UCF College of Business Administration

Dr. P. Phillips School of Real Estate

Client Externality Effects of Agents Selling Their Own Properties

Xun Bian
Longwood University

Bennie D. Waller
Longwood University

Geoffrey K. Turnbull
University of Central Florida

Working Paper 1302

Client Externality Effects of

Agents Selling Their Own Properties

Xun Bian
bianx@longwood.edu

Bennie D. Waller*
wallerbd@longwood.edu

Geoffrey K. Turnbull
Geoffrey.Turnbull@ucf.edu

July 8, 2013

Abstract. This study is the first to examine the principal-agent issues surrounding how agents' efforts to sell their own properties affect their efforts to sell concurrently listed client properties. The principal-agent model shows that listed agent-owned properties induce agents to worker harder over all, but diminish effort dedicated to marketing concurrently listed client properties, leading to reduced liquidity and/or lower selling prices for those properties. The empirical results show that client properties competing with agent-owned properties remain on the market 30% to 46% longer and sell for 1.8% less than properties whose agents have no such conflict of interest.

*contact author

1. Introduction

This study is the first to examine the principal-agent problem that exists when a client's property is marketed concurrently with properties owned by the listing agent. It focuses on the extent to which agents' sales efforts on behalf of clients are influenced by their interest in marketing their own properties. Previous studies examine differences in sale price and/or time on market between agent-owned properties and client properties. Agency theory predicts that real estate agents work harder to sell their own properties than they do client properties (Rutherford, Springer and Yavas, 2005). The empirical results show that owner-agent properties stay on the market for equal or longer period of time but sell at a price premium relative to client properties (Rutherford, Springer and Yavas, 2005; Levitt and Syverson, 2008), evidence of misaligned principal-agent incentives between sellers and their real estate agents.

This paper explores a different dimension of the principle agent problem in real estate brokerage. Instead of focusing on the difference in individual sales of agent-owned and agent-represented properties, we focus on how agents allocate their selling efforts across listings in order to isolate how selling their own properties affects performance on concurrently listed client properties. The stylized model of agent selling effort predicts that agent-owned properties on the market at the same time as client properties lead to inferior marketing outcomes for client properties; agents work harder over all but also divert effort from client properties to marketing their own, creating an agent-listing externality on client properties. The empirical study draws on eleven years of housing sales data to test the relative performance hypothesis, estimating how client selling price and time on market changes when the listing agent is simultaneously marketing its own

property. The results are relevant to understanding housing market performance, given that approximately 85% of homeowners rely on the services of licensed real estate professionals when selling their homes (NAR, 2011).

It is not unusual for real estate agents to engage in personal transactions for speculation, long term investing or buying and selling personal residences. In our sample, approximately 6% of listings are owned by a licensed real estate agent. This percentage is considerably larger than the roughly 3% reported by Levitt and Syverson (2008) and Rutherford, Springer and Yavas (2005). Some of the difference may be attributed to differences in sample periods and locations. The sample in this study covers 1999-2009, which includes the bubble of the early-to-mid 2000s and the market collapse later in the decade. In contrast, Rutherford, Springer and Yavas (2005) and Levitt and Syverson (2008) look at earlier periods, 1998-2002 and 1992-2002, respectively.

The typical seller, whether a real estate professional or not, is looking for an expedient transaction at the maximum selling price. Real estate agents are typically compensated for their services in the form of a commission when successfully marketing a client property and the entire selling price when marketing their own property.[1] Since a number of agents market their own properties concurrently with client properties and their efforts on behalf of a client are not directly observable, they have an opportunity to shirk on servicing client properties. Standard search theory suggests that lower agent sales effort decreases the arrival rate of buyers for client properties and decreases expected selling price and/or liquidity. The housing market data confirm the predicted price and liquidity wedges for client properties represented by agents with and without their own properties on the market.

[1] The presence or absence of co-brokerage commissions does not alter the conclusions.

2. Background Literature

Existing studies examine principal-agent conflicts inherent in real estate brokerage from a variety of perspectives including agent effort, compensation, and dual agency (Miceli, 1989; Geltner, Kluger and Miller, 1991; Anglin and Arnott, 1991; Arnold, 1992; Munneke and Yavas, 2001; Rutherford, Springer and Yavas, 2005; Gardiner, et al., 2007; Levitt and Syverson, 2008; Hendel, Nelo and Ortelo-Megne, 2009; and Waller, Brastow and Johnson, 2010). Asymmetric information may create an incentive for agents to misrepresent market information to the principal (Arnold, 1992). Anglin and Arnott (1991) argue that asymmetric information drives the principal-agent problem between seller and broker and conclude that commission based contracts do not allocate risk efficiently or provide appropriate incentives for agents.

Geltner, Kluger and Miller (1991) scrutinize the principal-agent conflict from two dimensions; the level of selling effort exerted by the listing broker and broker effort to influence the seller's reservation price. They contend that the principal-agent conflict is greatest at the start of the listing period as brokers are likely to rationally procrastinate, increasing effort only as the listing period nears its end. On the other hand, Miceli (1989) suggests that listing contracts of limited duration can help overcome agent rational procrastination and can be structured to elicit greater broker effort on behalf of the seller. There is evidence that longer listing contracts lead to longer marketing durations (Waller, Brastow and Johnson 2010).

Previous studies acknowledge the principal-agent dilemma surrounding agent-owned properties and as such have focused on the selling price and liquidity of owner-

agent properties relative to client-owned properties. The results of these studies find that agent-owned properties transact at significantly higher selling prices relative to client owned properties with mixed results for property liquidity. This is attributed to, at least in part, asymmetric information. Levitt and Syverson (2008) examine approximately 98,000 transactions from an Illinois MLS occurring between 1992 and 2002, of which approximately 3.4% involved owner-agents. Using OLS, the authors find that agent-owned properties sell at a 4.8% premium and sustain an extended marketing duration of almost 17 days relative to client owned properties. After taking into account agent reputation and experience, owner-agent properties continue to have longer marketing durations of approximately 11 days relative to client owned properties and transact for a 4.2% premium. After adjusting for location differences, they find that agent-owned properties stay on the market approximately 10 days longer and sell for 3.7% more than client properties. They suggest that agents' greater market knowledge and the commission form of agent compensation lead to client properties being sold too quickly at a lower price.

Rutherford, Springer and Yavas (2005) use MLS data from 1998-2002 to examine the same questions. In order to address censoring associated with the unsold properties the authors use a Weibull hazard model for estimating duration. The pricing model is a standard log-linear OLS hedonic equation. In additional to capturing the impact of owner-agents on selling price and marketing duration, the authors also use dummy variables to capture the impact of agents that have sold multiple owner-agent properties. Their results indicate that, while client properties have approximately the same degree of liquidity, owner-agent properties tend to sell for 4.5% higher prices.

This paper differs from previous owner-agent studies. It focuses on client properties, examining how an agent's attempt to sell its own property influences price and liquidity performance on client properties. The next section of the paper presents a simple model of agent behavior that illustrates why agents selling their own properties will expend greater total sales effort across their inventory of listings, but will also tend to reallocate effort from selling client properties to selling their own property. As a consequence, client properties being concurrently marketed with agent-owned properties will have lower realized prices and longer time on the market. Section 4 provides an overview of the data and sample, in which over 11% of client properties listed over the sample period compete with an agent-owned property. Section 5 explains the empirical approaches used in this study. Following earlier agency studies, we use separate OLS hedonic pricing and liquidity models, a Weibull hazard duration model, and a 3SLS simultaneous model of price and liquidity. Section 6 presents the empirical estimates. The price effects estimates show some sensitivity to the estimation method, but the preferred 3SLS estimates nonetheless indicate that client properties concurrently marketed with agent-owned properties sell at a significant discount relative to other client properties whose listing agent is not marketing its own property. The liquidity results are robust across empirical models. Liquidity is negatively affected by concurrent marketing of agent-owned properties; it takes as much as 50% longer to sell client listings marketed concurrently with agent-owned properties than client properties being marketed by agents without agent-owned properties. The final section concludes.

3. Agent Search Effort

This section offers a stylized agent search model to study the incentives confronting listing agents. We adopt the simple bargaining structure of Rutherford et al. (2005) in which the seller's asking price is treated as a take-it-or-leave-it offer to the buyer.[2] We assume that the seller of the property sets the asking price P.[3] As a result, a buyer will accept an asking price if and only if the asking price is below his reservation price. The continuous density function of buyers' reservation prices is given by $f(\cdot)$ over the interval $\left[\underline{p}, \overline{p}\right]$. As a member of the local multiple listing service (MLS), the listing agent submits the listing to the MLS. There is a large number of agents who are members of the MLS; any other agent procuring a buyer for the listing is referred to as the selling agent. Along with the information about the property, the listing agent also indicates the percentage of the price k_s that he will share with the selling agent. The MLS then disseminates the listing to all other members of the MLS. Following the current practice in the industry, the listing agent receives k percentage of the price as commission from the seller upon the sale of the property. Out of the total commission, the listing agent pays $k_s, k_s < k$, proportion of the price to the selling agent. If the listing agent finds the buyer himself, he retains the entire commission kP. Following convention, we assume that the total commission rate, k, and the selling agent's share, k_s, are exogenously determined in the market.

[2] This model, like most agency models, suppresses the buyer-seller negotiation process. See Harding, Rosenthal and Sirmans (2003) and Merlo and Ortalo-Magne (2004) for empirical analyses of bargaining issues.

