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The Effect of Listing Price Changes on the Selling Price of Single-Family Residential Homes

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Abstract Sellers of unsold residential real estate usually have difficulty deciding whether to change the listing price and, if so, by how much. The purpose of this study is to determine what factors lead to listing price changes and the effect of listing price changes on the net selling price received by sellers. This study uses a sample of 13,461 single-family home sales in which 4308 had a selling price reduction during the listing period. The average original listing price for properties with one or more listing price changes is 18 % larger compared to properties where the listing price is unchanged; this difference narrows to 9.7 % when comparing final listing prices. The results indicate that the probability of a listing price reduction and the percent reduction are positively associated with house size, vacant property status, and a weak economy. A sample selection bias appears to exist for list price reduction properties, and while overpricing of properties often leads to a listing price reduction, the effect of a listing price change on the net selling price is estimated to be two to three times the given reduction in the listing price.

Keywords Listing price · Listing price change · Listing price reduction · Signaling

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Introduction

Pricing heterogeneous real assets to sell within a reasonable time and at the highest possible price has always been challenging, especially considering the fact that these two goals are usually contradictory (Miller and Sklarz 1987). The listing price chosen by the seller communicates information regarding the sellers' perception of value and the relative value the seller places on a high selling price relative to a shorter time on market. Typically, when sellers set what they perceive to be a low listing price they expect offers to come in more quickly, but often at lower prices. The expectation is that no future list price reduction will be necessary. Sellers that set a listing price designed to maximize the selling price should expect to wait longer for offers or eventually lower the listing price. Yavas and Yang (1995) address the question of setting the "optimal" selling price, and they provide a theoretical and empirical analysis of the listing price on TOM and the transaction price.

When the emotional factor is introduced in selling a personal residence and financial constraints are taken into consideration, selecting a listing price becomes more challenging and overpricing is more likely because sellers fear "leaving money on the table" and they often have an outright lack of knowledge of true market value. Assistance from a real estate professional should theoretically make pricing more accurate, but agents may have the incentive of recommending a higher listing price to obtain the listing with the intent to persuade the seller to lower the list price at a later point in time.[1] However, Geltner et al. (1991) suggest that conflict of interest problems between the seller and broker about the broker's effort level is potentially high at the beginning of the contract but becomes minor or nonexistent near the end of the contract, whereas the conflict regarding the reservation price is much higher near the end of the listing contract. The mispricing of single-family homes often leads to longer marketing times than are acceptable to sellers, which results in listing price decreases.

Numerous academic studies that have examined the compensation model for real estate brokers.[2] Many have concluded that the percentage commission structure has led to substantial problems such as excessive rates for consumers (Crockett 1982), non-price competition (Miceli 1992), insufficient broker effort (Miceli 1991), and agency problems (Rutherford et al. 2005; Miceli et al. 2007). Researchers have proposed alternative compensation models based on fixed fees to the listing broker and commission to the broker locating the buyer (Miceli 1991), an assessed value instead of sales price approach as a basis for applying the percentage commission rates (Colwell et al. 1993, 1994), and having sellers pay the listing broker's fee while the buyer pays the buyer broker's fee (Yavas and Colwell 1999).

Sellers frequently set a higher than optimal listing price with the mindset that it can be lowered at a later date. However, many sellers do not realize that the majority of market attention occurs when a property is first offered on the market, and initial overpricing of a house can have negative consequences.[3] A higher than optimal listing

[1] Salter et al. (2010) also studied the listing prices set by financially constrained sellers and determined that when homes were listed by agents that specialized in listings, as opposed to sales, that the listing price was more accurate when compared to the final selling price.

[2] In addition to the commission structure, another popular stream of research has examined contract duration and the role of buyer brokers on broker effort and competition.

[3] Source: Realtor.com Home Seller's Guide http://marketing.realtor.com/star/emails/images/Home_Sellers_Guide.pdf

pricing is often based on faulty logic such as what was paid for the property or how much money the sellers may need to purchase the next property as opposed to what the property being sold is actually worth in current market conditions.

According to the Appraisal Institute, the definition of market value is: "The most probable price that the specified property interest should sell for in a competitive market after a reasonable exposure time, as of a specified date, in cash, or in terms equivalent to cash, under all conditions requisite to a fair sale, with the buyer and seller each acting prudently, knowledgeable, for self-interest, and assuming neither is under duress."[4] Based on this definition, it is possible that by overpricing a house a seller could possibly find a buyer that was under a time constraint, had to have a home in a very specific location with limited supply, or found the home so personally irresistible, that they would pay more than market value for the property, but it is much more likely to lead to a future listing price change.

