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Homeowners' Repeat-Sale Gains, Dual Agency and Repeated Use of the Same Agent

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Abstract Previous studies of dual agency, where one agent serves both buyer and seller in a transaction, use hedonic models. Repeat-sale methods can test for the price effect of accepting dual agency. Dual agency does not show convincing effects on expected gain, which would occur if there was a systematic bias, or on heteroscedasticity, which would occur if there are large effects that are rare. Earlier researchers could not test for the effect of an owner picking a listing agent who was the earlier selling agent. Consistently positive mean abnormal price gains come from this choice, as well as significant heteroscedasticity.

Do inherent principal/agent conflicts cause the real estate brokerage industry to systematically misrepresent buyers and/or sellers? Dual agency in a transaction involves one agent representing both buyer and seller. Consumer advocates provide anecdotal evidence that the incidence of representation problems is not zero. The industry recognized several of the problems long ago. Brokerage professional associations responded with ethical guidelines that would eliminate the problem if agents fully and faithfully adhered to the principles. More recently, states have enacted regulations requiring that clients be fully informed of the potential for conflict of interest.

A review of extensive contributions to the literature on this important topic finds that cross-sectional statistical analysis has been the mode of empirical tests as to whether transaction price is higher versus lower when buyer and seller are represent by alternative agency formats. This study differs from earlier research in that it uses a repeat-sale price index model to test for the effect of agency choice on the percentage gain in price over the tenure of a given owner. Bailey, Muth and Nourse (1963) and Archer, Gatzlaff and Ling (1996) provide alternative repeat-sale formats for statistical tests.

For a data unit in this model, the buyer makes a choice on dual agency in the first of a pair of transactions, then another choice at the end of his tenancy in the house. In addition to the decision to accept dual agency, the owner also chooses whether to return to the same agent for the second transaction. Using a data set that lists agent names in each transaction, indicator variables can be defined to record dual agency on the first or second of repeat sales of the same house. Also, a variable may be defined to indicate whether the same agent served the buyer in the first transaction as a selling agent, and then represented that same owner as a listing agent in the second transaction.

Positive mean abnormal returns may be anticipated for variables defined to indicate that an owner returned to an agent who sold him the house for repeat service as a listing agent. The owner may believe that the agent's superior representation gave him the opportunity to buy the house at a price lower than market terms. The owner may believe that these same agency skills will generate a resale price that is also in the owner's favor. The positive coefficient may also come from another source. If an agent becomes familiar with a house while serving as the selling agent on a transaction, then that familiarity may allow the agent to more successfully market the house, generating abnormal gains for the owner.

In applying the repeat-sale regression analysis, two main contexts are asserted as indication of the existence of principal/agent problems. Of course, if the estimated repeat-sale regression coefficients are statistically significant, then mean holding-period gains are abnormal for the groups of transactions associated with dual agency and repeat use of the same agent.

In a second context, the indicator variables may have no significant impact on expected price gain, but still have measurable importance. For example, suppose such a large number of agents follow ethical guidelines that the distorted transactions are rare anomalies. While there may be no significant regression coefficients that indicate an effect on expected price gain, the agency variables may be associated with outliers and the variance of price gains. Thus, a second set of tests—for heteroscedasticity—may indicate important influences from the owners' agency choices. Findings that agency variables are associated with heteroscedasticity would also mean that researchers estimating repeat-sale price indexes need to add even more variables to the list now known to create statistical problems.

The main results of this paper and its organization are as follows. A review of the literature for agency effects indicates a lack of consensus among empirical papers that use cross-sectional hedonic price models. Empirical results also differ across house price ranges. The next two sections adapt repeat-sale price analysis to this application and provide sample information and variable definitions. A section of statistical results for alternative models deals first with tests for heteroscedasticity, then tests for differences in the expected price gain that a homeowner may enjoy. The concluding section asserts that the results add new heteroscedasticity worries for general users of repeat-sale methods. The section also claims that there is no compelling evidence that dual agency has either the effects anticipated if there is a general bias in favor of either buyers or sellers or the effects that might be anticipated if agent misrepresentation has large effects, but is rare. The final main conclusion regards the homeowner's agency choice of returning to the agent who sold him the house for employment as a listing agent upon resale. This agency factor is a major source of heteroscedasticity and is associated with increased price gains over the period of ownership. These effects range from almost one-third to more than one-half more than the gain that could be anticipated from market price trends.

Review of the Literature

Principal/agent conflicts and ambiguities that had existed for years led to a broker's minefield of liability, litigation and professional disciplinary activity that Bryant and Epley (1992) make vivid. Their review of existing case law made it clear that a broker has the obligation to negotiate the best possible price for his client. For example, a seller's listing agent, having independently found one offer, is obligated to inform his client of a second broker's intention to submit a better offer. Since the seller's agent would collect a higher income if he did not have to split commission with the second agent, this obligation presents a principal/agent conflict.

Bryant and Epley (1992) emphasized that the agency relation requires undivided loyalty to the principal. If one agent represents both buyer and seller, their opposing interests creates dual agency, which could lead to the agent owing damages, losing the commission, suffering licensing discipline, and/or allowing the parties to void the sales contract. If both parties make informed agreement to the agent's role, then the agent has better protection than under undisclosed dual agency.

Bryant and Epley (1992) described how two agents may, even without intention, create uninformed dual agency if the buyer believes that the selling agent is his advocate when, in fact, the selling agent is a subagent to the listing agent. The legal crisis that developed virtually forced the real estate brokerage industry to reform long-honored relations that had become untenable. Many buyers now have formal agency contracts with buyer's brokers, while other buyers get formal notification that their brokers owe all their loyalty to the seller.

The literature has conflicting evidence on the benefit of real estate brokerage for the seller or buyer, whether under old modes of representation or with new arrangements. An early paper by Jud (1983) made the startling conclusion that brokers do not affect a given house's price, even though they do increase the level of housing consumed by buyers. Using different data and methods, Jud and Frew (1986) later found evidence that brokers obtain higher prices. They also validated the earlier indication that broker intermediation increases demand for houses.

After the crisis in brokerage arrangements detailed by Bryant and Epley (1992), Black and Nourse (1995) compared price and closing cost allocations between buyers and sellers under two brokerage modes. The first involved buyers with contracts with a buyers' agent, while the seller has a listing agent or is unrepresented. The second involved either the seller's listing agent acting as a dual agent or the selling agent acting as a subagent to the listing agent. Cash charges at closing were lower when there was a buyers' agent. This was more pronounced in higher price ranges. There was no significant evidence that the transactions using a buyer broker had higher prices to reflect the reallocation of closing costs. Of course, this also means that buyers did not win lower prices by engaging an agent owing all loyalty to the buyers.

Bajtelsmit and Worzala (1997) used bargaining theory to anticipate the impact of adversarial brokerage and separate buyer representation on final price, on buyer's net gain relative to reservation price, on seller's net gain relative to reservation price and on payments to brokers. Their theoretical comparisons were among transactions with no agents, with one agent serving both buyer and seller, with two agents and the buyer informed that the second agent is a subagent for the seller, with two agents and the buyer not aware of the nature of sub agency, and with two agents and the buyer having an agency representation that the seller is aware of.

