UCF College of Business Administration

Dr. P. Phillips School of Real Estate

How Many Listings are too Many? Agent Listing Inventory and Sales Performance

Xun Bian
Longwood University

Geoffrey K. Turnbull
University of Central Florida

Bennie D. Waller
Longwood University

Scott A. Wentland
Longwood University

Working Paper 1303

How Many Listings are too Many?

Agent Listing Inventory and Sales Performance

Xun Bian
Longwood University
Farmville, VA 23909
bianx@longwood.edu

Bennie D. Waller*
Longwood University
Farmville, VA 23909
wallerbd@longwood.edu

Geoffrey K. Turnbull
University of Central Florida
Orlando, FL 32816
Geoffrey.Turnbull@ucf.edu

Scott A. Wentland
Longwood University
Farmville, VA 23909
wentlandsa@longwood.edu

Abstract. This paper examines potential principal-agent issues arising from the size of the agent listing inventory; how does an agent's inventory affect sales outcomes of individual client properties in terms of selling price and liquidity? The theory implies that greater inventory tends to dilute agent selling effort for individual properties. It remains an empirical question whether diluted sales effort leads to lower prices, longer marketing time or both. Using a sample of residential properties listed for sale between 1999 and 2009 from an east coast multiple listing service, we empirically test this prediction by analyzing the effect of agent inventory level on both selling price and marketing duration. Results indicate that higher agent inventory tends to reduce selling price and substantially increases marketing duration.

Key Words. listing agent, principal-agent problem, agency costs, moral hazard, asymmetric information

*contact author

1. Introduction

The popular view in real estate brokerage is that visibly busy agents are productive agents,[1] conflating ubiquitous advertisements or numerous FOR SALE signs creating exposure for a particular agent's listings with performance. But what casual observers define as indicators of productivity may also signal potential drawbacks for clients. This paper considers whether agents have an incentive to take on too many listings—at least from the point of view of their clients. Additional listings may represent additional broker commissions, but they also place greater claims on the broker's time and energy which in turn can have adverse sales performance consequences for their clients. This paper focuses the relationship between agent inventory and sales performance in terms of selling price and liquidity of client properties in order to ascertain the degree, if any, to which agent listing inventories adversely affect client sales outcomes.

The compensation structure in the real estate brokerage industry constantly puts agents in situations where they must balance their own and various clients' interests. Agents are rewarded only if the property sells; traditional full service broker compensation does not take into account the effort exerted to sell property (Kurland, 1991). The exclusive ownership of listings means that, the more listings a broker secures, the greater the probability of receiving more commission income. The theory offered here focuses on how the incentive to acquire listings drives the relationship between listing inventory and sales performance. Intuitively, the theory implies that, even if broker effort to obtain new listings does not divert effort from sales activities in general, adding to the inventory nonetheless forces the broker to reallocate marketing effort among all houses in the expanding inventory of listings. After a certain point, greater inventory increases the total amount of sales effort needed to service clients, thereby increasing the marginal cost of

[1] This paper uses broker and agent interchangeably to refer to licensed real estate salespersons.

selling effort. The resultant higher opportunity cost of agent sales effort reduces sales effort allocated to individual houses, with the resultant negative effects on realized sales performance. Whether the lower sales performance is reflected in lower selling prices and/or longer time on the market remains an empirical question.

This paper is organized as follows. The next section reviews the relevant literature on real estate agency. The third section presents a simple model of agent behavior illustrating how greater agent inventory translates into poorer sales performance in terms of lower sale price and/or liquidity for individual listed properties. The fourth section of the paper explains the sample and the data. Section five presents the empirical framework, explaining how a three stage least squares (3SLS) methodology can be applied to examine the sales performance effects of agent inventory within a simultaneous price and liquidity framework. Section six reports the empirical results showing that greater listing agent inventory has significant and negative effects on selling prices and liquidity of properties. Section seven concludes.

2. Principle-Agent Issues in Real Estate Brokerage

When clients acquire brokerage services for the sale of property, a contract is negotiated between the client and agent. This contract gives the client an implicit expectation that the listing agent's priorities are at least somewhat aligned with their own. Clients generally want to sell their properties as quickly as possible at the highest possible price. Given that the listing agent receives a commission only if a buyer is found (either by the agent or a cooperating broker), it is therefore understandable why the client may expect the agent to market the property to locate potential buyers. As a rule, clients do not expect to receive substantially reduced service as a

result of the reallocation of agent effort to selling a more expensive home or one that offers a higher commission.

Nonetheless, agents have multiple clients, most with similar expectations of primary focus on his or her individual property who are likely to be disenchanted with the listing agent if their expectations are not met. Depending on individual utility and holding costs, some sellers will choose a pricing strategy of setting list price at or below market value with the anticipation of a quicker transaction, while others may choose an exposure strategy of pricing above market value and waiting for a buyer to be matched (Benjamin and Chinloy, 2000).

While sellers may be drawn listing with an experienced broker that has a large inventory of listings, it is possible that these sellers do not fully appreciate the complexity of an agent's various roles and responsibilities beyond listing and selling their home, some of which lead to principal-agent conflicts arising from inherently misaligned incentives. Indeed, the real estate literature has not yet fully digested the complex interactions of agent's actions in terms of the logistics required to manage the acquisitions of new listings, marketing and negotiating existing listings all the way through closing and the renegotiation of expiring listings (Turnbull and Dombrow, 2007). The agent's overall burden of responsibilities grows with each additional listing. As a result, as shown below, the proportion of effort that the agent dedicates to a given property decreases as inventory rises.

While it is standard operating procedure for brokers to use comparable properties as a basis for suggesting an initial listing price, they have considerable latitude choosing comparable properties, which presents an opportunity to support a wide range of asking price recommendations. Recognizing that many real estate agents tend to focus on a pricing strategy

(Benjamin and Chinloy, 2000) coupled with assumption that agents want to sell their entire inventory, agents have incentives to suggest list prices that promote faster sales (Yavas and Yang, 1995; Knight, 2002). The unanswered question is whether the incentive to do so increases with greater inventory. At the least, it is possible that the effects of managing larger listing inventories may have differential effects on selling price and selling time for individual properties.

Research on principal-agent issues in brokerage is increasingly intertwined with the literature on modeling pricing and liquidity in housing markets. Principal-age issues include commissions, firm size, and geographic specialization (Zorn and Larsen, 1986; Knight, Sirmans, and Turnbull, 1994; Yang and Yavas, 1995; Yavas and Yang, 1995; Knight, 2002; Benefield, Rutherford and Allen, 2012; Brastow, Springer and Waller, 2012). Miller (1978) and Anglin, Rutherford, and Springer (2003) in particular find that higher list price leads to longer marketing time. Knight's (2002) empirical study of listing price changes concludes that a greater difference between list price and selling price generally leads to a longer time on market and ultimately a lower selling price.