In recent years a new strategy has emerged for sellers in high-demand markets where the listing price is set below estimated value in hopes of generating multiple offers and starting a bidding war among potential buyers.[5] This strategy is based on the premise that purchasers understand the true market value of a property and that a property priced below estimated value will create an extraordinary amount of interest, resulting in a sale price above the listing price. Haurin, et al. (2013) found this selling strategy to be more common in robust housing markets with substantial buyer demand. A seller has to be extremely careful using this strategy, but in some markets it has been effective in generating selling prices substantially above the artificially low listing price in a very short period of time.

A considerable number of research studies have examined listing prices of residential real estate sales, but research specifically addressing the effect of listing price changes on the sales price is less prevalent. It is an important research question because it speaks to the argument of market efficiency. In an efficient real estate market, the manipulation of the listing price should not affect the selling price of property after controlling for time on the market, property characteristics, location and other extraneous influences. Case and Shiller (1989) concluded that the market for single-family homes does not appear to be efficient since price increases in one year tend to be followed by increases in the following year. They also remarked that that it was very difficult to prove the inefficiency or to predict excess returns on an individual property. However, if the market is actually efficient then we would expect that the initial listing price and subsequent price changes would have little effect on the final selling price. In other words, in an efficient market a higher initial listing price would not fool buyers into paying more for a property than it was truly worth given its features and the current economic environment. Also, a listing price change would not lead a buyer to make an unwise decision in an efficient market. Research by Knight (2002) perhaps most directly examines the effect of a listing price change on time on the market and the selling price. The findings indicate that the knowledge of a listing price change has a significant effect on market behavior and ultimately increases the amount of time it takes to sell a home and lowers the final selling price. This result tends to support the

[4] The Dictionary of Real Estate Appraisal, 5th edition, The Appraisal Institute.

[5] Source: Bankrate.com Five Tips to Start a Bidding War on Your Home http://www.bankrate.com/finance/real-estate/tips-start-bidding-war-for-home.aspx#slide=2

idea of market inefficiency, at least in that market at that point in time, but real estate markets have changed significantly since the 1997–98 time period the data was taken from and there is more information than ever available to potential purchasers. Listing price changes, as opposed to simple knowledge of previous changes, may not have an effect on the final selling price. Overall, the heterogeneity of homes and the various constraints, biases and incentives of the parties involved in residential real estate markets make choosing a listing price difficult and often leads to a future adjustment in the listing price.

The purpose of this research is to examine the determinants of listing price changes and the effect of listing price changes on the net selling price of single-family residential properties. The sample includes traditional non-distressed sales, short sales, and properties that have gone through the foreclosure process and are re-sold by real estate agents through the MLS by banks (REOs), other financial and investment entities, and by individuals.[6] The time period of the study is 2004–12, which encompasses a period of rising housing prices, a housing debacle and finally a period of housing recovery, which provides a full economic cycle to appropriately address the influence of listing price changes on the net selling price. The problems of using an endogenous listing price change variable and of sample selection bias for listing price change properties are also addressed in this study. Our findings indicate that using a 2SLS approach with sample selection bias correction for estimating the effect of a listing price decrease on the net selling price results in a statistically significant price discount almost double the estimate of OLS. Also, the listing price reduction effect does appear to result in a decrease in the net selling price when holding constant the days on the market, and a sample selection bias is present. There is also evidence that the effect of a listing price discount effect on the net selling price is greater for foreclosure properties.

Literature Review

Horowitz (1992) presents a theory of seller's behavior explaining the existence of listing prices and why they are distinct from sellers' reservation prices. Listing prices signal a seller's reservation price and an upper boundary of the seller's reservation price. The author finds that the prediction of the selling price is considerably more accurate compared to a standard hedonic regression. Knight et al. (1994) present a model to determine whether listing prices include useful information for anticipating trends in future transaction prices. Their model is based on buyer behavior where listing prices act as signals to buyers, and providing insight to the role of the buyer behavior as the mechanism for transmitting listing to selling prices in the market. Their findings support Horowitz's conclusion that the listing price provides a powerful predictor of the selling price at the market level. Knight et al. (1998) find that the listing price is useful in predicting selling prices for almost all categorical and geographical data.

