Examining Both Sides of the Transaction: Bargaining in the Housing Market

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Abstract

This article examines the bargaining power of market participants in the housing market with special interest in the outcomes of individuals compared to real estate agents. Prior studies examine agents' sales of their own properties and find that they obtain higher prices than their clients, which is notable because it suggests a conflict of interest. In addition to reexamining agents' sales after correcting for a simultaneity issue, we consider both agents' sales and purchases of their own properties as well as all other market participants. Agents' purchases offers direct evidence of their ability to transaction residential real estate while in competition with other market participants. We also examine the interactions between individuals, agents and other market participants such as companies using a bargaining model that mitigates an endogeneity concern inherent in prior studies. The results demonstrate that agents hold bargaining power relative to individuals but not companies. We also find that agents' are able to buy low and sell high across the economic cycle from 2002 to 2013.

Key Words: Bargaining power; Real estate brokerage; Real estate agent; Principal-agent conflict; Asymmetric information

JEL Specifications: C70, D12, D53, D83, G14, R21

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I. Introduction

Studies by Rutherford, Springer, and Yavas (2005), Levitt and Syverson (2008), Bian, Turnbull, and Waller (2017), and Xie (2017) find that, on average, real estate agents obtain transaction prices for their homes that are approximately 2–4 percent higher than clients' properties. This line of research is important because the finding suggests a conflict of interest stemming from the principle-agent relationship. While agents should be experts in their chosen profession and local market and therefore maximize the prices for their own homes, they should be equally diligent in obtaining the maximum value for their clients. However, since sellers' agents receive only a small portion of any increase in sales prices (typically 1.5 percent), agents may be motivated to persuade their clients to accept suboptimal values to induce a transaction.

But price is not the only outcome that concerns sellers. The other is the amount of time the home is on the market (TOM). Here the literature is mixed. Bian, Turnbull, and Waller (2017) find a reduction in the TOM for agents compared to other sellers while Rutherford, Springer, and Yavas (2005) and Xie (2017) observe no significant change in marketing durations. Levitt and Syverson (2008) find agents' experience longer TOM. It is argued that the increase is due to agents advising their clients to sell too quickly; however, a longer TOM is also consistent with fundamental search theory. Due to the spatial fixity of heterogeneous products, real estate is foremost a search and matching market. Standard search theory shows there is a positive relation between prices and marketing durations (Krainer (2001) and Krainer and LeRoy (2002)). Consequently, if selling agents experience increases in both prices and TOM, the reason may be the expected positive relation between the two outcomes.

Further, consideration must be given to the fact that TOM and prices are jointly determined and prior literature in this area, with the exception of Bian, Turnbull and Waller (2017), has failed to do so. With our sample, we confirm that agents' transactions increase in prices and TOM in OLS specifications similar to those used by Rutherford, Springer, and Yavas (2005), Levitt and Syverson (2008), and Xie (2017). Upon including TOM and a number of other relevant determinants in the price model using a system of simultaneous equations, we find the positive price coefficient on agents' sales decreases to less than 50 percent of our OLS slope coefficient. After similar inclusion of the additional controls and price in the TOM equation, we find that marketing durations are not significantly different for agents selling their own homes, which suggests that agents are not uniformly advising their clients to sell their homes too quickly.

Beyond addressing the simultaneity of prices and TOM, the first innovation of our study is to investigate home purchases by agents. Examining purchases removes the potential principle-agent conflict and provides a straightforward test of agents' ability to transact while in competition with other market participants. In perfectly competitive markets, buyers and sellers have the same information; agents would thus have no comparative advantage and should pay market prices. Conversely, a finding of a price discount obtained by agents is consistent with them being able to trade on characteristics such as asymmetric information, sellers' urgency and other reductions in bargaining power, and/or being in the right place at the right time due to continuous activity in the market. Our results indicate that agents are able to purchase residential real estate at lower prices than individuals. Using a dataset of more than 200,000 transactions in the Dallas-Fort Worth Metroplex (DFW) from 2002 to 2013, we observe an average price reduction of approximately 1 percent.

Our next contribution is to combine the home purchases with sales transactions to investigate bargaining power. Using the framework of Harding, Rosenthal, and Sirmans (HRS, 2003), we examine whether the type of market participant influences negotiation ability. Since bargaining between agents and individuals is only one of a number of pairings between types of market participants, we classify all buyers and sellers in our sample as individuals, agents, partnerships and other firms (companies), government agencies, and estates, and investigate the interactions. We observe that agents and companies hold negotiating power over individuals. The results further indicate the bargaining power of companies over individuals is greater than agents, which equates to companies holding bargaining power over agents.

In addition to identifying the influence market participants have on bargaining outcomes, the HRS framework controls for the likely possibility that the participant type will also impact the demand for unobserved attributes of the home. We find this is an important additional consideration. Using simple binary variables, the results suggest that, compared to individuals, companies will purchase homes for substantial price reductions but also sell for significantly lower prices. Within the bargaining framework, the findings indicate that companies buy at lower prices and sell for higher amounts than individuals. The difference between the two models can be attributed to the measurement of demand effects of companies versus individuals; companies trade in lower priced properties that cannot be disentangled using only binary variables.

Our final analysis investigates whether bargaining power varies over an economic cycle. The sample period includes the marked decrease in house prices from 2006 to 2009 and allows us to examine whether agents' ability to buy low may be partially due to providing liquidity during the recessionary period. Similarly, agents may have sold high during the pronounced expansionary period from 2002 to 2005 to overconfident buyers as described by Scheinkman and Xiong (2003) and Hayunga and Lung (2009). In contrast to these explanations though, we find that agents demonstrate bargaining power over individuals consistently across the economic cycle.

