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Seller Over-Pricing and Listing Contract Length: The Effects of Endogenous Listing Contracts on Housing Markets*

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Abstract. This paper examines how seller pricing decisions influence listing contract length and how these decisions affect price and liquidity in housing markets. Because list price affects broker effort required to sell the property, brokers respond to seller overpricing by increasing their desired listing period. At the same time, sellers respond to longer listing contracts by adjusting their pricing strategy. Both affect broker sales effort, hence realized selling price and liquidity. House transaction data from Virginia indicate that greater over-pricing by sellers prompts brokers to pursue longer listing contracts, which subsequently lengthen marketing time but increase selling price. The results reveal a novel transmission mechanism from higher list price (which induces longer contracts) to selling price and liquidity.

Keywords: Listing contract, list price, seller pricing, house price, house liquidity

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1. INTRODUCTION

This paper examines the relationship between real estate broker listing contract terms and how these terms influence housing market outcomes over the life of the contract. It is the first paper to examine how the listing price and listing contract duration agreed to in the negotiation phase of the listing contract affect each other and ultimately affect time on the market and selling price.

There is a substantial theoretical and empirical housing market literature on the relationship between listing prices and selling prices or liquidity.[3] There are, however, relatively few studies focusing on the role of the listing contract duration in the transaction process, how it affects agent behavior and ultimately influences prices or liquidity.[4] This paper begins with the recognition that the transaction process comprises two distinct phases, the initial listing contract agreement phase followed by a period of search and matching to find willing buyers. This approach is new. It recognizes that the listing contract terms are set before the search and matching process begins and that the broker's subsequent search and matching activities are influenced by the contract terms set in the listing phase. This perspective motivates a new empirical framework for modeling the housing market; the theory provides a choice-theoretic rationale for an empirical modeling strategy that accounts for the endogeneity of contract terms and their influence on subsequent sales prices and liquidity.

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[3] See, for example, Miller (1978), Zorn and Larsen (1986), Knight, Sirmans, and Turnbull (1994), Yang and Yavas, (1995), Yavas and Yang (1995), Knight (2002), Anglin, Rutherford, and Springer (2003), Benefield, Rutherford and Allen (2011), and Brastow, Springer and Waller (2011). See Cheng, Lin, and Liu (2008) for a review of studies of time on the market studies and its relationship to pricing.

[4] The relevant papers are Miceli (1989), Asabere, Huffman and Johnson (1996), Clauretie and Daneshvary (2008), Waller, Brastow and Johnson (2010), and Brastow, Springer and Waller (2011).

In first phase of the transaction process, listing brokers would prefer unlimited listing contract duration in order to ensure an eventual commission, regardless of selling effort expended. Regardless of whether sellers find such arrangements acceptable, contract law simply does not allow indefinite listing duration.[5] Nonetheless, given the advantages that the listing broker enjoys from lengthier exclusive listings, it is reasonable to assume that listing brokers prefer longer contract periods, holding all else constant. Sellers, on the other hand, may recognize the moral hazard that lengthy listing duration engenders for the listing agent, and therefore may find shorter listing durations more desirable.

At the same time, the seller's reservation price, signaled to some extent by the seller's choice of listing price, indicates to the listing broker how difficult it likely will be to sell the property. If length of contract is a substitute for intensive selling effort then brokers may be motivated to offer longer listing periods when they perceive that a particular house is significantly over-priced for current market conditions. In this sense, the longer listing contract reflects the broker's response to the seller's insistence on a high reservation price.

We view the listing contract terms as a Nash equilibrium in the first phase of the transaction process, balancing the opposing interests of the property seller and broker regarding length of contract (*LOC*) and the seller's over- or under-pricing, the latter measured by the variation in the seller's list price relative to the expected market list price for the property or the degree of over-pricing (*DOP*). In the second phase of the transaction process, the broker and seller expend their selling effort and reset reservation

[5]For example, relevant to our sample, the Commonwealth of Virginia code 18 VAC 135-20-290 considers entering into a brokerage relationship without a specific definite termination date to be an action that constitutes improper dealing.

prices, respectively, given the established contract terms and realized market conditions. Integrating both phases in the empirical model allows us to trace the impact of the endogenous contract terms and seller pricing undertaken at the outset on the ultimate selling price and liquidity.

This study is the first to empirically integrate both of these phases of the transaction process while treating price and liquidity as jointly determined outcomes in the second phase. It uses a stylized theoretical framework to guide the empirical modeling effort. The empirical results support the theoretical proposition that the degree of over-pricing by the seller significantly affects length of contract (and vice versa). In turn, longer listing contracts lead to lower liquidity (longer time on market) but also higher sales prices. The empirical conclusions are consistent with our hypotheses about broker incentives when setting the length of listing contract and homeowners when setting listing price, which ultimately influence selling price and liquidity through their joint effects on broker selling effort.