Bajtelsmit and Worzala (1997) anticipated that lowest price and largest gains to buyer and seller would come with no broker. They note that this result ignores all costs other than brokerage fees. Of course, there would be zero payments to brokers. Their theoretical results indicated that both a dual agency function by one broker and the case of two agents with disclosed agency yield a higher price and lower net benefits to buyer and seller. Payments to brokers exist and are a function of this higher price.

For the case in which two agents do not disclose agency relations to the buyer, theory indicated the highest price, zero net benefit to the buyer, and seller net benefits that fall between the no-broker level and the level seen for disclosed agency. Broker receipts are higher. Finally, buyer brokerage, with agency disclosed to the seller, yielded a price equivalent to the low, no-broker level. Net benefits were lower than the no-broker case, but higher than with either dual agency or sub agency. Broker receipts depend on the details of the buyer broker's contract. If brokers are paid a fixed percentage of transaction prices, then brokers will get paid less under buyer-brokerage than under the agency relations that generate higher prices.

Benjamin and Chinloy (2000) found a positive relation between buyer brokerage and sales price, as well as a positive relation between transaction price and the probability of using a buyers' broker. They explain the relation by referring to alternative house marketing strategies. The first is a Pricing Strategy: set list price at or below market price in hopes of a timely sale. The Exposure Strategy involves setting list price higher than the market price, then depend on increased brokers' effort and advertising to generate higher final price. Benjamin and Chinloy conclude that brokers concentrate their time on sellers following the pricing strategy, as opposed to the exposure strategy.

Elder, Zumpano and Baryla (2000) tested for the effect of buyer brokers on selling price and search duration. Their tests conclude that real estate brokers have no independent effect on home prices, regardless of the type of broker. The principal effect is a reduction of buyer search time. Buyer agents reduce this time relative to for-sale-by-owner cases, but also relative to traditional seller's agents. Also, higher income buyers are more likely to employ a buyer's agent, as are those with more information and experience. Buyers who receive agency disclosure during a broker-assisted transaction are more likely to employ a buyer's agent.

Zietz and Newsome (2001) also addressed the effect of buyer's agent commission rates and sale price. Their data are a cross-sectional set of 592 observations from Orem, Utah, for 1990 through 1997. Variables were sales price, hedonic variables and the percentage commission paid to the buyer's agent. The coefficient on the buyer's agent commission rate was positive for the whole sample and for a subset of lower priced houses. The coefficient calculated from higher priced houses is positive, but not significant.

Zietz and Newsome (2002) used a larger and later sample from Orem in a second study. Buyers not represented by a buyer's agent paid 2% more for their houses, but the effect is focused on medium-to-small houses. Small houses, medium-to-large and large houses showed no statistically significant coefficients with respect to buyer's agency. However, raising the commission percentage paid to the buyer's agent raised price for the small-to-medium group. Negative coefficients for the other groups were not statistically significant. Buyers hiring a buyer's agent from the same firm as the listing agent paid lower prices, but the relation is significant only for medium-to-large houses.

Applying the Repeat-Sale Methodology

The Bailey, Muth and Nourse Specification

Bailey, Muth and Nourse (1963) initiated repeat sale price index analysis by modeling the ratio of a house's prices across an individual owner's period of buying, *b*, and selling, *s*, as being the product of a random component (U_{ibs}) and a ratio of market price indexes:

$$p_{is}/p_{ib} = U_{ibs}\,(M_s/M_b). \tag{1a}$$

Expressing the relation in natural logarithms:

$$r_{ibs} = \ln(p_{is}) - \ln(p_{ib}) = u_{ibs} + m_s - m_b. \tag{1b}$$

The market price indexes could be estimated as a regression problem by using time period indicator variables, such as Q_{0i}, Q_{1i}, Q_{2i}, ... , Q_{Ti}, where individual transactions in the data set occur in $T + 1$ alternative quarters. In the statistical record for an individual's ownership of a house, if neither transaction occurred in period t, then Q_{ti} is assigned a zero value. An individual data record would have two non-zero values across the indicator variables: assign $Q_{bi} = -1$ to indicate the period that the homeowner first bought the house, and $Q_{si} = +1$ to indicate the period in which it sold a second time. Setting $M_0 = 1$, $m_0 = 0$, normalizes the index to be defined at 1.00 in the initial period. Equation (1b) is restated as Equation (1c):

$$r_{ibs} = u_{ibs} + \Sigma_t m_t Q_{ti}, \text{ or}$$

$$r_{ibs} = u_{ibs} + m_0(0) + \ldots + m_b(-1) + \ldots + m_s(+1) + \ldots + m_T(0). \tag{1c}$$

This basic Bailey, Muth and Nourse (1963) model can be applied to testing for the effects of agency representation in alternative ways. First, if the variance of residuals from empirical estimates of Equation (1c) is associated with agency variables, then the indication of heteroscedasticity is evidence of the influence of agency representation. In such a case, weighted least squares (WLS) estimates of Equation (1c) may need to include agency variables, in addition to such well established variance factors as the time between transactions. The existence of heteroscedasticity also indicates the need for improvement in the specification, beyond the basic repeat sale model.

Bailey, Muth and Nourse (1963, page 935) suggest a second way to apply their methodology to measure the effects of such factors as "....remodeling of or addition to a structure, a change in the number of dwelling units in an apartment building, a change in the race of the residents of a building or a neighborhood, and sale for demolition and redevelopment of the property to a new use." Adding new variables to the model in Equation (1c) yields:

$$r_{ibs} = u_{ibs} + \Sigma_t m_t Q_{ti} + b_1 X_{1i} + b_2 X_{2i} + \ldots + b_k X_{ki}. \tag{1d}$$

This variation in the basic repeat sale may be applied to the current research topic by using (1,0) variables to indicate agency representation alternatives. Rejecting the null hypothesis that all of agency-related coefficients are zero means that some agency representation effect on expected price gain across homeowners' tenures can be identified. If the null hypothesis that a particular coefficient is zero is rejected, a positive regression coefficient indicates a higher average percentage price gain observed for that sub-group of houses. If dual agency favors sellers over buyers, then a negative coefficient on a variable defined to indicate that an owner bought his house while being served by the seller's own agent would be expected. By the same logic, a variable defined to indicate dual agency on the second of a pair of transactions may have a positive sign. If dual agency gives biased representation in favor of the buyer, then the pattern of signs would be reversed

Applying the Archer, Gatzlaff and Ling Specification

The Bailey, Muth and Nourse (1963) specification cannot test for price patterns that vary over time within the sub-group relative to the rest of the sample. To measure sub-group deviations in price that can change over time, Archer, Gatzlaff and Ling (1996) adapted the repeat sale methodology. Their variation of Equation (1a) can be written:

$$p_{ijs}/p_{ijb} = U_{ijbs}\,(M_s/M_b)(G_{js}/G_{jb}), \qquad (2a)$$

where variables G_{js} and G_{jb} are group index values to describe how the group of houses in sub-market j differs from the overall market. The random term U_{ijbs} is the ratio of random variation in an individual house's price appreciation in its first sale and its second, R_{ijs}/R_{ijb}. Expressing the relation in natural logarithms:

$$r_{ijbs} = \ln(p_{ijs}) - \ln(p_{ijb}) = u_{ijbs} + m_s - m_b + g_{js} - g_{bj}. \qquad (2b)$$

Setting $M_0 = 1$, $m_0 = 0$, $G_{j0} = 1$ and $g_{j0} = 0$ normalizes indexes for the overall market and sub-market to be 1.00 in the initial period.