Beyond the aforementioned papers examining agent-owner sales, this article builds on several literature strands. Regarding the principle-agent conflict, real estate agents are not the only experts relied upon by clients and examined in economic studies. Articles in this literature including Hubbard (2002), Fong (2005), and Dulleck and Kerschbamer (2006) consider service-experts in industries such as auto repair, legal, and medical. This paper also adds to the vast bargaining literature spanning more than six decades. In addition, we complement research examining real estate agents' value and expertise (e.g., Hendel, Nevo, and Ortalo-Magné (2009) and Bernheim and Meer (2013)). Lastly, our study is similar to working papers by Allen, et al (2015) and Agarwal, et al. (2015), who examine agents' purchases of real property, but not in a bargaining framework.

The logical structure of the remainder of this article is as follows. Section II describes the bargaining model. Section III details the data sample. Section IV presents the empirical findings and Section V offers conclusions.

II. The Model

Our primary empirical equations use the HRS bargaining model similar to Colwell and Munneke (2006). As in the HRS and Colwell and Munneke studies, we introduce an additive term, B, to the hedonic price model used extensively in housing studies, such that

$$P_i = sC_i + B_i, \tag{1}$$

where P_i is the price of the ith traded home and sC_i measures the market value of home i, which is the property characteristics (C) multiplied by their implicit prices (s). B_i reflects the effect of bargaining for item i relative to item i's market value. A positive (negative) value indicates that the seller (buyer) has the bargaining advantage. After dropping the i subscripts to simplify notation, the econometric approach to estimating B begins by expressing it as

$$B = b^{sell}D^{sell} + b^{buy}D^{buy} + e_B. \tag{2}$$

In Equation (2), D^k is a vector of characteristics of the individual buyer or seller ($k = sell, buy$), and b^k is a vector of parameter estimates that reflects the impact of the individual characteristics on bargaining power. The vector e_B captures idiosyncratic differences in market power between sellers and buyers. Substituting (2) into (1) yields

$$P = sC + b^{sell}D^{sell} + b^{buy}D^{buy} + e_B, \tag{3}$$

where b^{sell} and b^{buy}measure the effect of bargaining on P relative to the mean.

Crucial points made by HRS are that there are characteristics of the buyers and sellers that jointly determine both bargaining and the demand for housing, and some attributes are unobservable to the researcher. To address this issue, HRS denote the characteristics that are observable to the researcher as C_1, unobservable attributes that buyers and sellers value as C_2, and

$$s_2C_2 = d^{sell}D^{sell} + d^{buy}D^{buy} + e_D, \tag{4}$$

where s_2 is the vector of shadow prices on C_2, D^k is the same individual characteristics in Equation (2), and e_D is a vector of idiosyncratic differences in preferences across buyers and sellers. Since buyers and sellers value C_2 the vector is correlated with D^{buy} and D^{sell}. Consequently, because C_2 is omitted in Equation (3), the measurement of the impact of D^k will be biased.

To address the omitted variable problem, we substitute Equation (4) into (3) and arrange terms to obtain

$$P = s_1C_1 + (b^{sell} + d^{sell})D^{sell} + (b^{buy} + d^{buy})D^{buy} + \epsilon, \tag{5}$$

where s_1 is a vector of shadow prices on C_1 and $\epsilon = e_B + e_D$. Equation (5) shows the challenge in using only binary variables to identify divergent price outcomes between agents, individuals, and other market participants within the traditional hedonic framework. Indicator variables do not disentangle the bargaining and demand effects for the various types of buyers and sellers.

If we define $\Omega^{\text{sell}} = b^{sell} + d^{sell}$ and $\Omega^{\text{buy}} = b^{buy} + d^{buy}$ the parameter estimates on a trait like agents versus individuals are a component of these two equation and the four unknowns. To resolve the issue, HRS impose two restrictions. The first is that buyers and sellers of the same type exhibit symmetric bargaining power: $b^{sell} = -b^{buy}$. This assumption implies that identical buyers and sellers have no bargaining advantage over the other party. The second constraint is symmetric demand: $d^{sell} = d^{buy}$. This implies that buyers and sellers with identical demographic traits place equal value on the home.

With the imposition of the restrictions, the price equation in (5) becomes

$$P = s_1 C_1 + b(D^{sell} - D^{buy}) + d(D^{sell} + D^{buy}) + \epsilon. \quad (6)$$

Equation (6) can then be estimated by including a vector of differences and sums of the buyer and seller characteristics. The vector of differences measures the effect of buyer and seller attributes on bargaining power. The vector of sums controls for unobserved characteristics of the traded home and allows us to consider whether certain types of buyers and sellers value unobservable attributes differently or whether preferences for these attributes are constant across buyer and seller classes. Following Colwell and Munneke (2006), we term the vector of sums as property class. Lastly, in addition to application to transaction prices, we extend the analysis to investigate bargaining regarding liquidity in the housing market through TOM.

III. Data

The dataset contains single-family broker-assisted housing transactions from the DFW MSA. The full sample consists of more than 200k valid observations from October 2002 to May 2013. To form the sample, we merge three datasets. Structural and most transactional information comes from the DFW MLS. To identify the grantors and grantees, we merge the MLS data of the two primary counties within the DFW MSA, Dallas and Tarrant, to the public tax assessors' files.

Dallas county is the ninth-most populous county in the US with a population over 2.3 million. Fort Worth is the county seat of Tarrant County, which is the sixteenth-most populous county in the US with a population of over 1.8 million. After matching the grantor and grantee, we identify real estate agents using a file from the Texas Real Estate Commission.