The literature concerning the relationships between listing price and selling price or liquidity in housing markets is typically intertwined with broker performance issues related to the principal-agent problem, commissions, firm size, property size, and broker geographic specialization (Zorn and Larsen, 1986; Knight, Sirmans, and Turnbull, 1994; Yang and Yavas, 1995; Yavas and Yang, 1995; Knight, 2002; Brastow, Springer and Waller, 2011). Miller (1978) and Anglin, Rutherford, and Springer (2003) in particular find that higher list price leads to longer marketing time (*TOM*). Knight's (2002) study of listing price change effects concludes that a greater difference between list price and selling price generally leads to a longer *TOM* and ultimately a lower selling price.

A thorough review of the literature, however, finds only a few studies that incorporate listing contract duration in the analysis of housing price and liquidity. These studies include Miceli (1989), Asabere, Huffman and Johnson (1996), Clauretie and Daneshvary (2008), Waller, Brastow and Johnson (2010), and Brastow, Springer and Waller (2011).

Miceli (1989) argues that shortening the listing contract motivates greater broker effort to sell the listed property before contract expiration in order to earn a commission. In the initial empirical investigation of listing contract length and selling price, Asabere, Huffman and Johnson (1996) examine the relationship between listing contract length and selling price to find that homeowners exact a price premium of 0.04% for each day that the property sells prior to contract expiration. In essence buyers can expect to obtain a discount of 0.04% for each day the property remains on the market. The authors interpret their findings to be the result of increasing opportunity costs for sellers, which leads anxious homeowners to lower reservation prices.

Clauretie and Daneshvary (2008) focus on the principal-agent relationship between sellers and brokers and the how the nature of this relationship is likely to change over the span of the listing contract. They hypothesize that brokers are likely to increase marketing efforts while simultaneously working to persuade the seller to lower their reservation price as contract expiration nears. Their empirical evidence indicates that prices are significantly lower for properties near contract expiration, a result consistent with brokers placing more emphasis on negotiating lower seller reservation price rather than increasing their selling effort as the listing contract expiration draws near.

Waller, Brastow and Johnson (2010) extend the analysis to investigate contract length effects on both price and liquidity in a simultaneous systems context. The estimates show that listing contract length has a positive and significant impact on selling time, a result consistent with both Miceli's (1989) theoretical analysis and Clauretie and Daneshvary's (2008) empirical conclusions.

Brastow, Springer, and Waller (2011) investigate broker incentives and their impact on selling time, selling price and probability of sale, while controlling for broker specialization in geographic submarkets. The estimates also imply that listing contract length has a positive and significant impact on both marketing time and the probability of sale.

This paper is organized as follows. Section 2 offers s simple theoretical model in order to motivate and guide the empirical modeling approach. Section 3 discusses the data and variables. Section 4 presents the empirical methodology while section 5 presents the results. Section 6 concludes.

2. LENGTH OF CONTRACT AND TRANSACTION OUTCOMES

The transaction process comprises two separate phases; the contracting phase between the seller and broker and the selling phase in which the seller, broker, and potential buyers interact. This stylized framework serves as a guide for the empirical analysis, so we focus only on the key elements needed to draw out the causal relationships.

Contracting phase. In the first phase of the transaction, the seller selects the list price, hence the degree of over-pricing, *DOP*, while the broker/agent selects the length of

contract, *LOC*. Following Rutherford, Springer and Yavas (2005), *DOP* is the difference between the seller's choice of list price and the list price for the property dictated by current market conditions. Of course, seller utility and agent utility are both affected by *DOP* and *LOC* through their influence on selling price and liquidity. We assume that the equilibrium contract terms are the values satisfying Nash equilibrium in the contracting phase.

To be more specific, seller utility is an increasing function of the expected selling price (*SP*) and liquidity (or decreasing in time on the market, *TOM*), denoted $U(SP,TOM)$. The shape of the utility function reflects seller characteristics and reflects the seller's willingness to trade off selling price for liquidity (Turnbull and Zahirovic-Herbert, 2010). The arguments in the utility function, however, in turn depend upon both the seller's choice of listing price, hence the degree of over pricing *DOP*, and the agent's selling effort *e* mediated by agent ability or productivity and market conditions. Thus, in the first phase, the seller maximizes *U* with respect to *DOP* given the fact that selling price and liquidity depend upon both agent effort and the seller's degree of over-pricing, or $SP = P(e,DOP)$ and $TOM = L(e,DOP)$. Clearly, the seller's utility at this point depends upon his expectation of the agent's future behavior *e*. The seller is rational, however, and recognizes that agent effort *e* in the second phase is affected by the contract provisions determined in the first phase.[6] Suppose the agent's effort supply function turns out to be $e(LOC,DOP)$ in the selling phase. Substituting this effort supply function as a constraint into the selling price and liquidity functions *P* and *L* yields the seller constrained utility