[3] Real estate agents may try to influence sellers' asking prices in which case they may have an incentive to suggest suboptimal asking prices (Arnold, 1992; Rutherford et al. 2005). This model does not address these complications.

Using this notation, the listing agent's expected payoff *V* from a single contract is given by

$$V = \psi(L)\int_P^{\bar{p}} kPf(p)dp + \phi\int_P^{\bar{p}} (k - k_s)Pf(p)dp - C(L) \tag{1}$$

where $\psi(L)$ is the probability that the listing agent will find a buyer, the dual agency outcome in which the listing agent represents both the seller and the buyer. We assume agent search effort L increases ψ at a decreasing rate, $\psi' > 0$ and $\psi'' < 0$. The first additive term in (1) is the expected payoff under dual agency, under which the listing broker receives the entire commission *kP*. The commission *kP* is first integrated within the range $[P, \bar{p}]$, and it is then weighted by the probability of dual agency, $\psi(L)$. The second additive term in (1) is the expected payoff from a co-brokered sale assisted by another (selling) agent. ϕ is the probability that one of the other MLS agents locates a buyer. Given the large number of MLS members and the competition among them to sell the property, the listing broker takes ϕ as given. In the co-brokered case, the listing agent receives $(k - k_s)P$. The third additive term in (1), $C(L)$, is the listing agent's search or selling cost, which is increasing in effort at an increasing rate, $C' > 0$ and $C'' > 0$.

Suppose the listing agent simultaneously services *n* contracts, indexed by subscripts $i \in [1 \cdots n]$. The agent chooses search effort levels for each property, $L_1, \cdots, L_n$, to maximize the total expected payoff. Thus, the listing agent's problem is

$$\begin{aligned} \max_{L_1 \cdots L_n} \Pi(L_1 \cdots L_n) &= \sum_n V_i \\ &= \sum_n \left[\psi(L_i)\int_{P_i}^{\bar{p}} k_i P_i f(p)dp + \phi\int_{P_i}^{\bar{p}} (k_i - k_s)P_i f(p)dp \right] - C\left(\sum_n L_i\right) \end{aligned} \tag{2}$$

The *n* first-order conditions for an interior solution are given by

$$\psi'(L_i)\int_P^{\bar{p}} k_i P_i f(p)dp - C'\left(\sum_n L_i\right) = 0\,,\ \forall i \tag{3}$$

The first term of (3) is the agent's marginal benefit from additional effort. Since $\psi'(L_i) > 0$, additional search increases the likelihood of earning the entire commission $k_i P_i$. The second term is the agent's marginal cost of greater search intensity. The agent's search efforts $L_1, \cdots, L_n$ satisfy (3); the agent's effort on each property equates the expected marginal payoff from additional effort to the common marginal cost of search.

To find the impact of the commission rate k_j on agent effort to sell property *j*, implicitly differentiate the system of *n* equations (3) and solve for

$$\frac{\partial L_j^*}{\partial k_j} = -\psi'\left(L_j^*\right)\int_P^{\bar{p}} P_j f\left(p\right) dp \frac{\det H_{n-1}}{\det H_n} > 0 \tag{4}$$

where H_r is the *r*-order principle minor of the Hessian matrix of (2) and $\det H_{n-1}/\det H_n < 0$ using the negative definiteness of the Hessian for the strictly concave objective function (2). As a consequence, (4) is unambiguously positive. The intuition here is straightforward. A greater commission rate k_j for one particular property increases the expected marginal payoff and, hence, induces greater search effort for that property.

Turning to the effect of commission rate for another property *i* on the effort to sell property *j*, first note that, because (3) must be satisfied for all properties, it is true that

$$\psi'\left(L_i^*\right)\int_P^{\bar{p}} k_i P_i f\left(p\right) dp = \psi'\left(L_j^*\right)\int_P^{\bar{p}} k_j P_j f\left(p\right) dp \tag{5}$$

The agent allocates effort such that expected marginal payoffs are the same across properties. Differentiating (5) illustrates that the agent decreases the amount of effort allocated to other properties *i* (holding total effort constant) when the commission rate k_j rises:

$$\left(\frac{\partial L_i^*}{\partial k_j}\right)_{dL=0} = -\frac{-\psi'\left(L_j^*\right)\int_P^{\bar{p}} P_j f(p)\,dp}{\psi''\left(L_i^*\right)\int_P^{\bar{p}} k_i P_i f(p)\,dp} < 0 \tag{6}$$

This is intuitively appealing; the agent has an incentive to allocate (relatively) less effort to other properties when the commission rate on one increases. But while intuitively appealing, this relationship does not consider the concomitant effect of the agent increasing or decreasing total search effort as the commission rate k_j on property *j* changes. Differentiating (3) for $n = 2$ without loss of generality (where applying (5), subscript *i* now indicates a representative other listing) yields

$$\frac{\partial L_i^*}{\partial k_j} = \frac{-C''\psi'\int_P^{\bar{p}} P_j f(p)\,dp}{\det H_2} < 0 \tag{7}$$

so that the agent unambiguously reduces search effort expended on behalf of other properties when the effective commission rate for one property rises. The effect on total agent effort across all properties follows from (4) and (7), which together yield

$$\frac{dL^*}{dk_j} = \frac{\partial L_i^*}{\partial k_j} + \frac{\partial L_j^*}{\partial k_j} = \frac{-\psi''\psi'\int_P^{\bar{p}} P_j f(p)\,dp}{\det H_2} > 0 \tag{8}$$

In sum, in response to an increase in the commission rate for one property, the agent expends more total effort (8) but channels that additional effort (4) as well as some effort reallocated from other properties (7) into selling the higher commission property. A higher commission rate for one property creates a negative effort allocation externality for other properties in the agent's portfolio of listings. These relationships drive the main conclusions of the analysis, considered next.

While there is some variation in commission rates across properties (Turnbull and Sirmans, 1997; Sirmans, Turnbull and Benjamin, 1991), most full service contract rates nonetheless lie within a fairly narrow range of 5-7% in many housing markets, a range that is generally narrower for cross section samples over fairly short time periods than over extended periods covering various market phases.[4] Therefore, it appears reasonable to expect variation in selling effort across client properties arising from differences in commission rates to be relatively small at a given point in time. The exception is when the agent sells his own property.

When a buyer for the agent's property is located by the listing agent, the owner-agent receives $P - R$, which is the difference between the selling price P and the owner-agent's reservation price R. When a buyer is located by other agents, the listing agent receives $P - R - k_s P$ for its property. In either case, we can view owner-agent properties as a special type of contract with a commission rate k_O greater than prevailing market commission rate k. Cast this way, (4), (7), and (8) predict that, while an agent with its own properties on the market exerts more total sales effort, it nonetheless expends less sales effort on client properties relative to client properties of other agents without

[4] Turnbull and Sirmans (1997) show that much of the commission rate variation reflects varying housing (hence brokerage) market conditions over time over the housing market cycle.

property for sale. The latter relationship has not yet been studied in the empirical literature. It is to this task that we now turn.

Before doing so, however, we note that Hubbard (2002) argues that reputation effects can mitigate moral hazard by agents providing expertise, like doctors, mechanics, and lawyers, although he admits the theory is not developed and the process is not fully understood. It seems reasonable that the same rationale may apply to real estate agents, vitiating the client externality moral hazard identified here. In any case, the presence or absence of agent-owned effects on client properties remains an unanswered empirical question.

4. Data

The data used in this analysis covers residential properties listed with a real estate agent and displayed for sale in a central Virginia MLS. The data in the sample are limited to exclusive right to sell listings, which entitles the listing agent to a commission during the term of the listing contract, regardless of who sells the property. The sample covers residences listed for sale over the 11 year period 1999-2009. The data set used in this study allows us to identify those client properties which are marketed concurrently with the listing agent's own property. Just over 11% of client listed properties (1,215) in the sample data competed directly with their listing agent's property in the sense that they were concurrently listed for sale with at least one property owned and listed for sale by their listing agent.[5]

[5] Agent-owned properties were not included in the empirical analysis.

The data are vetted for incomplete, missing or illogical entries. Since MLS data are entered by the listing agent or office staff, we compare random samples of the MLS data with property tax records as an additional check for accuracy. The sampled MLS data are in full agreement with property tax records. Additional filtering includes removing transactions with lot sizes exceeding 1 acre. Very few agent-owned properties list for less than $75,000 or greater than $265,000, so we focus on transactions between $75,000- $265,000. The final data set comprises 10,818 observations of which 7,406 are sold and 3,412 withdrawn from the MLS or expired listings. There are 583 agent-owned properties, approximately 5.4% of the sample. Of the owner-agent properties listed for sale, 341 were sold and 242 were withdrawn or allowed to expire during the sample period.

The MLS provides data on almost all properties listed for sale in the area, regardless of whether the property is sold. Data collected from the MLS include the usual property characteristics such as age, square footage, various amenities including a garage or fireplace, geographic location information, lot size and listing and selling price. We use the reported calendar information to construct a quarterly time index to control for changing market conditions. The data also indicate whether the owner of the property holds a real estate salesperson license, essential information for this study. Table 1 provides a complete list of variables and definitions.