To classify all other market participants, we use keywords matched on the grantor and grantee names. Companies are those that have taken the effort to create a firm name to own residential real estate such as "LLC", "LP", "Investments", and "Partnership". We posit that these companies are likely real estate investors. Government entities are identified with names like "National", "Federal", and "Secretary". Estates are coded using keywords such as "Intervivos", "Trustee", and "Custodian".[1] All others are classified as individuals.

In addition to removing observations with missing information important to the analysis, we apply a few filters. For example, we remove sales with list prices less than $40,000 and more than $1 million. We also require properties have between one and eight bedrooms, at least one bathroom, and a minimum of 800 square feet. Table 1 presents descriptive statistics of the sample.

IV. Empirical Findings

The analysis begins with a calibration of our sample to the existing literature examining agents' sales of their homes. We model the natural log of transaction prices and TOM against a binary variable set to one when the agent is the owner of the property, a broad set of structural and quality controls, and four features of atypical homes to control for properties trading in thin markets and exhibiting unique price-TOM trade-offs. To quantify atypicality, we follow Harding,

[1] We remove approximately one percent of the sample because the data are difficult to classify based upon the name (e.g., Aames Mortgage Trust 2000). However, we include these data when computing market competition and listing density variables described in the next section because the properties are valid transactions.

Knight, and Sirmans (2003) and set a binary variable equal to one when the property possesses a large number of bedrooms or bathrooms, is brand new or exceptionally old, and zero otherwise.

Table 2 reports the parameter estimates of the price and TOM equations. In the price model, the slope coefficient on agent-owned properties is 0.049. Following Kennedy (1981) to properly interpret a binary coefficient in a semilogarithmic equation (which we do throughout this paper), the parameter estimate suggests that agents sell their own properties for a price 5.0 percent higher than other market participants. The TOM model demonstrates that agents' properties also are on the market longer than the rest of the sample. The slope coefficient of 0.064 equates to an additional 4 days when valued at the sample mean. The combined increases in price and TOM are consistent with search theory as well as Levitt and Syverson (2008).

A. System of simultaneous equations

When selling their homes, owners maximize two outcomes. They prefer higher transaction prices and shorter marketing durations. In order to obtain higher prices, search theory shows that homeowners should expect to stay on the market long enough to find prospective buyers with reservation prices equal or greater than owners' reservation prices. Conversely, to obtain shorter TOM, sellers can reduce their list prices. Thus, there is a positive relation between transaction prices and TOM and the outcomes are joint determined.

Further, price and TOM are determined by identical factors, leading to a problem of identification within the system of equations. To avoid using ad hoc approaches to determine price and TOM instruments that are potentially not correlated with the other outcome, we follow Turnbull and Dombrow (2006) to define two new variables that separately appear in the price and TOM specifications and resolve the identical factors dilemma. The first is a market competition variable ($COMP$) that measures the number of competing homes for sale in the local market.

$COMP$ is stated in terms of the number of days that the market exposure of competing homes overlaps with the subject property.[2] Zahirovic-Herbert and Turnbull (2008) show further that including TOM as an explanatory variable in the selling price equation means that the parameter estimate on $COMP$ 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 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. Including these parametric restrictions to Equations (6) and (7) yields the simultaneous system

$$\ln(Price) = \alpha_1 + X'\beta_1 + \gamma\ln(TOM) + \psi LD + \theta_1 S + \rho_1 T + \epsilon_1 \tag{6}$$

$$\ln(TOM) = \alpha_2 + +X'\beta_2 + \lambda\ln(Price) + \delta COMP + \theta_2 S + \rho_2 T + \epsilon_2, \tag{7}$$

where X is a matrix of structural and transactional attributes, S is fixed effects for locally-defined geographical areas, and T is temporal fixed effects. To these models, we first examine simple binary variables for all market participants as both buyers and sellers and report the results in Table 3. We then replace the binary variables with the bargaining measures and detail the findings in Table 4.

With individuals as the control group in Table 3, we observe that agents sell their own properties for higher prices than individuals. The percent magnitude in 2.1. Agents are also able to purchase residential properties at discounts averaging 1.2 percent. Similar to agents, the price equation indicates that companies buy at discounts, but at a considerably lower mean magnitude. The slope coefficient of negative 0.113 equates to a reduced purchase price of more than $21,000 when valued at the mean transaction price of $179,702. However, unlike agents' experiences, the

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[2] For our sample, competing houses are those that, in comparison to a subject property, are no more than 15 percent different in price, 5 years different in age, and 15 percent different in square feet. Competing homes also are within 1 mile of the subject. See the appendix for additional specifics on $COMP$ and LD.

binary variable for company sellers indicates that they transact for 3.4 percent less than individuals (holding TOM constant).

The models in Table 3 include the structure, occupancy, and atypicality measures used in the calibration models in Table 2. The specifications also include a number of other possible determinants including financing methods, $COMP$, LD, and a proxy for agent experience (their MLS ID). The marginal slopes on these variables are largely as expected. For instance, cash transactions are the holdout class and the various methods of mortgage financing exhibit the expected price increases.

When identifying grantors and grantees, it is a challenge to discern when a transaction is a market transaction by a bank or a federal agency versus a foreclosure by a lender. To disentangle the two transaction types and account for an important consideration of bargaining, we are fortunate that the MLS data has a field that identifies foreclosures. We control for these transactions with a binary variable in the Table 3 equations. As expected, foreclosures experience price decreases of negative 0.167. Likewise, it is challenging to separate homebuilders selling new housing stock from other companies. The MLS provides a field denoting when sellers are builders, which we again code as a binary variable. The parameter estimate in Table 3 indicates that home builders experience price increases of 6.8 percent.

