The Impact of Contract Type on Broker Performance: Submarket Effects

Authors

Ronald C. Rutherford, Thomas M. Springer and Abdullah Yavas

Abstract

Rutherford, Springer and Yavas (2001) develop and empirically test a model that analyzes the effect the type of listing contract, either exclusive agency (EA) or exclusive right to sell (ERTS), has on the performance of the agent/broker. This paper extends the work of Rutherford et al. and looks at differences between housing submarkets delineated by price. The results show a selling price discount associated with both broker-effected and owner-effected sales for lower-priced houses with EA contracts. For higher-priced houses, there is no price advantage to an EA-listing if the broker achieves the sale, but if the owner sells the house, there is a modest price premium associated with the sale. The primary implication of the results is that owners of lower-priced houses should be wary of alternative listing arrangements, namely EA contracts.

Introduction

In the interests of house sellers, the performance of real estate brokers is typically assessed by two inter-related measures: time-on-the-market (TOM) and selling price. Relatively speaking, the best performing brokers will sell properties faster and/or at higher prices. Economic search theory establishes the trade-off between price and TOM. Sellers get their best prices by being patient, thus incurring a longer TOM. Conversely, houses that sell faster typically sell at a discount.

There is an extensive literature on the role of brokerage in the residential real estate market (see Benjamin, Jud and Sirmans, 2000; and Yavas, 1992a; for summaries). Many studies have focused on the effort levels of the broker. Broker participation partially substitutes for the effort levels and expended resources of both buyers and sellers (Yavas, 1992b). Geltner, Kluger and Miller (1991) examine broker effort and find that broker effort is less than optimal at the beginning of a listing contract and that the finite duration of listing contracts motivates broker effort. There is also evidence that brokers get better prices, but that the increase in price does not cover the typical commission (Jud and Frew, 1986).

When a property owner decides to use the services of a real estate broker to sell the property, the listing contract formalizes the agency relationship with the broker.

The exclusive-right-to-sell (ERTS) listing is the most common listing arrangement. With this listing, the agent/broker receives a commission if the house sells or if a signed purchase-and-sale agreement is obtained prior to the expiration of the listing contract. This listing is popular with Multiple Listing Services (MLSs) because it offers the strongest guarantee of a commission. Other listing arrangements allow the seller to avoid a commission if the seller is responsible for achieving the sale. One such arrangement is the exclusive-agency (EA) listing. In this contract, the seller reserves the right to sell the property without the use of a broker and not pay a commission. However, similar to the ERTS listing, the listing broker (the exclusive agent) receives the commission if any real estate broker achieves the sale prior to contract expiration. Then, the commission, under MLS guidelines, is split among cooperating brokers.

Regardless of the type of marketing arrangement, as Anglin and Arnott (1991: 112–113) note, the seller bears all of the price risk. Thus, the performance of different marketing approaches is of primary interest to the seller of the property. Geltner, Kluger and Miller (1991) note a potential and serious conflict of interest that can result near the end of the listing contract. They also conclude that seller self-education regarding property value can mitigate this conflict. The authors further acknowledge that sellers may not be accustomed to the pressure of negotiation and may be prone to accepting first offers that may be suboptimal.

Given that the broker does not earn compensation with a FSBO (for sale by owner) arrangement and the lower probability of earning a commission with an EA listing, the ERTS arrangement is clearly the listing broker's preference. However, even though the ERTS listing is preferred, the listing broker will engage in EA contracts because the broker can list the property, expend minimal effort and still have a nonzero probability of earning a commission. Given an EA listing, the listing broker is motivated to select properties or contractual conditions that minimize the probability of the owner selling the property without the broker's assistance, leading to no compensation for the broker. Generally, these conditions are likely to occur in thin markets or with atypical properties where the seller faces a decreased likelihood of locating a buyer and the broker's services are more highly valued. These conditions are also present when the listing broker already has contact with a probable buyer through the course of regular business.

Arnold (1999) looks into pricing and its relationship to the outcomes of a real estate sale. He concludes that ''while an increase in seller patience unambiguously increases the seller's expected return, it is possible that a more patient seller may actually have a shorter marketing time than a less patient seller.'' For an EA listing, the seller's lack of negotiating expertise may result in accepting sub-optimal offers to ensure not paying a commission. However, if the seller prices the property appropriately, Arnold offers evidence that shorter marketing times can be achieved without sacrifice of price. Given that the EA contract is a hybrid arrangement between an ERTS listing and a FSBO property, it is possible that the sellers using this arrangement are trying to get the best of both worlds.

Rutherford, Springer and Yavas (2001) develop and empirically test a model that analyzes the effect the type of listing contract has on the performance of the agent/broker. ERTS and EA contracts are compared. The results show that overall, houses sell faster and at marginally lower prices under EA contracts than for ERTS contracts. Also, EA-listed houses are priced lower initially than ERTS-listed houses. Secondary results show differences according to whether the house was new or a resale house and to whether a house was ultimately sold by a broker or the owner. Their results show that EA-listed houses ultimately sold by the owner take longer to sell, but generally sell at a premium to those sold under ERTS contracts.