The principal-agent relationship between seller and listing agent arise because sellers cannot monitor broker effort. Most sellers of owner-occupied homes are infrequent market participants which likely exacerbates asymmetric information problems. Asymmetric information provides an opportunity for agents to misrepresent market information (Arnold, 1992). Also, pure commission-based compensation induces broker moral hazard in part because it does not efficiently allocate risk between seller and broker (Grossman and Hart, 1983; Anglin and Arnott, 1991). Geltner, Kluger and Miller (1991) look at the principal-agent conflict from two dimensions, the level of selling effort and the reservation price of the property. They posit

that the principal-agent conflict is greater near the beginning of the listing contract as brokers are more likely to rationally procrastinate at that point, with increasing effort over time as the contract nears expiration.

In an examination of the moral hazard induced by dual agency, Gardiner, Heisler, Karlberg and Liu (2007) analyze the effect of dual agency disclosure. They find that legislation requiring the disclosure of dual agency significantly reduced the impact of dual agency on selling price from 8% to 1.4%. The liquidity of dual agency properties also significantly improved following the legislation. The legislation requiring the disclosure of dual agency also reduced the frequency of dual agency from 44% to 28%. These results provide ancillary evidence of substantial principal-agent conflict prior to enacting the legislation.

Rutherford, Springer and Yavas (2005) and Levitt and Syverson (2008) examine the selling price and marketing duration of owner-agent properties relative to client properties. Rutherford, Springer and Yavas (2005) find that agent-owned homes, while spending approximately the same amount of time on the market, listed for 4.1% higher than comparable client homes and sold for a 4.5% premium. Levitt and Syverson (2008) empirically find that agent-owned homes are marketed for almost 10 days longer and sell for 3.7% more than client-owned properties, suggesting that agents may encourage clients to sell their homes prematurely at reduced prices.

Turnbull and Dombrow (2007) compare individual agent relative and brokerage firm effects and find that greater scale of listing or selling activities at the firm level decrease selling price and liquidity. In an investigation of agent specialization, Brastow, Springer and Waller (2012) find that more listings dilute agents' efforts and increase their focus on higher priced properties. Clauretie and Daneshvary (2008) examine principal-agent conflict between agent

marketing and client reservation price coaxing. Two possibilities include that the broker expends less than the optimal level of sales effort and that the broker encourages the homeowner to lower the reservation price in order to induce a faster sale. They conclude that properties selling near the end of the listing contract have significantly lower prices, indicating that brokers do expend more effort on persuading the homeowner to lower their reservation price at that point. Waller, Brastow and Johnson (2010) find ancillary evidence of this particular principal-agent problem in that longer listing contracts lead to decreased liquidity as a result of broker effort.

3. Agent Listing Inventory and Sales Performance

We offer a simple search model in the spirit of Rutherford et al. (2005) to examine the listing agent's effort allocation problem. We assume that the seller of the property sets the asking price.[2] Following Rutherford et al. (2005), we adopt a simple bargaining model for the negotiation stage of the game; the seller's asking price is treated as a take-it-or-leave-it offer to the buyer.[3] As a result, a buyer will accept an asking price if and only if the asking price is below his reservation price. The density function of buyers' reservation prices is given by $f(\cdot)$ over the interval $\left[\underline{p}, \overline{p}\right]$, where f is continuous everywhere. As a member of the local multiple listing service (MLS), the listing agent submits the listing to the MLS. Along with the information about the property, the listing agent also indicates the percentage of the price that he will pay as commission if another MLS agent finds the buyer. The MLS then makes available this information to all other members of the MLS.

[2] Sellers often consult real estate agents on how to set the asking price. It is well established in the literature that real estate agents have incentives to advise a suboptimal asking price (Arnold, 1992; Rutherford et al. 2005). The influence of real estate agents on asking price does not affect our main conclusions and so is suppressed.

[3] This model, like most agency models, suppresses the buyer-seller negotiation process. See Harding, Rosenthal and Sirmans (2003), Merlo and Ortalo-Magne (2004) and Turnbull and Zahirovic-Herbert (2011) for empirical analyses of bargaining issues.

There are a large number of other brokers who are members of the MLS. The one that identifies the buyer for the listing is the selling agent. Following the current prevailing practice in the full service industry, the listing agent receives *k* proportion of the price as commission from the seller upon the sale of the property. Out of this commission, the listing agent pays $k_s, k_s < k$, proportion of the price to the selling agent. The listing agent retains the entire commission if its finds the buyer. We assume that the total commission rate, *k*, and the selling agent's share, k_s, determined in the market and exogenous to the individual agent.

Consider a risk neutral listing agent deciding how many identical contracts *n* to service with sales or search effort *L* dedicated to each. The probability that the agent finds a buyer for a particular house in its listing inventory is a function of search effort, $\psi(L)$, where search effort increases this probability at a decreasing rate ($\psi' > 0$, $\psi'' < 0$). The probability that another member of the MLS contacts a buyer for a particular house is ϕ. Given the large number of MLS members and the competition among them to sell the property, the probability of a sale by another MLS member is exogenous to the listing agent. given. The agent's search cost is an increasing convex function of the search effort per house and number of houses in the inventory, *C*(*nL*), with *C'* > 0 and *C''* > 0. The marginal cost of acquiring an additional listing for the agent's inventory is *v*; the total cost of listing acquisitions is *vn.*

The listing agent's problem is

$$\max_{L,n} \Pi(L,n) = n\left[\psi(L)\int_P^{\bar{p}} kPf(p)\,dp + \varphi\int_P^{\bar{p}} (k-k_s)\,Pf(p)\,dp\right] - C(nL) - vn$$

The first-order conditions are

$$n\psi'(L)\int_{P}^{\bar{p}} kPf(p)\,dp - nC'(nL) = 0 \tag{1}$$

$$\left[\psi(L)\int_{P}^{\bar{p}} kPf(p)\,dp + \varphi\int_{P}^{\bar{p}} (k-k_s)Pf(p)\,dp\right] - LC'(nL) - v = 0 \tag{2}$$

The first condition requires that sales and search effort balances the marginal expected return from the increased probability of selling a house from the inventory with the marginal cost of the effort. The second condition requires that the expected commission revenue from an addition to the inventory of listings (the first term in (2)) equals the marginal effort cost of servicing the listing, *LC'*, plus the marginal cost of acquiring the listing, *v*. Totally differentiating the system (1) and (2) and solving for the comparative statics of marginal listing acquisition cost on search effort and inventory size in the usual way yields, respectively,

$$\frac{\partial L^*}{\partial v} = \frac{C'(nL) + nC''(nL)L}{\det H_2} > 0 \tag{3}$$

$$\frac{\partial n^*}{\partial v} = \frac{\det H_1}{\det H_2} < 0 \tag{4}$$

where *H* is the negative definite Hessian matrix of the agent's expected profit function. Subscripts indicate the appropriate principle minors of *H.* These results show that lower agent productivity (i.e., greater marginal cost) of acquiring additional listings increases the search effort allocated to the typical listing in the agent's inventory (3) and decreases the agent's optimal inventory (4). These comparative statics also imply a testable relationship between agent inventory and sales performance: agents with greater inventory will also exert less sales and search effort on each house in its inventory. The extent to which the lower sales effort leads to

lower expected selling prices and/or longer marketing duration cannot be ascertained from the theory and remains an empirical question.