With respect to the TOM results in Table 3, we find that agents are buying homes that have been on the market slightly longer than expected. The increase of 5 percent equates to nearly 4 days based on the mean TOM. It is essential to keep in mind that price is held constant in the TOM specification and so it cannot be said that agents buy properties at a discount because they have been on the market longer. At the least, the result indicates that agents are not buying homes newly listed in MLS prior to other buyers knowing of the properties. Company buyers similarly transact in properties that are on the market longer, ceteris paribus. We note that agent and company sellers do not experience a significant difference in TOM.

The binary variables are informative but potentially bias so to suitably measure market acumen we replace them with the bargaining variables and report the findings in Table 4. In the price specification, agents exhibit bargaining power over individuals. Recall that the convention is $Seller - Buyer$, thus, the positive slope indicates that agents realize price increases on sale and discounts on purchase that average 1.7 percent on each side of the transaction for a total of more than 3 percent.

Companies similarly exhibit bargaining power over individuals. The binary variables in Table 3 suggest companies sell for less than individuals but this appears to be a function of both bargaining and demand effects. Based upon the property class variable, companies trade in homes that are less expensive. Upon controlling for the demand effect, the bargaining variable demonstrates that companies hold negotiation power over individuals. The parameter estimate of 0.040 equates to a total benefit of 8 percent. Additionally, the slope coefficient for companies' bargaining power is greater than the parameter estimate for agents. This equates to companies exhibiting greater negotiation ability than agents, which we confirm in an untabled specification that switches the holdout class to agents.

A few additional results are notable. Individuals hold bargaining power over government agencies and these government entities trade in properties that are significantly lower priced. In the TOM equation, agents buy and sell a property class that takes longer to sell as evident by the positive parameter estimate of 0.041. This finding indicates that differences in property class between agents and individuals manifests more in the TOM outcome than the price. Companies similarly transact in a property class that exhibits a significant increase in TOM.

B. Subdivision matched

The Table 4 models control for a wide array of transaction and structure variables, temporal fixed effects, as well as unobserved characteristics of market participants and the traded homes. We also control nonparametrically for unobservable differences between geographical zones defined by the local real estate information organization (NTREIS), which can be larger than a zip code. But since subdivisions or neighborhoods can be defined as small urban areas with a common set of socioeconomic effects (Goodman (1977)), there may be systematic differences within a more granular spatial boundary than is measured using the locally-defined areas. Consequently, we repeat the analysis by restricting the data to those subdivisions where agents trade a property.

Table 5 presents the parameter estimates and standard errors within the bargaining framework for the matched-subdivision sample. The findings are generally consistent with the unrestricted results in Table 4. Agents and companies hold bargaining power over individuals. Companies and government agencies trade in lower priced homes than individuals. When holding price constant, agents and companies transact properties that take longer to sell. The one difference in restricting the sample to subdivisions where agents transact is the parameter estimate on agent property class. The determinant is statistically significant but economically slight.

C. Economic cycle

The specifications thus far are able to isolate market power while controlling for heterogeneity at the transaction level. Though confident in the findings and conclusions, we recognize that macroeconomic conditions across an economic cycle may have an additional impact on bargaining power between market participants. We thus split our data based upon the expansion, contraction, and recovery periods within our sample timespan.

Figure 1 details two data series that identify the phases. Housing Starts reflects the number of privately-owned new homes that commenced building during the measured period. Consumers are more (less) likely to purchase new homes in a strong (weak) economy, which will affect employment and other outcomes in related industries such as banking, raw materials, and construction. The other data series is Private Residential Fixed Investment (PRFI), which is expenditures on residential structures and equipment that are owned by companies. It is part of the Gross Private Domestic Investment (GPDI), which in turn is a critical component of the Gross Domestic Product. The GPDI is the official government measure of investment expenditures undertaken by the private business sector, of which PRFI is the amount allocated to residential real estate. Based on these data series, we identify the expansionary period from the beginning of our sample in 2002 to 2005, the contractionary period as 2006–2009, and the recovery from 2009 to the end of our sample in 2013.

Table 6 reports the results. We observe that agents consistently exhibit bargaining power over individuals across the economic cycle with an increase during the recovery period from 2010 to 2013. As in previous specifications, the results indicate that agents transact in properties that take longer to sell but now we observe that the difference in property class is in the contraction and recovery periods and not the initial expansion timeframe.

Companies demonstrate greater bargaining power during the two economic growth periods but this is much reduced during the contractionary period. Companies obtain higher (lower) prices as sellers (buyers) that are more than 5 percent different than individuals during the two expansionary intervals, a total effect of more than 10 percent. The mean magnitude decreases to 1.9 percent for each side of the transaction during the period from 2006 to 2009. Across all three timeframes, the results demonstrate that companies trade in lower priced homes than individuals as measured by the property class variable.

D. Foreclosures

One final notable result in Table 6 is the bargaining of government agencies. The prior equations find a general loss of market power to individuals. The results across the economic cycle indicates that the lower leverage occurs in the expansion and contraction intervals. While foreclosures are already accounted for in the models using a binary variable, there may be an additional bargaining implication for government agencies during the severe economic downturn in 2006–2009. To test for this we remove foreclosures from the sample and reexamine the models across the economic cycle.[3]

Table 7 reports the results.[4] The parameter estimates on the government bargaining power are insignificant in all three economic phases. This finding indicates that the results in Table 6 related to government agencies are driven by property foreclosures. We note that the other parameter estimates and inferences remain relatively unchanged compared to Table 6.

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[3] We compute the market competition and listing density measures on the full sample and prior to removing the foreclosure sales because these properties are available in the market and are competition for other properties.