This paper extends the work of Rutherford, Springer and Yavas (2001) and looks at differences between housing submarkets delineated by price. Arguments are developed around the difference in listing agreements and how the contracts should differently affect the sale of lower- and higher-priced houses. A large data set of MLS transactions allows for empirical investigation. First, to better model parameter instability between housing submarkets segmented by price, Quandt's (1958) switching regimes model is used to determine the most likely break-price to delineate lower- and higher-priced houses. Next, Probit models are estimated to generate self-selection correction variables and to ascertain the influence of certain property and market characteristics on the choice of either an EA or an ERTS listing contract. Finally, simultaneous equations models are estimated, then corrected for self-selection and heteroscedasticity of selling price and TOM for houses under alternative contracts.

The results of the simultaneous equations model show that for TOM, the results are very similar for lower- and higher-priced houses. In both price ranges, EA contracts resulted in faster broker-effected sales with owner-effected sales resulting in longer marketing times. The results further show that lower-priced houses (selling price $<$\$87,500) with EA listings sold at a discount, completely in line with the expected trade-off between price and TOM. The price discount is associated with both broker-effected and owner-effected sales. For higher-priced houses, there was no significant overall price effect accompanying the reduced TOM. For higher-priced houses, the results show no clear advantage to an EA listing if the broker sells the house. However, if the owner sells the house, there is an associated price premium of approximately 1.2%.

The results imply that owners of lower-priced houses should be wary of alternative listing arrangements, namely EA contracts, because there appears to be no relative benefit associated with the higher probability of not being required to pay a commission. However, the results suggest it is advantageous to the owner of a higher-priced house to seek a broker willing to engage in this type of listing arrangement.

A Simple Model

This section provides a simple model to study the relationship between the market price of a property and the relative attractiveness of the two listing contracts. The model is a modified version of the one in Rutherford, Springer and Yavas (2001).

The seller and the respective broker have to search in order to find a buyer. The seller first decides whether to sign an EA contract or an ERTS contract with the broker. Given the seller's contract choice, the seller and the broker then choose their effort levels. Since the seller's choice of the contract type will affect the broker's effort choice, the seller has to conjecture the impact on the broker's effort level before deciding on the contract type.

Assume that the seller takes the price of the property as given (*i.e.*, assume that the price is determined by the supply and demand in the market). This will allow an examination of how the relative attractiveness of the two contract types varies between housing submarkets delineated by price. Let $S \varepsilon [0,L]$ and $\varepsilon [0,L]$ denote the seller's and the broker's search intensity choice, respectively, where L is a finite upper bound on the search intensities. The probability that either the seller or the broker contacts the buyer is given by $\Phi \leq (S,B)$ where $0 (S,B) \leq ½$ for $\forall S$ and B, whereas the probability that the buyer is contacted by the broker is given by $\Gamma(B)$ where $0 \leq \Gamma(B) \leq ½$ for $\forall B$. Clearly, $\Gamma(B)$ is a subset of $\Phi(S,B)$, $\Gamma(B) \leq \Phi(S,B) \leq \forall S$ and B. The probability functions Φ and Γ have the properties that $\Phi_S > 0$, $\Phi_B > 0$, $\Gamma_B > 0$, $\Phi_{SS} \leq 0$, $\Phi_{BB} \leq 0$, $\Phi_{BS} = 0$ and $\Gamma_{BB} \leq 0$, where subscripts denote the corresponding (partial) derivatives. The cost of search is given by $\Theta(S)$ for the seller and $\Omega(B)$ for the broker, where Θ and Ω are strictly increasing and convex with $\Theta_S(0) = \Omega_B(0) = 0$. The matching technology and the cost functions are common knowledge.

When the property is sold, the seller receives a surplus of R where R equals the selling price minus the seller's reservation value of the property. The seller's expected return under an EA contract is given by:

$$\Pi^{S\text{-}E\lambda}(S,B) = \Phi(S,B)\mathrm{R} - \Gamma(B)kP - \Theta(S), \qquad (1)$$

where k is the commission rate and P is the value of the property. The first two terms represent the fact that the seller enjoys R upon the sale of the property but has to pay a commission to the broker if the buyer is contacted by the broker.

It is clear from Equation (1) that the seller's expected payoff under an EA contract depends on the broker's effort choice as well as the effort choice of the seller. Thus, the seller needs to determine the effort choice of the broker before deciding on the contract type. The seller knows that the broker under an EA contract will choose an effort level, B, which maximizes:

$$\Pi^{B\text{-}EA}(S,B) = \Gamma(B)kP - \Omega(B). \quad (2)$$

Equation (2) is simply the expected commission revenue of the broker minus the broker's search costs.