In order to get a sense of the similarities between client and owner-agent properties and how such properties are likely to compete for similar buyers, Table 2 reports the descriptive statistics for client properties being concurrently marketed with agent-owned properties compared to agent-owned properties on the market. A

comparison of means between agent-owned and concurrently marketed client properties reveals no significant differences in listing price ($149,998 versus $148,002), selling price ($145,046 versus $141,477), square footage (1,687 versus 1,712 square feet), fireplaces (0.57 versus 0.54), garages (0.34 versus 0.32), brick exterior (0.56 versus 0.54), or finished basements (0.20 versus 0.23). These results suggest that the properties owned by these listing agents are likely substitutes for those they are concurrently marketing for their clients. Agent-owned properties are more likely to be vacant (0.30 versus 0.15), have hardwood floors (0.54 versus 0.43) and ceramic tile flooring (0.27 versus 0.23). Client properties listed with agents concurrently marketing an agent-owned property spend a significantly longer time on market than do agent-owned properties (170 versus 140 days).

5. Empirical Models

The principal objective of this study is to determine whether real estate agents are apt to allocate less effort to client properties that are concurrently being marketed with their agent-owned listings. The empirical test is conceptually straightforward: compare selling price and marketing duration of client properties concurrently marketed with an agent-owned property to client properties with no such potential principal-agent conflict.

There are differing philosophies regarding the best empirical approach for pricing and liquidity or time on market models. The majority of studies use OLS for pricing models (Rutherford, Springer and Yavas, 2005; Levitt and Syverson, 2008) as well as liquidity models (Belkin, Hempel and McLeavey, 1976; Levitt and Syverson, 2008). However, since OLS may be inappropriate for estimating duration or time on the market

(Lancaster, 1990), we follow a second branch of the empirical liquidity literature and also apply the Weibull hazard model to analyze duration in the single equation approach (Anglin, Rutherford and Springer, 2003; Rutherford Springer and Yavas, 2005; Waller, Brastow and Johnson, 2010; Rutherford and Yavas, 2012).

Another approach in the pricing and duration literature does not treat price and liquidity as independent outcomes, but instead models them as a system of simultaneous equations. Examples include Sirmans, Turnbull and Benjamin, (1991), Knight (2002), Turnbull and Dombrow (2006, 2007), Clauretie and Daneshvary (2008), and Waller, Brastow and Johnson (2010).

This study uses each of these approaches in order to both provide estimates that are methodologically comparable to previous studies looking at other aspects of the principal-agent problem in house sales and to assess the robustness of the empirical results. The OLS price model, the Weibull duration model of liquidty, and the 3SLS simultaneous price-liquidity model broadly follow the same general framework, with the specific differences in empirical specifications noted below.

The separate single equation price and liquidity empirical models are based on the estimated equations

$$ln(SP_i) = \beta_0 + \beta_1 OACL + \beta_2 OAMCL + \beta_3 OASQFT + \beta_4 OADISTANCE + \sum \beta_i X_i + \varepsilon_{Pi} \quad (9)$$

$$ln(TOM_i) = \beta_0 + \beta_1 OACL + \beta_2 OAMCL + \beta_3 OASQFT \quad (10)$$
$$+ \beta_4 OADISTANCE + \sum \beta_i X_i + \varepsilon_{Li}$$

where *ln*(*SP*) is selling price, **X** is a vector of property characteristics, fixed effect controls, time and economic controls, *OACL* is a dummy variable indicating if the listing agent has an owner-agent concurrent listing being marketed with the client property, *OAMCL* is a dummy variable indicating if the listing agent has more than one such agent-owned property being concurrently marketed with the client property, and $OASQFT_i$ is the square footage of a client property relative to a concurrently listed owner-agent property. In instances where an agent owns more than one property concurrently competing with a client property, the average square footage of owner-agent properties is used in the calculation:

$$OASQFT = \frac{SQFT(Client\ property) - SQFT(Owner/agent\ property)}{SQFT(Owner/agent\ property)}$$

The variable $OADISTANCE_i$ is the (great circle) distance between the client property and the concurrently marketed owner-agent property. In instances where an agent owns more than one property concurrently competing with a client property, the measure uses average distance of the owner-agent properties from the subject client property. Finally, ε is the Gaussian error term

Rutherford, Springer and Yavas (2005) and Levitt and Syverson (2008) represent one approach, estimating separate price and liquidity equations using OLS. Another

approach follows Rutherford and Yavas (2012), estimating the single equation duration framework using a Weibull hazard model.

The third approach estimates price and liquidity as a simultaneous system. This is our preferred approach. The empirical model is motivated by search theory, which implies that both price and time on the market are co-determined by identical factors (Krainer, 2001). This creates econometric problems, since the system of price and liquidity equations implied by search theory is not identified. Early studies using simultaneous price-liquidity approaches rely on *ad hoc* restrictions in order to identify both equations (Sirmans, Turnbull and Benjamin, 1991). In contrast, Zahirovic-Herbert and Turnbull (2008) offer a practical procedure for dealing with the identification problem.

We briefly summarize the approach and its rationale here. Following Turnbull and Dombrow (2006, 2007), the variable *COMP* measuring surrounding or neighborhood competition is defined as the distance-weighted number of houses in the surrounding neighborhood that are on the market at the same time as the subject property (by construction, *COMP* measures competition in terms of house-days). Competing houses are those that are no more than 20% larger or smaller than the subject property. This variable captures the surrounding neighborhood market conditions and, following the implications of search theory, appears in both price and liquidity equations like (9) and (10) as do all of the other house and location characteristics. Using these modified equations as a starting point, Zahirovic-Herbert and Turnbull (2008) show that including time on the market as an explanatory variable in the selling price equation (as implied by search theory) means that the estimated coefficient on the *COMP* variable in the price

equation is not the total effect of the number of competing houses on the market at the same time as the subject property, but instead is the effect of the number of competing houses on the market per day of subject market exposure, which is defined as the listing density (*LD*). Imposing this parametric restriction across the equations (9) and (10) with *COMP* included yields the simultaneous system

$$ln(SP_i) = \beta_0 + \beta_1 OACL + \beta_2 OAMCL + \beta_3 OASQFT + \beta_4 OADISTANCE + \sum \beta_i X_i + \beta_j LD_j + \varepsilon_{Pi} \quad (11)$$

$$ln(TOM_i) = \beta_0 + \beta_1 OACL + \beta_2 OAMCL + \beta_3 OASQFT + \beta_4 OADISTANCE + \sum \beta_i X_i + \beta_j COMP_j + \varepsilon_{Li} \quad (12)$$

This system of equations is identified. The search theory that motivates the simultaneous price-liquidity system also implies cross-equation correlation of error terms, in which case 3SLS is asymptotically more efficient than 2SLS (Belsley 1988).

The interpretation of the coefficients on the *LD* and *COMP* variables follows Turnbull and Dombrow (2006). If a greater number of nearby houses on the market only increases the competition among sellers for the same pool of potential buyers then *LD* and *COMP* will have a negative coefficient in the price equation and/or positive coefficient in the liquidity equation, respectively. If, however, more nearby houses on the market also increases buyer search traffic in the neighborhood then the coefficients may

be positive in the price and/or negative in the liquidity equations, indicating the presence of shopping externalities from the surrounding properties.[6]

The agent-owner listing variables are interpreted the same regardless of the empirical approach taken; 3SLS, OLS single price equation, or Weibull single equation duration model. The theory predicts that agents with agent-owned properties concurrently marketed with client properties will reallocate effort from client listings toward their own listing. We expect an owner-agent listing (*OACL*) concurrently marketed with client properties to reduce selling price and/or increase marketing duration of client properties. If agents with more than one agent-owned property concurrently marketed with client properties reallocate greater effort toward their own listings then multiple owner-agent listings concurrently marketed with client properties (*OAMCL*) will also reduce selling price and/or increase marketing duration of client properties.

The degree of substitutability between the client and agent-owned properties may affect the sales outcome. In this vein, we expect that client properties that are poorer substitutes for the agent-owned property, measured by size of client property relative to the agent's own property (*OASQFT*), may suffer less diversion of selling effort to the agent-owned property, in which case greater relative size leads to higher seller price and/or shorter marketing time. Similarly, client properties located near a concurrent owner-agent property (*OADISTANCE*) are expected to exhibit negative price and/or positive market time effects to the extent that proximity indicates greater substitutability.

[6] See Turnbull and Dombrow (2006) for a more thorough discussion of the relationship between the estimated coefficients and underlying competition and shopping externality effects.

6. **Empirical Results**

The simultaneous price-liquidity model follows from search theory and so represents the preferred model; single equation estimates are reported later for comparison. Table 3 reports the results of the jointly estimated price-liquidity models for the full sample period. The signs and magnitudes of typical variables included in pricing and duration models are consistent with previous studies. Looking at the Table 3 estimates for the full sample period 1999-2009, the *OACL* coefficient for the pricing model is negative and significant indicating that client properties do sell at lower prices when being marketed at the same time as an agent's own listing. The estimates indicate that a client property listed by an agent who is concurrently marketing its own property will on average sell for approximately 1.5% less than a comparable property being marketed by an agent without this additional principal-agent complication. This translates into a $2,250 price reduction based on the sample average. Table 3 also reports liquidity equation estimates. As expected, the coefficient for *OACL* is positive and significant, indicating that client properties remain on the market longer when marketed concurrently with an agent-owned property. The client property being concurrently marketed with that of the listing agent is expected to remain on the market approximately 48% longer or an additional 58 days based on average marketing duration of 120 days.

