER* is an indicator variable that incorporates information from 14 water-related categories. It takes the value 1 if the listing describes the property, in general, as either on the water or having a water view. Finer delineations of the components of *WATER* have been used by other authors, such as Poor, Boyle, Taylor, and Bouchard (2001). However, subjective classifications within the MLS, combined with the number of possible classifications and the sample size, preclude the breakdown of this variable into meaningful subcategories.

MOTIVATE is an indicator variable that takes the value 1 if there is wording in the agent notes, which are viewable only to MLS members, or in the comments, which are viewable to Internet searchers of the MLS, that reveals a highly motivated seller. Phrases that might signal an increased motivation level would include variations of: motivated seller, bring all offers, seller relocated, or foreclosure proceedings started. This is very much in the spirit of related measures used by Dotzour and Levi (1992), Forgey, Rutherford, and VanBuskirk (1994), and Springer (1996). *VACANT* takes the value 1 if the property is identified as being vacant, which is identified as an important control in Herrin, Knight, and Sirmans (2004), among others. *REDUCED* takes the value 1 if the property experienced a price reduction at any point during the marketing period. This measure is very similar to the measure investigated in Knight (2002).

BONUS, a variable originally identified in Johnson, Anderson, and Benefield (2004), takes the value 1 if there is a bonus offered to the agent that presents an acceptable contract. Bonuses may take the form of an additional cash payment at

closing, a gift card to a local merchant, or use of a vacation property. The *NOMKT* variable, which takes the value 1 if the property sold within three days of appearing in the MLS, controls for properties that were actually sold before the listing was entered. While this definition of *NOMKT* may erroneously categorize a small number of properties that legitimately sold in only one-to-three days, controlling for so-called ''hip-pocket'' listings is important enough in modeling marketing time to allow a relatively small mis-categorization rate. The *NOMKT* variable is very similar to the measure used in Sirmans, Turnbull, and Dombrow (1995).

The variable of interest, *LIM_SERVICE*, takes the value of 1 if the property is listed as a limited service offering. As mentioned earlier, the MLS providing the data requires that limited service listings be identified as such by the words ''limited service'' or a close variant in the agent notes, avoiding a scenario in which limited service brokers are identified as all brokers offering less than the prevailing commission split for the area. Summary statistics for the full sample are provided in Panel A of Exhibit 2.

Methodology

Before estimating any price or time-on-market models, possible selection bias in the data must be addressed. There are two potential sources of selection bias: bias due to failure to be included in the final sample and bias related to a property being marketed as a limited service offering. An Inverse Mills' Ratio (IMR) is computed for each possible source of selection bias. Thus, *IMR-SAMPLE* controls for *SOLD* properties that did not enter the final sample, and *IMR-LIM_SERVICE* controls for possible selection bias associated with those properties that are marketed as limited service listings.

The first step in computing the IMR is estimating the probability of the outcome in question. For example, the estimate of the probability that the ith *SOLD* property will be included in the final sample is obtained using the following binary logistic regression model:

$$P(SAMPLE_i) = \frac{\exp\left(\beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j\right)}{1 + \exp\left(\beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j\right)}. \qquad (1)$$

Similarly, the estimate of the probability that the ith *SOLD* property is a limited service property is obtained from the following binary logistic regression:

Exhibit 2 | Summary Statistics

Panel A: Full Sample

Variable	Full Sample	Full Service Contracts	Limited Service Contracts	< Median	> Median	Through Peak	After Peak
SP	237,155 (87,785)	236,724 (87,682)	273,233 (89,233)	168,394 (26,897)	304,065 (73,640)	237,632 (88,815)	237,364 (86,544)
ORIGLP	245,472 (94,137)	245,055 (94,097)	280,364 (91,332)	173,131 (29,775)	315,865 (81,085)	245,411 (95,518)	247,539 (93,349)
DOM	60.0 (63.6)	60.2 (63.8)	43.8 (46.7)	54.7 (58.1)	65.2 (68.2)	60.6 (66.8)	63.6 (63.5)
SF	1,869.8 (486.6)	1,868.5 (486.1)	1,978.4 (515.8)	1,592.8 (318.9)	2,139.3 (469.9)	1,880.2 (487.2)	1,852.4 (482.8)
AGE	14.259 (13.807)	14.266 (13.840)	13.612 (10.698)	15.415 (13.709)	13.133 (13.811)	14.102 (13.614)	14.644 (14.148)
BED2	0.014 (0.117)	0.014 (0.118)	0.009 (0.093)	0.020 (0.139)	0.008 (0.091)	0.014 (0.116)	0.014 (0.117)
BED3	0.644 (0.479)	0.645 (0.479)	0.629 (0.485)	0.763 (0.425)	0.529 (0.499)	0.642 (0.480)	0.650 (0.477)
BED4	0.342 (0.474)	0.341 (0.474)	0.362 (0.483)	0.218 (0.413)	0.462 (0.499)	0.345 (0.475)	0.336 (0.472)
BATH2	0.907 (0.290)	0.907 (0.290)	0.905 (0.294)	0.969 (0.173)	0.847 (0.360)	0.906 (0.292)	0.909 (0.288)
BATH3	0.093 (0.290)	0.093 (0.290)	0.095 (0.294)	0.031 (0.173)	0.153 (0.360)	0.094 (0.292)	0.091 (0.288)
HBATH	0.429 (0.495)	0.428 (0.495)	0.526 (0.502)	0.285 (0.451)	0.570 (0.495)	0.443 (0.497)	0.411 (0.492)
NC	0.239 (0.426)	0.241 (0.428)	0.035 (0.183)	0.227 (0.419)	0.249 (0.433)	0.258 (0.438)	0.201 (0.401)
FP	0.780 (0.414)	0.779 (0.415)	0.836 (0.372)	0.659 (0.474)	0.898 (0.303)	0.781 (0.413)	0.780 (0.414)
KITCHEN ISLAND	0.102 (0.303)	0.102 (0.303)	0.092 (0.290)	0.050 (0.219)	0.150 (0.357)	0.099 (0.299)	0.108 (0.311)
SPECIALTY CEILING	0.739 (0.439)	0.738 (0.440)	0.807 (0.396)	0.676 (0.468)	0.798 (0.402)	0.732 (0.443)	0.748 (0.434)
SUN	0.080 (0.271)	0.080 (0.272)	0.069 (0.255)	0.052 (0.223)	0.107 (0.309)	0.080 (0.271)	0.079 (0.269)
STUDY	0.081 (0.273)	0.080 (0.272)	0.138 (0.346)	0.040 (0.195)	0.121 (0.326)	0.080 (0.272)	0.081 (0.273)
LIVING ROOM	0.267 (0.442)	0.266 (0.442)	0.319 (0.468)	0.184 (0.388)	0.347 (0.476)	0.271 (0.445)	0.257 (0.437)
SITTING ROOM	0.030 (0.170)	0.029 (0.169)	0.069 (0.255)	0.014 (0.118)	0.045 (0.207)	0.029 (0.167)	0.031 (0.174)
WALK IN	0.630 (0.483)	0.630 (0.483)	0.664 (0.475)	0.567 (0.496)	0.691 (0.462)	0.628 (0.483)	0.633 (0.482)
MULTI-STORY	0.490 (0.500)	0.489 (0.500)	0.578 (0.496)	0.352 (0.478)	0.624 (0.484)	0.505 (0.500)	0.470 (0.499)