Yavas and Yang (1995) developed a theoretical model showing the relationship between listing price and time on the market. They provide a framework within which a

[6] Former foreclosure properties are referred to hereafter as foreclosure or foreclosed properties for the sake of simplicity.

seller can determine the optimal listing price and also examine the effect of the listing price on the time it takes to sell the property. Their theoretical model shows that listing price is a function of the seller's estimate of the property's market value, the seller's bargaining power, and the commission rate among other things. The relationship between list price and time on the market is ambiguous and depends on the same factors. Using a two-stage regression model, empirical evidence in the study indicates that the relationship between list price and time on the market was positive for mid-priced homes, and not significant for lower and higher priced homes. They also found some significant effects caused by seasonal factors and listing brokerage firm characteristics, indicating that some individual factors are mispriced in the market and have an effect on time on market.

Springer (1996) investigated the relationship between seller motivations, listing price and time on the market. The author shows that motivated sellers more often set a list price that is close to, or even below, the true value of the home when compared to sellers who are not as motivated. In the majority of cases, there was no significant relationship between seller motivation and time on the market with the one exception of foreclosed properties. However, when the list price-to-value ratio was lower, selling prices and time on market tended to be significantly reduced.

Genesove and Mayer (2001) propose that loss aversion can determine a seller's behavior regarding setting of the listing price and whether or not to accept an offer. Their study of downtown Boston condominium sales in the 1990s shows that owners subject to nominal losses set higher asking prices of 25–35 % of the difference between the expected selling price and purchase price of their properties, attained a higher selling price of 3–18 % of the difference, and had a lower hazard rate of sale. Owner occupants raise their asking prices by about one-half of their prospective loss while investors raise their asking prices by about one-quarter.

Benjamin and Chinloy (2000) examine the various seller strategies that affect listing price and determined that sellers can follow one of two strategies. Sellers can either follow a pricing strategy where the list price is set close to or below the estimated value of the home or they can choose an exposure strategy where the listing price is set higher relative to estimated value and more is spent on advertising, attracting buyer brokers, etc. in order to obtain favorable offers on the property. The data used came from the Washington D.C. area where listing contracts had the feature of either including or excluding cooperation with buyer brokerage. Allowing buyer brokerage was positively associated with a higher list price relative to the estimated value. Buyer brokerage cooperation was less likely when the house was priced at or below estimated market value. The authors concluded that it is better to follow a strategy where the listing price is close to the estimated value of the property since these properties sell more quickly and without a significant decrease in the selling price. Overpricing properties yields a minimal additional return even with the extra market exposure from buyer brokers.

Knight (2002) examines the effect of listing price change in selling price models. If a property is unsold at the end of one period, the seller may decide to (1) withdraw the property, (2) leave the listing price unchanged and wait for a buyer, or (3) send a signal through revising the listing price. In addition to the seller motivations, learning occurs during the listing period that helps the seller determine the new strategy. In the empirical model, the listing price change is measured by a dummy variable for change and also by the percentage listing price change. The sample consists of 3490 single-family dwellings in Stockton, CA sold in 1997–98, with 376 observations where the selling price exceeded the listing price. Knight finds that the initial overpricing of a home is costly to the seller in time and money. A listing price change is associated with a lower selling price, and also, the larger the percentage price reduction, the longer the time on the market and the lower the selling price. The findings indicate that a listing price change is associated with a decrease in the selling price, holding constant typical hedonic model variables and time on the market.[7]

Anglin et al. (2003) also examine the trade-off between selling price and time on the market. They conclude that the results obtained depend heavily upon which methodology is chosen as well as whether the data includes information on homes that did not sell or were withdrawn. In their theoretical model there is no direct trade-off between selling price and time on market, but rather "market conditions generate a locus which describes how the expected selling price and the expected time on market vary jointly based on the choice of the list price." The empirical results in the study do indicate that higher list prices do result in a longer time on market. A very interesting and logical result is that this effect is magnified for those types of houses with a low variance in list prices. For example, in a market where there were many homes that were very similar and the market was very active it would be relatively simple for purchasers to determine the market value of listed properties. If a seller chose a list price substantially higher than this generally-accepted level of value, the time on market would be longer. However, the authors do not find that the degree of overpricing (or the percentage deviation from a "typical" listing price for a similar house) is related to the selling price, suggesting the markets are probably efficient in residential property selling prices.