[4] In addition to removing foreclosure transactions, we analyze the sample with foreclosures included by interacting the bargaining power and property class variables with the companies and government agencies that are sellers of these properties and the buyers across all type classes who purchase foreclosures. The results support the hypothesis that government agencies lose bargaining power when selling foreclosed property. However, since individuals, agents, and estates are not sellers of foreclosures, the bargain and property class variables are perfectly inversely correlated (negative 1 as buyers and positive 1 for the property class) and we are not able to disentangle the bargaining and property class functions. Accordingly, we do not report the equations.

V. Conclusion

Bargaining is a common element of markets for heterogeneous goods. Despite negotiation being a key component there is a paucity of literature exploring the outcomes of bargaining between buyers and sellers of residential real estate. The one area that has been examined is the outcomes of real estate agents transacting against others when selling their own homes. This article examines the bargaining power between five primary types of market participants in the housing market: individuals, real estate agents, companies (investors), government agencies, and estates.

The method of measuring the outcomes of real estate agents in the extant literature is a binary variable set equal to one for agent-owner sales in a hedonic regression. An issue with this approach is that the traits of market participants will likely be correlated with unobservable attributes of the neighborhoods and structures, which may bias the parameter estimate on the binary variable. In fact, all studies comprising this literature find significant differences in transaction and structural attributes between the samples of agent sales and other sellers.

Consequently, we use the model of Harding, Rosenthal, and Sirmans (2007) to directly measure bargaining power while also controlling for any residual correlation between attributes of the market participants and unobservable characteristics of the neighborhood, structure, and transaction. We find that controlling for unobservable attributes is important. For instance, the simple binary variable approach suggests that companies sell their properties for lower prices than individuals. However, upon controlling for the influence demand characteristics have on transaction outcomes, we observe that companies exhibit bargaining power over individuals with a mean increase in selling prices for companies of more than 3 percent. The combined increase in selling prices and decrease in purchase values averages more than 6 percent.

Our equations also demonstrate that real estate agents exhibit bargaining power over individuals. Agents sell for higher prices and purchase at lower prices for a total magnitude that averages more than 3 percent. The fact that the bargaining power of companies over individuals (6+ percent) is greater than agents (3+ percent) demonstrates that firms exhibit bargaining power over real estate agents.

When examining the negotiation ability of government agencies, the initial finding is that government agencies hold lower bargaining power relative to individuals. However, when foreclosures sales are removed from the sample, government agencies do not exhibit a significant loss of bargaining power to individuals.

Appendix

The Turnbull and Dombrow (2007) approach measures the number of competing homes for sale in the local market. Two variables are created to control for the opportunity available to buyers interested in competing houses, and avoids counting other houses that sell early in the marketing period of the subject property. Turnbull and Dombrow (2007) show how these factors alleviate the problem of a lack of quality instruments used in a system of simultaneous TOM-price equations.

To form the variables, denote the listing and selling data for house i, as $L(i)$ and $S(i)$. The days on market for house i is then $S(i) - L(i) + 1$ and the overlapping days on the market for contemporaneously listed houses j and i is defined as $O(i,j) = \min[S(i), S(j)] - \max[L(i), L(j)] + 1$. After mapped all homes in the sample by their spatial coordinates, the distance in miles between houses i and j is computed as $D(i,j)$. The variables measuring competing listings for house i is defined as

$$COMP_i = \sum_j [1 - D(i,j)]^2 O(i,j).$$

To form the listing density measure, $COMP$ is scaled by a distance weighting to factor in the fact that competing houses near the subject property will have stronger competition effects that others farther away. The listing density is

$$LD_i = \sum_{j \in I} \frac{[1 - D(i,j)^2 O(i,j)]}{S(i) - L(i) + 1}.$$

The system of equations is identified when $COMP$ is included in the TOM model and LD is added to the price specification.

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Table 1 Descriptive statistics (N = 207,527)

Variable	Mean	Standard Deviation	Minimum	Maximum
List price ($k)	181.247	125.246	40.000	1,000.000
Selling price ($k)	179.702	172.882	9.100	1,006.000
TOM (days)	70.677	73.412	0.000	1,530.000
Individual buyer (yes=1)	0.937	0.240	0.000	1.000
Agent buyer (yes=1)	0.011	0.106	0.000	1.000
Company buyer (yes=1)	0.045	0.208	0.000	1.000
Government buyer (yes=1)	0.002	0.043	0.000	1.000
Estate buyer (yes=1)	0.003	0.053	0.000	1.000
Individual seller (yes=1)	0.669	0.471	0.000	1.000
Agent seller (yes=1)	0.009	0.092	0.000	1.000
Company seller (yes=1)	0.221	0.415	0.000	1.000
Government seller (yes=1)	0.083	0.276	0.000	1.000
Estate seller (yes=1)	0.018	0.133	0.000	1.000
Listing density	1.147	1.805	0.000	30.328
Market competition	122.307	262.116	0.000	6,697.514
Foreclosure (yes=1)	0.143	0.350	0.000	1.000
Seller is builder (yes=1)	0.103	0.303	0.000	1.000
Relocation company (yes=1)	0.015	0.122	0.000	1.000
Cash financing (yes=1)	0.118	0.323	0.000	1.000
Conventional loan (yes=1)	0.594	0.491	0.000	1.000
FHA loan (yes=1)	0.233	0.423	0.000	1.000
VA loan (yes=1)	0.033	0.178	0.000	1.000
Owner occupied (yes=1)	0.606	0.489	0.000	1.000
Vacant (yes=1)	0.376	0.484	0.000	1.000
Tenant occupied (yes=1)	0.018	0.133	0.000	1.000
Home age (years)	24.465	20.932	0.000	111.000
Square feet (k)	2.109	0.817	0.800	15.800
Number of bedrooms	3.386	0.682	1.000	8.000
Number of bathrooms	2.176	0.645	1.000	8.100
Pool (yes=1)	0.142	0.349	0.000	1.000
Lot size (acres)	0.100	0.819	0.000	55.000
Garage spaces	1.864	0.701	0.000	9.000
Brick construction (yes=1)	0.916	0.277	0.000	1.000
Siding construction (yes=1)	0.201	0.401	0.000	1.000
Stucco construction (yes=1)	0.010	0.098	0.000	1.000
Wood construction (yes=1)	0.103	0.302	0.000	1.000
Rock construction (yes=1)	0.063	0.242	0.000	1.000