4. Data

The data for this study consist of residential properties obtained from a Virginia multiple listing service (MLS). The initial data included over 21,450 properties marketed and sold, withdrawn or expired for the period April 1999 through June 2009. As noted by Levitt and Syverson (2008), MLS data are entered by real estate agents and can be incorrect or incomplete. As a result, the data are carefully vetted. After culling for incomplete, missing or illogical data that suggest data entry errors, the final data set comprises 12,388 *sold* properties.[4] The data collected from the MLS include typical property characteristics (square footage, bedrooms, baths, etc.), location, and market and calendar information (list date, sale date, length of listing contract). Table 1 presents a complete variable legend.

The average property in the sample has a listing and selling price of $173,631 and $168,096, respectively. The average listed property is 26.42 years of age, with 1,924 square feet, 3.2 bedrooms, and 2 bathrooms with an average contract listing duration of 187 days and time on market of 111 days.

There are differences in the performance of above average-volume agents[5] and below average-volume agents. In particular, above average-volume agents list properties for

[4] Consistent with other real estate studies, we cull mobile homes and other outliers from the data set. For example, we confine all regressions to homes with a sale price of greater than $25,000, and in some cases trim extreme outliers for our variables of interest (which are noted in footnotes below). The primary findings of this study are not sensitive to dropping these observations, however. As an additional quality check, a sample of the MLS data was compared to county government records which contain data on price and housing characteristics. The MLS data were 100% accurate.

[5] Defined as those agents with an average of 7 or more listings on the market over the period 1999-2009.

significantly higher prices ($169,684 vs. $158,872) and sell for significantly higher prices ($158,673 vs. $147,997). These agents also have significantly longer listing contracts (208 vs. 181 days) and longer times on market (137 vs. 115 days). The above average-volume agents sell smaller properties (1,813 vs. 1,853), newer properties (23 vs. 32 years), more new construction homes (35% vs. 12%) and a lower percentage of vacant properties (19% vs. 25%). Similarly, these agents list more properties with brick exterior (60% vs.56%), ceramic tile (30% vs. 24%) and garages (36% vs. 34%). Hence, it is important to control for an array of property characteristics when determining the impact of agent inventory on price and liquidity.

5. Empirical Methodology

This section summarizes our empirical approach to estimating price and liquidity within a simultaneous system. It also describes the method used to econometrically identify the system of price and liquidity equations.

A. Identifying the Price-Liquidity Simultaneous System

Housing markets are search markets and search theory clearly shows that price and liquidity are jointly determined in such environments. Shifts in buyers' valuation over time or across neighborhoods lead to changes in the average time properties take to sell and in the prices at which they sell (Krainer, 2001). This creates technical problems when empirically modeling housing market outcomes, as it implies that selling price and liquidity (or marketing duration) are simultaneously determined by identical factors; the vector of factors that determine a house price is identical to the vector of factors that determine how long it takes to sell, resulting in an under-identified system of equations. While a number of empirical studies acknowledge and model this

simultaneity,[6] the methods to identify price and liquidity equations have generally been *ad hoc* as authors make a case that some factors only affect price and not liquidity, and vice versa. A series of papers starting with Turnbull and Dombrow (2006) and Zahirovic-Herbert and Turnbull (2008) take a different approach, offering an identification method based on the implicit cross-equation parametric restrictions that arise when incorporating variables that capture neighborhood market conditions.

Drawing from Krainer's (2001) search market theory, Turnbull and Dombrow (2006) explain that a home's expected liquidity, E[*T*], measured as a home's marketing duration or time on market, and expected house price, E[*P*], are simultaneously determined in search equilibrium and the relationship between them can be implicitly defined as:

$$F(\mathrm{E}[P], \mathrm{E}[T], \mathbf{X}, \mathbf{C}) = 0 \tag{5}$$

where **X** is a vector of house (and market) characteristics and **C** are neighborhood market conditions. Regarding the latter, they argue that there may be a localized competition effect when the number of nearby homes on the market increases, as this supply ought to negatively impact the price and liquidity of a nearby home. Alternatively, the increased traffic generated from additional nearby homes on the market could positively impact a home's price and liquidity, a type of shopping externality. Regardless of the specific relationship between the supply of houses for sale in a given neighborhood and the selling price and liquidity of the subject property, the relationship between expected price and liquidity in (5) can be restated in terms of realized price and time on market as separate functions with jointly distributed stochastic errors ε_p and ε_T

$$P = \varphi_p(T, \mathbf{X}, COMP) + \varepsilon_p \tag{6}$$

[6] For example, see Sirmans, Turnbull, and Benjamin (1991), Yavas and Yang (1995), Forgey, Rutherford, and Springer (1996), Huang and Palmquist (2001), Rutherford, Springer, and Yavas (2001), Knight (2002), Turnbull and Dombrow (2006).

$$T = \varphi_T (P, \mathbf{X}, COMP) + \varepsilon_T \quad (7)$$

The neighborhood competition measure, *COMP*, is the (distance weighted) number of houses for sale in the surrounding neighborhood at the same time the subject property is for sale It is this neighborhood competition variable, *COMP*, that characterizes market conditions vectors in the simultaneous equations above. In addition to *COMP*, it is also useful to generate another key variable, defined as the listing density (or *LD*), which the number of neighborhood listings on the market at the same time as the subject property, measured per day on the market (Turnbull and Dombrow, 2006; Zahirovic-Herbert and Turnbull, 2008).