Allen and Dare (2004) looked at listing price from a marketing viewpoint by examining the effect of "charm" pricing on net selling price. Charm pricing is defined as setting the list price slightly below some round number, for example, $99,900 instead of $100,000. Their results indicate that in many cases using charm pricing results in a higher selling price. Beracha and Seiler (2014) examine the pricing strategies of round pricing (thousands digit is 0 or 5), "just below" rounding pricing (thousands digit is 9 or 4) and precise pricing (all other digits). Their findings indicate that houses listed using a "just below" rounding strategy are associated with the greatest discount negotiated relative to the asking price but that the initial degree of listing overpricing of "just below" rounding properties more than offsets the greater discount and that it is the most effective pricing strategy. Allen et al. (2005) also examined a marketing technique dealing with listing price. Value range marketing is the technique of offering a home with a range of pricing as opposed to a single list price. The idea is to broaden the number of people looking at a house, thus lowering the time on market and potentially increasing the selling price. The results of the study indicate

[7] Knight also notes other important findings. Results differ whether or not there is knowledge of price changes occurring. When purchasers are ignorant of price changes including the original list price and listing date, the time-on-market coefficient is negative and significant. However, if buyers have knowledge of a price change the time-on-the-market coefficient is positive and significant. Knight suggests that the inconsistent sign of the time-on-market variable throughout the real estate literature may be a result of not including listing price change data in the models used. Consistent with other literature, he found that the most significant causes of listing price changes were the total length of time that a home had been on the market, the amount by which the home had been overpriced initially, and whether the house was vacant. Atypical homes were less likely to undergo price changes since a failure to sell does not communicate as much information as it would for a more typical home.

that value range marketing actually increased the time-on-the-market and had no significant effect on the selling price.

Haurin, et al. (2010) develop a search behavior model to consider how sellers will optimally set both their listing and reservation prices. With the buyers' distribution of potential offers held constant, a higher list price results in a slower flow of offers, but ultimately results in a higher selling price. When the variance of the offer distribution increases, sellers are shown to set higher listing prices relative to expected sale prices. Using sales data from the Columbus, Ohio real estate market, they use house atypicality as a proxy for the variance of the offer distribution. The results obtained show that the list price to sales price ratio increases at a decreasing rate for atypical houses relative to more conventional houses. Time on market is also higher for atypical homes. These results are logical given the lower level of certainty regarding the value of an atypical house.

Tucker et al. (2013) study of the effect of a policy change in Massachusetts which prevents sellers from resetting the published days on market by withdrawing and then relisting their property. They found that the new policy led to a $16,000 temporary reduction in average sale price. The negative effect was more pronounced for slower moving homes and newer listings actually had a small increase in selling prices. Also, the negative effect is stronger when there is uncertainty about a home's quality and where real estate markets were more liquid. The authors hypothesize that in a liquid market a longer time on market is a signal to a potential buyer about a home's quality or value. Subsequent to the policy change sellers used lower listing prices to accelerate the sale of their properties. The authors concluded that the time on market information is valuable to potential purchasers.

Haurin et al. (2013) investigate the relationship between listing price and selling price during various phases of the housing market from booms to busts, modifying the traditional search behavior model to allow for selling prices to be above the listing price as opposed to the listing price representing the upper limit of possible selling prices. They hypothesize that in stronger housing markets sellers often use an auction-like model where the listing price becomes the floor for the possible selling price, and the sellers expect to take the highest offer above listing as opposed to the nearest offer below the listing price. Their data provides empirical support for this hypothesis with a low list price to selling price ratio remaining long into boom periods.

Bucchianeri and Minson (2013) analyze listing prices from a behavioral standpoint using a sample of 14,000 repeat-sale transactions. The authors conclude that overpricing a home between ten and twenty percent resulted in sales prices that were $117–$163 higher, after controlling for time on market. The increased price was suggested to be as result of the anchoring effect created by the higher listing price. The effect was most significant in areas where there was a high percentage of delinquencies and foreclosures. The authors suggest that their findings are not likely to be related to seller motivations or unobserved home qualities. The authors' finding of an increased sales price related to a higher listing price suggests a market anomaly inconsistent with efficient markets for residential property pricing.