Exhibit 2 | (continued)

Summary Statistics

Variable	Full Sample	Full Service Contracts	Limited Service Contracts	< Median	> Median	Through Peak	After Peak
BRICK	0.317 (0.465)	0.317 (0.465)	0.293 (0.457)	0.311 (0.463)	0.322 (0.467)	0.312 (0.463)	0.332 (0.471)
DR_ST	0.071 (0.257)	0.071 (0.257)	0.069 (0.255)	0.096 (0.294)	0.048 (0.213)	0.071 (0.256)	0.074 (0.261)
CPORT	0.019 (0.137)	0.019 (0.137)	0.017 (0.131)	0.021 (0.145)	0.017 (0.128)	0.020 (0.139)	0.017 (0.130)
GAR1	0.220 (0.414)	0.221 (0.415)	0.138 (0.346)	0.334 (0.472)	0.109 (0.312)	0.217 (0.412)	0.225 (0.418)
GAR≥2	0.689 (0.463)	0.688 (0.463)	0.776 (0.419)	0.548 (0.498)	0.826 (0.379)	0.692 (0.462)	0.684 (0.465)
SLAB	0.643 (0.479)	0.643 (0.479)	0.603 (0.491)	0.752 (0.432)	0.536 (0.499)	0.642 (0.479)	0.641 (0.480)
ELEV_BASE	0.011 (0.106)	0.011 (0.105)	0.017 (0.131)	0.002 (0.041)	0.021 (0.142)	0.011 (0.104)	0.012 (0.110)
CRAWL	0.346 (0.476)	0.346 (0.476)	0.379 (0.487)	0.246 (0.431)	0.444 (0.497)	0.347 (0.476)	0.347 (0.476)
IRRIG	0.113 (0.317)	0.114 (0.317)	0.095 (0.294)	0.050 (0.218)	0.175 (0.380)	0.115 (0.319)	0.111 (0.314)
FENCING	0.499 (0.500)	0.497 (0.500)	0.603 (0.491)	0.569 (0.495)	0.431 (0.495)	0.481 (0.500)	0.535 (0.499)
POOL	0.043 (0.203)	0.043 (0.203)	0.035 (0.183)	0.046 (0.210)	0.040 (0.195)	0.043 (0.202)	0.046 (0.209)
GOLF	0.019 (0.136)	0.019 (0.136)	0.017 (0.131)	0.005 (0.073)	0.032 (0.176)	0.022 (0.146)	0.013 (0.113)
CUL-DE-SAC	0.191 (0.393)	0.190 (0.392)	0.293 (0.457)	0.177 (0.382)	0.205 (0.403)	0.186 (0.389)	0.199 (0.399)
FOREST	0.212 (0.409)	0.213 (0.409)	0.172 (0.379)	0.167 (0.373)	0.256 (0.437)	0.207 (0.405)	0.227 (0.419)
WATER	0.152 (0.359)	0.151 (0.358)	0.198 (0.400)	0.074 (0.261)	0.228 (0.420)	0.156 (0.363)	0.151 (0.358)
DOCK	0.009 (0.093)	0.009 (0.093)	0.009 (0.093)	0.001 (0.038)	0.016 (0.125)	0.008 (0.091)	0.010 (0.099)
C and R	0.760 (0.427)	0.759 (0.428)	0.814 (0.391)	0.674 (0.469)	0.843 (0.363)	0.767 (0.423)	0.744 (0.436)
HOA	0.719 (0.449)	0.719 (0.450)	0.776 (0.419)	0.622 (0.485)	0.814 (0.389)	0.727 (0.446)	0.708 (0.455)
LON	80.076 (0.134)	80.076 (0.134)	80.022 (0.134)	80.119 (0.102)	80.034 (0.147)	80.076 (0.134)	80.075 (0.133)
LAT	32.912 (0.104)	32.912 (0.104)	32.882 (0.101)	32.961 (0.081)	32.864 (0.101)	32.912 (0.103)	32.912 (0.104)
AGENT-OWNED	0.052 (0.221)	0.052 (0.222)	0.009 (0.093)	0.043 (0.204)	0.059 (0.237)	0.054 (0.227)	0.049 (0.217)

Exhibit 2 | (continued)