These two market conditions variables provide the solution to the identification problem. To see how, note that the coefficient on the *COMP* variable is the partial derivative $\partial\varphi_p/\partial COMP$ when regressing sales price on the right-hand side variables in (6). But Zahirovic-Herbert and Turnbull (2008) point out that time on the market is included as an explanatory variable in (6) so changing competition while holding selling time constant yields the partial derivative with respect to listing density; that is, $\partial\varphi_p/\partial COMP \equiv \partial\varphi_p/\partial LD$ in (6). The import of this parametric restriction is that the equation system (6)-(7) can be rewritten as:

$$P = \varphi_p(T, \mathbf{X}, LD) + \varepsilon_p \quad (8)$$

$$T = \varphi_T (P, \mathbf{X}, COMP) + \varepsilon_T \quad (9)$$

which is an identified system of equations.

B. Baseline Empirical Model

Following Krainer (2001) and a number of empirical studies, including those cited above, we specify two market equations in which sales price and liquidity, measured by time on market, are jointly determined. The empirical system takes the form

$$LnSP = \beta_0 + \beta_1 Inventory + \beta_2 \mathrm{LD_l} + \sum_{i=1}^{N} \beta_i X_i + u \quad (10)$$

$$Ln(TOM) = \beta_0 + \beta_1 Inventory + \beta_2 \mathrm{COMP_l} + \sum_{i=1}^{N} \beta_i X_i + v \quad (11)$$

where *Inventory* represents the total number of listings an agents has currently listed at the time of listing and captures the degree to which an agent's efforts are spread out across concurrently marketed properties. *LD* and *COMP* are the listing density and competition variables as constructed by Zahirovic-Herbert and Turnbull (2008). The X_i are the usual types of property characteristics[7] and include time and macroeconomic control variables[8] as well as location controls.[9] The cross equation correlation for (10)-(11) requires a 3SLS estimation approach (Belsley 1988).

While agent inventory may exhibit a linear effect on price and liquidity, we also wish to consider non-linear and other alternative ways to measure the inventory effect. The first alternative model allows for a quadratic inventory effect

[7]We use the following property specific variables: square footage, age, acreage, number of bedrooms, bathrooms, length of the listing contract, whether the home is a one-story, new, vacant, whether it has a brick exterior, hardwood floors, a pool, fenced yard, walk-in closet.

[8]We use the following time and macroeconomic controls: year the home sold, season the home sold, Consumer Sentiment Index, fixed rate mortgage interest rate at the sale date, Virginia unemployment rate, and the Leading Economic Indicator Index. The macro controls are monthly aggregates, which correspond to the month the home was sold.

[9] Hedonic analysis of the housing market requires some control for spatial heterogeneity because location itself (LOC_i above) is a key source of differences in housing prices. Following Pope (2008), we chose census block groups to control for unobserved heterogeneity *across* these areas so that the explanatory variables' effects are identified from variation *within* a given area (or even in a given year, as is the case for time fixed effects). According to the U.S. Census, census tracts are "small, relatively permanent statistical subdivisions of a county...designed to be homogenous with respect to population characteristics, economic status, and living conditions."[9] Yet, census block groups are *subsections* of census tracts and the smallest spatial area for which the U.S. Census tabulates sample data. This study uses block groups from the 2000 census, which on average contain between 600 to 3,000 people, usually around 1,500. Our sample of houses falls within a total of 163 census block groups in central Virginia.

$$LnSP = \beta_0 + \beta_1 Inventory + \beta_2 Inventory^2 + \beta_3 \mathrm{LD_l} + \sum_{i=1}^{N} \beta_i X_i + u \quad (12)$$

$$Ln(TOM) = \beta_0 + \beta_1 Inventory + \beta_2 Inventory^2 + \beta_3 \mathrm{COMP_l} + \sum_{i=1}^{N} \beta_i X_i + v \quad (13)$$

Another approach distinguishes inventory by category, representing homes whose agents either have low, high, or very high inventory (with medium being the excluded category), which takes the following form:

$$LnSP = \beta_0 + \beta_1 VeryHigh + \beta_2 High + \beta_3 Low + \beta_4 \mathrm{LD_l} + \sum_{i=1}^{N} \beta_i X_i + u \quad (13)$$

$$\mathrm{Ln}(TOM) = \beta_0 + \beta_1 VeryHigh + \beta_2 High + \beta_3 Low + \beta_4 \mathrm{COMP_l} + \sum_{i=1}^{N} \beta_i X_i + v \quad (14)$$

Roughly half of all listings are represented by agents with medium inventory, where the agent is representing anywhere from two to seven additional listings. This is the reference group. Nearly 10% of listings are represented by agents with *VeryHigh* inventory where agent inventory exceeds 15 or more additional listings. Nearly 17% of listings in our data set are represented by agents with a *High* or above average number of listings, from 8 to 14 additional listings. Nearly 20% of homes sold with listing agents having one or zero additional inventory on the market, which characterizes the *Low* dummy variable above. The bulk of these listings are likely represented by agents who work part-time. Breaking inventory out by category allows us to differentiate the effect by discrete intervals allows the model to pick up different marginal effects of inventory size on sales outcomes.

C. Measuring Inventory with Distance-weighted Overlapping Listings

The inventory variables above represent additional agent inventory on the market *at the list date* of the property on the MLS. However, inventory varies as active agents sell some inventory and take on new inventory throughout the marketing period of a given home. The variables above represent a snapshot of agent inventory at the initial list date and does not reflect the external effect or agency costs of agent inventory as it evolves throughout the marketing period.[10] Given the limitations of this measure, we construct another measure to encapsulate the effect of agent inventory based on the distance-weighted inventory that overlaps on the market with the subject property.

This inventory measure is based on the Turnbull and Dombrow (2006) approach to measuring the effects of nearby homes on the market at the same time as the subject property. They measure competition from nearby homes by constructing a sum of overlapping days on the market weighted by distance. Their competition variable increases with the number of competing properties, the number of days properties are on the market together, and their proximity to the subject property. Adapting their approach, we construct analogous measures for the other houses in the agent's inventory that are on the market at the same time as the subject property. The coefficient on this variable (and its listing density counterpart) indicates the extent to which nearby houses in the same agent's inventory represent competing houses (reducing selling price and/or increasing marketing time) or produce shopping externalities (increasing price and/or reducing selling time) over and above the effects captured by the *COMP* and *LD* variables.[11] The

[10] Despite not encompassing the entire inventory effect, the impact of each list date inventory variable is still important to estimate. As we explain later in the paper, the number of additional listings an agent has at the time of the list date is information that sellers can conceivably ask the agent about before agreeing to an exclusive listing contract.

[11] See, e.g., Zahirvoic-Herbert and Turnbull (2008) for a different application of this marginal effects approach.