To examine additional factors associated with the relationship between client and owner-agent properties, we add variables for multiple agent-owner properties, the relative size and the distance between the properties. Tables 4-6 report the 3SLS estimates of the simultaneous price-liquidity system for the full sample period and the pre- and post-crisis periods respectively with the additional variables. The signs and magnitudes of the usual

variables included in the hedonic models are consistent with previous pricing and duration studies. Looking at the Table 4 estimates for the full sample period 1999-2009, the *OACL* coefficient for the pricing model is negative and significant as in the base model reported in Table 3. The coefficient for agents with more than one agent-owned property (*OAMCL*) is also negative in the pricing equation although not significant at conventional levels. These results are broadly consistent with the potential principal-agent conflict identified in the theory, but offer no strong evidence that the agent own-listing externality on client properties increases with the number of agent-owned listings. The positive and marginally significant *OASQFT* coefficient indicates that larger client properties relative to the agent-owned property sell at higher prices, although the effect is modest. Finally, the distance of an agent-owned property (*OADISTANCE*) relative to that of a concurrently marketed client property does not have a significant impact on the selling price of the latter.

Table 4 also reports liquidity equation estimates. As in the base model, the coefficient for *OACL* is positive and significant, supporting the notion that client properties remain on the market longer when marketed concurrently with an agent-owned property. The client property being concurrently marketed with that of the listing agent is expected to remain on the market approximately 45% longer or an additional 54 days based on the average marketing duration. But additional owner-agent properties (*OAMCL*), the relative size of the client property (*OASQFT*) and the distance from the owner-agent property (*OADISTANCE*) do not have a significant impact on client property marketing duration.

We also examine subsamples for the sample period prior to the housing crisis (1999-2006) and during the crisis (2007-2009). Table 5 provides the 3SLS pricing and liquidity estimates for the pre-crisis period 1999-2006. As in the full sample estimates, an owner-agent property that is being concurrently marketed with a client property significantly reduces the selling price of client properties but now the effect is stronger. Client properties sell for nearly 2 percent less than when listed with agents with no such conflicts, which translates into a price decline of approximately $2,700.

The liquidity results for the pre-housing crisis period are also included in Table 5. As with the full sample period, the *OACL* coefficient is positive and significant. The estimate indicates that a client property being concurrently marketed with an owner-agent property will incur an increased marketing duration of almost 40 percent longer relative to properties with no such conflicts. This amounts to an additional 48 days based on average marketing duration of 120 days. Unlike the full sample estimates, the *OAMCL* coefficient is positive and significant in the pre-crisis period; clients with more than one owner-agent property being concurrently marketed have an increase in marketing duration of nearly 74 percent above those clients without such agent conflicts. This translates into an additional marketing duration of 88 days or a cumulative expected time on market of 208 days. Interestingly, neither the relative size of client properties relative to agent properties (*OASQFT*) nor the distance of the owner-agent property from the client property (*OADISTANCE*) has a separate significant impact on the marketing duration in the pre-crises sample period.

Table 6 reports the 3SLS results for the post-crisis period 2007-2009. As with in the full sample and the pre-crisis sample, the owner-agent concurrent listing (*OACL*)

coefficient is again negative in the post-crisis period, although not significant at conventional levels. The *OAMCL*, *OASQFT* and *OADISTANCE* coefficients are not significant. Similarly, the *OACL* coefficient in the liquidity equation is positive, albeit insignificant. As in the price equation, the *OAMCL*, *OASQFT* and *OADISTANCE* variables are not significant in the liquidity equation. The complete estimates suggest that the transactions patterns before the housing market crisis simply do not carry over into the post-crisis period. This does not mean that the principal-agent problem arising from concurrent marketing of client and agent-owned properties is not as important as before the crisis; instead, it reinforces the notion that price discovery and sales performance were deeply disrupted during the housing market collapse and its immediate aftermath to the extent that it is hard to pick up stable relationships among the variables of interest.

As explained earlier, other studies of related housing market principal-agent issues tend to rely on single equation price and liquidity models. In order to evaluate sensitivity to the estimation method, we re-estimate agent-owned property externality effects on client properties using the single equation models explained earlier. Table 7 reports price equation OLS estimates, Table 8 reports OLS duration model estimates, and Table 9 the Weibull duration model estimates. Looking at the price equation results first, it is interesting that none of the OLS estimates of interest is significant—although the point estimates on the *OACL* variable indicate lower client prices when the agent is concurrently listing, the coefficients are not significant in the pooled sample or the pre- and post-crisis subsamples. The other agent related variables also reveal no consistent story across samples. Taken in the context of the 3SLS estimates, the empirical price

conclusions appear to be sensitive to whether the endogenous time on the market is adequately controlled in the estimation.

The liquidity or marketing time results, however, tell a different story. Tables 8 and 9 present the marketing duration results for the OLS and Weibull models. The key variables offer strong evidence of a stable concurrent agent listing effect on expected selling time; the *OACL* and *OAMCL* coefficients are significantly positive for both OLS and Weibull estimates in the pooled sample and both subsamples. The full and pre-crisis sample results are qualitatively in line with the simultaneous system results discussed earlier. And the post-crisis sample period results are surprisingly similar to the pre-crisis results, something not observed in the systems approach.

The relative size (*OASQFT*) effect on liquidity resembles the simultaneous system estimates to the extent that it is significantly positive in the pooled and pre-crisis samples for both OLS and Weibull approaches. But the post-crisis sample yields very different results for the two approaches: significantly negative in the OLS model and positive but insignificant in the Weibull model. The distance from agent-owned property (*OADISTANCE)* variable coefficients are significantly negative in both OLS and Weibull models for the pooled and pre-crisis samples. The negative coefficient is consistent with the notion that agent-owned listings farther away from client properties depress client property prices more than when the agent-owned listings are closer. These results contrast with the simultaneous system estimates. When taken at face value, the estimates indicate that nearby agent-owned properties may have a shopping externality effect on nearby client properties. This particular conclusion is not robust, as it is sensitive to the empirical method used.

As a final robustness test, we re-estimate the simultaneous price-liquidity model using a propensity scoring method (PSM) matched sample approach. This method is designed to control for omitted variable or self-selection effects. It allows for the possibility that certain types of clients may be attracted to certain characteristics of agents with their own properties for sale (even though the fact that they have their own properties on the market need not be divulged to their clients) or that those agents are more likely to list certain types of client properties. In this application, the PSM provides consistent estimates of the concurrent agent-owned listing effect on price and liquidity of client properties (Rosenbaum and Rubin, 1983).

The first stage of the analysis estimates the probability that a house is listed by an agent with its own property listed concurrently, conditional on the set of property characteristics included in the price and liquidity equations. The propensity score of a particular property is the predicted logistic value based on the function estimated in the first stage. This approach has the advantage of reducing the multiple dimension matching problem to a single dimension (Dehejia and Wahba, 2002). We construct the matched sample using the predicted logistic values based on the function estimated in the first stage to match a property listed with an agent with no agent-owned property on the market with each observation of a client property listed with an agent with a concurrently listed agent-owned property. There are several techniques for matching observations of the treated samples with those of the control sample, including nearest-neighbor, radius, kernel matching, and stratification techniques (Becker and Ichino, 2002; Guo and Fraser, 2010). We apply the nearest-neighbor technique, whereby treated observations and

control observations are randomly ordered and paired based on closest propensity scores. The resultant matched pair sample comprises 1,455 total observations.

The second stage of the matched sample analysis estimates the 3SLS price-liquidity model using the matched pair sample. If the full sample and the matched sample yield significantly different results, then the difference indicates omitted variable or selection bias in the full sample results. If, however, the full and matched samples yield estimates that are not significantly different, then this indicates that the treatment effect (owner-agent concurrent listing, *OACL* = 1) can be interpreted as the underlying causal effect on price and liquidity outcomes.

Table 10 reports the results from the second stage 3SLS estimation of the price-liquidity system on the matched sample. The price effect of concurrent agent-owned listing remains negative, as before, but is now insignificant. The liquidity effect is significant. As in the full sample analysis without matching, concurrent agent-owned listing significantly increases selling time of client properties. The effect of multiple agent-owned listings is not significantly greater than one such listing. The remaining key variable effects resemble the non-matched sample as well. Client houses that are larger than the agent-owned houses sell for higher prices but distance between client and agent-owned properties has no significant effect on either price or how long it takes to sell. In sum, the matched sample estimates are broadly consistent with the non-matched sample results; the latter do not appear to be driven by omitted variable or selection effects.

7. Conclusions

This study examines the principal-agent issue surrounding agent sales performance when the listing agent is marketing his/her own property at the same time as client properties.

The theory shows that listing an agent's own property creates an incentive to expend greater total search and selling effort, but at the same time prompts agents to reallocate effort away from selling client properties to selling their own property. In this sense, concurrently listed agent-owned properties create a negative externality for client properties in the agent's listing inventory. This is a new dimension of real estate agency moral hazard previously overlooked in the literature.