Archer, Gatzlaff and Ling (1996) tested for differences between overall market price trends and prices in specified sub-markets, seventy-nine alternative neighborhoods in Dade County, Florida. They tested for sub-market differences, one group at a time. For a house in group j, their variation of the repeat-sale regression can be written as:

$$r_{ijbs} = u_{ijbs} + \Sigma_t m_t Q_{tij} + \Sigma_t g_{tj} I_{ij} Q_{tij}, \qquad (2c)$$

where I_{ij} is a (1,0) indicator variable to indicate whether an individual house is or is not in the group. If a house is not in the group, the Equation (2c) algebraically reverts to Equation (1c). If the house is in the group, then Equation (2c) becomes:

$$r_{ijbs} = u_{ijbs} + m_b(-1) + m_s(+1) + g_{jb}(1)(-1) + g_{js}(1)(+1). \quad (2d)$$

Rejecting the null hypothesis that all g_{jt} are zero means that it is reasonable to discuss differences in price trends between the overall market and one sub-market. The null hypothesis means that the price index for the whole market is the same as for the sub-market in every quarter. If the null hypothesis that an individual sub-market coefficient is zero is rejected, then there is an indication that there is a one-period deviation between overall market appreciation and the sub-market.

Archer, Gatzlaff and Ling (1996:342) point out that the existence of a significant one-period abnormal return may be irrelevant. Given transaction costs, homeowners do not buy and sell quarter by quarter. Their holding-period gain or loss relative to the overall market is based on the cumulative abnormal appreciation in their sub-market, not on any one individual quarter. With $T + 1$ quarters in the analysis, there are $T + 1 - h$ conceivable h-quarter holding-periods. Archer, Gatzlaff and Ling argue that the appropriate test for important sub-market deviations is a test of the null hypothesis that the average holding-period abnormal gain is zero.

The sub-market h-quarter holding-period deviation from the overall market price trend can be written as $g_{jt} - g_{j(t-h)}$. If the sum of all $T + 1 - h$ of these differences is zero, then the average holding-period return in the sub-market is no different from the overall market. Assuming $h = 4$ and $T = 21$, this sum can be written as $(g_{j21} - g_{j17}) + (g_{j20} - g_{j16}) + (g_{j19} - g_{j15}) + (g_{j18} - g_{j14}) + (g_{j17} - g_{j13}) + \ldots + (g_{j8} - g_{j4}) + (g_{j7} - g_{j3}) + (g_{j6} - g_{j2}) + (g_{j5} - g_{j1}) + (g_{j4} - g_{j0}) = g_{j21} + g_{j20} + g_{j19} + g_{j18} - g_{j3} - g_{j2} - g_{j1} - 0$, since normalization set g_{j0} at zero.

Thus, an F-test of the null hypothesis that the sub-market h-quarter holding-period gains average zero can be formulated as a test on a restriction expressed as a linear combination of the estimated coefficients:

$$0 = g_{jT} + g_{j(T-1)} + \ldots + g_{j(T-h+1)} - g_{j(h-1)} - \ldots - g_{j1}. \quad (2e)$$

If dual agency systematically favors sellers, then holding-period abnormal gains may have negative means for the sub-market defined by dual agency on the first of a pair of transactions. Under that assumption, abnormal gains may have positive averages for the sub-market defined by dual agency on the second of a pair of transactions. If dual agency favors buyers instead of sellers, then means for abnormal gains would have the opposite pattern of signs.

In one aspect, this study deviates in application from Archer, Gatzlaff and Ling (1996). Most likely because of the large number of groups, Archer, Gatzlaff and

Ling estimated Equation (2c) in two steps for each group. In the first step—common to all groups, only the overall market index coefficients were estimated in a regression that does not differ from the basic Bailey, Muth and Nourse (1963) model. The residuals from the first step become ''abnormal returns'' associated with sub-market membership. They are the dependent variable for a second regression to estimate the sub-market price index coefficients.

As shown in Exhibit 1, sub-markets in this study account for 16.5% to 23.3% of the total sample. If one group is large enough as a proportion of the sample, then the two step procedure will allow the observations within that group to heavily influence the first step. Those observations' residuals would be smaller in absolute

Exhibit 1 | Sample Proportions

Sample Count	*DUAL_2* = 0	*DUAL_2* = 1	
DUAL_1 = 0	2910	557	3467
DUAL_1 = 1	559	128	687
	3469	685	4154
Proportions	*DUAL_2* = 0	*DUAL_2* = 1	
DUAL_1 = 0	70.1%	13.4%	83.5%
DUAL_1 = 1	13.5%	3.1%	16.5%
	83.5%	16.5%	100.0%
Contingencies	*DUAL_2* = 0	*DUAL_2* = 1	
Given *DUAL_1* = 0	83.9%	16.1%	100%
Given *DUAL_1* = 1	81.4%	18.6%	100%
Sample Count	*RETURN* = 0	*RETURN* = 1	
DUAL_1 = 0	2620	847	3467
DUAL_1 = 1	566	121	687
	3186	968	4154
Proportions	*RETURN* = 0	*RETURN* = 1	
DUAL_1 = 0	63.1%	20.4%	83.5%
DUAL_1 = 1	13.6%	2.9%	16.5%
	76.7%	23.3%	100.0%
Contingencies	*RETURN* = 0	*RETURN* = 1	
Given *DUAL_1* = 0	75.6%	24.4%	100%
Given *DUAL_1* = 1	82.4%	17.6%	100%

Notes: DUAL_1 is defined to be zero, except when one agent represented both parties in the first of a pair of transactions for a given house—then *DUAL_1* = 1. *DUAL_2* is defined to be zero, except when one agent represented both parties in the second of a pair of transactions for a given house—then *DUAL_2* = 1. *RETURN* is defined to equal zero, except if the same agent represented the buyer in his first transaction, and then the seller in the second transaction—then *RETURN* = 1.

value, distorting the test for sub-market differences. This point would not justify disputing the empirical results of Archer, Gatzlaff and Ling (1996). Seventy-nine sub-markets are enough so that no one is likely to unduly influence their first step's estimation. Of course, there was no practical alternative for their study. However, the reader should note that the results reported here come from joint estimation of the coefficients in Equation (2c) instead of the two-step method used by Archer, Gatzlaff and Ling.

Sample and Data Definitions

Transaction data come from houses in Memphis, Tennessee that had at least one agent with membership in the Multiple Listing Service. The MLS recorded 65,525 sales between the fourth quarter of 1997 and the mid-point of the first quarter of 2003. The data set included data on transaction price, day of sale, street address, ZIP code, the name of the agent representing the seller—the listing agent, and the name of the agent representing the buyer, the selling agent. If data were incomplete for a transaction, or if the ZIP code was not in the Memphis area, then the data point was dropped from the sample.