Inventory Density and *Inventory Competition* variables below measure the number of distance-weighted houses *j* in the agent's inventory that are on the market the same time as property *i*:

$$\textit{Inventory Density}\ (i) = \sum_j (1\text{-D}(i, j))^{*} \{\min[s(i), s(j)] - \max[l(i), l(j)]\} / s(i) - l(i) + 1$$

$$\textit{Inventory Competition}\ (i) = \sum_j (1\text{-D}(i, j))^{*} \{\min[s(i), s(j)] - \max[l(i), l(j)]\} + 1$$

where D(*i,j*) is the distance between houses *i* and contemporaneous agent inventory property *j*, *s(i)* is the sales date for *i*, *l(i)* is the listing date for *i*, *l(j)* is the list date for contemporaneous agent inventory property *j*, and *s(j)* is the sell date for *j*. The inventory density and competition variables are analogous to the listing density and competition variables and enter the sale price and time on market equations in the same fashion as those variables for the reasons outlined earlier.

This approach provides two benefits. First, it accounts for all inventory overlapping with the subject property throughout the marketing period. This recognizes that only those properties that are on the market at the same time are likely to place a larger burden on the agent's time or effort. Second, the construction of this variable allows the agent inventory effect to vary with distance between the subject and other listed properties. The intuition here is that agent inventory located farther away from a property may have a different externality effect than one nearby. Listing properties farther away from one another increases agent travel time (and its subsequent opportunity cost) and may requires additional effort to exploit location-specific factors relative to properties listed nearby. Hence, inventory density and competition are positive functions in

distance to contemporaneous agent inventory, marketing time overlap, and additional agent inventory properties. The modified empirical model is[12]

$$LnSP = \beta_0 + \beta_1 Inventory\ Density + \beta_2 \mathrm{LD_l} + \sum_{i=1}^{N} \beta_i X_i + u \quad (15)$$

$$Ln(TOM) = \beta_0 + \beta_1 Inventory\ Competition + \beta_2 \mathrm{COMP_l} + \sum_{i=1}^{N} \beta_i X_i + v \quad (16)$$

Finally, we explore different forms of the inventory measures to allow for varying marginal distance effects. The original listing density and competition variables based on Turnbull and Dombrow (2006) assume marginal effects diminish (in absolute value) at a decreasing rate with distance. Therefore, we estimate a form more closely analogous to the original listing density and competition variables, where distance is allowed to vary as a quadratic:

Inventory Density (D^2) $(i) = \sum_j (1\text{-}D(i, j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} / s(i) - l(i) + 1$

Inventory Competition (D^2) $(i) = \sum_j (1\text{-}D(i, j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} + 1$

where the terms are defined the same as above. We estimate the impact these measures have in the following 3SLS model:

[12] In all inventory density and competition models (equations 17-18 and 21-22), the top 1% are trimmed from each variable calculation. Many MLS listings include extreme outliers with respect to distance, where a seller, for example, may list a vacation home on the Outer Banks (in NC) with a familiar agent in a Virginia MLS, despite the fact that the listing may be hundreds of miles away. These outliers generate extraordinarily high listing density and competition values.

$$LnSP = \beta_0 + \beta_1 Inventory\ Density\ (D^2)\ + \beta_2 \mathrm{LD_l} + \sum_{i=1}^{N} \beta_i X_i + u \quad (17)$$

$$Ln(TOM) = \beta_0 + \beta_1 Inventory\ Competition\ (D^2) + \beta_2 \mathrm{COMP_l} + \sum_{i=1}^{N} \beta_i X_i + v \quad (18)$$

Further, we estimate a variation of the simultaneous equation above by allowing the measures to vary based on whether the agent inventory is located nearby (within one mile) or farther away. The original Turnbull and Dombrow (2006) listing density and competition variables were trying to capture relevant nearby market competition, which they defined as locations with one mile of a given home *i*. We are instead interested in whether or not widely spread agent inventory exacerbates the inventory externality effect on client properties relative to narrowly clustered inventory. Therefore this approach deconstructs the inventory density and competition variables to allow homes within one mile of agent inventory to have different price and liquidity effects than homes farther away from agent inventory, as the following

<u>*For D(i,j)<1*</u>*:*

$$Inventory\ Density\ (i) = \sum_j (1 - D(i,j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} / s(i) - l(i) + 1$$

$$Inventory\ Competition\ (i) = \sum_j (1 - D(i,j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} + 1$$

<u>*For D(i,j)>1*</u>*:*

$$Inventory\ Density\ (i) = \sum_j (D(i,j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} / s(i) - l(i) + 1$$

$$Inventory\ Competition\ (i) = \sum_j (D(i,j))^{2} * \{\min[s(i), s(j)] - \max[l(i), l(j)]\} + 1$$

6. Empirical Results

A. Baseline Results – Inventory at List Date

The first set of results reveal a significant relationship between additional agent inventory and price and liquidity. Table IV reports the baseline estimates, which show that an increase in agent inventory is associated with a slight discount in price and a substantial increase in time on market. The magnitude of the marginal effects are small, which is consistent with the expectation that one additional listing may not impose a very high marginal cost. The first model (1a) and (1b) report the baseline estimates and indicate that a one standard deviation increase in agent inventory (9 listings) reduces the sale price by 0.6% and increases marketing time by 13.6%, or approximately $1,000 and 15 days on average, respectively. Introducing a quadratic term does not appear to improve the fit of the model, as shown in columns (2a) and (2b) in Table IV, as the quadratic terms are not statistically significant. Based on the initial estimates, it appears that the agency costs associated with agents taking on additional listings have a substantial impact, particularly through time on the market.

The estimates in the final columns (3a) and (3b) in Table IV indicate that breaking out inventory into categories generates interesting differences across inventory levels. While categories may not help us pin down the general relationship between inventory and sale price/liquidity, it does help us understand the effect as it relates to the reference group (or the "typical" listing inventory). If the listing agent representing a seller has a *VeryHigh* number of other listings (i.e., 15+), that home generally sells for approximately 3% less and remains on the market for 129% longer than a home listed with an agent with a more modest inventory (i.e., 2 to 7 listings). This amounts to 160 days longer than the reference group whose time on market is on average 124 days. Despite the fact that this group represents a relatively small number of listings

(approximately 10% of the sample) and the *VeryHigh* inventory group contains observations where agents represent dozens of properties, the result is still striking. Agents representing 15 or more listings may be trying to represent "too many" clients at one time, resulting in a substantially longer marketing duration.

Table IV does not necessarily impugn high inventory. Agents with *High* or above average inventory (i.e., 8 to 14 listings) do not seem to have a discernible impact on the sale price and time on market of the homes they represent relative to the reference group.[13] While overall effect of additional agent listings may still be negative for all groups, as the initial regressions indicate, regressions (3a) and (3b) in Table IV suggest that the largest effects are likely at the top inventory range. At the other end of the spectrum, Table IV reports that a home whose agent represents one or fewer additional listings also has a negative impact on price and liquidity. However, this is likely a part-time agent effect, as agents who represent few homes may have a different level of experience, skills, and motivation than agents representing more listings as part of a full-time career. Homes represented by agents with *Low* inventory sell for a slight discount (about 1%) and stay on the market approximately 35% longer than the reference group.