Summary Statistics

Variable	Full Sample	Full Service Contracts	Limited Service Contracts	< Median	> Median	Through Peak	After Peak
VACANT	0.069 (0.253)	0.069 (0.254)	0.026 (0.159)	0.066 (0.248)	0.072 (0.258)	0.067 (0.250)	0.074 (0.262)
BONUS	0.045 (0.207)	0.045 (0.207)	0.043 (0.204)	0.044 (0.205)	0.046 (0.209)	0.038 (0.191)	0.060 (0.237)
MOTIVATED	0.134 (0.340)	0.134 (0.341)	0.086 (0.282)	0.132 (0.338)	0.135 (0.342)	0.124 (0.330)	0.157 (0.364)
REDUCED	0.324 (0.468)	0.325 (0.468)	0.259 (0.440)	0.290 (0.454)	0.357 (0.479)	0.308 (0.462)	0.378 (0.485)
DOP	−0.468 (0.203)	−0.469 (0.203)	−0.399 (0.209)	−0.574 (0.153)	−0.364 (0.192)	−0.470 (0.201)	−0.459 (0.205)
ATYP	0.016 (0.161)	0.016 (0.162)	0.049 (0.119)	−0.030 (0.118)	0.061 (0.183)	0.018 (0.165)	0.013 (0.158)
NOMKT	0.106 (0.308)	0.106 (0.308)	0.112 (0.317)	0.104 (0.305)	0.109 (0.311)	0.107 (0.310)	0.100 (0.299)
MONTHLY SALES	568.42 (569.00)	568.2 (129.9)	587.2 (114.2)	568.26 (575.00)	568.58 (569.00)	603.70 (622.00)	512.70 (520.00)
IMR-SAMPLE	0.335 (0.079)	0.336 (0.079)	0.302 (0.026)	0.344 (0.087)	0.327 (0.068)	0.339 (0.081)	0.331 (0.076)
IMR-LIM_SERVICE	0.791 (0.008)	0.791 (0.008)	0.783 (0.013)	0.793 (0.004)	0.788 (0.009)	0.791 (0.007)	0.790 (0.008)
LIM_SERVICE	0.012 (0.108)	0.000 (0.000)	1.000 (0.000)	0.007 (0.086)	0.016 (0.126)	0.013 (0.115)	0.010 (0.100)

Panel B: Matched Sample

	Limited Service Properties				Matched Sample Properties			
	Mean	Std. Dev.	Max	Min	Mean	Std. Dev.	Max	Min
SP	273,233	89,233	495,000	135,000	248,209	85,607	496,000	70,000
DOM	43.8	46.7	198	1	67.3	57.7	287	1
SF	1,978.4	515.8	3,592	1,100	1,973.8	474.9	3,130	1,108
AGE	13.612	10.698	63	1	11.595	10.406	48	1
Difference in Sale Date	14.88	9.70	37	0				

Note: The matched sample is formed based on high school attendance zone, date of sale, property age, square footage, number of bedrooms and bathrooms, and presence of a half-bath. Local real estate professionals report that these are the parameters most often used in initial screening of properties.

$$P(LIM\_SERVICE_i) = \frac{\exp\left(\beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j\right)}{1 + \exp\left(\beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j\right)}, \quad (2)$$

where X_i is a matrix of property-specific characteristics, including structural features, quality signals, lot attributes, and location controls. Z_j is a matrix used to control for other characteristics found to influence the probability that a particular *SOLD* property is included in the final sample or is a limited service property, respectively, for Equations (1) and (2). Components of the X- and Z-matrices differ for Equations (1) and (2); Exhibit 3 provides the list of variables for each regression. Once the event probabilities have been estimated and recorded, the IMR is a relatively simple calculation. Setting u_i equal to the probability from Equation (1) of a particular *SOLD* property being included in the final sample, then:

$$IMR - SAMPLE_i = \frac{\frac{1}{\sqrt{2\pi}} e^{-0.5u_i^2}}{\int_{-\infty}^{u_i} \frac{1}{\sqrt{2\pi}} e^{-0.5u_i^2} du_i}. \quad (3)$$

IMR-LIM_SERVICE is computed in a similar manner.

Hedonic pricing models have been ubiquitous in the real estate literature for many years, and hazard modeling of time-on-market has more recently become the standard property duration methodology. A brief examination of recent works utilizing hedonic modeling reveals that the most common and appropriate general specification for property price estimation is:

$$\ln(SP) = \beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j + \beta_k LnDOM_k + \beta_l LIM\_SERVICE + \varepsilon, \quad (4)$$

where X_i is again a matrix of property-specific characteristics. Z_j is a matrix used to control for other determinants of price identified in prior works, such as the Rutherford, Springer, and Yavas (2005) premium for agents selling properties that they own. Exhibits 4–7 detail the complete contents of the X- and Z-matrices used

Exhibit 3 | Binary Logistic Regressions to Compute Inverse Mills' Ratios

Dependent Variable is *SAMPLE*	
Constant	−11.149***
LnORIGLP	1.153***
BED2	0.650**
BED4	−0.337***
NC	−2.374***
KITCHEN ISLAND	−0.229**
SPECIALTY CEILING	0.167**
SUN	0.668***
STUDY	0.389***
LIVING ROOM	−0.230***
SITTING ROOM	0.821***
WALK IN	0.297***
BRICK	0.416***
CPORT	−1.273**
GAR1	−0.491*
GAR≥2	−0.428*
ELEV_BASE	−0.058
CRAWL	0.524***
IRRIG	−0.247**
FENCING	0.326***
CUL-DE-SAC	0.996***
FOREST	0.762***
C and R	−0.638***
HOA	−0.412**
AGENT-OWNED	2.506***
VACANT	1.719***
MOTIVATED	2.069***
REDUCED	0.276***
NOMKT	−0.267***

Dependent Variable is *LIM_SERVICE*	
Constant	222.860***
LnSF	0.732*
LnAGE	−0.284**
NC	−3.129***
STUDY	0.590**
SITTING ROOM	0.712*
CUL-DE-SAC	0.492**
FOREST	−0.411*
LON	−2.272***
LAT	−1.537
AGENT-OWNED	−2.098**
VACANT	−1.203**
MOTIVATED	−0.709**
MONTHLY SALES	0.001

Note: LnORIGLP, *LnSF*, and *LnAGE* represent the natural logs of the variables *ORIGLP*, *SF*, and *AGE*, respectively. Those three variables are defined in Exhibit 1, as are the remainder of the variables reported in the models. The model for whether an observation is included in the final sample contains time controls, but these are not reported due to space considerations. For *SAMPLE*, $N = 10{,}919$ and the log-likelihood is −3,199.6. For *LIM_SERVICE*, $N = 13{,}157$ and log-likelihood is −636.4. The signs are all positive and highly significant, with the exception of the fall of 2006, just after the market peak, which is insignificant.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 4 | Standard Price and Time-on-Market Models