If the seller signs an ERTS with the broker, then the seller's expected return is given by:

$$\Pi^{S\text{-}ERTS}(s,b) = \Phi(s,b)\,(R - kP) - \Theta(s). \quad (3)$$

The difference from the EA contract is that the seller now pays the brokerage commission even if the seller finds the buyer himself.[2] The seller also knows that the broker's effort choice under an ERTS contract will maximize:

$$\Pi^{B\text{-}ERTS}(s,b) = \Phi(s,b)kP - \Omega(b). \quad (4)$$

The first-order conditions under EA contract are obtained by maximizing Equation (1) with respect to S and maximizing Equation (2) with respect to B:

$$\Phi_S R - \Theta S = 0 \quad (5)$$

and

$$\Gamma_B kP - \Omega B = 0 \quad (6)$$

where the arguments of the probability functions and their partials have been suppressed for notational ease.

Similarly, the first order conditions under the exclusive right-to-sell contract are obtained by maximizing Equation (3) with respect to s and maximizing Equation (4) with respect to b *is*:

$$\Phi_s(R - kP) - \Theta s = 0 \quad (7)$$

and

$$\Phi_b kP - \Omega_b = 0. \tag{8}$$

It is clear that in equilibrium the seller expends a greater search effort under the EA contract than under the exclusive right-to-sell contract, $S^* > s^*$. Whether the same is true for the broker, on the other hand, will depend on Φ_b versus Γ_B, i.e., whether an increase in the broker's effort level will have a greater impact on the overall probability of finding the buyer or on the probability that the broker will find the buyer. If $\Phi_b > (<)\ \Gamma_B$ for any $B = b$, then $B^* > (<)\ b^*$.

In order to determine how the impact of the contract choice on the effort levels varies between housing submarkets delineated by price, we need to examine how a change in the property value P affects the equilibrium effort levels of the seller and the broker under the two contract types. Let $dR/dP \geq 0$ so that the seller's surplus from the sale of the property is a non-decreasing function of the market value of the property. Given the properties of the probability functions Φ and Γ, differentiating the four first-order conditions 5–8 with respect to P will yield the following:

Remark:

1. $dS^*/dP \geq ds^*/dP \geq 0$: An increase in P results in an increase in the seller's effort level under both contract types, but the increase will be greater under the EA contract than under the exclusive right to sell contract.
2. $dB^*/dP \geq 0$, $db^*/dP \geq 0$ and $dB^*/dP \geq (\leq)\ db^*/dP$ for $|\Phi_{BB} > 0| \geq (\leq)\ |\Gamma_{BB} > 0|$: An increase in P results in an increase in the broker's effort level under both contract types, but the increase will be greater (smaller) under the EA contract when the increase in the effort level generates a bigger (smaller) drop in the marginal probability Φ_B than Γ_B.

As stated in the second part of the Remark, the key for the impact of an increase in P on the broker's effort level under the two contract types is the second partial derivatives of the probability functions Φ and Γ with respect to the broker's effort level. If a higher effort level by the broker leads to a bigger decrease in the marginal probability Φ_B than the marginal probability Γ_B, it will produce the following result:

Claim:

For $|\Phi_{BB} > 0| \geq (\leq)\ |\Gamma_{BB} > 0|$, an increase in the value of a property leads to a greater increase in both the seller's and the broker's effort levels under the EA contract than under the ERTS contract.

A higher effort level by both parties will translate to a shorter TOM. Although the price of the property is determined in the market as a general rule, the seller's and/or the broker's effort level may have some influence on the outcome of the price negotiations with the buyer. The seller may also agree to a price discount vis-à-vis the market value in order to achieve a quicker sale. Thus, the implication of the above Claim is that the EA contract offers a better (TOM, negotiated price) combination to more expensive properties than to less expensive properties. This implication will be tested empirically in the following section.

Methodology

To establish the delineation point between lower-priced and higher-priced housing, Quandt's (1958) switching regimes model is employed for two regimes. Basically, the data are sorted by selling price and split at observation, r, and regressions are run on each of the two price-delineated samples. Quandt's log-likelihood ratio (LLR) test is used to detect the most probable price at which to separate the two regression regimes. The LLR test statistic is:

$$\lambda = \tfrac{1}{2}\, r \log \sigma_1^2 + \tfrac{1}{2}\,(T - r) \log \sigma_2^2 - \tfrac{1}{2}\, T \log \sigma^2, \qquad (9)$$

where σ_1^2, σ_2^2 and σ^2 are the ratios of the residual sums of squares to the number of observations for the regressions on the first r observations, the remaining $T - r$ observations and all T observations, respectively. The minimum value of λ is associated with the most likely location of the point at which the regression relationship switches.[3]

Once the most likely switchpoint is established, the Chow test is used to statistically verify that the two price-delineated models differ from one another. The Chow (F) statistic is calculated as:

$$\begin{aligned} F = {} & \{[SSR_C - (SSR_1 + SSR_2)]/(SSR_1 + SSR_2)\} \\ & \times \{(N_1 + N_2 - 2k)/k\}, \end{aligned} \qquad (10)$$

where SSR_1, SSR_2, SSR_C, N_1, N_2 and N are the sum of the squared residuals and the number of observations for the individual and the combined models, and k is the number of parameters.