A sort of the file by day of sale allowed the calculation of a variable, the percentile rank of the house among the closest 200 houses in the sorted file. (This is the 100 houses just before and the 100 houses just after the house in the list of all houses sorted by date of sale.) Resorting the file by street address allowed the identification of 10,891 transactions involving individual houses that sold more than once during the time span of the data set. Repeat-sale price indexes are calculated only from samples of houses that sell more than once. The odd number, 10,891, is not divisible by two because some houses sold three or more times. If one house sold three times, then it would provide two separate data points for a repeat-sale price index analysis.

The organization of the sample data set is by individual owners' price and sales history. The variable *p1*, the first price, is what a given owner paid, while the variable *p2*, the second price, is what the same owner sold the house for on resale. Variables *d1* and *d2* are numerical values representing the dates of the two sales. The variable $DAYSIN = d2 - d1$, is the length of ownership in days. The transactions were not considered reliable indicators of market trends if *DAYSIN* was less than 31. These data points were edited from the statistical sample.

A series of quarterly indicator variables were defined, *Q_1997_4*, *Q_1998_1*, ... and *Q_2003_1*. If *d1* fell into a given quarter, then the value of that quarterly indicator was assigned a value of −1. If *d2* fell into a given quarter, then the value of that quarterly indicator was assigned a value of +1. All the other quarterly indicator variables for that individual were assigned values of 0. If *d1* and *d2* fell into the same quarter, then the data point was edited from the sample as incapable of providing information about price trends across quarters.

The statistical results reported here are limited to houses that are in the upper three quarters of the price ranges for their period of first sale. Many houses in the lowest quartile are purchased, in fact, for land only. Memphis also has an active market involving the purchase of abandoned houses for the purpose of heavy investment in rehabilitation, then resale as low income housing. The price trend in the market would not be represented by price patterns for these transactions. The data set had no variable to indicate individual houses in these categories. Thus, the house was dropped from the statistical sample if the first price was below the twenty-fifth percentile of houses that sold at about that same time. The house was also deleted from study if there was more than a twenty point change in the percentile ranking between the first and second transactions. A positive change larger than this limit makes it more likely that heavy rehabilitation had markedly changed the house's market position. A negative change of more than twenty points is likely to reflect severe depreciation over a relatively short period. The success of repeat-sale price index is predicated on the individual house being roughly the same at the two dates of sale.

Agency variables are defined as follows. If one agent represented both buyer and seller in the first transaction for a given pair of sales, then the variable *DUAL_1* is assigned a value of 1. If there was not dual agency in this transaction, then *DUAL_1* = 0. Likewise, *DUAL_2* = (1,0) to indicate dual agency in the second of the two transactions. The agents' names in the MLS records indicate whether the selling agent in the first transaction was the same person as the listing agent in the second transaction. The variable *RETURN* = (1,0) is used to indicate whether the owner returned to the same agent who helped the owner buy the house when it came time to resell the house.

Exhibit 1 reports the sample sizes, proportions and conditional proportions across these agency variables. The proportion of the first transactions that saw separate representation for the parties, 83.5%, is virtually the same proportion as seen among second transactions. However, only 70.1% of the paired sales had no incidence of dual agency. Dual agency for both transactions occurred in 3.1% of the sample. Given that a buyer accepted dual agency on the first transaction, there was an 18.6% probability of dual agency on the second.

The owner returned to list with the same agent that he knew from the first transaction in 23.3% of the sample. Interestingly, this indication of satisfaction varies by the nature of the representation in the first transaction. If the agent represented the buyer only in the first transaction, then there was a 24.4% probability that the owner would return to the same agent. If that agent had been serving both buyer and seller on the first transaction, then there was only a 17.6% probability of return.

Exhibit 1 makes it clear that an alternative set of agency variables is possible. *DUAL_1and2*, *DUAL_1not2* and *DUAL_2not1* were defined to cover the four permutations of the incidence of dual agency in repeat-sale data. None of the statistical results change in a qualitative way depending on the set of variables applied.

Unfortunately, the data set cannot make an important dual agency distinction. When a buyer is associated with his own agent, that agent may fall into two categories. The selling agent may be acting as a sub-agent to the listing agent, in which case the selling agent represents the seller. Alternatively, the buyer may have signed a contract with his agent to represent him as a buyer's agent, which would better align the agent's incentives with the buyer. The data set does not allow the definition of a variable to indicate this important distinction.

With data editing and exclusions, the resulting sample size is 4,154 repeat sales. Many researchers, for example Zietz and Newsome (2001, 2002), found different principal/agent problems in different house price categories. The sample used here may be divided into a mid-range category of 1,537 houses and a high-end range with 2,617. The houses in the mid-range sub-sample ranked between the twenty-fifth and the sixtieth percentile in their first transaction—and then did not change up or down more than twenty percentile points, while the high-end houses initially ranked above the sixtieth percentile.

Empirical Results

Using the Bailey, Muth and Nourse Specification

Exhibit 2 presents the results of tests for heteroscedasticity, using squared residuals from model (1c), Bailey, Muth and Nourse's (1963) basic repeat-sale price index model. The set-wise test for zero coefficients on all these variables gives an *F*-Statistic of 2.68, which defines a range of larger *F*-Statistics that has only 0.02 probability of occurring by sampling error if the null hypothesis is true. The null hypothesis is that none of the variables are associated with heteroscedasticity. Thus, there is reason to believe that there is heteroscedasticity with respect to the residuals from the ordinary least squares (OLS) estimation of the repeat-sale price index model.

Individually and as a set of two, the variables *DAYSIN* and $DAYSIN^2$ do not appear highly associated with heteroscedasticity in the full sample of 4,154 houses. Likewise, neither dual agency variable is statistically significant as a determinant of heteroscedasticity. However, *RETURN* has a non-zero estimated coefficient that is large relative to its standard error. The 3.12 *t*-ratio is significant at beyond the 0.01 level in this test for heteroscedasticity.

Exhibit 2 also shows the results of a test for heteroscedasticity in an OLS estimation of Equation (1d). This is Bailey, Muth and Nourse's (1963) specification with added explanatory variables to test for the effect of agency choice. The heteroscedasticity found for the full sample has the same qualitative nature as described for the residuals from Equation (1c).

Exhibit 2 | Tests for Heteroscedasticity: Estimated Coefficients Using OLS Squared Residuals as Dependent Variables

	DUAL_1	*DUAL_2*	*RETURN*	*DAYSIN*	*DAYSIN*^{2}	*F*
Equation (1c)						
Full Sample	−.0013	.0008	.0063*	−.0000	.0000	2.68**
Mid-Range Sub-sample	−.0013	.0029***	−.0013	−.00002*	.00001*	3.64*
High-End Sub-sample	−.0013	−.0004	.0114*	.0000	.0000	2.87*
Equation (1d)						
Full Sample	−.0011	.0009	.0053*	−.0000	.0000	2.19**
Mid-Range Sub-sample	−.0008	.0027***	−.0024***	−.00002*	.00001*	3.55*
High-End Sub-sample	−.0012	−.0002	.0105*	.0000	.0000	2.66**
Equation (2d), *DUAL_1* Included						
Full Sample	−.0016	.0008	.0064*	−.0000	.0000	2.78**
Mid-Range Sub-sample	−.0015	.0025	−.0006	−.00002*	.00001*	3.09*
High-End Sub-sample	−.0019	−.0006	.0116*	.0000	.0000	3.04*
Equation (2c), *DUAL_2* Included						
Full Sample	−.0013	.0004	.0064*	−.0000	.0000	2.74**
Mid-Range Sub-sample	−.0010	.0022	−.0005	−.00002*	.00001*	3.34*
High-End Sub-sample	−.0015	−.0011	.0114*	.0000	.0000	2.94**
Equation (2c), *RETURN* Included						
Full Sample	−.0011	.0009	.0055*	−.0000	.0000	2.45**
Mid-Range Sub-sample	−.0010	.0027	−.0021	−.00002*	.00001*	3.56*
High-End Sub-sample	−.0009	−.0003	.0102*	.0000	.0000	2.73**

Notes: The *F*-Statistic tests the null hypothesis that none of the variables are associated with heteroscedasticity. *DUAL_1* = (1,0) indicates that one agent served both parties in the first of a pair of sales. *DUAL_2* = (1,0) indicates that one agent served both parties in the second of a pair of sales. *RETURN* = (1,0) indicates that the same agent represented buyer in the first transaction and seller in the second. *DAYSIN* = the number of days between the pair of transactions.