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	Hedonic	2SLS		Weibull	2SLS
Constant	9.492***	9.492***	Constant	5.249***	19.307***
LnDOM	−0.000	−0.000	*LnSP*	−0.552***	−2.394***
LnSF	0.670***	0.661***	*LnSF*	0.506***	2.236***
LnAGE	−0.048***	−0.048***	*LnAGE*	−0.050***	−0.215***
BED2	0.084***	0.084***	*BED2*	0.117*	0.314***
BED4	−0.023***	−0.023***	*BED4*	−0.022	−0.030
BATH3	0.070***	0.070***	*MULTI-STORY*	0.014	0.024
HBATH	0.027***	0.027***	*NC*	−0.038	0.005
FP	0.026***	0.026***	*ELEV_BASE*	0.189***	0.588***
NC	0.056***	0.056***	*CRAWL*	0.054***	0.236***
MULTI-STORY	−0.018**	−0.018***	*CUL-DE-SAC*	−0.042**	−0.101***
BRICK	0.019***	0.019***	*MOTIVATED*	0.078***	0.238***
ELEV_BASE	0.128***	0.128***	*VACANT*	0.071**	0.307***
CRAWL	0.070***	0.073***	*BONUS*	0.080**	0.213***
CPORT	0.073***	0.084***	*NOMKT*	−2.517***	−3.561***
GAR1	0.065***	0.065***	*ATYP*	0.537***	2.591***
GAR≥2	0.095***	0.095***	*DOP*	0.041	0.002***
IRRIG	0.096***	0.096***	*MONTHLY SALES*	−0.000***	−0.001***
POOL	0.016**	0.016**	*IMR-SAMPLE*	−0.508***	−0.298
GOLF	0.107***	0.107***	*IMR-LIM_SERVICE*	−0.457	−1.373
FOREST	0.017***	0.017***	*LIM_SERVICE*	−0.124*	−0.200**
WATER	0.031***	0.031***			
DOCK	0.118***	0.118***			
AGENT-OWNED	0.033***	0.033***			
MONTHLY SALES	0.000***	0.000***			
IMR-SAMPLE	−0.334***	−0.334***			
IMR-LIM_SERVICE	−2.348***	−2.348***			
LIM_SERVICE	0.038***	0.038***			
F	919.2***	919.2***	F		347.2***
R^2	84.0%	84.0%	R^2		55.8%
Adj. R^2	83.9%	83.9%	Adj. R^2		55.7%

Exhibit 4 | (continued)
Standard Price and Time-on-Market Models

Note: LnSP, LnDOM, LnSF, and *LnAGE* represent the natural logs of the variables *SP, DOM, SF,* and *AGE,* respectively. Those four variables are defined in Exhibit 1, as are the remainder of the variables reported in the models. Time and location controls are included in the pricing models, but are not reported due to space considerations; these control variables all behave as expected. Location controls are included in the time-on-market model, but not reported due to space considerations. Location controls are all negative and significant in the 2SLS model of marketing time, except for School Zone 1, which is insignificant. Location controls do not behave as consistently in the Weibull model, which is not unexpected given the nature of hazard models. The first-stage estimate of price, which is used in the second-stage estimate of time-on-market, contains the same predictors detailed in the hedonic model above, except *LnDOM*. The reverse is true of the first-stage estimate of marketing time. Variable of interest is *LIM_SERVICE*. $N = 8{,}828$. For the TOM hazard model, the log-likelihood is $-16{,}830.2$ and α is 1.544.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

to estimate Equation (4). *DOM* is used in Equation (4) to control for variation in sales price related to marketing time. Finally, the variable of interest, *LIM_SERVICE*, controls for properties marketed via limited service contracts.

Regarding the time-on-market model, the Weibull hazard model is favored over ordinary least squares (OLS) estimation, since the increased adaptability and flexibility of the Weibull has fairly thoroughly displaced OLS estimation of marketing time. This function takes the form:

$$\lambda(t, X) = \gamma\alpha t^{\alpha-1}, \tag{5}$$

where α represents the shape parameter; γ represents the operational specification of the model; and t represents a time variable. If the shape, or duration dependence, parameter is greater than one, then the model exhibits positive duration dependence. In this case, the probability that a property sells is increasing across time. In contrast, if the duration dependence parameter is less than one, then the model exhibits negative duration dependence, and the probability that a property sells is decreasing over time. In the special case where the duration dependence parameter equals one, then the Weibull hazard function conveniently reduces to the exponential hazard function, and the probability that a property sells is constant through time.

A quick review of recent studies modeling time-on-market reveals the following as a fairly standard general specification for estimating marketing duration:

Exhibit 5 | Firm-Clustered Standard Error and Matched Sample Price and Time-on-Market Models

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	Cluster	Matched		Cluster	Matched
Constant	9.777***	5.327***	Constant	5.252***	2.810
LnDOM	−0.000	0.017*	*LnSP*	−0.552***	0.266
LnSF	0.658***	0.944***	*LnSF*	0.506***	−0.322
LnAGE	−0.048***	−0.021	*LnAGE*	−0.050***	0.043
BED2	0.070***	0.532***	*BED2*	0.117	−0.220
BED4	−0.023***	−0.046*	*BED4*	−0.022	0.202*
BATH3	0.073***	0.086*	*MULTI-STORY*	0.014	0.051
HBATH	0.030***	0.038	*NC*	−0.038	0.324
FP	0.025***	0.032	*ELEV_BASE*	0.189***	−0.852*
NC	0.063***	−0.223***	*CRAWL*	0.054***	−0.237**
MULTI-STORY	−0.023***	−0.101***	*CUL-DE-SAC*	−0.042***	−0.180*
BRICK	0.016**	0.041	*MOTIVATED*	0.078***	−0.031
ELEV_BASE	0.124***	0.107	*VACANT*	0.071***	−0.079
CRAWL	0.077***	−0.002	*BONUS*	0.080***	0.062
CPORT	0.082***	0.075	*NOMKT*	−2.517***	−3.691***
GAR1	0.068***	0.229***	*ATYP*	0.537***	−0.402
GAR≥2	0.094***	0.173***	*DOP*	0.041	0.703*

Exhibit 5 | (continued)

Firm-Clustered Standard Error and Matched Sample Price and Time-on-Market Models

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	Cluster	Matched		Cluster	Matched
IRRIG	0.094***	−0.011	*MONTHLY SALES*	−0.000	−0.000
POOL	0.016	0.040	*IMR-SAMPLE*	−0.509***	−6.409**
GOLF	0.107***	0.150**	*IMR-LIM_SERVICE*	−0.456	N/A
FOREST	0.016**	0.009	*LIM_SERVICE*	−0.124***	−0.198**
WATER	0.031***	−0.048			
DOCK	0.121***	0.065			
AGENT-OWNED	0.033***	0.148**			
MONTHLY SALES	0.000***	−0.000			
IMR-SAMPLE	−0.369***	0.484			
IMR-LIM_SERVICE	−2.568***	N/A			
LIM_SERVICE	0.038***	0.126***			
F	969.3	26.4***	α	1.544	1.730
R^2	84.0%	87.3%	Wald χ^2	2,488.3	
Adj. R^2		84.0%	Log-pseudolikelihood	−11,653.4	
			Log-likelihood		−379.5
N	8,828	214	*N*	8,828	214