Once the two price-delineated housing submarkets have been identified, the separate Probit models are estimated. The primary purpose of the Probit models is to generate self-selection correction variables (Inverse Mill's Ratios) for later

use in the simultaneous equations models of selling price. To a limited extent, the Probit models permit a determination of the influence of certain property and market characteristics on the seller's choice of either an EA or an ERTS listing contract.

Finally, a two-equation simultaneous equations model is used to estimate the effect that EA listings have on TOM and selling price. The first equation of the model regresses the log of TOM against various factors including the type of listing contract. The second stage regresses the log of selling price against a similar set of factors. The two equations in the simultaneous equations model are:

$$ln(DOM) = f(ln(SP), X, EA), \quad (11)$$

and

$$ln(SP) = f(ln(DOM), X, EA), \quad (12)$$

where:

DOM = Days on the market;
SP = Selling price;
X = A vector of variables describing physical characteristics, location, market conditions, and marketability factors similar to other hedonic housing models; and
EA = A dummy variable indicating exclusive agency listings.

Equation (11) allows assessment of the impact of different contract types on the marketing time of single-family houses marketed through an MLS. Equation (12) equation allows for a test of the impact of the different contract types on the selling prices of single-family houses sold through an MLS. To correct for possible selection bias related to the choice of contract, the Inverse Mill's Ratio (IMR) was derived using a Probit model and included in the simultaneous equation models of selling price and TOM to correct for selection bias. The dependent variable for the Probit was the choice of using an EA contract (dummy variable = 1) versus the choice of using an ERTS contract. Heteroscedasticity was also detected using White's test, thus the standards errors of all regressions have been corrected for heteroskedasticity using the Huber/White/Eicker estimates of variance as indicated in Wooldridge (2003).

Data

The model is estimated with data from Rutherford et al. (2001). The final sample, after removal of missing and incomplete observations and some outliers, consists

of 49,219 observations of MLS housing transactions from the Dallas-Fort Worth MLS covering the period of 1994 to 1997. Exclusive agency listing comprised 11.6 percent (5732 observations) of the total sample with the remainder of the observations being exclusive right to sell contracts. Of the EA contracts, 1564 or 27.3 percent were sold by a MLS nonmember, presumably the owner of the property. The data were divided into two parts to ascertain differences between the EA and ERTS subsamples. Univariate t-tests show that, on average, EA listings are not statistically different from ERTS listings with respect to selling price, list price, time-on-the-market, age, and square footage.[4]

Using Quandt's (1958) technique to delineate the breakpoint in the data, the log-likelihood ratio for the selling price model is minimized at a selling price of $87,500.[5] The Chow test statistically verifies the resulting models are different at the 1% level or better. At this breakpoint, there are 23,709 observations in the sample of smaller houses (those that sold for less than $87,500) and 25,510 houses in the sample of larger houses (those that sold for at least $87,500).

A look at the data (Exhibit 1) shows that the higher-priced houses had a slightly lower percentage of EA contracts than the lower-priced houses. T-test results show that, compared to lower-priced houses, higher-priced houses have approximately the same percentage of listings with EA contracts, with a higher percentage of these EA listings sold by a nonMLS member, presumably the owner/seller, rather than a broker. On the other hand, lower-priced houses with EA contracts were more likely than the higher-priced houses with EA listings to have been sold by a broker. Also, the higher-priced houses were more likely to be larger and newer than lower-priced houses. The lower-priced houses were more likely to be older and vacant and were more overpriced than the higher-priced houses. Exhibit 1 summarizes the data.

Results and Implications

A Probit Model of Contract Choice

The results of a simple Probit model provide some insight to the choice of listing contract. The data limit the analysis to whether the choice is affected by physical house characteristics or market attributes. The variable, *Newer*, accounts for the higher percentage of builder-owned houses for houses less than a year old. The results (Exhibit 2) show that the probability of a lower-priced (<$87,500) house being listed with an EA contract decreases with the size of the house and is substantially higher for newer (builder-owned) homes in comparison to resale houses. This size effect correlates positively with price and perceived quality and is further enhanced by the negative coefficients for garages and large lots. Six of nine geographic indicators had significant coefficients. For the sample of higher-priced houses, the probability of a house being listed with an EA contract increases slightly with square footage, is lower for larger lots and is substantially higher for