The empirical analysis draws upon eleven years of housing market transaction data in Virginia to test the basic propositions regarding agent-owned listings and sales performance on client listings. The study applies a simultaneous price-liquidity system approach as well as single equation OLS and hazard models for comparison. The estimates provide strong support for the agent-owned negative externality effect identified in the theory; client properties on the market concurrently with their agent's property tend to sell for less and take longer to sell. The evidence of these relationships, however, is mixed in the post-crisis sample period 2006-2009. Nonetheless, the propensity scoring matched sample approach to the simultaneous price-liquidity model provides evidence that the pooled sample and pre-crisis sample 3SLS results are not being driven by omitted variables or selection biases.

The 3SLS estimates indicate that client properties will sell approximately 1.5% below that of comparable client properties listed by an agent with an agent-owned property listed for sale. This corresponds to a price reduction of about $2,300. Estimates of the effect on liquidity indicate that client properties listed with agents with their own properties concurrently on the market endure significantly longer selling time, ranging from 33% to 46% longer, depending upon estimation method. Both price and liquidity

effects are economically significant. The results offer new evidence on a previously overlooked dimension of the principal-agent problem inherent in real estate brokerage, new evidence that helps clarify the multifaceted roles of real estate brokers in the market process and their influence on housing market performance.

References

Anglin, P.M., R.C. Rutherford, and T.M. Springer. 2003. The Trade-off Between Selling Price of Residential Properties and Time-on-the-Market: The Impact of Price Setting. *Journal of Real Estate Finance and Economics*, 26:1, 95 - 111.

Anglin, P.M. and R. Arnott. 1991. Residential Real Estate Brokerage as a Principal-Agent Problem. *Journal of Real Estate Finance and Economics* 4, 99-125.

Arnold, M. A. 1992. The Principal-Agent Relationship in Real Estate Brokerage Services. *Real Estate Economics* 20, 89-106.

Becker, A. and A. Ichino. 2002. Estimation of Average Treatment Effects Based on Propensity Scores. *Stata Journal* 2, 358-377.

Belkin, J., D.J. Hempel, and D.W. McLeavey. 1976. An Empirical Study of Time on Market Using a Multidimensional Segmentation of Housing Markets. *AREUEA Journal*, 4:1, 57 - 75.

Belsley, D.A. 1988. Two- or Three-stage Least Squares? *Computational Economics* 1, 21-30.

Clauretie, T.M. and N. Daneshvary. 2008. Principal-Agent Conflict and Broker Effort Near Listing Contract Expiration: The Case of Residential Properties. *Journal of Real Estate Finance and Economics* 37, 147-161.

Dehejia, R.H. and S. Sahba. 2002. Propensity Score-Matching Methods for Nonexperimental Causal Studies. *Review of Economics and Statistics* 84, 151-161.

Geltner, D., B.D. Kluger and N.G. Miller. 1991. Optimal Price and Selling Effort from the Perspectives of the Broker and Seller. *AREUEA Journal* 19, 1-24.

Gardiner, J.l, J. Heisler, J.G. Kallberg and C.H. Liu. 2007. The Impact of Dual Agency. *Journal of Real Estate Finance and Economics* 35, 39-55.

Guo, S. and M. Fraser. 2010. *Propensity Score Analysis – Statistical Methods and Applications*. SAGE Publications.

Harding, J.P., S.R. Rosenthal and C.F. Sirmans. 2003. Estimating Bargaining Power in the Market for Existing Homes. *Review of Economics and Statistics* 85, 178-188.

Hendel, I., A. Nevo and F. Ortalo-Megne. 2009. The Relative Performance of Real Estate Marketing Platforms: MLS versus FSBOMadison.com. *American Economic Review* 99, 1878-1898.

Hubbard. T. 2002. How Do Consumers Motivate Experts? Reputational Incentives in an Auto Repair Market. *Journal of Law and Economics* 45, 437-468.

Knight, J. R. 2002. Listing Price, Time on Market and Ultimate Selling Price: Causes and Effects of Listing Price Changes. *Real Estate Economics* 30, 213-237.

Krainer, J. 2001. A Theory of Liquidity in Residential Real Estate Markets. *Journal of Urban Economics.* 49, 32-53.

Lancaster, T. 1990. The Econometric Analysis of Transition Data, Cambridge University Press, New York.

Levitt, S.D. and C. Syverson, 2008. Market Distortions When Agents Are Better Informed: The Value Of Information In Real Estate Transactions. *Review of Economics and Statistics* 90, 599-611.

Merlo, A. and F. Ortalo-Magne. 2004. Bargaining Over Residential Real Estate: Evidence from England. *Journal of Urban Economics* 56: 192-216.

Miceli, T.J. 1989. The Optimal Duration of Real Estate Listing Contracts. *AREUEA Journal* 17, 267-277.

Munneke, H.J. and A. Yavas. 2001. Incentives and Performance in Real Estate Brokerage. *Journal of Real Estate Finance and Economics* 22, 5-21.

National Association of Realtors. 2011. Why Use A Realtor. Retrieved from http://www.realtor.org/home_buyers_and_sellers/why_use.

Rosenbaum, P.R. and D.B. Rubin. 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70, 41-55.

Rutherford, R.C., T.M. Springer and A. Yavas. 2005. Conflicts Between Principals and Agents: Evidence from Residential Brokerage. *Journal of Financial Economics* 76, 627-665.

Rutherford, R. C. and A Yavas. 2012. Discount Brokerage in Residential Real Estate Markets. *Real Estate Economics* 40, 508-535.

Sirmans, C.F., G.K. Turnbull and J.D. Benjamin. 1991. The Markets for Housing and Real Estate Broker Services. *Journal of Housing Economics* 1, 207-217.

Turnbull, G.K. and J. Dombrow. 2006. Spatial Competition and Shopping Externalities: Evidence from the Housing Market. *Journal of Real Estate Finance and Economics* 32, 391-408.

Turnbull, G.K. and J. Dombrow. 2007. Individual Agents, Firms and the Real Estate Brokerage Process. *Journal of Real Estate Finance and Economics* 35, 57-76.

Turnbull, G.K. and C.F. Sirmans. 1997. Brokerage Pricing under Competition. *Journal of Urban Economics* 41, 102-117.

Waller, B., R. Brastow and K.H. Johnson. 2010. Listing Contract Length and Time on Market. *Journal of Real Estate Research* 32, 271-288.

Zahirovic-Herbert, V. and G.K. Turnbull. 2008. School Quality, House Prices, and Liquidity. *Journal of Real Estate Finance and Economics* 37, 113-130.

Table 1: Variable definitions.

Variable	Description
SP	Selling price
TOM	Number of days on market
OACL	Dummy variable, 1 if owner/agent property concurrently listed with client property
OAMCL	Dummy variable, 1 if agent owner has multiple properties concurrently listed with client property
OASQFT	Relative size of client property relative to owner-agent property
OADISTANCE	Distance from client property to owner-agent property
Institutional	Dummy variable, 1 if owned by institutional owner, 0 otherwise
SQFT	Square footage of living area
Age	Age of property
Institutional	Dummy variable, 1 if owned by institutional owner, 0 otherwise
Tenant	Dummy variable, 1 if occupied by tenant, 0 otherwise
Vacant	Dummy variable, 1 if vacant, 0 otherwise
New	Dummy variable, 1 if new construction, 0 otherwise
Bedrooms	Number of bedrooms
Fullbath	Number of full bathrooms
Halfbath	Number of half bathrooms
Finished basement	Dummy variable, 1 finished basement, 0 otherwise
Paved drive	Dummy variable, 1 paved driveway, 0 otherwise
Whirlpool	Dummy variable, 1 if whirlpool bath, 0 otherwise
Heatpump	Dummy variable, 1 if property has heat pump, 0 otherwise
Twozone Pump	Dummy variable, 1 if property has two-zone heat pump, 0 otherwise
Condo Townhouse	Dummy variable, 1 if condo or townhouse, 0 otherwise
Hardwood	Dummy variable, 1 hardwood floors, 0 otherwise
Ceramic tile	Dummy variable, 1 ceramic tile floors, 0 otherwise
Vinyl floor	Dummy variable, 1 if vinyl flooring, 0 otherwise
Garage	Dummy variable, 1 if property has garage, 0 otherwise
Fire	Dummy variable, 1 if property has fireplace, 0 otherwise
Brick	Dummy variable, 1 if brick exterior, 0 otherwise
Vinyl siding	Dummy variable, 1 if vinyl siding, 0 otherwise
Area i	Dummy variable, 1 if located in area *i*, 0 otherwise
Time	Chronological quarterly control variable
Mortgage rate	Fed funds rate at listing date
Agent Inventory	Agent productivity, measured by total listings over sample period
Listing Density	Listing density measure (see text for explanation)
Competition	Competition measure (see text for explanation)

Table 2: Difference in means for owner/agent versus sample of concurrently listed client properties