*Test statistic is significant at the 0.01 level.

**Test statistic significant at the 0.05 level.

***Test statistic is significant at the 0.10 level.

Heteroscedasticity patterns are different when the sample is segmented. Results for the mid-range sub-sample are reported in Exhibit 2. The dependent variable is the squared residual from an OLS estimate of Equation (1c) estimated from this sub-sample. For only this sub-sample, the variables *DAYSIN* and *DAYSIN*^{2} are statistically significant, as could be expected based on other researchers' application of the repeat-sale price index model. For this sub-sample only, dual agency on the second of the pair of transactions (but not on the first) would be significant at the 0.10 level in a test for heteroscedasticity. Again unique to this sub-sample, the *RETURN* variable was not statistically significant. The tests for heteroscedasticity in the high-end sub-market follow the pattern described for the combined sample, with only *RETURN* being an apparent source of heteroscedasticity.

While some of these variables in the specification for a test for heteroscedasticity appear redundant, all are included to generate weights for WLS estimations. Some are well established in the literature on heteroscedasticity in repeat-sale regressions. Some have statistically significant coefficients when the sample is segmented by price range.

Exhibit 3 has the WLS estimates associated with Equation (1d). A test of the null hypothesis that the three agency indicator variables are redundant indicates that

Exhibit 3 | WLS Estimates for Equation (1d)—A Test for Agency Variables' Impact in the Bailey, Muth and Nourse Model

Variable	Full Sample	Mid-Range Sub-sample	High-End Sub-sample
DUAL_1	0.0049	0.0110	−0.0014
	(0.97)	(1.57)	(−0.17)
DUAL_2	−0.0025	0.0034	−0.0088
	(−0.57)	(0.56)	(−1.27)
RETURN	0.0422	0.0494	0.0392
	(13.0)*	(7.05)*	(9.12)*
Q_1997_4	0	0	0
	(na)	(na)	(na)
Q_1998_1	0.0089	0.0204	0.0008
	(1.22)	(1.93)**	(−0.08)
Omitted Section of Exhibit			
Q_2003_1	0.1271	0.1290	0.1280
	(12.9)*	(8.97)*	(8.76)*
H_0: Variables *DUAL_1*, *DUAL_2* and *RETURN* are redundant as a set			
F-Statistic	57.0*	18.4*	27.8*
H_0: Variables *DUAL_1* and *DUAL_2* are redundant as a set			
F-Statistic	0.60	1.51	0.83

Note: *t*-ratios are beneath coefficients. The dependent variable is $LN(P_2/P_1)$. For the full sample, $n = 4{,}154$; for the mid-range sub-sample, $n = 1{,}537$; and for the high-end sample, $n = 2{,}617$. *DUAL_1* = (1,0) indicates that one agent served both parties in the first of a pair of sales. *DUAL_2* = (1,0) indicates that one agent served both parties in the second of a pair of sales. *RETURN* = (1,0) indicates that the same agent represented buyer in the first transaction and seller in the second. *DAYSIN* = the number of days between the pair of transactions.

*Test statistic is significant at the 0.01 level.

**Test statistic significant at the 0.05 level.

***Test statistic is significant at the 0.10 level.

they are significant, having a 57.0 *F*-Statistic in a set-wise test. The coefficient on *DUAL_1* is positive, while the coefficient on *DUAL_2* is negative. This would be consistent with dual agency being biased in favor of buyers. However, neither individual coefficient is statistically significant. A test of the null hypothesis that both coefficients are zero yields an insignificant *F*-Statistic.

The positive coefficient on *RETURN* indicates that homeowners who returned to the agent who represented them in the first transaction had higher average price gains over their tenure. This coefficient is statistically significant. Exhibit 3 also shows relevant coefficients from WLS estimates of Equation (1d), using alternative sub-samples. In both sub-samples, *RETURN* has positive, statistically significant coefficients.

If dual agency systematically favors buyers over sellers, or vice versa, then the coefficients on *DUAL_1* and *DUAL_2* would have opposite signs. The signs on *DUAL_1* and *DUAL_2* are not opposite in signs in either sub-sample. In addition, none of the coefficients on dual agency variables are statistically significant. Thus, tests from the Bailey, Muth and Nourse (1963) model find that dual agency did not impact expected price gain in any statistically significant way that would favor either buyers or sellers. On the other hand, expected gain increased for those homeowners who listed for their resale with the same agent that sold the house to them.

Results Using the Archer, Gatzlaff and Ling Specification

Ordinary least squares estimates of Equation (2c) generates residuals with significant heteroscedasticity regardless of the agency variable used in the specification suggested by Archer, Gatzlaff and Ling (1996). These statistical results are reported in Exhibit 2. All the *F*-Statistics indicate significant heteroscedasticity for each test reported in the exhibit. For the full sample, the heteroscedasticity has the same general qualitative form as discussed above for the Bailey, Muth and Nourse model (1963). That is, *DAYSIN* and $DAYSIN^2$ are not statistically significant as individual variables or as a set of two variables in the test for heteroscedasticity. Similar heteroscedasticity results are found for *DUAL_1* and *DUAL_2*. Only the variable *RETURN* is statistically significant in the tests for heteroscedasticity in the full sample.

Segmenting the housing market into high-end and mid-range sub-markets generates some differences in tests for heteroscedasticity and expected value of price increases. For the mid-range sub-sample of 1,537 repeat sales, the residuals of OLS estimates of Equation (2c) show heteroscedasticity with respect to *DAYSIN* and $DAYSIN^2$, for each estimation using *DUAL_1*, *DUAL_2* and *RETURN* in cross product variables. No heteroscedasticity with respect to *DUAL_1*, *DUAL_2* or *RETURN* is indicated for the mid-range sub-sample. The estimated coefficients for these tests are in Exhibit 2.

For the high-end sub-sample of 2,617 houses, the residuals of OLS estimates of Equation (2c) show no heteroscedasticity with respect to *DAYSIN* and *DAYSIN*^{2}, for each estimation using *DUAL_1*, *DUAL_2* and *RETURN* in cross product variables. *DUAL_1* and *DUAL_2* are also not statistically significant sources of heteroscedasticity. However, *RETURN* is significant as a source of heteroscedasticity in all three OLS estimations, reported below, they are estimated from models of heteroscedasticity that include all five potentially important sources of heteroscedasticity, *DAYSIN*, *DAYSIN*^{2}, *DUAL_1*, *DUAL_2* and *RETURN*.