Exhibit 1 | Summary Statistics of the Data

	Lower-priced Houses		Higher-priced Houses			
Variable	Mean	Std. Dev	Mean	Std. Dev	T-Test	Description
DOM	97.86	64.26	96.35	61.50	***	Time on the market (in days)
Selling Price	64,501	14,091	150,534	65,264	***	Selling price (in dollars)
List Price	66,791	14,447	155,080	67,290	***	Listing price (in dollars)
Overpricing	3.709	5.038	3.076	3.697	***	Percentage by which list price exceeds selling price
Age	24.10	14.64	11.88	11.66	***	Age of house (in years)
Newer	0.014	0.116	0.113	0.317	***	1 if *Age* $\leq$ 1 year
Older	0.488	0.500	0.154	0.361	***	1 if *Age* $>$ 1 year
Sq. Ft. (/100)	15.04	7.99	24.27	11.55	***	Square feet of living area
Bedroom	2.98	0.45	3.54	0.61	***	Number of bedrooms
Bathroom	1.896	0.444	2.684	0.745	***	Number of bathrooms
Vacant	0.041	0.197	0.015	0.123	***	1 if vacant, 0 if not
Garage	0.798	0.401	0.908	0.289	***	1 if garage, 0 if not
Fireplace	0.381	0.486	0.048	0.214	***	1 if 1 or more fireplaces
Large Lot	0.029	0.169	0.072	0.258	***	1 if lot size exceeds 1 acre
Pool	0.057	0.232	0.219	0.414	***	1 if pool
Lakefront	0.022	0.148	0.056	0.229	***	1 if lakefront

Exhibit 1 | (continued)

Summary Statistics of the Data

	Lower-priced Houses		Higher-priced Houses			
Variable	Mean	Std. Dev	Mean	Std. Dev	T-Test	Description
Well-maintained	0.033	0.177	0.017	0.129	***	1 if comments include 'well-maintained'
List-Spring	0.295	0.456	0.299	0.458	—	1 if listed in the Spring (2nd quarter)
List-Summer	0.239	0.426	0.238	0.426	—	1 if listed in the Summer (3rd quarter)
List-Fall	0.158	0.365	0.151	0.358	**	1 if listed in the Fall (4th quarter)
Sale-Spring	0.195	0.396	0.190	0.392	—	1 if sold in the Spring (2nd quarter)
Sale-Summer	0.289	0.453	0.287	0.453	—	1 if sold in the Summer (3rd quarter)
Sale-Fall	0.301	0.459	0.311	0.463	**	1 if sold in the Fall (4th quarter)
List-Time	7.836	4.351	8.374	4.395	***	1 for each quarter listed after the first quarter of 1994
Sale-Time	8.289	4.354	8.625	4.519	***	1 for each quarter of sale starting in the second quarter of 1994
Exclusive Agency	0.119	0.324	0.114	0.318	*	1 if EA listing
EA-Sale by Owner	0.029	0.168	0.034	0.182	***	1 if sold by owner (MLS nonmember)
EA-Sale by Broker	0.090	0.286	0.080	0.270	***	1 if sold by MLS member-broker

Notes: Means and standard deviations; along with significance for T-test on difference in means between lower- and higher-priced samples ($N = 49{,}219$ observations of houses listed on the Dallas-Fort Worth MLS and ultimately sold). Lower-priced houses: selling Price $< \$87{,}500$; $N = 23{,}709$. Higher-priced Houses: selling price $\geq \$87{,}500$; $N = 25{,}510$.

*T-value at the 0.1 level.

**T-value at the 0.05 level.

***T-value at the 0.01 level.

Exhibit 2 | Probit Results for the Choice of an EA Listing Rather than an ERTS Listing

	Higher-priced Houses		Lower-priced Houses	
Variable	Coefficient	Marginal Effect (%)	Coefficient	Marginal Effect (%)
Constant	−0.268		−1.110***	
Sq. Ft. (/100)	−0.164***	−0.80	−0.015	−0.28
Sq. Ft-Sq	2.00 E-3	0.02	3.11 E-4*	0.00
Overpricing	5.08 E-3	0.05	−1.67 E-3	−0.03
Age	0.017	0.26	−0.020	−0.37
Older	−0.098	−1.04	0.062	1.18
Newer	0.422**	5.11	0.485***	1.11
Bedrooms	0.074	7.85	−5.90 E-3	−0.11
Bathrooms	−0.040	−0.43	−9.53 E-3	−0.18
Fireplace	−0.057	−0.61	−0.048	−0.87
Garage	−0.111**	−1.20	−0.059	−1.13
Pool	0.112	1.23	6.66 E-3	0.12
Large Lot	−0.292**	−2.82	−0.119***	−2.07
Well-maintained	−0.182	−1.82	−0.067	−1.19
Lakefront	−0.244	−2.38	0.035	0.66

Exhibit 2 | (continued)

Probit Results for the Choice of an EA Listing Rather than an ERTS Listing

	Higher-priced Houses		Lower-priced Houses	
Variable	Coefficient	Marginal Effect (%)	Coefficient	Marginal Effect (%)
Vacant	0.142	1.57	0.072	1.49
List-Spring	3.47 E-3	0.04	0.033	0.62
List-Summer	0.060	6.46	0.044	0.83
List-Fall	−0.022	−0.23	0.059*	1.11
MLS-Area 2	−0.139	−1.42	−3.73 E-3	−0.07
MLS-Area 3	0.559***	6.92	0.488***	11.41
MLS-Area 4	−0.355***	−3.39	−0.102	−1.78
MLS-Area 5	−0.319***	−3.17	−0.013	−0.24
MLS-Area 6	0.268***	2.97	0.254***	5.27
MLS-Area 7	−0.173**	−1.78	4.30 E-3	0.08
MLS-Area 8	0.228	2.59	0.501***	12.13
MLS-Area 9	0.146	1.62	0.432***	10.14
MLS-Area 10	−0.393***	−3.69	−0.227*	−3.64

Notes: Table includes estimated coefficients with significance of the Chi-square-test. Lower-priced houses: selling price $<$ \$87,500; N = 23,709. Higher-priced Houses: selling price $\geq$ \$87,500; N = 25,510.