[6] Under rational expectations the first phase equilibrium is the backwards induction solution to the two-stage game.

$$u(LOC,DOP;\mathbf{Z}^s) = U(P(e(LOC,DOP),DOP),L(e(LOC,DOP),DOP),\mathbf{Z}^s)$$

where $\mathbf{Z}^s$ is the vector of seller characteristics. The seller chooses *DOP* to maximize the constrained utility *u*. Applying the implicit function theorem to the first order condition for this problem yields the seller's best response to the broker's choice of contract length *LOC* in the contracting phase as

$$DOP = S(LOC,\mathbf{Z}^s) \qquad (1)$$

Now consider the broker/agent. Agent utility, *W*, is an increasing function of the expected commission revenue from sale, *R*, and a decreasing function of the effort *e* that will need to be expended to sell the property, denoted $W(R,e)$. The expected revenue depends upon the commission rate, realized selling price, and whether the property will sell within the contract time frame. Selling price and probability of sale are both functions of broker effort, broker characteristics $\mathbf{Z}^b$, and market conditions. The probability of sale is also a function of listing contract length and the degree of mispricing adopted by the seller. We summarize these relationships in the expected revenue function $R = R(LOC,DOP,e,\mathbf{Z}^b)$. Substituting this into the agent utility function, we have the constrained utility function

$$W(R(LOC,DOP,e,\mathbf{Z}^b),e) \qquad (2)$$

The agent is rational and recognizes that the optimal *LOC* in the contracting phase depends upon the efforts he is willing to exert in the second phase. Solving the agent's problem using backwards induction, we denote the second phase effort that maximizes (2) for given *LOC* and *DOP* as $e(LOC,DOP)$; this is the same effort supply incorporated by the rational seller in his contracting phase optimization problem outlined above. In any case, substitute this effort supply function into the constrained broker utility (2) to obtain the indirect function

$$w(LOC,DOP,\mathbf{Z}^b) = W(R(LOC,DOP,e(LOC,DOP),\mathbf{Z}^b),e(LOC,DOP)) \quad (3)$$

Maximizing (3) with respect to *LOC* and solving the first order condition implicitly yields the agent's best response to the seller's choice of *DOP* as

$$LOC = B(DOP, \mathbf{Z}^b) \quad (4)$$

The Nash equilibrium contract in the listing phase comprises the terms jointly satisfying the two best response functions (2) and (4).

Regarding the empirical implications, note that the empirical model of the contracting phase consists of two simultaneous equations, one for the seller's best response function (2) and the other for the broker's best response function (4). Paying particular attention to (4), *LOC* is a function of broker characteristics $\mathbf{Z}^b$, including market conditions, and the degree of mispricing *DOP*. The coefficient on *DOP* in the empirical model reflects the broker's response to seller's listing price—a positive

coefficient indicating that in order to take the listing, agents require longer listing periods the larger the *DOP*.

Selling phase. Search theory implies that selling price and time on the market are jointly determined (Krainer, 2001; Zahirovic-Herbert and Turnbull, 2008)[7]. Following Zahirovic-Herbert and Turnbull (2008), henceforth ZHT, the second phase transaction outcome selling price *SP* and time on the market (an inverse liquidity measure) *TOM* each are functions of property characteristics and broad market conditions, **X,** and neighborhood market conditions, measured by *Total Comp*, the (distance-weighted) number of neighboring competing houses on the market during the market exposure of the subject property. The construction of this variable is explained in detail later. In addition, though, we allow for the possibility that price and liquidity also may be influenced by agent selling effort supplied, *e*(*LOC*,*DOP*), the two arguments in this function representing the Nash solution to the contracting problem in the first phase of the transaction process. We therefore expand the ZHT empirical price-liquidity model to include the jointly estimated values ($\widehat{DOP}$,$\widehat{LOC}$) from the first phase empirical model, yielding the system

$$SP = P(TOM, \widehat{DOP}, \widehat{LOC}, \mathbf{X}, Total\ Comp) \quad (5)$$

$$TOM = L(SP, \widehat{DOP}, \widehat{LOC}, \mathbf{X}, Total\ Comp) \quad (6)$$

[7] Additionally, Merlo and Ortalo Magné (2004) examine how the listing price changes when new offers arrive and the sequencing of events in the selling process.