	Sample		Client properties		Owner-agent properties		
Variable	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**t-value**
SP	140444	40782.49	141477.1	41536.49	145045.7	43164.61	-1.32
TOM	115.8380	93.6898	170.0305	118.4471	139.9451	116.7092	5.07
Institutional	0.2439	0.4294	0.3794	0.4854	0.4030	0.4909	-0.96
SQFT	1744.29	547.57	1712.268	541.2683	1687.379	486.4228	0.94
Age	27.5795	27.3423	23.0922	28.0230	25.7976	29.9855	-1.87
Tenant	0.0186	0.1350	0.0189	0.1363	0.0411	0.1988	-2.77
Vacant	0.2187	0.4134	0.1547	0.3617	0.3001	0.4587	-7.29
New	0.1844	0.3878	0.3481	0.4765	0.3344	0.4722	0.57
Bedrooms	3.0731	0.7377	2.9991	0.7456	3.0583	0.7552	-1.57
Fullbath	1.8990	0.5899	1.8781	0.5594	1.8970	0.5650	-0.67
Halfbath	0.4311	0.5313	0.5094	0.5397	0.4065	0.4985	3.88
Finished basement	0.2871	0.4524	0.2345	0.4239	0.2041	0.4034	1.45
Paved drive	0.6056	0.4979	0.6534	0.4880	0.5488	0.5216	4.16
Whirlpool	0.0430	0.2028	0.0502	0.2184	0.0566	0.2312	-0.57
Heatpump	0.6980	0.4591	0.7473	0.4347	0.7478	0.4346	-0.02
Twozone	0.1078	0.3101	0.0979	0.2973	0.1046	0.3063	-0.44
Condo Townhouse	0.2049	0.4039	0.2584	0.4379	0.2195	0.4143	1.79
Hardwood	0.5096	0.4999	0.4271	0.4948	0.5420	0.4986	-4.60
Ceramic tile	0.2306	0.4213	0.2271	0.4191	0.2727	0.4457	-2.11
Vinyl floor	0.7616	0.4261	0.8139	0.38927	0.7135	0.4524	4.85
Garage	0.2980	0.4574	0.3152	0.4647	0.3430	0.4751	-1.18
Fire	0.6374	0.4808	0.5390	0.4986	0.5677	0.4958	-1.14
Brick	0.5865	0.4925	0.5423	0.4984	0.5557	0.4973	-0.53
Vinyl siding	0.5330	0.4989	0.6139	0.4870	0.5866	0.4928	1.11
Time	25.6095	8.7315	26.0757	8.8943	26.924	8.4926	-1.92
$Time^2$	732.0802	436.41	758.9877	447.637	796.931	429.23	-1.70
Mortgage rate	2.9387	1.6737	2.972428	1.6350	3.1183	1.6693	-1.76
Agent Inventory	107.4081	147.64	245.0239	260.355	69.2367	113.911	15.60
Listing Density	2.6409	3.9271	3.5293	4.4859	2.7937	3.3350	3.52
Competition	361.8540	817.94	679.5644	1123.217	401.3735	598.3744	5.61

Note: 1,215 client properties are listed concurrently with agent-owner properties of which 813 sold. 583 Owner-agent properties are concurrently listed with client properties of which 341 sold

Table 3: 3SLS estimates of price-liquidity model for full 1999-2009 sample

	LnSP		LnTOM	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
LnTOM	0.0193***	0.0054		
LnSP			18.4286***	2.7092
OACL	-0.0148**	0.0065	0.4758***	0.1126
Institutional	-0.0249***	0.0062	0.4607***	0.1362
LnSQFT	0.4319***	0.0104	-7.8436***	1.1981
LnAGE	-0.0873***	0.0026	1.6077***	0.2412
Tenant	-0.0720***	0.0169	1.3896***	0.3654
Vacant	-0.0615***	0.0047	1.1626***	0.1841
New	-0.0233**	0.0100	0.6299***	0.1882
Bedrooms	-0.0282***	0.0035	0.5225***	0.1021
Fullbath	0.0660***	0.0043	-1.2051***	0.1988
Halfbath	0.0210***	0.0042	-0.3777***	0.0967
Finished basement	-0.0365***	0.0048	0.6308***	0.1353
Paved drive	0.0250***	0.0040	-0.4769***	0.0986
Whirlpool	0.0323***	0.0088	-0.6041***	0.1877
Heatpump	0.0333***	0.0047	-0.6371***	0.1261
Twozone Pump	0.0730***	0.0065	-1.3708***	0.2215
CondoTownhouse	-0.1268***	0.0071	2.3994***	0.3869
Hardwood	0.0535***	0.0042	-0.9906***	0.1654
Ceramic tile	0.0361***	0.0047	-0.6651***	0.1327
Vinyl floor	-0.0186***	0.0046	0.3373***	0.0985
Garage	0.0929***	0.0042	-1.7067***	0.2624
Fire	0.0629***	0.0045	-1.1787***	0.1909
Brick	0.0226***	0.0040	-0.4484***	0.0916
Vinyl siding	-0.0487***	0.0043	0.8977***	0.1575
Area 1	0.0359***	0.0082	-0.6806***	0.1791
Area 2	0.0816***	0.0068	-1.5719***	0.2429
Area 3	-0.0411***	0.0114	0.8177***	0.2382
Area 4	0.0110**	0.0054	-0.2974***	0.0969
Area 5	-0.0129	0.0086	0.2001	0.1651
Time	0.0187***	0.0014	-0.3714***	0.0548
$Time^2$	-0.0001***	0.0000	0.0026***	0.0006
Mortgage rate	0.0403***	0.0043	-0.7549***	0.1334
Agent Inventory	0.00003**	0.00001	-0.0008***	0.0003
Listing Density	-0.0040***	0.0008		
Competition			0.0005***	0.0001
_cons	7.9971***	0.0805	-144.9205***	21.9082

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively. N=9,637

Table 4: 3SLS estimates of price-liquidity model for full 1999-2009 sample.

	LnSP		LnTOM	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
LnTOM	0.0199***	0.0049		
LnSP			17.5288***	2.1503
OACL	-0.0151**	0.0074	0.4462***	0.1270
OAMCL	-0.0077	0.0123	0.2412	0.2180
OASQFT	0.0001*	0.0000	-0.0011	0.0007
OADISTANCE	-0.0002	0.0008	0.0003	0.0149
Institutional	-0.0278***	0.0063	0.4833***	0.1309
LnSQFT	0.4450***	0.0107	-7.6650***	0.9863
LnAGE	-0.1129***	0.0027	1.9723***	0.2473
Tenant	-0.0954***	0.0163	1.7505***	0.3498
Vacant	-0.0496***	0.0047	0.8930***	0.1327
New	-0.0821***	0.0101	1.6614***	0.2450
Bedrooms	-0.0183***	0.0035	0.3188***	0.0750
Fullbath	0.0600***	0.0043	-1.0485***	0.1523
Halfbath	0.0110***	0.0040	-0.1832**	0.0760
Finished basement	-0.0484***	0.0047	0.8196***	0.1340
Paved drive	0.0317***	0.0039	-0.5801***	0.0959
Whirlpool	0.0317***	0.0089	-0.5125***	0.1760
Heatpump	0.0252***	0.0047	-0.4609***	0.1002
Twozone Pump	0.0535***	0.0064	-0.9743***	0.1521
CondoTownhouse	-0.1324***	0.0063	2.3899***	0.3198
Hardwood	0.0396***	0.0043	-0.6968***	0.1156
Ceramic tile	0.0346***	0.0045	-0.6003***	0.1109
Vinyl floor	-0.0158***	0.0045	0.2696***	0.0869
Garage	0.0812***	0.0043	-1.4134***	0.1903
Fire	0.0834***	0.0046	-1.4777***	0.1982
Brick	0.0239***	0.0039	-0.4477***	0.0825
Vinyl siding	-0.0338***	0.0043	0.5942***	0.1079
Area 1	0.0651***	0.0100	-1.1658***	0.2247
Area 2	0.1063***	0.0075	-1.9279***	0.2550
Area 3	-0.0331*	0.0172	0.7077**	0.3137
Area 4	0.0416***	0.0065	-0.8069***	0.1298
Area 5	0.0046	0.0096	-0.0937	0.1723
Time	0.0199***	0.0014	-0.3770***	0.0480
$Time^2$	-0.0001***	0.0000	0.0025***	0.0006
Mortgage rate	0.0417***	0.0043	-0.7448***	0.1158
Agent Inventory	0.00002*	0.0000	-0.0006***	0.0002
Listing Density	-0.0043***	0.0007		
Competition			0.0005***	0.0001
_cons	7.8851*	0.0811	-135.828***	17.171

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.
LnSP (p-value=0.000;N=7,085);
LnTOM (p-value=0.000; N=7,085)

Table 5: 3SLS estimates of price-liquidity model for pre-crisis 1999-2006 sample.