*Significant at the 0.1 level.

**Significant at the 0.05 level.

***Significant at the 0.01 level.

newer houses. Five of nine geographic indicators had significant coefficients. For both samples of houses, the probability of being listed with an EA contract varies by location, but show little significance over the seasons. Once again, the primary purpose of the Probit model is to generate an Inverse Mill's Ratio to control for self-selection bias in the simultaneous equations model.[6]

Assuming a house with average traits, the marginal effect associated with each variable is the change in the probability that a seller will select an EA contract over an ERTS contract associated with a one unit change in the variable of interest. For the significant variables not associated with geographic location, the largest effect on the probability of selecting an EA contract is associated with the variable *Newer*, which is included to proxy for houses that are more likely to be builder-owned. This result is consistent with the observation that builders sell many of their houses without broker participation and have a preference for EA contracts. Many of the geographic variables also had large impacts on the probability of a seller choosing an EA contract.

Simultaneous Equations Model of Price and Time-on-the-Market

The results for the single regression model are found in Rutherford, Springer and Yavas (2001) and show that, overall, houses sold with EA listings sell faster, but at a slightly lower price than houses sold with ERTS listings. For the Rutherford et al. study, the data were separated by the age of the house being sold on the premise that builders (new houses) are more likely to use EA contracts and to use them for different purposes than typical sellers of resale houses. The results from Rutherford et al. show distinct differences between new and resale houses for price effects of listing contract choice.

This paper assesses differences for differing housing market segments based on price. A simultaneous equations model for price and TOM was run for both lower-priced ($SP < \$87{,}500$) and higher-priced ($SP \geq \$87{,}500$) houses.

As shown in Exhibit 3, for the TOM models of both lower-priced and higher-priced houses, the coefficient on EA is significant and negative, suggesting that houses listed with EA contracts sell approximately faster (4.8% for lower-priced houses and 3.9% for higher-priced houses) than similar houses listed with ERTS contracts.[7] The results for the selling price model illustrate the primary difference between the two samples.[8] For lower-priced houses, the coefficient on *EA* is significant and negative, suggesting that houses listed with EA contracts sell at about a 1.7% discount to similar houses sold with ERTS contracts. For the selling price model of more costly houses (those that sold for $87,500 or more), the coefficient on *EA* is insignificant, indicating no price effect based on the contract choice.

Exhibit 3 | The Results for the Estimation of Equation 1: The Impact on Time-on-the-Market

	Lower-priced Houses		Higher-priced Houses	
Variable	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale
Constant	9.818***	9.772***	2.122**	2.781***
ln (Selling Price)	−0.519***	−0.515***	0.191**	0.129
Sq. Ft. (/100)	0.032***	0.032***	4.45 E-3	7.27 E-3*
Newer	0.158***	0.158***	−0.040	−4.50 E-3
Bedrooms	4.16 E-3	4.76 E-3	1.79 E-3	−2.29 E-3
Garage	−0.022	−0.022	−0.020	−0.024
Pool	−1.67 E-3	−3.05 E-3	−0.039***	−0.034***
Lakefront	0.036	0.038	0.070***	0.078***
Vacant	0.014	0.017	0.042	0.048
List-1995	−0.118***	−0.130***	−0.033**	−0.044***
List-1996	−0.156***	−0.164***	−0.066***	−0.075***
List-1997	−0.308***	−0.305***	−0.224***	−0.214***
List-Spring	−0.108***	−0.117***	−0.107***	−0.115***
List-Summer	−0.135***	−0.129***	−0.148***	−0.137***
List-Fall	−0.051***	−0.045***	−0.060***	−0.047***
Area 2	0.105***	0.102***	0.166***	0.174***
Area 3	0.103***	0.101***	0.070*	0.108***

Exhibit 3 | (continued)

The Results for the Estimation of Equation 1: The Impact on Time-on-the-Market

	Lower-priced Houses		Higher-priced Houses	
Variable	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale
Area 5	0.020	0.023	0.109***	0.120***
Area 6	0.074***	0.079***	0.159***	0.187***
Area 7	−0.084***	−0.082***	−0.062***	−0.045**
Area 8	0.136***	0.139***	0.159***	0.199***
Area 9	0.165***	0.168***	0.168***	0.222***
Area 10	0.058**	0.062**	0.252***	0.240***
Exclusive Agency	−0.056***	—	−0.045***	—
EA—Sale by Owner	—	0.198***	—	0.207***
EA—Sale by Broker	—	−0.137***	—	−0.162***
Inverse Mill's Ratio	7.79 E-3	7.64 E-3	−6.92 E-3***	9.63 E-3
R^2	0.046	0.050	0.043	0.050

Notes: Table includes estimated coefficients with significance of the T-test. Dependent variable = *ln* (*DOM*). Lower-priced houses: selling price < $87,500; $N = 23{,}709$. Higher-priced Houses: selling price ≥ $87,500; $N = 25{,}510$.