B. Inventory Density and Competition Results

In order to probe more deeply into the inventory effect, Table V reports the model estimates for models including the various *Inventory Density* and *Inventory Competition* variables defined earlier. Qualitatively, the results are consistent with the notion that additional agent inventory adversely impacts selling price and marketing duration. Regressions (4a) and (4b) in Table V indicate that a one standard deviation increase in inventory density and

[13] It is important to remember that this does not say that the effect of additional listings is nil for this group. Rather, it says that the marginal impact for this group is equal to that of the reference group of agents.

competition reduce price by 0.8% and increase time on market by 26%. This means that a home is represented by an agent who has taken on 9 additional listings that are (on average) 10 miles apart and overlap with the home's marketing period 100 days leads to an increase in time on market of nearly a month.[14] Similar to the baseline results, the price effect is slight, but the agent inventory impact on time on market is substantial, particularly for agents who representing a high number of listings which are located farther away from one another.

The next columns of Table V tell a similar story, showing that the inventory effect is not particularly sensitive to variations of how distance is factored into the calculation. Regressions (5a) and (5b) in Table V show the effects when the inventory measure is based on quadratic distance weights. This approach allows properties that are 8 miles apart to have a far greater multiplicative effect than properties that are 2 miles apart. The results indicate that a one standard deviation increase in these variations of the inventory density and competition variables are associated with a 1% lower sale price and a 19% higher time on market. Generally speaking, these results are consistent with the previous findings.

The final columns in Table V allow agent inventory within one mile to be estimated separately from those whose distance exceed one mile. When distance exceeds one mile, agent inventory has a very similar impact as compared to the two other regressions in this table. For these observations, a one standard deviation increase in inventory density and competition reduces price by 2% and increases time on market by 13%. However, the estimates for inventory density and competition *within* one mile are different, particularly for time on market. For inventory density and competition within one mile, a one standard deviation increase is

[14] There are countless additional configurations of distance, number of listings, and overlap that will generate a number close to 9,291 (the standard deviation of the inventory competition variable), but this combination was chosen for illustrative purposes.

associated with a 2% lower sale price and a 3% higher time on market.[15] The effect on time on market appears muted for inventory competition within one mile. It appears that additional listings still require additional time and effort on behalf of the listing agent, but if the additional listing is, say, a neighboring property, the listing agent may not have to devote as much additional effort toward the listing as one across town. The agent may even show the properties to interested buyers (or buyers' agents) in tandem—giving rise to a shopping externality effect not present for more distant listings.

C. Identification Strategy and Interaction Models

It is clear from the results that there is a relationship between agent inventory and outcomes that sellers care most about: selling price and time on market. That is, higher agent inventory is associated with a slightly lower price and a significantly higher time on market. However, if the effects reflect the incentives underlying our theoretical prediction then we should see different outcomes when the agent's incentives change. In this section, we employ a straightforward method of incorporating interaction terms to examine whether the agent inventory effect is a result of incentives and if the empirical relationship is properly identified.

As noted earlier, Levitt and Syverson (2008) looked at market distortions flowing from the agent compensation scheme and the information asymmetry between agent and owner, comparing agent owned homes and non-agent owned homes to identify the consequences of the principal-agent conflict. We employ a similar approach by incorporating an owner agent interaction into (17) and (18) to disentangle the agency cost effect. When an agent is marketing his/her own property, there is no principal-agent conflict (since the principal is the agent). Agents

[15] Like the original Turnbull and Dombrow (2006), the distance in this calculation is inversely weighted (as $(1\text{-}D)^2$), where a *closer* proximity represents a higher value of the variable calculation.

feel the full costs of taking on additional listings and have a greater incentive to account for those costs when deciding to accept (or seek out) new listings. Therefore, an owner-agent interaction term allows us to compare the effect of additional inventory when there is a principal-agent conflict and when there is not.

Additional inventory has a much smaller effect on marketing time in particular for agent-owned houses on the market. Regressions (7a) and (7b) in Table VI show this result. (The first two columns reproduce regressions (4a) and (4b) from Table V for easier reference.) Agents generally sell their homes for approximately 1.6% more than client properties. While there does not appear to be a different inventory effect on the price of agent-owned houses, additional inventory competition has approximately half the effect on time on market for agent-owned as it does for client properties. A one standard deviation increase in inventory competition increases time on market by 26% for clients, but only 12% for agents. In sum, it appears that agent-owned homes still take longer to sell with additional inventory but not as long as client properties. This supports the theory; the inventory effect found in this paper is driven by the agent incentives.

It also seems reasonable that new construction may be easier for listing agents to market. In this sample new homes sell for an 18% premium and sell more rapidly than existing houses. Agents marketing new homes generally work with builders or developers and may be able to manage a larger inventory more effectively. If so, we expect a larger inventory to also have a weaker effect on sales performance for new homes. While all of the models control for new construction, we have not yet explored whether the marginal effect of greater inventory affects new home sales the same way it affects existing home sales. Regressions (8a) and (8b) in Table VI include interaction variables to pick up any new home differential effects. The results show that inventory does not have a different new house effect on price, but inventory competition has

roughly half the effect on the marketing time of new homes relative to existing homes, results that are qualitatively consistent with our expectation.

7. Conclusion

There are a variety of potential principal-agent conflicts in real estate transactions, some more important and others less so. The empirical literature is just beginning to sort out which are important and which are not. This paper examines how broker listing inventory affects the principle-agent relationship; it focuses on how agent effort to secure additional listing contracts influences sales performance on existing listings. The theory implies a negative impact of agent inventory on house selling price and liquidity, a relationship supported by the empirical results. While the empirical negative impact on price is modest, the effect on marketing time is substantial. Using a simple measure based on the agent listing inventory at the subject house listing date, 9 additional listings (one standard deviation) increases time on market by 14%. A richer inventory measure taking into account distance-weighted overlapping listings yields a 26% effect on time on market.

Overall, the results imply that agent incentives to secure additional contracts and their potential commissions generates negative externalities for other properties in their inventory; greater inventory diverts selling effort from existing inventory, resulting in longer time on market for all houses in the inventory. Agent effort to list properties has a direct effect on selling effort itself—a relationship previously overlooked. Further, the effect is both statistically and economically significant. The results provide new evidence, probing more deeply into agent moral hazard arising from the multifaceted principal-agent conflicts that permeate the transaction process and underlie particular (in)efficiencies in real estate markets.