Table 2 OLS specifications

	Log Prices	Standard Errors	Log TOM	Standard Errors
Agent seller	0.049**	(0.006)	0.064*	(0.027)
Log square feet	0.770**	(0.002)	0.364**	(0.011)
Log home age	-0.044**	(0.001)	-0.082**	(0.004)
Pool	0.080**	(0.002)	-0.117**	(0.008)
Log garage spaces	0.139**	(0.003)	-0.090**	(0.010)
Log carport spaces	0.027**	(0.003)	0.051**	(0.011)
Log lot size	0.141**	(0.003)	0.076**	(0.013)
Brick construction	0.016**	(0.003)	-0.036**	(0.012)
Siding construction	-0.043**	(0.001)	0.025**	(0.006)
Stucco construction	0.098**	(0.006)	0.073**	(0.027)
Rock construction	0.142**	(0.002)	0.019	(0.012)
Wood construction	-0.015**	(0.002)	0.035**	(0.009)
Intercom	-0.006*	(0.003)	0.032	(0.017)
Skylights	0.013**	(0.002)	0.011	(0.010)
Window treatments	0.039**	(0.001)	-0.056**	(0.006)
Vaulted ceilings	0.013**	(0.001)	0.009	(0.006)
Dual vanities	0.025**	(0.001)	-0.004	(0.006)
Security system	0.060**	(0.001)	0.004	(0.006)
Sprinkler system	0.099**	(0.001)	-0.028**	(0.006)
Tile floors	0.056**	(0.001)	0.021**	(0.006)
Walk-in closets	0.019**	(0.001)	-0.008	(0.006)
Gas hot water	0.010**	(0.001)	0.018**	(0.006)
Vacant	-0.097**	(0.001)	0.100**	(0.006)
Tenant occupied	-0.043**	(0.004)	0.142**	(0.020)
New construction	0.046**	(0.002)	-0.420**	(0.015)
Old home	0.270**	(0.009)	0.088**	(0.030)
Many bedrooms	-0.116**	(0.010)	0.089	(0.052)
Many bathrooms	0.121**	(0.004)	0.139**	(0.023)
Constant	5.510**	(0.061)	1.186**	(0.232)
Observations	207,527		207,527	
Adjusted R^2	0.837		0.040	

This table details calibrations of our sample to the literature that finds agents sell their own properties for higher prices than clients. The models include temporal fixed effects controlling for monthly and annual heterogeneity and spatial fixed effects that account for up to 125 locally-defined submarkets. Standard errors in parentheses are robust to heteroscedasticity. ** and * denote p-values <0.01 and <0.05, respectively

Table 3 Binary variables models (full sample)

	Log Prices	Standard Errors	Log TOM	Standard Errors
Agent seller	0.021**	(0.005)	0.034	(0.026)
Company seller	-0.033**	(0.002)	0.021	(0.011)
Government seller	-0.062**	(0.003)	-0.135**	(0.016)
Estate seller	-0.047**	(0.004)	-0.028	(0.018)
Agent buyer	-0.012**	(0.004)	0.049*	(0.023)
Company buyer	-0.113**	(0.002)	0.035**	(0.012)
Government buyer	0.013	(0.011)	-0.813**	(0.056)
Estate buyer	0.052**	(0.009)	-0.054	(0.046)
Foreclosure property	-0.167**	(0.003)	0.037**	(0.014)
New construction	0.066**	(0.003)	0.305**	(0.017)
Relocation property	0.012**	(0.004)	-0.071**	(0.020)
Log Agent MLS ID	-0.006**	(0.001)	-0.010	(0.007)
Conventional financing	0.109**	(0.001)	-0.136**	(0.008)
FHA financing	0.072**	(0.002)	-0.117**	(0.009)
VA financing	0.074**	(0.003)	-0.137**	(0.015)
Log TOM	-0.007**	(0.001)		
Log listing density	-0.015**	(0.001)		
Log prices			0.580**	(0.013)
Log market competition			0.191**	(0.001)
Constant	5.578**	(0.050)	-2.770**	(0.291)
Covariates	Yes		Yes	
Temporal fixed effects	Yes		Yes	
Spatial fixed effects	Yes		Yes	
Observations	207,527		207,527	
Adjusted R^2	0.859		0.104	

The table presents a system of simultaneous equations using 2SLS. The models include all structural, occupancy, and atypicality covariates detailed in Table 2. Individual sellers and buyers is the control class for market participants. The temporal fixed effects control for monthly and annual heterogeneity. Spatial fixed effects control for up to 125 locally-defined submarkets. Standard errors in parentheses are robust to heteroscedasticity and the use of instrumental variables. ** and * denote *p*-values <0.01 and <0.05, respectively.