Exhibit 5 | (continued)

Firm-Clustered Standard Error and Matched Sample Price and Time-on-Market Models

Note: LnSP, *LnDOM*, *LnSF*, and *LnAGE* represent the natural logs of the variables *SP*, *DOM*, *SF*, and *AGE*, respectively. Those four variables are defined in Exhibit 1, as are the remainder of the variables reported in the models. Again, the matched sample is formed based on high school attendance zone, date of sale, property age, square footage, number of bedrooms and bathrooms, and presence of a half-bath. Time and location controls are included in the pricing models, but are not reported due to space considerations. Both sets of controls behave as expected in the firm-clustered standard errors model. Location controls are negative and highly significant for all available school zones except School Zone 6 in the matched sample pricing model, while time controls are generally insignificant in the matching price model, as expected. Location controls are included in the time-on-market models, but not reported due to space considerations. They are all negative and significant in the firm-clustered standard errors model of time-on-market, except for School Zones 1 and 8, which are insignificant. Location controls are generally insignificant in the matched sample marketing time model, which is to be expected. Variable of interest is *LIM_SERVICE*.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 6 | Price and Time-on-Market Models for Above- and Below-Median Limited Service Sale Price

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	< Median	> Median		< Median	> Median
Constant	11.940***	10.681***	Constant	6.148**	6.766***
LnDOM	0.002**	−0.006***	*LnSP*	−0.465***	−0.836***
LnSF	0.530***	0.451***	*LnSF*	0.362***	0.644***
LnAGE	−0.042***	−0.014***	*LnAGE*	−0.047***	−0.054***
BED2	0.043**	0.109***	*BED2*	0.153**	−0.054
BED4	−0.011**	−0.007	*BED4*	−0.014	−0.035
BATH3	0.035***	0.048***	*MULTI-STORY*	0.022	0.004
HBATH	0.017***	0.015**	*NC*	0.006	−0.070
FP	0.015***	0.026**	*ELEV_BASE*	0.061	0.185***
NC	0.052***	0.066***	*CRAWL*	0.066**	0.060**
MULTI-STORY	−0.008	−0.011	*CUL-DE-SAC*	−0.065**	−0.005
BRICK	0.012***	0.012**	*MOTIVATED*	0.107***	0.021
ELEV_BASE	−0.059*	0.183***	*VACANT*	0.087**	0.046
CRAWL	0.013***	0.101***	*BONUS*	0.067	0.090*
CPORT	0.058***	0.062***	*NOMKT*	−2.553***	−2.455***
GAR1	0.093***	−0.036***	*ATYP*	0.561***	0.666***
GAR≥2	0.141***	−0.020*	*DOP*	−0.100	0.363***

Exhibit 6 | (continued)

Price and Time-on-Market Models for Above- and Below-Median Limited Service Sale Price

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	< Median	> Median		< Median	> Median
IRRIG	0.057***	0.075***	*MONTHLY SALES*	−0.000*	−0.000**
POOL	0.001	0.007	*IMR-SAMPLE*	−0.661***	−0.371
GOLF	0.063***	0.048***	*IMR-LIM_SERVICE*	−1.739	1.001
FOREST	0.011***	0.013**	*LIM_SERVICE*	0.028	−0.193**
WATER	0.027***	0.011**			
DOCK	−0.003	0.101***			
AGENT-OWNED	0.041***	0.025**			
MONTHLY SALES	0.000***	0.000			
IMR-SAMPLE	−0.170***	−0.392***			
IMR-LIM_SERVICE	−4.284***	−1.622***			
LIM_SERVICE	0.031**	0.018			
F	317.2***	79.3***			
R^2	73.7%	56.4%	α	1.473	1.708
Adj. R^2	73.5%	55.7%	Log-likelihood	−10,760.0	−6,027.8
N	5,712	3,116	*N*	5,712	3,116

Exhibit 6 | (continued)

Price and Time-on-Market Models for Above- and Below-Median Limited Service Sale Price

Note: LnSP, *LnDOM*, *LnSF*, and *LnAGE* represent the natural logs of the variables *SP*, *DOM*, *SF*, and *AGE*, respectively. Those four variables are defined in Exhibit 1, as are the remainder of the variables reported in the models. Time and location controls are included in the pricing models, but are not reported due to space considerations. Location controls are all negative and highly significant in the pricing models, except School Zone 6 in the below-median price subsample and School Zone 9 in the above-median price subsample. Time controls in the pricing models are negative and significant through the winter of 2005, and insignificant thereafter in the below-median price subsample; exceptions are positive, significant coefficients for the fall of 2006 and the spring of 2007. Time controls in pricing models for the above-median price subsample are negative and significant in the summer and fall of 2005, the winter of 2006, and the spring of 2007, and are insignificant otherwise. Location controls are included in the time-on-market model, but not reported due to space considerations. Half of the location controls are negative and significant in each subsample; the other half are insignificant. This is not surprising, given the reduced sample sizes and small number of observations in some school zones. Variable of interest is *LIM_SERVICE*.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 7 | Price and Time-on-Market Models for Properties Sold Before and After Market Peak

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	Through Peak	After Peak		Through Peak	After Peak
Constant	9.492***	9.677***	Constant	5.804***	6.386***
LnDOM	0.002	−0.003*	*LnSP*	−0.590***	−0.644***
LnSF	0.683***	0.637***	*LnSF*	0.537***	0.571***
LnAGE	−0.057***	−0.046***	*LnAGE*	−0.051***	−0.047***
BED2	0.086***	0.118***	*BED2*	0.156**	0.080
BED4	−0.026***	−0.020***	*BED4*	−0.021	−0.020
BATH3	0.072***	0.064***	*MULTI-STORY*	0.008	0.028
HBATH	0.025***	0.029***	*NC*	0.034	−0.046
FP	0.031***	0.024***	*ELEV_BASE*	0.279***	0.140*
NC	0.053***	0.048***	*CRAWL*	0.033	0.081***
MULTI-STORY	−0.016**	−0.018**	*CUL-DE-SAC*	−0.064***	−0.012
BRICK	0.017***	0.020***	*MOTIVATED*	0.059**	0.062**
ELEV_BASE	0.131***	0.111***	*VACANT*	0.057	0.058
CRAWL	0.076***	0.075***	*BONUS*	0.091**	0.053
CPORT	0.084***	0.085***	*NOMKT*	−2.828***	−2.186***
GAR1	0.061***	0.060***	*ATYP*	0.571***	0.582***
GAR≥2	0.087***	0.092***	*DOP*	−0.000	0.037