	LnSP		LnTOM	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
LnTOM	0.0339***	0.0053		
LnSP			12.4390***	1.2770
OACL	-0.0180**	0.0083	0.3948***	0.1030
OAMCL	-0.0207	0.0140	0.3408*	0.1797
OASQFT	0.0001*	0.0000	-0.0008	0.0005
OADISTANCE	0.0001	0.0008	-0.0040	0.0106
Institutional	-0.030***7	0.0073	0.3771***	0.1037
LnSQFT	0.4563***	0.0119	-5.5596***	0.6128
LnAGE	-0.1129***	0.0031	1.4073***	0.1500
Tenant	-0.0919***	0.0181	1.1765***	0.2585
Vacant	-0.0546***	0.0053	0.6961***	0.0956
New	-0.0801***	0.0115	1.2027***	0.1738
Bedrooms	-0.0175***	0.0039	0.2210***	0.0555
Fullbath	0.0609***	0.0047	-0.7549***	0.1001
Halfbath	0.0124***	0.0044	-0.1487**	0.0591
Finished basement	-0.0519***	0.0051	0.6146***	0.0945
Paved drive	0.0296***	0.0044	-0.3933***	0.0658
Whirlpool	0.0268***	0.0095	-0.3035**	0.1289
Heatpump	0.0184***	0.0052	-0.2420***	0.0715
Twozone Pump	0.0525***	0.0067	-0.6590***	0.1040
CondoTownhouse	-0.1234***	0.0070	1.5922***	0.1889
Hardwood	0.0427***	0.0047	-0.5438***	0.0827
Ceramic tile	0.0418***	0.0051	-0.5292***	0.0847
Vinyl floor	-0.0189***	0.0051	0.2208***	0.0695
Garage	0.0825***	0.0047	-1.0144***	0.1198
Fire	0.0798***	0.0052	-1.0212***	0.1224
Brick	0.0227***	0.0043	-0.3114***	0.0604
Vinyl siding	-0.0348***	0.0047	0.4200***	0.0780
Area 1	0.0701***	0.0116	-0.9228***	0.1715
Area 2	0.1066***	0.0085	-1.4044***	0.1650
Area 3	-0.0239	0.0201	0.4021	0.2605
Area 4	0.0443***	0.0075	-0.6417***	0.1008
Area 5	0.0067	0.0110	-0.1067	0.1425
Time	-0.0004	0.0032	-0.0023	0.0417
Time^2	0.0004***	0.0001	-0.0047***	0.0011
Mortgage rate	0.0075	0.0068	-0.0919	0.0883
Agent Inventory	0.00002	0.00001	-0.0005**	0.0002
Listing Density	-0.0057***	0.0008		
Competition			0.0005***	0.0001
_cons	8.1439***	0.1056	-99.3739***	10.6339

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.
LnSP (p-value=0.000; N=5,291);
LnTOM (p-value=0.000; N=5,291)

Table 6: 3SLS estimates of price-liquidity model for post-crisis 2007-2009 sample.

	LnSP		LnTOM	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
LnTOM	-0.0086	0.0092		
LnSP			-1.4981	17.4797
OACL	-0.0024	0.0174	0.3521	1.9153
OAMCL	0.0377	0.0253	0.3199	2.8695
OASQFT	0.00003	0.0001	-0.0008	0.0163
OADISTANCE	-0.0043	0.0037	-0.0146	0.4255
Institutional	-0.0275**	0.0124	-0.1414	1.4873
LnSQFT	0.3967***	0.0236	0.6866	7.7712
LnAGE	-0.1163***	0.0055	-0.1941	2.1006
Tenant	-0.0939***	0.0348	0.2342	4.1983
Vacant	-0.0327***	0.0097	0.0374	1.2142
New	-0.0907***	0.0214	0.1292	2.7923
Bedrooms	-0.0217***	0.0076	-0.0547	0.9594
Fullbath	0.0604***	0.0096	0.1517	1.4622
Halfbath	0.0083	0.0090	0.1267	1.0076
Finished basement	-0.0314***	0.0107	-0.0314	1.3488
Paved drive	0.0394***	0.0082	0.0555	1.1494
Whirlpool	0.0450**	0.0226	0.1863	2.6651
Heatpump	0.0465***	0.0100	0.0282	1.3844
Twozone Pump	0.0432**	0.0169	-0.2486	2.0297
CondoTownhouse	-0.1743***	0.0138	-0.4095	3.4540
Hardwood	0.0269***	0.0092	0.0849	1.1342
Ceramic tile	0.0207**	0.0093	0.1249	1.0962
Vinyl floor	-0.0097	0.0093	0.0024	1.0474
Garage	0.0809***	0.0097	0.1588	1.8010
Fire	0.0965***	0.0093	0.1905	1.9211
Brick	0.0326***	0.0082	-0.0287	1.0802
Vinyl siding	-0.0262***	0.0095	0.0137	1.1492
Area 1	0.0473**	0.0197	0.0902	2.3077
Area 2	0.1253***	0.0161	0.1253	2.8467
Area 3	-0.0479	0.0327	0.1006	3.7752
Area 4	0.0461***	0.0123	-0.1735	1.5659
Area 5	-0.0059	0.0193	-0.0487	2.1662
Time	0.1949***	0.0589	0.9995	9.3396
Time^2	-0.0027***	0.0008	-0.0140	0.1322
Mortgage rate	-0.0250*	0.0146	-0.0712	1.8245
Agent Inventory	0.00004	0.00003	-0.0007	0.0034
Listing Density	-0.0028***	0.0010		
Competition			0.0004	0.0007
_cons	5.8602***	0.9992	(omitted)	
N	1,794			
LnSP (p-value)	0.000			
LnTOM (p-value)	0.000			

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 7: OLS price equation estimates.

	1999-2009		1999-2006		2007-2009	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
OACL	-0.0052	0.0071	-0.0015	0.0080	-0.0064	0.0172
OAMCL	0.00002	0.0122	-0.0093	0.0139	0.0345	0.0253
OASQFT	0.0001**	0.00004	0.0001	0.00004	0.00002	0.0001
OADISTANCE	-0.0004	0.0008	-0.0002***	0.0008	-0.0040	0.0038
Institutional	-0.0307***	0.0063	-0.0330***	0.0073	-0.0300**	0.0125
LnSQFT	0.4516***	0.0107	0.4671***	0.0118	0.3964***	0.0238
LnAGE	-0.1130***	0.0027	-0.1136***	0.0031	-0.1152***	0.0056
Tenant	-0.0905***	0.0163	-0.0866***	0.0182	-0.0970***	0.0350
Vacant	-0.0479***	0.0047	-0.0524***	0.0053	-0.0347***	0.0098
New	-0.0826***	0.0095	-0.0772***	0.0109	-0.1035***	0.0199
Bedrooms	-0.0196***	0.0035	-0.0189***	0.0039	-0.0220***	0.0077
Fullbath	0.0611***	0.0043	0.0621***	0.0048	0.0610***	0.0096
Halfbath	0.0117***	0.0040	0.0116***	0.0045	0.0097	0.0090
Finished basement	-0.0494***	0.0047	-0.0540***	0.0051	-0.0312***	0.0108
Paved drive	0.0305***	0.0039	0.0268***	0.0044	0.0384***	0.0083
Whirlpool	0.0356***	0.0089	0.0336***	0.0095	0.0427*	0.0227
Heatpump	0.0262***	0.0047	0.0192***	0.0052	0.0481***	0.0101
Twozone Pump	0.0460***	0.0063	0.0428***	0.0067	0.0441***	0.0169
CondoTownhouse	-0.1405***	0.0060	-0.1294***	0.0066	-0.1839***	0.0136
Hardwood	0.0409***	0.0043	0.0445***	0.0047	0.0273***	0.0093
Ceramic tile	0.0358***	0.0045	0.0433***	0.0051	0.0188**	0.0093
Vinyl floor	-0.0160***	0.0045	-0.0189***	0.0051	-0.0104	0.0093
Garage	0.0807***	0.0043	0.0803***	0.0047	0.0822***	0.0098
Fire	0.0841***	0.0046	0.0803***	0.0052	0.0965***	0.0094
Brick	0.0207***	0.0039	0.0186***	0.0043	0.0308***	0.0083
Vinyl siding	-0.0355***	0.0043	-0.0377***	0.0048	-0.0288***	0.0095
Area 1	0.0633***	0.0101	0.0665***	0.0116	0.0464**	0.0199
Area 2	0.1008***	0.0075	0.0968***	0.0085	0.1249***	0.0162
Area 3	-0.0304*	0.0172	-0.0186	0.0202	-0.0469	0.0331
Area 4	0.0296***	0.0063	0.0275***	0.0073	0.0412***	0.0123
Area 5	0.0022	0.0097	0.0025	0.0111	-0.0058	0.0195
Time	0.0189***	0.0014	-0.0013	0.0032	0.1647***	0.0566
Time^2	-0.0001***	0.0000	0.0004***	0.0001	-0.0023***	0.0008
Mortgage rate	0.0404***	0.0043	0.0072	0.0068	-0.0218	0.0147
Agent Inventory	0.000006	0.00001	0.0000003	0.00001	0.00004	0.00003
_cons	7.9515***	0.0796	8.2403***	0.1052	6.3330***	0.9687
N	7,130		5,328		1,802	
R-sq	0.7530		0.7690		0.7077	
F-statistic	617.90		503.43		122.16	

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 8: OLS duration model estimates.