*Significant at the 0.1 level.

**Significant at the 0.05 level.

***Significant at the 0.01 level.

For both segments of the data, the results suggest that EA contracts create a race between the broker and the owner, resulting in faster sales. This result is consistent with the theory presented here. For lower-priced houses, the faster sale is associated with a discount from the selling price, a result consistent with the behavior of a motivated seller and fully supporting typical housing search models, which postulate a trade-off between selling prices and marketing time. For the more costly housing segment, when compared to the ERTS listing, the EA listing offers the benefit of quicker sales without a sacrifice in price. This result supports a demand-driven model where buyers pay similar prices for similar houses without regard for, and perhaps even knowledge of, the type of contract the seller uses. This result also supports the theory here in that as selling price increases, both sellers and brokers will increase their search effort. The evidence of this increased effort is faster sales with no sacrifice to price (Arnold, 1999).

To gain more insight to the price and marketing time effects of EA listings, the EA listings are separated according to whether the owner or a broker achieved the sale. The data do not allow the identification of the owner as a seller, but do identify that an MLS nonmember was the seller. Thus, only a proxy for owner-sold properties by the seller being an MLS nonmember can be asserted.

For the TOM model (Exhibit 3) of lower-priced houses, the coefficient for broker-sold EA-listed houses was significant and negative, suggesting that broker-sold EA houses sell approximately 12% faster than similar houses listed with ERTS contracts.[9] The results for owner-sold EA houses suggest that lower-priced houses sell much slower (about 23%) than ERTS houses. The results for the selling price model (Exhibit 4) show the coefficient for broker-sold EA houses to be negative and significant, suggesting a 1.2% selling price discount for sellers using EA listings. For owner-sold houses, there is a similar discount of 1.9% for EA contracts in comparison to similar houses sold with ERTS contracts.

In summary, for lower-priced houses, houses with EA contracts sell faster on average than houses with ERTS contracts. A broker-sold EA listing sells faster than an owner-sold EA listing and for a slightly lower discount on price. Thus, for lower-priced houses, the results suggest that the seller is better off using an ERTS listing and not taking the selling price discount associated with the EA contract.

For the TOM model of more costly houses, the coefficient for broker-sold EA-listed houses was significant and negative, suggesting that broker-sold EA houses sell approximately 15% faster than similar houses listed with ERTS contracts. The results for owner-sold EA houses suggest that these houses sell more than 20% slower than ERTS listed houses. The results for the selling price model show the coefficient for broker-sold EA houses to be insignificant, suggesting no price effect for sellers using EA listings. For owner-sold houses, there is an estimated 1.2% premium for houses listed with EA contracts in comparison to similar houses sold with ERTS contracts.

Exhibit 4 | The Results for the Estimation of Equation 2: The Impact of Contract Type on Selling Price

	Lower-priced Houses		Higher-priced Houses	
Variable	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale
Constant	10.183***	10.183***	10.736***	10.739***
Ln (DOM)	−0.026***	−0.026***	−0.012***	−0.012***
Sq. Ft. (/100)	0.093***	0.093***	0.057***	0.057***
Sq. Ft-Sq	−1.87 E-3***	−1.87 E-3***	−2.47 E-4***	−2.46 E-4***
Age	−9.19 E-3***	−9.19 E-3***	−0.011***	−0.011***
Age-Sq	8.33 E-5***	8.33 E-5***	1.69 E-4***	1.69 E-4***
Newer	0.021***	0.021***	0.064***	0.065***
Bathrooms	0.048***	0.048***	0.033***	0.033***
Bedrooms	−4.64 E-3	4.64 E-3	−0.054***	−0.054***
Fireplace	−0.075***	−0.075***	0.022***	0.021***
Garage	0.054***	0.054***	7.95 E-3*	7.64 E-3
Pool	0.058***	0.058***	0.076***	0.076***
Lakefront	0.035***	0.035***	0.073***	0.073***
Vacant	−0.029***	−0.030***	−0.039***	−0.039***
Sale-Spring	3.38 E-3	3.40 E-3	0.012***	0.012***
Sale-Summer	0.016***	0.016***	0.019***	0.018***
Sale-Fall	0.016***	0.016***	0.026***	0.026***
Sale - 1995	0.017***	0.018***	0.020***	0.020***
Sale - 1996	0.046***	0.047***	0.041***	0.040***
Sale - 1997	0.087***	0.087***	0.085***	0.085***

Exhibit 4 | (continued)

The Results for the Estimation of Equation 2: The Impact of Contract Type on Selling Price