REFERENCES

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.

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

Arnold, M. A. 1992. The Principal-Agent Relationship in Real Estate Brokerage Services, *Journal of the American Real Estate and Urban Economics Association* (now *Real Estate Economics*), 20, 89-106.

Benefield, D.B., R.C. Rutherford and M.T. Allen. 2012. The Effects of Real Estate Sales of Residential Real Estate on Price and Marketing Time, *Journal of Real Estate Finance and Economics*, 45, 965-981.

Benjamin, J.D. and P.T. Chinloy. 2000. "Pricing Exposure and Residential Listing Strategies," *Journal of Real Estate Research,* 20, 61-74.

Benjamin, J.D., G. Donald Jud and G.S. Sirmans. 2000. Real Estate Brokerage and the Housing Market: An Annotated Bibliography, *Journal of Real Estate Research*, 20, 217-278.

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

Brastow, R.T., T.M. Springer and B.D. Waller. 2012. The Motivating Causes of Dual Agency Transactions: Specialization and Incentives, *Journal of Real Estate Finance and Economics,* 45, 1041-1061.

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.

Foregy, A.F., R.C. Rutherford and T.M. Springer. 1996. Search and Liquidity in Single-Family Housing, *Journal of the American Real Estate and Urban Economics Association* (now *Real Estate Economics*), 24, 273-292.

Geltner, D., B.D. Kluger and N.G. Miller. 1991. Optimal Price and Selling Effort from the Perspectives of the Broker and Seller, *Journal of the American Real Estate and Urban Economics Association* (now *Real Estate Economics*), 19, 1-24.

Gardiner, J., H. Heisler, J.G. Kallberg and C.H. Liu. 2007. The impact of dual agency, *Journal of Real Estate Finance and Economics*, 35, 39-55.

Grossman, S. and O. Hart. 1983. An Analysis of the Principal-Agent Problem, *Econometrica*, 51, 17-45.

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.

Huang, J., and R.B. Palmquist. 2001. Environmental Conditions, Reservation Prices, and Time on the Market for Housing, *Journal of Real Estate Finance and Economics*, 22, 203-219.

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.

Knight, J.R., C.F. Sirmans and G.K. Turnbull. 1994. List Price Signalling and Buyer Behavior in the Housing Market, *Journal of Real Estate Finance and Economics*, 9, 177-192.

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

Kurland, N.B. 1991. The Ethical Implications of the Straight-Commission Compensation SYSTEM- An agency Perspective, *Journal of Business Ethics*, 10, 757-766.

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.

Miller, N.G. 1978. Time on the Market and Selling Price, American Real Estate and Urban Economics Association Journal (now Real Estate Economics), 6, 164-174.

Pope, J.C. 2008. Fear of crime and housing prices: Household reactions to sex offender registries. *Journal of Urban Economics* 64, 601-614.

Rutherford, R.C., T.M. Springer, and A. Yavas. 2001. The Impacts of Contract Type on Broker Performance, *Real Estate Economics*, 29, 389-409.

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.

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., 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 V. Zahirovic-Herbert. 2011. Why Do Vacant Houses Sell for Less: Bargaining Power, Holding Cost or Stigma? *Real Estate Economics*, 39, 19-43.

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

Yang, S. and A. Yavas. 1995. Bigger is Not Better: Brokerage and Time on the Market, *Journal of Real Estate Research*, 10, 23-33.

Yavas, A. and S. Yang. 1995. The Strategic Role of Listing Price in Marketing Real Estate: Theory and Evidence, *Real Estate Economics,* 23, 347-368.

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

Zorn T.S. and J.E. Larsen. 1986. The Incentive Effects of Flat-Fee and Percentage Commissions for Real Estate Brokers, *The Journal of the American Real Estate and Urban Economics Association* (now *Real Estate Economics*). 14:1, 24-47.

Table I
Variable Legend

Variable	Description
SP	Selling price
TOM	Number of days on market
LOC	Length of listing contract
Inventory	Amount of agent inventory at listing date
Low Inventory	Dummy variable, 1 if Inventory<3, 0 otherwise
Medium Inventory	Dummy variable, 1 if Inventory >1 & <8, 0 otherwise
High Inventory	Dummy variable, 1 if Inventory>7 & <15, 0 otherwise
Very High Inventory	Dummy variable, 1 if Inventory>14, 0 otherwise
SQFT	Square footage
Age	Age of property
Vacant	Dummy variable, 1 if property is vacant, 0 otherwise
New	Dummy variable, 1 if property is new construction, 0 otherwise
Bedrooms	Number of bedrooms
Bathrooms	Number of bathrooms
Finished Basement	Dummy variable, 1 if property has finished basement, 0 otherwise
Hardwood	Dummy variable, 1 if property has hardwood flooring, 0 otherwise
Brick	Dummy variable, 1 if property has brick exterior, 0 otherwise
Fenced Yard	Dummy variable, 1 if property has a fenced yard, 0 otherwise
Pool	Dummy variable, 1 if property has a pool, 0 otherwise
Walk-in closet	Dummy variable, 1 if property has walk-in closet, 0 otherwise
One Story	Dummy variable, 1 if property has one main floor, 0 otherwise
FRMD	30 year fixed mortgage rate at sale date
Consumer Sentiment	Consumer sentiment (as defined by U M CSI) at sale date
Virginia Unemp.	Virginia Unemployment at sale date
LEI	Leading Economic Index value at sale date
Census Block Groups	Geographical dummy variables for census block groups 1-163
Year	Time control variables (year dummies)
Season	Season controls (season dummies for fall, spring, winter, summer)
LD	Listing density (defined in the Section 5)
COMP	Competition (defined in Section 5)