As written, this system does not appear to be identified. ZHT, however, note that since *TOM* and *Total Comp* both enter (5), the effect of *Total Comp* on price holding *TOM* constant (the coefficient in the linear estimating equation) is identically equal to the effect of the number of surrounding competing houses on the market per day of market exposure for the target property (denoted *Listing Density*). Using this parametric restriction, the system (5)-(6) reduces to

$$SP = P(TOM, \widehat{DOP}, \widehat{LOC}, \mathbf{X}, Listing\ Density) \quad (7)$$

$$TOM = L(SP, \widehat{DOP}, \widehat{LOC}, \mathbf{X}, Total\ Comp) \quad (8)$$

This system is identified and can be easily estimated using 3SLS for standard price and liquidity functional forms.[8]

The *Listing Density* and *Total Comp* variables in the price and liquidity equations capture the effects of concentrations of listings in the neighborhood surrounding subject properties (Turnbull and Dombrow, 2006). The construction of these variables follows Turnbull and Dombrow (2006). *Total Comp* measures the number of competing properties surrounding the subject property taking into consideration how long each competing listing overlaps with the subject property as well as the distance between properties (more distant properties have lower weights than nearby properties). Competing properties are defined as those within 20% larger or smaller living areas. The *Listing Density* measures of the average intensity of competition per day on the market. A negative *Listing Density* effect on selling price indicates a competition effect; the

[8] See Sirmans, Turnbull and Benjamin (1991), Knight (2002), and Turnbull and Dombrow (2006) for examples of other approaches to identification.

greater supply of surrounding listings on the market at the same time as the subject property depresses selling price. A positive effect indicates that the greater supply of surrounding listings creates a shopping externality drawing additional potential buyers, offsetting the competition effect on price. Positive and negative effects of *Total Comp* on *TOM* similarly indicate neighborhood competition and shopping externality effects, respectively.[9]

3. DATA

The data used in this study are drawn from an MLS reporting broker listings and transactions in south central Virginia. The raw data cover 21,452 properties listed for sale between June 1999 and June 2009. The data include properties that are ultimately withdrawn, have expired listings or are sold. Incomplete, missing, or obviously erroneous data are culled from the data set. Furthermore, to avoid outlier influences, we exclude properties that list for less than $70,000 or more than $410,000 and outliers in terms of size (less than 2 or greater than 4 bedrooms). This leaves a sample of 18,055 observations. The price-liquidity model estimation samples also allow for a 6 month burn-in period when calculating the overlapping listings in the *Total Comp* and *Listing Density* local market conditions variables.

The property characteristics include square footage of living area, house age and the number of bedrooms and bathrooms, all standard in hedonic pricing models. Other variables associated with the listing contract include listing and selling dates, listing contract duration and days on market. Table 1 provides variable definitions and Table 2 summary statistics. The average property in the data is just under 30 years of age, listed

[9] See Turnbull and Dombrow (2006) or Zahirovic-Herbert and Turnbull (2008) for additional explanation.

for $195,453 and sold for $173,163 with 2,057 of square feet of living area, 3.36 bedrooms and 2.05 full bathrooms. The average contract listing duration is 185 days and sold properties take an average of 124 days to sell. Twelve percent of the listed properties are new construction. Approximately 23% of listed existing or resale houses are vacant when on the market.

Owner/seller characteristic variables include whether the seller is an institution (e.g., corporation), individual (male or female) or a couple, each represented as a dummy variable. Approximately 83% of the properties are listed by individuals and 17% by firms or other institutions. Of the individual owners, over 75% are male with just over 4.6% of the sellers being listed as co-owners or couples.

Broker/agent characteristics include licensure status (salesman, associate broker, or broker), whether or not the brokerage firm is a franchise, and the amount of competing inventory by listing agent. Thirty-nine percent of licensees are male, 36% are associate or principal brokers and 64% are salespersons. Approximately 38% of the agents are employed with franchised brokerage firms.

Additionally, as a rudimentary measure of agent ability, we calculate each agent's average price realization (the ratio of selling price to list price) for houses listed by the agent over the entire sample period as

$$Agent\ Realization = \sum_{i=1}^{n} \frac{SP/LP}{n}$$

for selling prices *SP* and listing prices *LP*. The average realization for all agents in the sample is approximately 0.98, indicating that average broker assisted transactions sold at

almost 98% of the listing price over the sample period. There is substantial variation in this variable across individual agents, ranging from 0.88 to 1.04.

4. EMPIRICAL RESULTS

Contracting Phase. When the services of a broker are acquired, the terms of the listing contract are negotiated and agreed upon including the listing price of the property and the length of the listing contract. The contracting period equilibrium yields the two reaction functions (2) and (4). Table 3 reports the 3SLS estimates of the simultaneous system.