Weighted least squares tests for the effect of *DUAL_1*, the variable indicating that the same agent represented both buyer and seller in the first of a pair of sales, are based on the coefficients presented in Exhibit 4. Coefficients on variables *Q_1998_1*, ... , *Q_2003_1* were estimated in the application of Equation (2c), but most are omitted from the exhibit to save space. (Coefficients on *Q_1997* and Q*_1997_4*DUAL_1* are set at 0 to normalize the indexes to equal 1.00 in that initial period.) All the tests here are based on the coefficients associated with the cross-product variables. The twenty-two cross-product variables have the general form of "*DUAL_1*Quarter*."

All but one of the coefficients are positive. Nine of the coefficients are significant in individual *t*-tests at the 0.10 level. However, they yield a low *F*-Statistic in a test that they are redundant as a set of variables. Thus, the null hypothesis that every coefficient is zero cannot be rejected. Exhibit 4 also includes calculation of all eighteen possible abnormal four-quarter period returns for the sub-market defined by this incidence of dual agency. The average four-quarter holding-period abnormal return, 0.00046, is positive. The significance of this mean abnormal return can be tested by testing for the linear restriction on the cross-product coefficients described in Equation (2d). The *F*-Statistic calculated for this restriction is very small. Thus, the null hypothesis that there are no abnormal returns in this sub-market over four-quarter holding-periods cannot be rejected. Similar conclusions come from a test over eight-quarter holding-periods, except that the mean effect is slightly negative.

Exhibit 5 has coefficients estimated to test for effects if one agent represented both buyer and seller in the second transaction observed for each house. In this case, no individual coefficient is significant in a test at the 0.10 level. However, the set of all cross-product variables generate an *F*-Statistic that is significant in a test at the 0.10 level.

In tests for abnormal holding-period returns associated with *DUAL_2*, means are negative and larger in absolute value than seen for *DUAL_1*. The negative mean for eight-quarter holding-periods is significant in a test at the 0.01 level, but a test would have to be conducted at the 0.12 level to reject the null hypothesis that there is no four-quarter abnormal return.

The strongest conclusions come from the tests on the *RETURN* variable, shown in Exhibit 6. All but two coefficients on the cross-product variables are positive.

Exhibit 4 | Dual Agency on the First of Paired Sales, WLS Estimates for Equation (2c) and Abnormal Holding-Period Price Changes–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
Q_1997_4	0		
Q_1998_1	0.0003 (0.04)		
Omitted Section of Exhibit			
Q_2003_1	0.1473 (13.8)*		
*DUAL_1*Q_1997_4*	0 (na)		
*DUAL_1*Q_1998_1*	0.0377 (1.59)		
*DUAL_1*Q_1998_2*	0.0171 (0.79)		
*DUAL_1*Q_1998_3*	0.0213 (1.01)		
*DUAL_1*Q_1998_4*	0.0426 (1.85)***	0.0426	
*DUAL_1*Q_1999_1*	0.0548 (2.37)**	0.0171	
*DUAL_1*Q_1999_2*	0.0458 (2.07)**	0.0286	
*DUAL_1*Q_1999_3*	0.0296 (1.19)	0.0083	0.0296
*DUAL_1*Q_1999_4*	0.0444 (1.49)	0.0018	0.0067
*DUAL_1*Q_2000_1*	0.0546 (1.65)***	−0.0002	0.0375
*DUAL_1*Q_2000_2*	−0.0014 (−0.05)	−0.0472	−0.0227
*DUAL_1*Q_2000_3*	0.0327 (1.35)	0.0031	−0.0099
*DUAL_1*Q_2000_4*	0.0501 (2.16)**	0.0058	−0.0047
*DUAL_1*Q_2001_1*	0.0503 (1.92)***	−0.0044	0.0045
*DUAL_1*Q_2001_2*	0.0425 (2.00)**	0.0439	0.0129

Exhibit 4 | (continued)

Dual Agency on the First of Paired Sales, WLS Estimates for Equation (2c) and Abnormal Holding-Period Price Changes–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
*DUAL_1*Q_2001_3*	0.0250 (1.12)	−0.0077	−0.0194
*DUAL_1*Q_2001_4*	0.0470 (1.84)***	−0.0031	−0.0076
*DUAL_1*Q_2002_1*	0.0140 (0.65)	−0.0362	0.0154
*DUAL_1*Q_2002_2*	0.0227 (1.04)	−0.0198	−0.0100
*DUAL_1*Q_2002_3*	0.0185 (0.88)	−0.0065	−0.0316
*DUAL_1*Q_2002_4*	0.0350 (1.70)***	−0.0120	−0.0152
*DUAL_1*Q_2003_1*	0.0082 (0.26)	−0.0059	−0.0343
Average Holding Period Change		0.0005	−0.0032

Notes: *t*-ratios are beneath coefficients. *DUAL_1* = (1,0) to indicate that one agent served both parties in the first of a pair of sales. H_0: Variables "*DUAL_1*Quarter*" are redundant as a set; $F = 0.83$. H_0: Mean abnormal four-quarter holding-period Change is 0; $F = 0.03$. H_0: Mean abnormal eight-quarter holding-period change is 0; $F = 0.34$.

*Test statistic is significant at the 0.01 level.

**Test statistic significant at the 0.05 level.

***Test statistic is significant at the 0.10 level.

Ten individual coefficients would be significant in tests at the 0.10 level. The set of variables would be considered significant in a test at the 0.01 level. The average abnormal returns for both four and eight-quarter holding-periods are positive; both are statistically significant in a test at the 0.01 level.

Summary statistics from WLS estimates for alternative price range sub-samples are in Exhibit 7. For the mid-range houses, the null hypothesis that the set of coefficients are zero for all the cross product terms including *DUAL_1* is rejected. While abnormal returns average positive values for both four-quarter and eight-quarter holding-periods, these are not statistically significant. For the high-end houses, no null hypothesis can be rejected.

For *DUAL_2*, the set of cross product variables are significant for the mid-range sub-sample, but not the high-end sub-sample. Tests for significant abnormal

Exhibit 5 | Dual Agency on the Second of Paired Sales, WLS Estimates for Equation (2c) and Abnormal Holding-Period Price Changes–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
Q_1997_4	0 (na)		
Q_1998_1	0.0074 (0.89)		
Omitted Section of Exhibit			
Q_2003_1	0.1559 (14.5)*		
*DUAL_2*Q_1997_4*	0 (na)		
*DUAL_2*Q_1998_1*	−0.0079 (−0.40)		
*DUAL_2*Q_1998_2*	0.0010 (0.05)		
*DUAL_2*Q_1998_3*	−0.0040 (−0.21)		
*DUAL_2*Q_1998_4*	−0.0094 (−0.45)	−0.0094	
*DUAL_2*Q_1999_1*	0.0092 (0.41)	0.0172	
*DUAL_2*Q_1999_2*	0.0176 (0.84)	0.0166	
*DUAL_2*Q_1999_3*	0.0186 (0.89)	0.0226	
*DUAL_2*Q_1999_4*	−0.0279 (−1.01)	−0.0185	−0.0279
*DUAL_2*Q_2000_1*	0.0041 (0.15)	−0.0051	0.0120
*DUAL_2*Q_2000_2*	−0.0216 (−1.09)	−0.0393	−0.0226
*DUAL_2*Q_2000_3*	0.0100 (0.47)	−0.0085	0.0140
*DUAL_2*Q_2000_4*	0.0122 (0.56)	0.0401	0.0216
*DUAL_2*Q_2001_1*	0.0169 (0.75)	0.0128	0.0077
*DUAL_2*Q_2001_2*	−0.0181 (−0.93)	0.0036	−0.0357