Table II
Summary Statistics

	Mean	*Std. Dev.*	*Min*	*Max*
Sale Price ($)	168,096	103,738.50	25,500.00	2,650,000
Time on Market (days)	110.55	88.79	0.00	963.00
List Price ($)	173,631	126,893.70	23,000	6,190,000
Sold	0.61	0.48	0	1
Inventory	6.78	8.963665	0	124
$Inventory^2$	126.37	472.0624	0	15376
Low Inventory	0.19	0.39	0	1
Medium Inventory	0.54	0.49	0	1
High Inventory	0.17	0.37	0	1
Very High Inventory	0.09	0.29	0	1
Inventory Density	44.87	59.66	0	420.01
Inventory Competition	5,706.15	9,291.69	0	71,450.66
Inventory Density (distance squared)	709.24	1,298.41	0	13,691.39
Inventory Comp. (distance squared)	91,548.39	191,824.2	0	1,819,572
Inventory Density (dist. sq. & < 1 mile)	0.35	1.29	0	12.99
Inventory Density (dist. sq. & > 1 mile)	708.69	1,302.93	0	13,691.39
Inventory Comp. (dist. sq. & < 1 mile)	53.87	214.07	0	2,030.95
Inventory Comp. (dist. sq. & > 1 mile)	90,233.87	190,441.20	0	1,819,260
Square Feet	1,924.02	782.09	417.00	8,418.00
Age (years)	26.42	28.15	0	267.00
Vacant	0.33	0.47	0	1
Bedrooms	3.20	0.78	1	8.00
Baths	2.04	0.69	1	6.00
Length of Contract (days)	186.83	102.98	0	990.00
One Story	0.39	0.49	0	1
New	0.16	0.37	0	1
Finished basement	0.27	0.44	0	1
Hardwood	0.55	0.50	0	1
Brick	0.54	0.50	0	1
Pool	0.17	0.37	0	1
Fenced Yard	0.17	0.37	0	1
Walk-in Closet	0.21	0.41	0	1
Acreage	2.04	7.67	0	248.66
Avg. Fixed Rate Mortgage at Sale Date	6.13	0.49	4.81	8.64
Virginia Unemployment Rate	3.57	0.59	2.20	7.10
Consumer Sentiment Index	86.17	10.45	55.30	112.00
Leading Economic Indicators Index	99.04	6.04	84.20	104.90
Listing Density	1.80	2.95	0	36.65
Competition	225.98	544.23	0	8,900.74
Fall	0.19	0.39	0	1
Winter	0.26	0.44	0	1
Spring	0.30	0.46	0	1
Summer	0.25	0.43	0	1

Table III

Comparison of Means (Agent Inventory).

	Agent Inventory <=7			*Agent Inventory >7*			
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	t-value
SP	6451	147996.5	70537.01	2402	158673.4	83500.06	-6.01
List Price	9926	158872.1	93396.33	3652	169684.1	98630.87	-5.89
LOC	9926	180.6872	101.7042	3652	207.7223	128.3483	-12.76
TOM	9926	115.4563	93.32828	3652	136.9373	111.2251	-11.27
Inventory	9926	3.099033	1.868785	3652	18.16977	13.1746	-110.98
Inventory-sq	9926	13.09601	14.0802	3652	503.6632	930.9198	-52.49
SQFT	9926	1852.87	728.4917	3652	1813.367	780.8674	2.75
Age	9926	31.81765	30.25563	3652	22.60871	29.6586	15.81
Vacant	9926	0.24864	0.432246	3652	0.186747	0.389762	7.59
New	9926	0.124522	0.330192	3652	0.346659	0.475971	-30.61
Bedrooms	9926	3.163208	0.783431	3652	3.060789	0.870482	6.55

Table IV
The Effect of Agent Inventory on a Home's Sale Price and Days on Market – Baseline Models (3SLS)

	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)
	[1a]	[1b]	[2a]	[2b]	[3a]	[3b]
Inventory	-.0007***	.0152*	-.0009**	.0211		
	(-3.07)	(1.77)	(-2.09)	(1.41)		
$Inventory^2$			0.000005	-.0001		
			(0.67)	(-0.54)		
Very High Inventory					-.0321***	.8331**
					(-4.44)	(2.07)
High Inventory					.0022	-.0636
					(0.40)	(-0.40)
Low Inventory					-.0112**	.3060*
					(-2.14)	(1.65)
Property Characteristics	✓	✓	✓	✓	✓	✓
Macroeconomic Controls	✓	✓	✓	✓	✓	✓
Season Fixed Effects	✓	✓	✓	✓	✓	✓
Census Block Groups	✓	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓
Observations	12,388	12,388	12,388	12,388	12,388	12,388

Notes. This table presents results of simultaneous estimation of the effect of agent inventory on a home's selling price and liquidity (time on market); z-statistics in parentheses; ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table V
The Effect of Agent Inventory on a Home's Sale Price and Days on Market – Inventory Density & Competition Models (3SLS)

	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)
	[4a]	[4b]	[5a]	[5b]	[6a]	[6b]
Inventory Density	-.000146***					
	(-6.00)					
Inventory Competition		.000028***				
		(4.48)				
Inventory Density (distance squared)			-.000008***			
			(-6.80)			
Inventory Comp. (distance squared)				.000001***		
				(4.21)		
Inventory Density (dist. sq. & < 1 mile)					-.016539***	
					(-8.47)	
Inventory Density (dist. sq. & > 1 mile)					-.000016***	
					(-9.43)	
Inventory Comp. (dist. sq. & < 1 mile)						.000141***
						(2.62)
Inventory Comp. (dist. sq. & > 1 mile)						.0000007***
						(16.69)
Property Characteristics	✓	✓	✓	✓	✓	✓
Macroeconomic Controls	✓	✓	✓	✓	✓	✓
Season Fixed Effects	✓	✓	✓	✓	✓	✓
Census Block Groups	✓	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓
Observations	12,251	12,251	12,314	12,314	12,110	12,110

Notes. This table presents results of simultaneous estimation of the effect of agent inventory on a home's selling price and liquidity (time on market), using density and competition variables to represent inventory differentiated by distance and marketing overlap; z-statistics in parentheses; ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table VI
The Effect of Agent Inventory on a Home's Sale Price and Days on Market – Interaction Models (3SLS)

	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)	3SLS Model Dependent Variable: ln(Sale Price)	3SLS Model Dependent Variable: ln(Days on Market)
	[4a]	[4b]	[7a]	[7b]	[8a]	[8b]
Inventory Density	-.000146***		-.000146***		-.000164***	
	(-6.00)		(-5.98)		(-5.77)	
Inventory Competition		.000028***		.000028***		.000036***
		(4.48)		(4.68)		(4.75)
Owner Agent			.01647*	-.18581		
			(1.71)	(-0.70)		
Inventory Density * Owner Agent			.00008			
			(1.54)			
Inventory Competition* Owner Agent				-.000015**		
				(-2.00)		
New					.182124***	-2.0993**
					(23.40)	(-2.13)
Inventory Density * New					.000004	
					(0.12)	
Inventory Competition* New						-.000019***
						(-2.86)
Property Characteristics	✓	✓	✓	✓	✓	✓
Macroeconomic Controls	✓	✓	✓	✓	✓	✓
Season Fixed Effects	✓	✓	✓	✓	✓	✓
Census Block Groups	✓	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓
Observations	12,251	12,251	12,251	12,251	12,251	12,251

Notes. This table presents results of simultaneous estimation of the effect of agent inventory interaction terms (owner agent and new respectively) on a home's selling price and liquidity (time on market); z-statistics in parentheses; ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.