	1999-2009		1999-2006		2007-2009	
LnTOM	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
OACL	0.4606***	0.0318	0.4776***	0.0393	0.4135***	0.0581
OAMCL	0.3479***	0.0549	0.3527***	0.0684	0.2787***	0.0905
OASQFT	0.0001	0.0002	0.0006***	0.0002	-0.0010***	0.0003
OADISTANCE	-0.0094**	0.0043	-0.0115**	0.0045	-0.0034	0.0128
Institutional	0.0543*	0.0282	0.1031***	0.0357	-0.0288	0.0444
LnSQFT	0.2436***	0.0470	0.3006***	0.0571	0.1236	0.0808
LnAGE	0.0172	0.0118	0.0211	0.0151	0.0099	0.0185
Tenant	0.1635***	0.0618	0.1383*	0.0778	0.2548***	0.0980
Vacant	0.0355*	0.0212	0.0417	0.0261	0.0340	0.0352
New	0.4439***	0.0414	0.4487***	0.0531	0.4490***	0.0656
Bedrooms	-0.0169	0.0157	-0.0258	0.0189	0.0040	0.0272
Fullbath	0.0176	0.0194	0.0077	0.0231	0.0289	0.0345
Halfbath	0.0043	0.0181	-0.0110	0.0218	0.0540*	0.0317
Finished basement	-0.0676***	0.0211	-0.0747***	0.0249	-0.0464	0.0387
Paved drive	-0.0290*	0.0175	-0.0495**	0.0215	0.0162	0.0291
Whirlpool	0.0906**	0.0406	0.1329***	0.0473	-0.0424	0.0766
Heatpump	-0.0270	0.0210	-0.0179	0.0253	-0.0616*	0.0369
Twozone Pump	-0.1460***	0.0288	-0.1381***	0.0327	-0.1836***	0.0627
CondoTownhouse	0.1797***	0.0273	0.2017***	0.0330	0.1100**	0.0480
Hardwood	0.0082	0.0190	0.0225	0.0229	-0.0093	0.0328
Ceramic tile	0.0666***	0.0204	0.0668***	0.0254	0.0466	0.0333
Vinyl floor	-0.0152	0.0199	-0.0227	0.0246	0.0034	0.0325
Garage	-0.0260	0.0192	-0.0401*	0.0230	0.0173	0.0338
Fire	-0.0229	0.0202	-0.0448*	0.0250	0.0037	0.0335
Brick	-0.0534***	0.0174	-0.0758***	0.0213	-0.0213	0.0296
Vinyl siding	0.0347*	0.0194	0.0107	0.0234	0.0898***	0.0336
Area 1	-0.0717	0.0443	-0.1224**	0.0549	-0.0609	0.0728
Area 2	-0.1825***	0.0329	-0.2062***	0.0405	-0.1878***	0.0559
Area 3	0.1938***	0.0698	0.2330**	0.0913	0.1139	0.1044
Area 4	-0.2283***	0.0267	-0.2765***	0.0341	-0.1671***	0.0418
Area 5	-0.1149***	0.0415	-0.1146**	0.0517	-0.1511**	0.0675
Time	-0.0418***	0.0062	-0.0318*	0.0166	2.2785***	0.1964
$Time^2$	0.0007***	0.0001	0.0003	0.0004	-0.0325***	0.0028
Mortgage rate	0.1133***	0.0191	0.0637*	0.0339	-0.0185	0.0493
Agent Inventory	-0.0007***	0.0001	-0.0006***	0.0001	-0.0009***	0.0001
_cons	2.5902***	0.3510	2.5455***	0.5232	-36.1282***	3.3906
N	10,307		7,047		3,260	
R-sq	0.1272		0.1448		0.1637	
F-statistic	42.78		33.92		18.03	

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 9: Weibull duration model estimates.

	1999-2009		1999-2006		2007-2009	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
OACL	0.3855***	0.0325	0.3926***	0.0381	0.3302***	0.0696
OAMCL	0.3296***	0.0554	0.3037***	0.0645	0.2993***	0.1081
OASQFT	0.0006***	0.0002	0.0006***	0.0002	0.0003	0.0006
OADISTANCE	-0.0115***	0.0037	-0.0099**	0.0041	-0.0184	0.0147
Institutional	0.1031***	0.0291	0.1627***	0.0343	-0.0309	0.0535
LnSP	0.5241***	0.0466	0.5838***	0.0601	0.4891***	0.0798
LnSQFT	0.1307***	0.0500	0.0569	0.0595	0.2723***	0.0963
LnAGE	0.0619***	0.0130	0.0790***	0.0154	0.0313	0.0245
Tenant	0.3596***	0.0736	0.2528***	0.0841	0.6452***	0.1463
Vacant	0.0446**	0.0211	0.0362	0.0244	0.0670*	0.0405
New	0.5040***	0.0418	0.5254***	0.0484	0.5197***	0.0826
Bedrooms	0.0241	0.0158	0.0271	0.0178	0.0109	0.0323
Fullbath	-0.0155	0.0194	-0.0320	0.0220	-0.0293	0.0392
Halfbath	0.0048	0.0181	-0.0258	0.0203	0.0675*	0.0381
Finished basement	-0.1053***	0.0209	-0.0813***	0.0235	-0.1691***	0.0448
Paved drive	-0.0949***	0.0177	-0.0986***	0.0204	-0.0674*	0.0346
Whirlpool	0.0189	0.0402	0.0065	0.0439	0.0100	0.0948
Heatpump	-0.1133***	0.0209	-0.1261***	0.0239	-0.0663	0.0425
Twozone Pump	-0.1205***	0.0284	-0.0613**	0.0311	-0.2683***	0.0695
CondoTownhouse	0.3238***	0.0281	0.3273***	0.0318	0.2642***	0.0600
Hardwood	-0.0503***	0.0188	-0.0461**	0.0214	-0.0673*	0.0387
Ceramic tile	-0.0129	0.0206	-0.0225	0.0239	-0.0158	0.0395
Vinyl floor	-0.0951***	0.0205	-0.1002***	0.0239	-0.0977**	0.0391
Garage	0.0290	0.0198	0.0177	0.0224	0.0293	0.0412
Fire	-0.1545***	0.0211	-0.1557***	0.0244	-0.1320***	0.0416
Brick	-0.0922***	0.0177	-0.1300***	0.0204	-0.0345	0.0356
Vinyl siding	0.0226	0.0197	-0.0198	0.0225	0.1509***	0.0398
Area 1	-0.2698***	0.0453	-0.2952***	0.0537	-0.2483***	0.0827
Area 2	-0.3758***	0.0342	-0.4074***	0.0400	-0.3029***	0.0674
Area 3	0.2708***	0.0776	0.3166***	0.0935	0.1403	0.1363
Area 4	-0.3009***	0.0283	-0.3327***	0.0338	-0.2360***	0.0512
Area 5	-0.1119***	0.0437	-0.1039**	0.0514	-0.1936**	0.0810
Time	-0.1112***	0.0072	-0.0326**	0.0161	2.3284***	0.2379
$Time^2$	0.0022***	0.0001	0.0002	0.0004	-0.0322***	0.0034
Mortgage rate	0.0833***	0.0214	0.1644***	0.0328	0.1407**	0.0629
Agent Inventory	-0.0007***	0.0001	-0.0006***	0.0001	-0.0011***	0.0001
_cons	-1.1055***	0.5235	-2.4244***	0.7008	-45.0963***	4.1202
/ln_p	.4026478	.0089075	.4211967	.0101514	.394876	.0186344
p	1.49578	.0133236	1.523784	.0154685	1.4842	.0276572
1/p	.6685476	.0059551	.656261	.006662	.6737636	.0125552

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 10: 3SLS propensity scoring method matched sample estimates of price-liquidity model for 1999-2009 sample period.

	LnSP		LnTOM	
	Coef.	Std. Err.	Coef.	Std. Err.
LnTOM	0.0111	0.0119		
LnSP			19.5585***	7.0600
OACL	-0.0055	0.0099	0.3715**	0.1746
Institutional	-0.0163	0.0146	0.2815	0.3144
LnSQFT	0.3982***	0.0244	-7.5985***	2.8608
LnAGE	-0.1198***	0.0061	2.3238***	0.8472
Tenant	-0.0906***	0.0315	1.8033**	0.8923
Vacant	-0.0434***	0.0110	0.8610**	0.3771
New	-0.1167***	0.0242	2.6346***	0.9202
Bedrooms	-0.0181**	0.0082	0.3490*	0.2065
Fullbath	0.0611***	0.0096	-1.2313**	0.4843
Halfbath	0.0074	0.0092	-0.1286	0.1881
Finished basement	-0.0465***	0.0107	0.9035**	0.3905
Paved drive	0.0497***	0.0089	-1.0180***	0.3799
Whirlpool	0.0380*	0.0200	-0.7731	0.4831
Heatpump	0.0213**	0.0107	-0.4590*	0.2631
Twozone Pump	0.0570***	0.0146	-1.0655**	0.5010
CondoTownhouse	-0.1397***	0.0137	2.8502***	1.0510
Hardwood	0.0364***	0.0096	-0.7154**	0.3196
Ceramic tile	0.0376***	0.0100	-0.7517**	0.3363
Vinyl floor	-0.0146	0.0104	0.3081	0.2329
Garage	0.0864***	0.0094	-1.7017***	0.6457
Fire	0.0903***	0.0102	-1.7960***	0.6689
Brick	0.0306***	0.0087	-0.6742**	0.2745
Vinyl siding	-0.0449***	0.0099	0.8550**	0.3744
Area 1	0.0813***	0.0226	-1.6867**	0.7181
Area 2	0.1302***	0.0181	-2.7316***	0.9511
Area 3	-0.0135	0.0275	0.3349	0.5586
Area 4	0.0481***	0.0146	-1.0982***	0.3889
Area 5	0.0136	0.0228	-0.3993	0.4606
Time	0.0216***	0.0033	-0.4561***	0.1640
Time^2	-0.0002**	0.0001	0.0037**	0.0017
Mortgage rate	0.0412***	0.0095	-0.8173**	0.3560
Agent Inventory	0.00002	0.00002	-0.0005	0.0004
Listing Density	-0.0046***	0.0016		
Competition			0.0005***	0.0001
_cons	8.2535***	0.1850	-158.5556***	58.5854
N	1,455			
LnSP (p-value)	0.000			
LnTOM (p-value)	0.0529			

Note: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.