Table 4 Bargaining models (full sample)

	Log Prices	Standard Errors	Log TOM	Standard Errors
Seller - Buyer				
Agent bargaining power	0.017**	(0.003)	-0.008	(0.017)
Company bargaining power	0.040**	(0.002)	-0.006	(0.008)
Government bargaining power	-0.038**	(0.006)	0.339**	(0.029)
Estate bargaining power	-0.050**	(0.005)	0.013	(0.025)
Seller + Buyer				
Agent property class	0.005	(0.003)	0.041*	(0.017)
Company property class	-0.073**	(0.002)	0.029**	(0.008)
Government property class	-0.024**	(0.006)	-0.474**	(0.030)
Estate property class	0.002	(0.005)	-0.041	(0.025)
Constant	5.578**	(0.050)	-2.769**	(0.291)
Covariates	Yes		Yes	
Temporal fixed effects	Yes		Yes	
Spatial fixed effects	Yes		Yes	
Observations	207,527		207,527	
Adjusted R^2	0.859		0.104	

The table presents a system of simultaneous equations using 2SLS. The models include the covariates used in the Table 2 and 3 models. The held out class is individual buyers and sellers. The spatial fixed effects control for up to 125 locally-defined submarkets. The time fixed effects control for monthly and annual heterogeneity. Standard errors in parentheses are robust to heteroscedasticity and the use of instrumental variables. ** and * denote *p*-values <0.01 and <0.05, respectively.

Table 5 Bargaining models (matched sample)

	Log Price	Standard Errors	Log TOM	Standard Errors
Seller - Buyer				
Agent bargaining power	0.018**	(0.003)	-0.010	(0.017)
Company bargaining power	0.034**	(0.002)	-0.015	(0.009)
Government bargaining power	-0.040**	(0.006)	0.344**	(0.032)
Estate bargaining power	-0.049**	(0.005)	0.006	(0.031)
Seller + Buyer				
Agent property class	0.007*	(0.003)	0.062**	(0.017)
Company property class	-0.070**	(0.002)	0.053**	(0.010)
Government property class	-0.022**	(0.006)	-0.496**	(0.034)
Estate property class	0.005	(0.005)	-0.044	(0.031)
Constant	5.806**	(0.048)	-3.656**	(0.321)
Covariates	Yes		Yes	
Temporal fixed effects	Yes		Yes	
Spatial fixed effects	Yes		Yes	
Observations	143,909		143,909	
Adjusted R^2	0.872		0.125	

The table details a system of simultaneous equations using 2SLS and a sample restricted to subdivisions where agents trade homes. The models include all covariates in Table 2 and 3. Individual buyers and sellers is the control class. The temporal fixed effects control for monthly and annual heterogeneity. The spatial fixed effects control for up to 125 locally-defined submarkets. Standard errors in parentheses are robust to heteroscedasticity and instrumental variables. ** and * denote *p*-values <0.01 and <0.05, respectively.

Table 6 Bargaining across an economic cycle (matched sample)

	Expansion (2002–2005)		Contraction (2006–2009)		Recovery (2010–2013)	
	Log Price	Log TOM	Log Price	Log TOM	Log Price	Log TOM
Seller - Buyer						
Agent bargaining power	0.016**	-0.049	0.016**	0.014	0.027**	-0.027
	(0.006)	(0.037)	(0.004)	(0.024)	(0.006)	(0.034)
Company bargaining power	0.052**	-0.006	0.019**	0.015	0.052**	-0.091**
	(0.004)	(0.023)	(0.002)	(0.013)	(0.003)	(0.019)
Government bargaining power	-0.022*	0.494**	-0.035**	0.326**	-0.023	0.145
	(0.011)	(0.067)	(0.007)	(0.040)	(0.016)	(0.088)
Estate bargaining power	-0.025*	-0.081	-0.053**	0.016	-0.048**	0.003
	(0.013)	(0.082)	(0.007)	(0.040)	(0.011)	(0.059)
Seller + Buyer						
Agent property class	0.002	0.033	0.007	0.052*	0.008	0.107**
	(0.006)	(0.038)	(0.004)	(0.024)	(0.006)	(0.034)
Company property class	-0.054**	0.084**	-0.071**	0.041**	-0.061**	0.003
	(0.004)	(0.024)	(0.002)	(0.013)	(0.003)	(0.019)
Government property class	-0.019	-0.748**	-0.044**	-0.481**	0.009	-0.354**
	(0.012)	(0.076)	(0.007)	(0.042)	(0.016)	(0.090)
Estate property class	-0.008	0.076	0.008	-0.100*	0.004	0.003
	(0.013)	(0.081)	(0.007)	(0.041)	(0.011)	(0.059)
Constant	5.833**	-6.784**	5.977**	-3.050**	6.017**	-2.439**
	(0.090)	(0.682)	(0.061)	(0.419)	(0.106)	(0.693)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Temporal fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Spatial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,757	28,757	77,906	77,906	37,246	37,246
Adjusted R^2	0.889	0.119	0.874	0.139	0.877	0.127

The table presents systems of simultaneous equations including all covariates in Tables 2 and 3. The spatial fixed effects are defined for up to 125 locally-defined submarkets. Individual sellers and buyers is the holdout class. The time fixed effects control for monthly and annual heterogeneity. Standard errors in parentheses are robust to heteroscedasticity and the use of instrumental variables. ** and * denote *p*-values <0.01 and <0.05, respectively.