Exhibit 5 | (continued)

Dual Agency on the Second of Paired Sales, WLS Estimates for Equation (2c) and Abnormal Holding-Period Price Changes–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
*DUAL_2*Q_2001_3*	0.0088 (0.42)	−0.0013	−0.0098
*DUAL_2*Q_2001_4*	−0.0323 (−1.41)	−0.0445	−0.0044
*DUAL_2*Q_2002_1*	−0.0096 (−0.47)	−0.0266	−0.0137
*DUAL_2*Q_2002_2*	−0.0332 (−1.56)	−0.0151	−0.0116
*DUAL_2*Q_2002_3*	0.0296 (1.52)	0.0208	0.0195
*DUAL_2*Q_2002_4*	−0.0257 (−1.27)	0.0066	−0.0379
*DUAL_2*Q_2003_1*	−0.0450 (−1.60)	−0.0354	0.0619
Average Holding Period Change		−0.0035	−0.0108

Notes: t-ratios are beneath coefficients. *DUAL_2* = (1,0) indicates that one agent served both parties in the second of a pair of sales. H_0: Variables "*DUAL_2*Quarter*" are redundant as a set; $F = 1.44$***. H_0: Mean abnormal four-quarter holding-period change is 0; $F = 2.39$. H_0: Mean abnormal eight-quarter holding-period change is 0; F = 7.53*.

*Test statistic is significant at the 0.01 level.

**Test statistic significant at the 0.05 level.

***Test statistic is significant at the 0.10 level.

holding-period gains indicate negative means for the mid-range houses; however, only the eight-quarter holding-period mean is significant. For the high-end houses, mean abnormal returns are negative; again, only the eight-quarter holding-period results are significant.

For the *RETURN* variable, the null hypothesis that the cross product variables are redundant as a set can be rejected. Abnormal holding-period gains average positive values. The eight-quarter means are significant for both groups, but only the high-end houses had a significant four-quarter mean abnormal return.

The Significance of the Choice to Return to an Agent

The Bailey, Muth and Nourse (1963) coefficients estimated from the full sample, shown in Exhibit 3, indicate that the price index would range from 1.000 in the

Exhibit 6 | Return to First Sale's Selling Agent as Listing Agent for Second of Paired Sales, WLS Estimates for Equation (2c)–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
Q_1997_4	0 (na)		
Q_1998_1	0.0128 (1.40)		
Omitted Section of Exhibit			
Q_2003_1	0.1222 (10.08)*		
*RETURN*Q_1997_4*	0 (na)		
*RETURN*Q_1998_1*	−0.0045 (−0.28)		
*RETURN*Q_1998_2*	0.0134 (0.91)		
*RETURN*Q_1998_3*	0.0196 (1.30)		
*RETURN*Q_1998_4*	0.0230 (1.42)	0.0230	
*RETURN*Q_1999_1*	0.0037 (0.22)	0.0082	
*RETURN*Q_1999_2*	0.0119 (0.80)	−0.0015	
*RETURN*Q_1999_3*	0.0170 (1.09)	−0.0025	
*RETURN*Q_1999_4*	0.0298 (1.48)	0.0069	0.0298
*RETURN*Q_2000_1*	−0.0063 (−0.31)	−0.0100	−0.0019
*RETURN*Q_2000_2*	0.0298 (1.92)**	0.0180	0.0164
*RETURN*Q_2000_3*	0.0240 (1.50)	0.0070	0.0044
*RETURN*Q_2000_4*	0.0025 (0.15)	−0.0274	−0.0205
*RETURN*Q_2001_1*	0.0495 (2.84)*	0.0558	0.0458
*RETURN*Q_2001_2*	0.0267 (1.76)***	−0.0032	0.0148

Exhibit 6 | (continued)

Return to First Sale's Selling Agent as Listing Agent for Second of Paired Sales, WLS Estimates for Equation (2c)–Full Sample

Variable	Coefficient	Four-Quarter Holding Period	Eight-Quarter Holding Period
*RETURN*Q_2001_3*	0.0638 (4.07)*	0.0399	0.0468
*RETURN*Q_2001_4*	0.0653 (3.83)*	0.0628	0.0354
*RETURN*Q_2002_1*	0.0686 (4.22)*	0.0190	0.0749
*RETURN*Q_2002_2*	0.0498 (3.17)*	0.0231	0.0199
*RETURN*Q_2002_3*	0.0548 (3.72)*	−0.0090	0.0308
*RETURN*Q_2002_4*	0.0639 (4.16)*	−0.0013	0.0614
*RETURN*Q_2003_1*	0.0856 (4.17)*	0.0171	0.0361
Average Holding Period Change		0.0125	0.0282

Notes: *t*-ratios are beneath coefficients. *RETURN* = (1,0) to indicate that one agent served both parties in the second of a pair of sales. H_0: Variables "*RETURN*Quarter*" are redundant as a set; $F = 5.96$*. H_0: Mean abnormal four-quarter holding-period change is 0; $F = 56.4$*. H_0: Mean abnormal eight-quarter holding-period change is 0; $F = 95.9$*.
*Test statistic is significant at the 0.01 level.
**Test statistic significant at the 0.05 level.
***Test statistic is significant at the 0.10 level.

fourth quarter of 1997, exp(0), to 1.136 midway into the first quarter of 2003, exp(0.1271), for houses with no incidence of dual agency and no return use of an agent. The interpretation of the coefficient on the *RETURN* variable is that the index for the first quarter of 2003 among houses where *RETURN* = 1 would be 1.185, exp(0.1271 + 0.0422). Thus, a homeowner taking the option of reselling the house using the same agent who first sold the house would have an expected gain that is 4.3% higher than the 13.6% gain attributable to market trends. The indicated premiums are 5.1% for the mid-range houses and 4.0% for the high-end houses.

Using the Archer, Gatzlaff and Ling (1996) coefficients reported in Exhibit 6 for the full sample, the mean abnormal gain over four-quarter holding-periods was

Exhibit 7 | Sub-sample Summary Results from WLS Estimates of Equation (2c)

	Mid-Range Sub-sample		High-End Sub-sample	
	Mean	*F*-Statistic	Mean	*F*-Statistic
DUAL_1				
H_0: Cross Product Variables Are Redundant As a Set		22.0*		0.78
H_0: Mean 4-Q Abnormal Change = 0	0.0474	2.10	0.0009	0.05
H_0: Mean 8-Q Abnormal Change = 0	0.0363	0.68	−0.0077	1.28
DUAL_2				
H_0: Cross Product Variables Are Redundant As a Set		31.5*		1.29
H_0: Mean 4-Q Abnormal Change = 0	−0.0051	0.20	−0.0038	0.91
H_0: Mean 8-Q Abnormal Change = 0	−0.0581	8.14*	−0.0107	2.65***
RETURN				
H_0: Cross Product Variables Are Redundant As a Set		29.1*		4.72*
H_0: Mean 4-Q Abnormal Change = 0	0.0265	2.28	0.0129	30.6*
H_0: Mean 8-Q Abnormal Change = 0	0.0779	6.09*	0.0317	66.3*

Notes: *t*-ratios are beneath coefficients. *DUAL_1* = (1,0) indicates that one agent served both parties in the first of a pair of sales. *DUAL_2* = (1,0) indicates that one agent served both parties in the second of a pair of sales. *RETURN* = (1,0) indicates that the same agent represented buyer in the first transaction and seller in the second.