The property's listing price, while likely influenced by the broker, is ultimately the seller's decision. Recall that our measure of seller behavior is the over-pricing exhibited in the listing price. Following Rutherford, Springer and Yavas (2005), the degree of over-pricing, *DOP*, is the difference between the actual listing price and the hedonically suggested price[10]

$$DOP = LnLP - \widehat{LnLP}$$

The seller reaction function is reported in Table 3(a). The dependent variable is *DOP*. Explanatory variables include seller characteristics *Agricultural*, *Male Owner*, *Couple Owner*, *Institution Owner*, and *Children* (a dummy variable for houses with 3 or more bedrooms). Some key property characteristics are included to capture differences in seller holding costs; *Vacant*, *New*, *Tenant*, and *Rental*. The coefficients on these variables indicate that sellers of new construction tend to list at a premium while sellers of properties that are vacant, tenant occupied, or designated as rental properties tend to list

[10] Hedonic list price estimates are based on property and economic characteristics, including ln(sqft), ln(age), mobile, quick, bedrooms, full bath, half bath, listtime, listtimesq, location fixed effects, , vacant, finbase, pool, paved drive, fenced yard, hardwood, ceramic tile, carpet, brick, vinyl siding, garage, fire, one story, two story, and mtg rate. DOP estimation results are not reported here but are available upon request.

at a discount. Market conditions variables are included as additional controls: *Fed Fund Rate*, *Mtg Rate*, and the leading economic indicator *LEI* at the time of listing and the quadratic time trend for time of listing. The *School Quality* variable is significantly positive, consistent with Dhar and Ross (2012) indicating that higher quality schools tend to prompt greater over-pricing.

The final set of controls in the empirical seller reaction function pertains to agent characteristics and agent contracting behavior. Our measure of agent performance, *Agent Realization*, exhibits a significantly positive over-pricing effect; sellers tend to price more optimistically when dealing with high-performing agents. The number of listings by the agent is a measure of the scale of agent activity (and possibly indicates the amount of attention the seller may expect from the agent), *Agent Scale*. Interestingly, the coefficient on this variable is positive and significant; sellers apparently respond to high activity listing agents with higher listing prices.

The main variable of interest in the seller reaction function, *LOC*, has a significantly positive coefficient estimate. Longer listing contracts give sellers an incentive for higher listing prices; length of contract and listing price are strategic complements for sellers.

Now consider the agent reaction function (4), the estimates of which are reported in Table 3(b). The dependent variable is *lnLOC*. At the contracting stage, agents are assumed to have sufficient expertise and market knowledge to estimate the market value of the property and approximate market duration of the listed property. Thus, the agent reaction function includes controls for agent characteristics, broad market conditions, and some key property characteristics typically associated with difficult sales. With respect to

agent characteristics, the coefficients on *Salesman*, *Franchise*, and *Male Agent* are not significant; these characteristics do not affect listing contract length. The *Agent Realization* variable, however, has a significantly negative coefficient; greater agent selling ability in this dimension leads to shorter listing contracts. Whether or not agent specializes geographically (*Geog Specialize* dummy variable) does not affect *LOC.* On the other hand, the negative coefficient on the *Agent Territory* dummy variable means that, for agents who do specialize geographically, properties within an agent's territory tend to call forth shorting listing periods than properties that lie outside the territory.

The controls for market conditions include the average time on the market for houses sold the previous quarter (*Prev Mkt TOM*), and the interest rates *Fed Fund Rate* and *Mtg Rate.* All of these market conditions variables are significant, but the positive coefficient on the *Prev Mkt TOM* variable provides an intuitively appealing result; slower sales in the previous period prompt the agent to pursue longer listing contracts.

Of the property characteristics associated with difficulty-of-sale, *Vacant*, and designated *Rental* lead to significantly longer listing contracts, as expected. *New* construction leads to longer contract duration as well. Somewhat surprising, *Tenant* occupancy does not have a significant effect on contract length at the 5% level.

Finally, the significantly positive *DOP* coefficient indicates that agents respond to greater seller over-pricing with longer listing contracts. This result is consistent with the agent effort-supply model posited earlier. From the agent's perspective, *DOP* and *LOC* are strategic complements; the more difficult the anticipated sale, the longer the contract duration required by the agent.

Selling Phase. Table 4 presents the hedonic price and liquidity equations estimates for the selling phase of transactions. The dependent variables are *lnSP* and *lnTOM*, respectively. The models include controls for standard property characteristics (including location), broad market conditions, surrounding neighborhood market conditions[11], as well as *DOP* and *LOC.* None of the property characteristics have unexpected price or liquidity effects. The *Rental, Tenant, and Vacant* conditions lead to lower prices and/or longer selling time—typical results. New construction, however, sells at a discount with no significant difference in time on the market, the former a surprising result. Looking at neighborhood market conditions, the *Listing Density* variable has a significant negative effect on price. This indicates that the spatial competition from surrounding houses for sale lowers prices enough to overcome any possibly offsetting shopping externality effects (Turnbull and Dombrow, 2006). Similarly, the positive *Total Comp* coefficient in the *TOM* equation indicates a strong competition effect from surrounding houses; the greater the number of surrounding listings, the longer it takes to sell the subject property. The *lnTOM* and *lnSP* variables are both significant in the price and liquidity equations, respectively. The joint determination of price and selling time leads to significant cross-effects on the two observable dimensions of the transactions outcomes.