Table 7 Bargaining across an economic cycle (matched sample with no foreclosure sales)

	Expansion (2002–2005)		Contraction (2006–2009)		Recovery (2010–2013)	
	Log Price	Log TOM	Log Price	Log TOM	Log Price	Log TOM
Seller - Buyer						
Agent bargaining power	0.015*	-0.037	0.012**	0.019	0.024**	-0.035
	(0.006)	(0.038)	(0.004)	(0.024)	(0.006)	(0.036)
Company bargaining power	0.050**	0.029	0.011**	0.067**	0.052**	-0.053*
	(0.004)	(0.025)	(0.002)	(0.014)	(0.004)	(0.022)
Government bargaining power	-0.056	0.192	0.011	0.401**	-0.061	0.214
	(0.029)	(0.187)	(0.014)	(0.085)	(0.070)	(0.411)
Estate bargaining power	-0.022	-0.068	-0.051**	0.022	-0.051**	0.011
	(0.013)	(0.082)	(0.007)	(0.044)	(0.011)	(0.066)
Seller + Buyer						
Agent property class	0.001	0.026	0.005	0.052*	0.002	0.115**
	(0.006)	(0.038)	(0.004)	(0.025)	(0.006)	(0.037)
Company property class	-0.044**	0.023	-0.057**	-0.041**	-0.056**	-0.060**
	(0.004)	(0.026)	(0.002)	(0.015)	(0.004)	(0.023)
Government property class	-0.075*	-0.267	-0.127**	-0.335**	-0.104	-0.490
	(0.029)	(0.188)	(0.014)	(0.085)	(0.070)	(0.410)
Estate property class	-0.014	0.083	-0.006	-0.081	-0.000	0.002
	(0.013)	(0.081)	(0.007)	(0.044)	(0.011)	(0.066)
Constant	5.777**	-7.243**	6.011**	-2.811**	5.624**	-2.881*
	(0.090)	(0.690)	(0.081)	(0.541)	(0.205)	(1.264)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Temporal fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Spatial fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,637	26,637	66,461	66,461	29,842	29,842
Adjusted R^2	0.887	0.126	0.870	0.160	0.867	0.157

The table presents systems of simultaneous equations including all covariates in Tables 2 and 3. Individual sellers and buyers is the holdout class. The geographical fixed effects are defined for up to 125 locally-defined submarkets. The time fixed effects control for monthly and annual heterogeneity. Standard errors in parentheses are robust to heteroscedasticity and the use of instrumental variables. ** and * denote p-values <0.01 and <0.05, respectively.

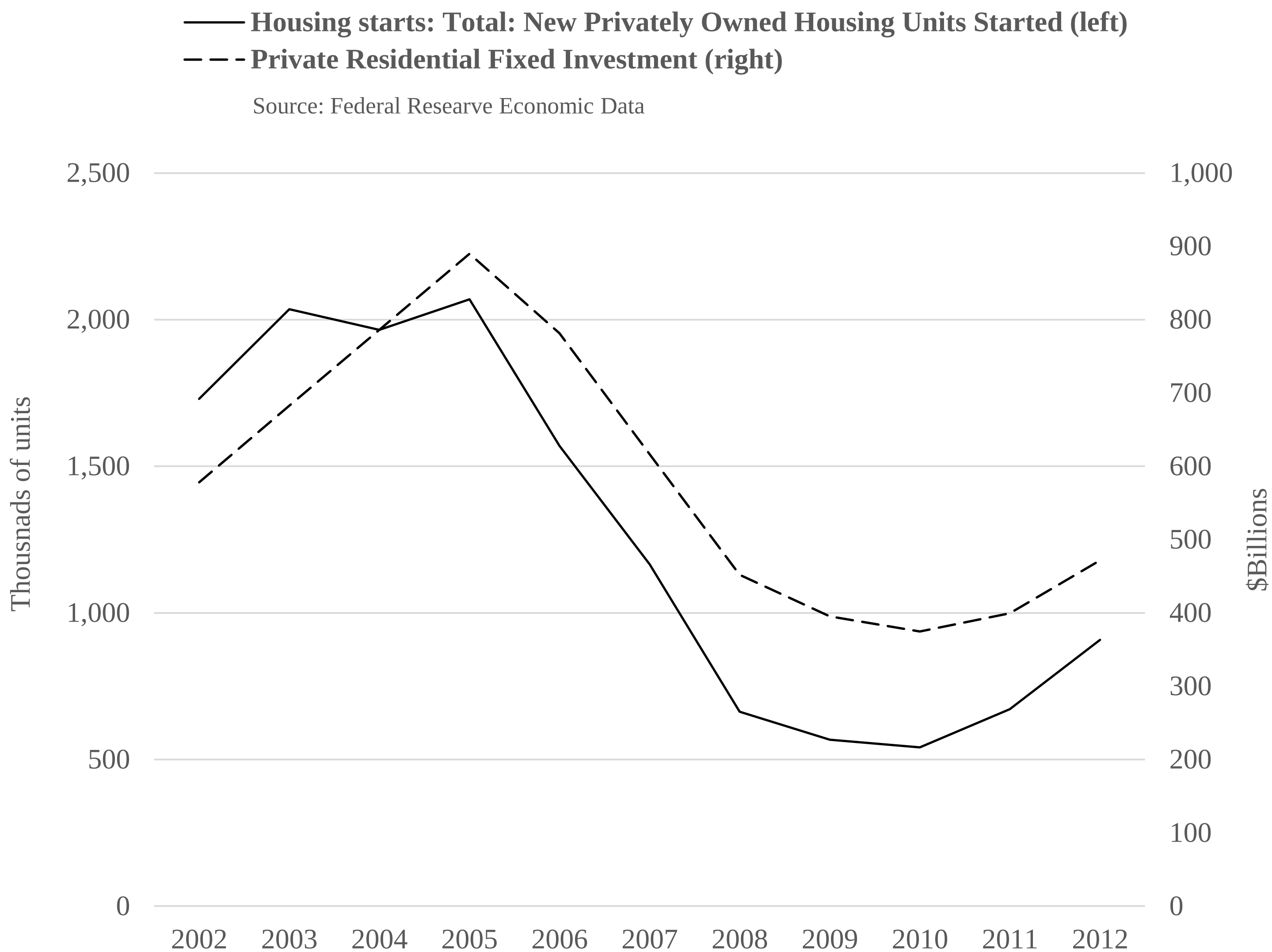

Figure 1. Housing economic cycle (seasonally-adjusted annual rates)