Exhibit 7 | (continued)

Price and Time-on-Market Models for Properties Sold Before and After Market Peak

	Pricing Models			TOM Hazard Models	
	Dependent Variable is *LnSP*			Dependent Variable is *LnDOM*	
	Through Peak	After Peak		Through Peak	After Peak
IRRIG	0.099***	0.099***	*MONTHLY SALES*	−0.000	−0.001***
POOL	0.012	0.019*	*IMR-SAMPLE*	−0.894***	−0.350
GOLF	0.094***	0.149***	*IMR-LIM_SERVICE*	−0.789	−0.767
FOREST	0.022***	0.017***	*LIM_SERVICE*	−0.108	−0.096
WATER	0.033***	0.026***			
DOCK	0.136***	0.127***			
AGENT-OWNED	0.036***	0.017			
MONTHLY SALES	0.000***	0.000***			
IMR-SAMPLE	−0.312***	−0.335***			
IMR-LIM_SERVICE	−2.457***	−2.295***			
LIM_SERVICE	0.033**	0.063***			
F	690.8***	474.9***			
R^2	84.1%	83.8%	α	1.469	1.769
Adj. R^2	84.0%	83.7%	Log-likelihood	−11,366.0	−7,659.3
N	6,049	3,983	*N*	6,049	3,983

Exhibit 7 | (continued)

Price and Time-on-Market Models for Properties Sold Before and After Market Peak

Note: LnSP, *LnDOM*, *LnSF*, and *LnAGE* represent the natural logs of the variables *SP*, *DOM*, *SF*, and *AGE*, respectively. Those four variables are defined in Exhibit 1, as are the remainder of the variables reported in the models. Time and location controls are included in the pricing models, but are not reported due to space considerations. Both sets of controls behave as expected in the pricing models using the before- and after-market peak subsamples. Location controls are included in the time-on-market models, but are not reported due to space considerations. Location controls in the marketing time models are negative and significant in the before-market peak subsample for all school zones except School Zone 1, which is insignificant. Location controls in the marketing time models are negative and significant in the after-market peak subsample for all school zones except School Zones 1, 6, and 8, which are insignificant. Variable of interest is *LIM_SERVICE*.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

$$\exp(X\beta) = \beta_0 + \sum_{i=1}^{N} \beta_i X_i + \sum_{j=1}^{N} \beta_j Z_j + \beta_k LnSP_k + \beta_l LIM\_SERVICE + \varepsilon, \quad (6)$$

where X_i and Z_j are as defined above, although neither contains exactly the same data as in Equation (4). For example, Z_j in Equation (6) includes variables to control for, among other things, the atypical property effect (*ATYP*) highlighted by Haurin (1988) and the degree of overpricing effect (*DOP*) from Anglin, Rutherford, and Springer (2003).[2] *SP* is used in Equation (6) to control for variation in time-on-market related to selling price. As before, *LIM_SERVICE* controls for properties marketed using limited service contracts. Exhibits 4–7 provide further details on the components of the X- and Z-matrices used in Equation (6).

The two-stage least squares (2SLS) treatment of these variables is slightly different as it requires specification of a model for the endogenously determined variable in the first stage. In the 2SLS model for property price, where *DOM i*s assumed endogenous, the instruments chosen in the first stage include all the variables utilized in the hazard model above, except *SP*. Similarly, for the 2SLS model of property marketing time, in which *SP* is assumed to be endogenous, the first-stage instruments include the variables for the standard hedonic model described above, except *DOM*. For the second stages of the 2SLS price and time-on-market models, the operational models described in Equations (4) and (6) are specified.

Results

Inverse Mills' Ratio

The Inverse Mills' Ratio (IMR) results control for systematic differences in the chosen variable that may be due to unobserved variables. In the case of *IMR-SAMPLE*, the IMR controls for systematic differences in completion of MLS records, since the only reason a successfully-screened *SOLD* property would be excluded from the final sample is missing or obviously erroneous information. Exhibits 4–7 provide some indication of a systematic component in determining which properties are more likely to have missing data, as *IMR-SAMPLE* is significant at the 1% level in every pricing model except the matched sample. *IMR-SAMPLE* is also significant at the 5% level or better in seven of the ten time-on-market models.

Surveying Exhibit 3, it seems that properties with higher original listing prices are more likely to have complete information provided, while newly constructed properties or ''hip-pocket'' listings are less likely to have full information.

Interestingly, variables one might associate with increased seller motivation, such as *VACANT*, *MOTIVATED*, or *REDUCED*, also significantly increase the probability of an observation having complete information provided. Agents also seem more likely to provide complete information when selling properties they own, as seen from the positive and significant coefficient on *AGENT-OWNED*.

For *IMR-LIM_SERVICE*, the IMR controls for systematic differences between properties marketed as limited service listings and conventionally-marketed properties. Given the lack of seller-specific information in the MLS, it is not surprising that this control is significant at the 1% level in every subsequent pricing model. The unobserved attributes contributing to the differences in pricing do not seem to affect determination of time-on-market to the same degree, as *IMR-LIM_SERVICE* is insignificant in each marketing time model. Obviously, there is no need to include *IMR-LIM_SERVICE* in the matched sample models.

Larger and newer properties, as well as properties with quality characteristics such as a formal study, a sitting room in the master bedroom, or a cul-de-sac lot, seem more likely to be listed as limited service offerings. Perhaps not surprisingly, *AGENT-OWNED* properties and properties with sellers that signal a high motivation level (i.e., *MOTIVATED* and *VACANT*) are less likely to utilize limited service listings. *MONTHLY SALES*, a measure of how many sales happen in the same month as a particular sample property, proxies for how ''hot'' the market is at a current time. As can be seen, market sales levels do not influence the likelihood that a seller chooses a limited service listing. This control for the current state of the market is included in all price and marketing time models as well.