Finally, consider the *DOP* and *LOC* coefficients in the price equation, the main variables of interest here. Both are positive and significant. While this may seem counterintuitive at first—longer contract length leads to higher selling price—the result is consistent with earlier work. Note that because both *TOM* and *LOC* are both included in the price equation, increasing *LOC* while holding *TOM* constant (which is what the *LOC* coefficient measures) means that the *remaining listing contract duration* increases. The

11 For additional discussion of neighnorhood choice and housing demand see Ioannides and Zabel (2008).

positive coefficient therefore implies that the selling price declines as the contract expiration draws near—the same price effect found by Clauretie and Daneshvary (2008). This is consistent with the notion that agents are more successful convincing sellers to lower their reservation price than they are at finding high-value buyers as the contract nears expiration.

The *TOM* equation *DOP* and *LOC* coefficient estimates are also both positive and significant. These results reflect what we expect—greater over-pricing by the seller and longer listing contracts each increase the time it takes to sell the property. Once again, while the contract length estimate taken at face value might seem to contradict the price equation result, recall that the price equation *LOC* estimate implies decreasing price with approaching contract expiration while the *TOM* equation *LOC* estimate implies longer expected selling time with longer contract length. The results for the two equations are entirely consistent with each other. The *TOM* estimate in particular supports the notion that longer contracts reinforce broker moral hazard; longer listing periods lead to longer selling time.

5. CONCLUSION

Buyers, sellers and intermediaries have conflicting objectives throughout the listing, marketing and selling phases of the real estate transaction. Decisions surrounding the pricing, listing contract length, selling price and selling time are interrelated. The empirical results provide strong support for the notion that mispricing by sellers significantly impacts listing contract length and vice versa. The longer listing contracts in turn negatively impact liquidity (increase selling time) but lead to higher selling price.

Thus there is implied indirect relationship between these measures. The empirical results are consistent with our hypotheses about broker incentives when setting the length of listing contract and homeowners when setting listing prices, which, in turn, affect broker effort, thereby impacting selling price and time on market. The observed price and liquidity effects support the notion that longer contracts reinforce broker moral hazard by providing greater incentive for lower effort at each point in time during the contract period.

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Exhibit 1: Variable legend

Variable	Description
LP	Listing price
SP	Selling price
TOM	Time on market
Prev Mkt TOM	Average time on market of properties sold in previous quarter
LOC	Length of listing contract
DOP	Hedonic measure for overpricing
Total Comp	Competition
Listing Density	Listing density
Sqft	Square foot living area of property
Age	Age of property
New	Dummy variable, 1 if property is new construction, 0 otherwise
Vacant	Dummy variable, 1 if property is currently vacant, 0 otherwise
Bedrooms	Number of bedrooms
Full bath	Number of full bathrooms
Half bath	Number of half bathrooms
Hardwood	Dummy variable, 1 if property has hardwood flooring, 0 otherwise
Ceramic tile	Dummy variable, 1 if property has ceramic tile flooring, 0 otherwise
Carpet	Dummy variable, 1 if property has carpet, 0 otherwise
Full Bsmt	Dummy variable, 1 if property has full basement, 0 otherwise
Fin Bsmt	Dummy variable, 1 if property has finished basement, 0 otherwise
Brick	Dummy variable, 1 if property has brick exterior, 0 otherwise
Vinyl Siding	Dummy variable, 1 if property has vinyl, 0 otherwise
Garage	Dummy variable, 1 if property has garage, 0 otherwise
Fire	Dummy variable, 1 if property has fireplace, 0 otherwise
Pool	Dummy variable, 1 if property has swimming pool, 0 otherwise
One Story	Dummy variable, 1 if property is one story dwelling, 0 otherwise
Two Story	Dummy variable, 1 if property is two story dwelling, 0 otherwise
Fenced Yard	Dummy variable, 1 if property has fenced yard, 0 otherwise
Paved Drive	Dummy variable, 1 if property has paved drive, 0 otherwise
Mobile	Dummy variable, 1 if property is mobile home, 0 otherwise
Other Bldgs	Dummy variable, 1 if property has other building on property, 0 otherwise
<1acre	Dummy variable, 1 if property is located on 1 acre or less, 0 otherwise
Male Owner	Dummy variable, 1 if property owner is male, 0 otherwise
Couple Owner	Dummy variable, 1 if property owner is a couple, 0 otherwise
Institution owner	Dummy variable, 1 if property owner is institutional, 0 otherwise
LA Salesman	Dummy variable, 1 if listing agent is a sales person, 0 otherwise
LA Franchise	Dummy variable, 1 if listing agent is employed by franchised brokerage firm, 0 otherwise
Agent Realization	Average broker discount
Agent Territory	Dummy variable, 1 if agent has a “specialized” area and listed property is in that area, 0 otherwise
Geog Specialize	Dummy variable, 1 if agent does not have geographically specialized area.
Tenant	Dummy variable, 1 if property is tenant occupied, 0 otherwise
Rental	Dummy variable, 1 if property is marketed as rental property, 0 otherwise