*Test statistic is significant at the 0.01 level.

**Test statistic significant at the 0.05 level.

***Test statistic is significant at the 0.10 level.

1.3%, 1-exp(0.0125), beyond the market's average of 2.6% price gains. Sub-market premiums were 2.7% for mid-range houses, 1-exp(0.0265), and 1.3% for high-end houses, 1-exp(0.0129).

Conclusion

One of the main research questions addressed here regards whether agency variables are associated with heteroscedasticity in repeat-sale price index models. Statistically significant heteroscedasticity appears in every test and every sub-sample set-wise test. Dual agency occurring in the first of the pair of sales is not significant as a source of heteroscedasticity in any one-variable test. Dual agency occurring in the second sale is not a significant source of heteroscedasticity in any test using the full sample or the high-end sub-sample.

Returning to the same agent for resale does have statistically convincing influence on the variance of price gains across owners for the full sample and for the high-end sub-sample. General users of repeat-sale price index methods may add agency variables to their growing list of sources of heteroscedasticity.

Another research question addressed here regards the expected value of the price gain over a homeowner's tenure. Returning to the selling agent for service as a listing agent is the only variable that had consistent expected price gain results across all samples. In the Bailey, Muth and Nourse (1963) repeat-sale regression format for tests on the effect of variables other than time, returning to the selling agent for service as listing agent for resale has a positive mean effect on the price gain. Archer, Gatzlaff and Ling's (1996) abnormal holding-period returns were consistently positive for the set of owners who returned to their earlier agent.

Dual agency in the first of an owner's pair of transactions over the period of tenancy had no statistically significant results in any sample alternative, using either model. Tests for abnormal expected price gain from dual agency in the owner's second transaction indicated negative influence in all but one test across the models and sample alternatives. However, the tests often had no statistical significance. The strongest statement possible across all sample alternatives comes from the Archer, Gatzlaff and Ling model (1996). For eight-quarter holding-periods, owners had negative mean abnormal price gains associated with accepting dual agency when they sold at the end of their tenancy. Negative coefficients in the Bailey, Muth and Nourse (1963) model for the full sample and the high-end sub-sample are consistent with those results, but are weak relative to the possibility of random sampling error.

In terms of public policy, do the principal/agent conflicts inherent in the real estate brokerage industry cause homeowner losses associated with dual agency? The review of the literature of applications of cross-sectional, hedonic methods found a mix of results—no effect, dual agency favoring buyers, and dual agency favoring sellers.

The introductory section has an argument that two alternative types of test could substantiate persistent claims by some consumer advocates. Misrepresentation may be important in individual cases, but relatively rare. In that case, heteroscedasticity would be associated with dual agency. The results on heteroscedasticity give no general conclusion that dual agency is important in individual cases.

If misrepresentation is widespread and systematic in effect, then expected price gains should reflect the direction of the bias. If buyers are systematically cheated in dual agency, then regressions with dependent variables measuring gain during ownership should have negative coefficients on variables indicating that a homeowner first bought the house under dual agency. Abnormal gains over given holding periods should have negative averages for that sub-market. By similar argument, there would be positive regression coefficients and positive average abnormal gains for the group characterized by dual agency on the second transaction if buyers are systematically cheated. If dual agency is biased in favor of buyers, then the pattern of signs would be reversed.

The results reported here give some incidence of a suspicious pattern of signs and some incidence of statistical significance. However, there is no case where both statistical significance and pattern would allow us to support any claim of bias associated with dual agency. For this sample of agents and homebuyers, the repeat-sale methodology applied here yields no indictment of agents.

Several caveats have been discussed as limiting the generality of these conclusions. The data set did not have variables that would allow applications of other path-breaking methodologies in the literature on repeat-sale price indexes, such as Case and Quigley (1991) and Hill, Knight and Sirmans (1997). In addition, the data applied here had no variable clearly distinguishing the second agent as a buyer's agent versus a sub-agent of the seller's agent. Suppose that having a separate agent who is a sub-agent gives the buyer virtually no more protection than accepting dual agency. In that case, a three-way indicator analysis would be needed to divide expected gain across homeowner sub-groups with independent agents, dual agency and agents tied to the seller by sub-agency.

References

Archer, W. R., D. H. Gatzlaff and D. C. Ling, Measuring the Importance of Location in House Price Appreciation, *Journal of Urban Economics*, 1996, 40, 334–53.

Bailey, M. R., R. Muth and H. Nourse, A Regression Method for Real Estate Price Index Construction, *Journal of the American Statistical Association,* 1963, 58, 933–42.

Bajtelsmit, V. L. and E. Worzala, Adversarial Brokerage in Residential Real Estate Transactions: The Impact of Separate Buyer Representation, *Journal of Real Estate Research*, 1997, 14:1/2, 65–74.

Benjamin, J. D. and P. T. Chinloy, Pricing, Exposure and Residential Listing Strategies, *Journal of Real Estate Research*, 2000, 20:1/2, 61–74.

Black, R. T. and H. O. Nourse, The Effect of Different Brokerage Modes on Closing Costs and House Prices, *Journal of Real Estate Research*, 1995, 10:1, 87–98.

Bryant J. and D. Epley, The Conditions and Perils of Agency, Dual Agency, and Undisclosed Agency, *Real Estate Law Journal*, 1992, 21, 117–35.

Case, B. and J. M. Quigley, The Dynamics of Real Estate Prices, *The Review of Economics and Statistics*, 1991, 73, 50–58.

Elder, H. W., L. V. Zumpano and E. A. Baryla, Buyer Brokers: Do They Make a Difference? Their Influence on Selling Price and Search Duration, *Real Estate Economics*, 2000, 28:2, 337–62.

Hill, R. C., J. R. Knight and C. F. Sirmans, Estimating Capital Asset Price Indexes, *The Review of Economics and Statistics*, 1997, 79, 226–33.

Jud, G. D., Real Estate Brokers and the Market for Residential Housing, *American Real Estate and Urban Economics Association Journal,* 1983, 11:1, 69–82

Jud, G. D. and J. Frew, Real Estate Brokers, Housing Prices, and the Demand for Housing, *Urban Studies*, 1986, 23:1, 21–31.

Zietz, J. and B. Newsome, A Note on Buyer's Agent Commission and Sale Price, *Journal of Real Estate Research*, 2001, 21:3, 245–53.

Zietz, J. and B. Newsome, Agency Representation and the Sale Price of Houses, *Journal of Real Estate Research*, 2002, 24:2, 165–91.

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