	Lower-priced Houses		Higher-priced Houses	
Variable	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale	Impact of EA Contracts	Impact of Whether Broker or Owner Effected the Sale
Area 2	0.129***	0.129***	0.076***	0.076***
Area 3	0.231***	0.231***	0.152***	0.153***
Area 5	0.052***	0.052***	0.014***	0.014***
Area 6	−5.09 E-3	−5.11 E-3***	0.031***	0.032***
Area 7	0.087***	0.087***	0.085***	0.085***
Area 8	0.048***	0.048***	0.052***	0.054***
Area 9	−5.03 E-3	−5.05 E-3	0.080***	0.082***
Area 10	7.34 E-3	7.32 E-3	−0.068***	−0.069***
Exclusive Agency	−0.019***	—	1.04 E-3	—
EA—Sale by Owner	—	−0.021***	—	0.012**
EA—Sale by Broker	—	−0.019	—	−4.28 E-3
Inverse Mill's Ratio	2.61 E-3**	2.61 E-3**	6.01 E-3**	6.81 E-3**
R^2	0.583	0.583	0.776	0.776

Notes: Table includes estimated coefficients with significance of the T-test. Dependent variable = *ln* (SP). Lower-priced houses: selling price < $87,500; N = 23,709. Higher-priced Houses: selling price ≥ $87,500; N = 25,510.

*Significant at the 0.1 level.

**Significant at the 0.05 level.

***Significant at the 0.01 level.

In summary, similar to lower-priced homes, higher-priced houses using EA listings sell faster on average than houses with ERTS contracts. However, whereas the owners of lower-priced houses are seemingly disadvantaged by EA contracts, these results suggest that the sellers of more expensive houses are better served by the use of EA listing contracts. If a broker achieves the sale, the seller realizes the same price as with an ERTS listing, but receives a sales contract more quickly. Also, if the seller achieves the sale, he not only saves the commission, but also receives a higher selling price in comparison to the ERTS contract.

Conclusion

The results of this study suggest that there are substantial differences in agent effort and outcome given alternative listing contracts and different price ranges of houses. For lower-priced houses, those selling for less than $87,500, the seller should be cautious about alternative listing arrangements because they may result in suboptimal performance by the broker. For these houses, the results show longer marketing times associated with EA contracts, as well as a selling price discount if a broker effects the sale. Interestingly, if the seller achieved the sale, there was no associated discount. The results further show that sellers of higher-priced houses are better served by the EA contracts. One implication of the results is that brokers operating in lower-priced market segments are motivated towards not getting the best price for the seller. This implication suggests that these brokers might be better motivated either by a different compensation mechanism, or by a technology, such as the Internet, which can make the selling of lower-priced properties more efficient.

Endnotes

[1] Rutherford, Springer and Yavas (2001) allows the seller to choose the price, as well as the search intensity, and shows that in equilibrium the seller chooses the same price under the two contract types.

[2] To differentiate between the search efforts under the two contract types, lowercase *s* and *b* will be used to denote the search efforts under the ERTS contract.

[3] Brown, Durbin and Evans (1975) present this version of Quandt's (1958) log-likelihood ratio statistic.

[4] A more complete description of the full data set can be found in Rutherford, Springer and Yavas (2001) or by request from the authors.

[5] Using Quandt's (1958) model as our basis and running OLS models at various breakpoints for the data (based on selling price), the LLR statistic was minimized at an $87,500 breakpoint within $250 of accuracy. Using the TOM model to determine the breakpoint results in a switch of regression regimes at a selling price of $86,000, which is very close to the $87,500 breakpoint for the selling price model.

[6] The procedure used for the selection bias correction is commonly used (Heckman, 1979). A Probit model is used to estimate an Inverse Mill's Ratio, which is then entered into

the regression equation (see also William H. Greene, *Econometric Analysis*, third edition; Prentice-Hall, 1997).

[7] The percentage discounts are calculated by estimating the models at the sample means and then re-estimating the model using a value of 1 for *EA*.

[8] One interesting result from the submarket models of TOM is the difference in sign of the log of the selling price. For lower-priced houses, marketing time decreases with price. For higher-priced houses, marketing time increases with price. The positive effect in the higher-priced model and the negative effect in the lower-price model suggest a distinct nonlinear relationship between selling price and TOM and that the overall market may be thinner at both the high and low ends. The result also provides additional validation for the identification of submarkets in the modeling process.

[9] For the models isolating broker- and owner-effected sales, the percentage discounts are calculated by estimating the models at the sample means and then re-estimating the model using a value of 1 for *EA-Sale by Broker* and 0 for *EA-Sale by Owner*, and vice versa.

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Ronald C. Rutherford, University of Texas–San Antonio, TX 78249-0637 or rrutherford@utsa.edu.

Thomas M. Springer, Florida Atlantic University, Jupiter, FL 33458 or springer@fau.edu.

Abdullah Yavas, Pennsylvania State University, University Park, PA 16802 or ayavas@psu.edu.