Agricultural	Dummy variable, 1 if property is zoned agricultural, 0 otherwise
Children	Dummy variable, 1 if property has 3 or more bedrooms , 0 otherwise
LEI	Leading economic indicator index at date of listing (composite index)*
School Quality	Average standard of learning measure of school district
Agent Scale	Total number of listings by listing agent over sample period
Fed Fund Rate	Fed funds rate at date of listing
Mtg Rate	30 year fixed mortgage rate at date of listing (Source: FHLMC)
List time	Chronological time control variable
List time-sq	Quadratic time control variable

* The ten components of **The Conference Board Leading Economic Index®** for the U.S. include: average weekly hours, manufacturing, average weekly initial claims for unemployment insurance, manufacturers' new orders, consumer goods and materials, ISM index of new orders, manufacturers' new orders, nondefense capital goods excluding aircraft orders, building permits, new private housing units, stock prices, 500 common stocks, leading Credit Index™, interest rate spread, 10-year Treasury bonds less federal funds, average consumer expectations for business and economic conditions

Exhibit 2: Descriptive statistics

	All Observations		Sold Properties	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
LP	195453.30	160469.30	177431.10	116090.70
SP	173162.50	108903.10	173162.50	108903.10
TOM	124.4889	96.4114	105.0400	82.3243
Prev Mkt TOM	131.5703	25.7574	129.5495	25.6231
LOC	185.1683	101.6177	182.1449	95.3699
DOP	12.0051	0.4889	11.9763	0.4571
Total Comp	149.1741	314.2819	135.9930	275.5416
Listing Density	1.2153	1.7098	1.2618	1.6585
Sqft	2057.40	886.69	2007.03	809.34
Age	29.9067	32.1929	28.9245	28.9455
New	0.1242	0.3298	0.1270	0.3330
Vacant	0.2252	0.4177	0.2375	0.4256
Bedrooms	3.3539	0.7617	3.3269	0.7291
Full bath	2.0560	0.7429	2.0370	0.7101
Half bath	0.3803	0.5277	0.3752	0.5218
Hardwood	0.5858	0.4926	0.6015	0.4896
Ceramic tile	0.2417	0.4281	0.2351	0.4241
Carpet	0.7990	0.4007	0.8075	0.3943
Full Bsmt	0.5746	0.4944	0.6103	0.4877
Fin Bsmt	0.2751	0.4466	0.2930	0.4552
Brick	0.5016	0.5000	0.5410	0.4983
Vinyl Siding	0.4871	0.4998	0.4710	0.4992
Garage	0.4044	0.4908	0.3948	0.4888
Fire	0.6974	0.4594	0.7145	0.4517
Pool	0.1401	0.3471	0.1435	0.3506
One Story	0.3859	0.4868	0.4032	0.4906
Two Story	0.2626	0.4401	0.2411	0.4277
Fenced Yard	0.1624	0.3689	0.1710	0.3765
Paved Drive	0.4695	0.5081	0.5183	0.5111
Mobile	0.0092	0.0952	0.0056	0.0745
Other Bldgs	0.3748	0.4841	0.3644	0.4813
<1acre	0.5964	0.4906	0.6391	0.4803
Male Owner	0.7514	0.4322	0.7374	0.4401
Couple Owner	0.0456	0.2086	0.0471	0.2119
Institution owner	0.1747	0.3798	0.1848	0.3882
LA Salesman	0.6404	0.4799	0.6319	0.4823
LA Franchise	0.3761	0.4844	0.3719	0.4833
Agent Realization	0.9780	0.0095	0.9786	0.0090
Agent Territory	0.3270	0.4691	0.3813	0.4857
Geog Specialize	0.2006	0.4004	0.1793	0.3837
Tenant	0.0182	0.1337	0.0121	0.1091
Rental	0.0482	0.2141	0.0361	0.1865
Agricultural	0.1277	0.3338	0.1046	0.3061

Children	0.3469	0.4760	0.3323	0.4711
LEI	98.9858	6.0862	98.8905	6.1440
School Quality	87.6959	5.1518	87.6819	5.1126
Agent Scale	96.6014	125.1304	106.7221	137.3641
Fed Fund Rate	2.9959	1.6501	3.0085	1.6716
Mtg Rate	6.1942	0.4522	6.1831	0.4839
	N = 18,352		**N = 11,118**	