Standard Price and Time-on-Market Models

The results in Exhibit 4 for the hedonic pricing model and the 2SLS model of property price are as expected. Most control variables exhibit the expected relationship to the dependent variable. The significantly positive coefficient for two-bedroom homes and the significantly negative coefficient for four-bedroom homes are surprising, since this price effect is measured relative to three-bedroom homes. *LIM_SERVICE*, the variable of interest, enters both models as positive and significant at the 1% level, which is the opposite of expectations. Limited service properties sell for 3.8% more on average according to both the hedonic pricing model and the 2SLS model of property price.

Turning to the standard time-on-market models in Exhibit 4, most variables again behave as expected across the Weibull hazard model and the 2SLS model of property marketing time. The variables included that might signal greater seller motivation, *MOTIVATED*, *VACANT*, and *BONUS*, enter as positive and significant, implying that these sellers actually take longer to sell their homes. However, this is not a unique finding, as other studies using similar variables have found significantly positive or insignificant results as well (e.g., Knight, 2002; Johnson, Anderson, and Benefield, 2004). The variable of interest, *LIM_SERVICE*, is

negative and significant at the 10% level in the Weibull model and at the 5% level in the 2SLS model. For the Weibull model, limited service properties are estimated to sell 13.2% faster than properties using conventional brokerage services. The estimated reduction in selling time for limited service properties in the 2SLS model is even larger, at 20.0%.

Robustness Tests

Firm-Clustered Standard Error Model. Despite controlling for potential bias due to sample selection or limited service usage in all four traditional price and time-on-market models, the counterintuitive results identified in all four models could be driven by a relatively small number of observations from one or a few firms. To help eliminate this possibility, the model was re-estimated allowing the standard errors to cluster by firm. Overall, the firm-clustered standard error results are very similar to earlier results, including the two-bedroom versus four-bedroom oddity in the pricing model and the significantly positive coefficients for seller motivation-related variables in the time-on-market model. Despite allowing for clustered standard errors, the same result is observed and reported in Exhibit 5. *LIM_SERVICE* is found to significantly increase selling price by an estimated 3.8% on average and reduce selling time by 13.2% on average.

Matched Sample Model. As a more direct test of pricing and time-on-market impacts due to limited service contracting arrangements, a matched sample of conventionally-marketed properties is formed. The matching is accomplished using high school attendance zone, date of sale, property age, total square footage, bedroom and bathroom counts, and presence of a half-bathroom. These criteria are developed based on conversations with area real estate salespeople, who indicated that these were the base statistics most home buyers used to define initial search parameters.

The high school attendance zones match exactly in all cases, as this was deemed the most important single criterion. Date of sale is kept within one month, although four cases have dates of sale that differ by one-to-six days more than one month (i.e., 32-to-37 days total). Square footage is kept within 100 square feet if possible, although a number of properties require concessions on this criterion. Age is kept to within five years when possible, but a number of properties again necessitate wider limits on this variable. Only 10 properties out of 116 differ along the bedroom or bathroom count dimensions. While a very few of the limited service properties are harder to match than others, the summary statistics for limited service and matching properties in Panel B of Exhibit 2 indicate that the matching is quite close overall.

Exhibit 5 shows that fewer control variables enter the models as significant predictors of either price or time-on-market using standard hedonic and hazard modeling, respectively. This is to be expected, given the use of a matched sample. After matching, the remaining significant predictors of price maintain consistent

signs, including the bedroom pricing anomaly. Of note, the pricing impact assigned to limited service usage is still significant at the 1% level and has a substantially larger coefficient of 12.6%. Also of note, *LIM_SERVICE* still reduces a property's marketing time by an estimated 21.9%, which is also significant at the 1% level.

Recall from the summary statistics presented in Exhibit 2 that only slightly more than 1% of the sample properties employ limited service listings. If the findings presented in the standard price and time-on-market models and the robustness check models are correct, namely that limited service properties sell for more and sell more quickly, then why do more sellers not choose limited service brokerage? There are at least two possible explanations. First, during the sample period, there were a relatively small number of firms in the area willing to offer limited service listings. Second, if the argument presented below regarding sellers' confidence and the choice of limited service listings is correct, then primarily those sellers who are most confident of their ability to sell their property would use limited service listing. This number could reasonably be expected to be relatively small.

Differential Impacts in Low- and High-Priced Subsamples

Given the somewhat surprising, but apparently quite robust, finding that limited service properties sell for more and sell more quickly than their conventionally-marketed counterparts, the obvious next step is to explore the reasons for this counterintuitive result. Direct investigation of those reasons is made more difficult due to the lack of data on seller characteristics in the MLS. However, proxies for certain seller characteristics can be constructed using available property and market attributes. First, the sample is split at the median sale price of the limited service sample. Then, the same standard hedonic and hazard models given in Equations (4) and (6), respectively, are employed to uncover any differences in price or time-on-market impacts across lower and higher price ranges.[3] The differences are quite telling.

The pricing models in Exhibit 6 indicate that the impact from using a limited service contract is more pronounced in lower-priced properties. The estimated coefficient for *LIM_SERVICE* in the lower-priced subsample is 3.1% and statistically significant, while the estimated coefficient in the higher-priced subsample is 1.8% and statistically insignificant. Conversely, in the time-on-market models, the estimated coefficient *for LIM_SERVICE* is statistically insignificant for the lower-priced subsample, but indicates a statistically significant 21.3% decrease in marketing time in the higher-priced subsample.

Owners of more expensive homes would presumably have higher incomes and higher opportunity costs of devoting time to selling their homes. Thus, in order to sell the property more quickly, these high opportunity cost owners are willing to accept a price statistically indistinguishable from the price that could be

obtained using conventional residential brokerage arrangements. In this scenario, limited service brokerage offers the added benefit that, by avoiding the selling commission, these seemingly impatient owners do not have to wait for as high an offer to be equally as well off with regard to net proceeds. This potential explanation of the observed differences across price ranges leaves open the question of why high opportunity cost owners would initially choose limited service brokerage.