Exhibit 3: 3SLS Agent (LOC) and Seller (DOP) Best Response Functions Estimates

Variable	lnLOC Equation	lnDOP Equation
DOP	0.0459**	
	(0.0187)	
LA Salesman	-0.0649	
	(0.0676)	
LA Fran	-0.0139	
	(0.0186)	
LA Sex	-0.0075	
	(0.1000)	
Prev Mkt TOM	0.0018***	
	(0.0002)	
Agent Territory	-0.0564***	
	(0.0127)	
Geog Specialize	-0.0181	
	(0.0171)	
lnLOC		0.0356***
		(0.0127)
Agriculture		-0.0563***
		(0.0092)
Children		0.4461***
		(0.0060)
LEI		-0.0050**
		(0.0021)
School Quality		0.0086***
		(0.0006)
Male owner		0.0290
		(0.0179)
Couple owner		0.0816***
		(0.0217)
Institutional owner		0.0552***
		(0.0193)
Agent Realization	-5.0037***	0.9670***
	(1.0935)	(0.3216)
Vacant	0.0425***	-0.2543***
	(0.0106)	(0.0072)
New	0.2628***	0.2636***
	(0.0133)	(0.0114)
Tenant	0.0499*	-0.2506***
	(0.0292)	(0.0221)
Rental	0.0620***	-0.0690***
	(0.0183)	(0.0139)
Fed Funds Rate	0.0162***	0.0001***
	(0.0035)	(0.0000)
Mtg Rate	-0.0466***	0.0176***
	(0.0124)	(0.0028)
Listtime	-0.0072*	0.0427***

	(0.0039)	(0.0095)
Listtime-sq	0.0001	0.0398***
	(0.0001)	(0.0061)
_cons	9.0580***	-0.0004***
	(1.2127)	(0.0001)

Notes: Standard error estimates in parentheses.

Exhibit 4: 3SLS Pricing and Duration System Results

Variable	lnSP Equation	lnTOM Equation
DOP*	0.1612***	0.8036***
	(0.0547)	(0.2737)
lnLOC*	0.0460***	0.2118***
	(0.0121)	(0.0597)
lnTOM	0.0765***	
	(0.0078)	
lnSP		2.5718***
		(0.5466)
Rental	0.0137	0.1215**
	(0.0143)	(0.0532)
Tenant	-0.1114***	0.6359***
	(0.0273)	(0.0953)
LEI	0.0069***	-0.0361***
	(0.0017)	(0.0065)
lnSQFT	0.5748***	-1.3813***
	(0.0129)	(0.3233)
lnAge	-0.0913***	0.2526***
	(0.0031)	(0.0498)
Vacant	-0.0744***	0.5423***
	(0.0153)	(0.0474)
New	-0.0974***	0.0540
	(0.0191)	(0.1046)
Hardwood	0.0640***	-0.1601***
	(0.0056)	(0.0405)
Ceramic tile	0.0750***	-0.1883***
	(0.0063)	(0.0464)
Full base	0.0443***	-0.1386***
	(0.0055)	(0.0298)
Brick	0.0491***	-0.1747***
	(0.0055)	(0.0308)
Garage	0.1085***	-0.2523***
	(0.0058)	(0.0637)
Fire	0.0726***	-0.2098***
	(0.0064)	(0.0441)
Bedrooms	-0.0118****	0.0623**
	(0.0070)	(0.0251)
Full bath	0.0884***	-0.2360***
	(0.0056)	(0.0527)
Half bath	0.0725***	-0.1982***
	(0.0056)	(0.0434)
Other bldgs	0.0176***	-0.0340
	(0.0056)	(0.0227)
Fed Funds	0.0014	

Rate	(0.0026)	
Mtg rate	0.0294***	-0.1556***
	(0.0088)	(0.0301)
Area1	0.0667***	-0.1749***
	(0.0110)	(0.0544)
Area2	0.0994***	-0.3897***
	(0.0093)	(0.0482)
Area3	-0.0638***	0.1342**
	(0.0145)	(0.0660)
Area4	0.0398***	-0.2789***
	(0.0077)	(0.0263)
Area5	-0.0105	-0.0459
	(0.0116)	(0.0425)
Children	-0.0963***	-0.3322**
	(0.0265)	(0.1393)
<1 acre	-0.0705***	0.1286**
	(0.0061)	(0.0511)
Listtime	0.0115**	-0.0454***
	(0.0052)	(0.0171)
Listtime-sq	-0.0001	0.0003
	(0.0001)	(0.0003)
Listing Density	-0.0249***	
	(0.0015)	
Total Comp		0.0010***
		(0.0000)
_cons	3.9753***	-20.8979***
	(0.6337)	(1.9892)

Note: Standard error estimates in parentheses.