Limited Service Impacts in Hot and Cold Markets

The sample sizes provided in Exhibit 7 show that many more sample properties sold in the year leading up to the market peak than in the year following the market peak. Assuming that the higher-priced homes referenced above also contain a greater quantity of desirable features, a potential explanation for high opportunity cost owners to initially choose limited service brokerage becomes clear. Simply put, the owners of these homes with greater quantities of desirable features were reasonably sure they could sell the homes without significant effort.[4] If sellers have sufficient and justified confidence in their ability to effect a sale, limited service brokerage becomes more attractive because the nominal level of opportunity cost is decreasing even if opportunity costs relative to similar owners utilizing conventional brokerage are constant.

The results from the pricing models in Exhibit 7 indicate that limited service properties sold for more than conventionally-marketed properties, on average, both before and after the market peak in the summer of 2006. The price impact from limited service usage is larger after the market peak (6.3%) than before the peak (3.3%), although both are significant at the 5% level. It may be the case that sellers of homes with greater quantities of desirable features (i.e., more confident sellers) are in a better relative bargaining position after the market slowdown. Alternatively, if market prices are decreasing rapidly enough, it may be the case that the shorter time-on-market for relatively expensive limited service properties is contributing to this result.

The time-on-market models in Exhibit 7 report no difference in marketing times related to the use of limited service brokerage either before or after the market peak. This is a rare occurrence of a good ‘‘no result.’’ Given the seller confidence argument put forth above, it is easy to envision a scenario in which the overall time-on-market results are being driven by a relatively small number of quick sales in the hottest part of the market. This does not appear to be the case. Instead, since *LIM_SERVICE* is insignificant both before and after the market peak, it would seem that limiting the sample to a sufficiently short timeframe reduces the variability in *DOM* to the point that the *LIM_SERVICE* effect disappears.

Conclusion

As limited service brokerage arrangements become increasingly common, questions about their price and time-on-market impacts will also become more

urgent for both sellers of real property and brokers engaged to sell real property. In addition, given the number of states that have passed, or are considering, minimum service legislation, which mandates a lower limit on the number and level of services that can be offered, rigorous inquiry into limited service brokerage is necessary. Using a sample of 15,038 sold properties from a medium-sized East Coast MSA collected from September 1, 2005 through August 31, 2007, this study provides an early step towards a better understanding of limited service brokerage arrangements.

Contrary to expectations, full sample results indicate that properties using a limited service listing arrangement sell for significantly more, and sell significantly faster, than those marketed using more traditional brokerage arrangements. These initial results include controls for possible bias due to choice of limited service brokerage and due to sample inclusion, which is a new addition to the real estate literature. The increased price and shorter marketing time are robust to the use of a firm-clustered standard error model and a matched sample.

To further explore this unexpected relationship, the sample is divided according to price and date of sale. The findings in the price subsamples indicate that more expensive homes listed via limited service arrangements sell more quickly than otherwise similar expensive homes, while less expensive homes using limited service contracts do not sell more quickly than otherwise similar less expensive homes. Results for the price subsamples further indicate that less expensive limited service properties experience a positive price impact versus other less expensive properties; this result is not present for more expensive limited service properties. When combined, it would seem that owners of more expensive homes, who would presumably have higher incomes and higher opportunity costs of selling, are willing to accept a price identical to that obtained through traditional brokerage in order to sell the property more quickly and avoid incurring additional opportunity costs. The reduced brokerage fees for limited service usage mean that these high opportunity sellers can accept the same price as another seller using traditional brokerage and still be at least as well off financially.

The results in the subsamples formed by date of sale reveal that limited service properties sold for a higher price than otherwise similar homes under traditional brokerage arrangements both before and after the market peak in the summer of 2006. No time on market effect is apparent during either the hot market leading up to the summer of 2006, or in the decidedly cooler market afterwards. Since a control for the number of homes sold in the same month as the subject is included in all models, the limited service impact cannot be attributed simply to selling at a particularly ‘‘hot’’ time during the sample period.

In short, despite anecdotal evidence that limited service brokerage leads to lower prices and extended marketing times, results of this study indicate exactly the opposite: higher prices and shorter marketing times for limited service contracts. These price and time-on-market impacts are influenced by the value of the property and the state of the local market. It should also be noted that the

data are drawn from a very unique time period—the two years immediately surrounding a real estate market peak. It could very well be the case that the overall market conditions prevailing during that time exerted some influence on the reported results. Thus, future studies should be undertaken in which the sample period does not include a market peak.

Endnotes

[1] Limited service brokers should not be confused with discount brokers, who offer full-service brokerage at a lower commission than the prevailing rate for a given geographic area.

[2] Calculation of both *ATYP* and *DOP* first requires that hedonically suggested prices be obtained for each sample property. Since results from this model are not reported elsewhere, the full model used to obtain the necessary hedonically suggested prices for use in the *ATYP* and *DOP* calculations is $LnORIGLP = \beta_0 + \beta_1 LnSF + \beta_2 LnAGE + \beta_3 BED2 + \beta_4 BED4 + \beta_5 BATH3 + \beta_6 HBATH + \beta_7 FP + \beta_8 NC + \beta_9 MULTI\text{-}STORY + \beta_{10} BRICK + \beta_{11} ELEV\_BASE + \beta_{12} CRAWL + \beta_{13} CPORT + \beta_{14} GAR1 + \beta_{15} GAR{\geq}2 + \beta_{16} IRRIG + \beta_{17} POOL + \beta_{18} GOLF + \beta_{19} FOREST + \beta_{20} WATER + \beta_{21} DOCK + \Sigma_{i=22}^{33} \beta_i SCHOOL + \Sigma_{j=34}^{44} \beta_j QUARTER + \beta_{45} AGENT\text{-}OWNED + \varepsilon$.

[3] More price range categories were considered, but the data are insufficient to allow finer delineations.

[4] As pointed out by an anonymous reviewer, the argument that homes with a greater number of desirable features should be easier to sell hints at some portion of the limited service brokerage premium being more closely related to the Forgey, Rutherford, and Springer (1996) liquidity premium. Two facts would seem to counter this concern. First, recall that the Forgey, Rutherford, and Springer results support the use of expected marketing time as a proxy for atypicality; that is, increased atypicality is closely associated with an extended marketing time. In this sample, a relatively large proportion of sample limited service listings are highly atypical and should, therefore, have small liquidity premia. Second, the results are actually somewhat stronger in the matched sample analysis, which should all but eliminate the effect of any liquidity premium.

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