In general, there are conflicting findings related to the effect of listing price levels and changes to net selling price. The current study intends to address several methodological problems from prior studies. One potential problem is that market conditions influence the effect of the listing price. The current study uses market data covering 2004–12, a time period of substantially different housing market conditions. A second potential problem is that an endogeneity problem exists with the use of listing price in the empirical equations for selling price and time on the market. The listing price can be changed by the seller at any time, and therefore, may not be considered an exogenous variable. As a consequence, the effect of listing price on selling price and days on the market may be biased. A third potential problem is that a sample selection bias may be associated with listing price change properties. Although conventional thought is that a listing price change occurs because the seller knowingly has a marketing strategy associated with the property such as overpricing the property and then reducing the price over time, some properties may be overpriced because of many reasons such as poor professional advice by a listing agent, an agency problem where the agent intentionally provided an inflated listing price to acquire the listing, an exigency of the seller requiring a quick sale the property, or other latent (or unobservable) effects that are not taken into consideration. Therefore, a separate sample selection model is developed and implemented in the first step; the second step uses a 2SLS selling price regression model that has a correction for sample selection bias and endogeneity of the percent change in listing price and time on the market. The findings indicate that the observed effect of the change in listing price on the net selling price is negative and statistically significant, suggesting that changing the listing price results in a larger than proportional decrease in the net selling price. This indicates that sellers that decrease their listing prices may be sending a signal to prospective buyers that they have lowered their reserve price.

Methodology

The initial step in the analysis is to compare the properties that had a listing price change with properties that kept the same listing price through the sale of the property. The dependent variable, therefore, is whether or not the property has a listing price change; this is therefore a binary choice dependent variable. The probit model is a commonly used statistical method when the dependent variable is binary choice as it produces predications that look like probabilities, unlike linear regression approaches.

In the case of listing price changes, the motivation for the probit model is that the decision by a homeowner to change the listing price (*LPCD*) is based on a latent variable (*LPCD**), that is determined by a set of explanatory variables (**W**) with corresponding coefficients (**γ'**). Generally *LPCD** cannot be observed, and only the sign of *LPCD** can be inferred. If the listing price is changed, *LPCD** is assumed to be positive and $LPCD = 1$. The probit model is:

$$\begin{aligned} &LPCD_{it}^{*} = \boldsymbol{\gamma}'\mathbf{W}_{it} + u_{it}, \quad u_{it}\ is\ N[0,1] \\ &LPCD_{it} = 1 \quad if\ LPCD_{it}^{*} > 0 \\ &LPCD_{it} = 0 \quad if\ LPCD_{it}^{*} \leq 0 \\ &Prob(LPCD_{it} = 1) = \varnothing\left(\gamma'\mathbf{W}_{it}\right) \\ &Prob(LPCD_{it} = 0) = 1 - \varnothing\left(\gamma'\mathbf{W}_{it}\right) \end{aligned} \tag{1}$$

where ∅ is the cumulative normal distribution. The dependent variable, whether or not a listing price change occurs, is defined as *LPCD*. The explanatory variables (**W**) include property characteristics, occupied or vacant status, cash sales, brokerage and transaction characteristics, distressed property sales, overpricing, and time and zip code location dummy variables. The time control variable is defined by month and year (*SLDYR05* through *SLDYR12*) of the sale. Because the probability of a listing price change may be related to property location, where observations may be correlated, a clustering specification based on Census tract is included, which provides a corrected covariance estimator. The sample consists of non-distressed properties as well as foreclosed (*FORCL*) and short sale (*SHORTSL*) property sales. The complete list of variables is shown in Table 1.

The property characteristics in matrix **W** include age (*AGE*), square footage (*SQFT*), the number of bedrooms (*BEDRMS*), the number of bathrooms (*TOTBATHS*), and dummy variables for central air conditioning (*CENTAC*), fireplace (*FIREPL*), and garage (*GARAGE*), and property condition (*CONDTN*). Financing and brokerage variables encompass cash sales (*STDTCASH*), occupied property status (*OCCUPIED*), whether or not the listing agent is also the selling agent (*SAMEAGT*) and the transaction brokerage commission in percent (*TRANSBRK*).

The *OVRPRR* variable captures relative overpricing, and it is expected to not only influence the decision to change the listing price, but potentially also the listing price change percentage. Sellers of properties with a high original listing price to the predicted net price (*OVRPRR*) may be more likely to reduce the listing prices and by a greater amount than properties sold closer to parity. The overpricing variable is developed using a two-stage regression methodology that focuses on developing predicted values for the net selling price, which is then utilized in a second regression with the spread between the original listing price and the predicted net selling price as the dependent variable. It is the standardized residuals from the latter regression (Eq. 3) that becomes the overpricing (OVRPRR) variable for use in the probit model, and the listing price change and pricing regressions. In the first stage, the predicted selling price is estimated using the following model:

$$NSP_{it} = \beta' \mathbf{Z} + \varepsilon_{it} \tag{2}$$

Matrix **Z** consists of matrix **X**, that is, property characteristics, occupied or vacant status, cash sales, brokerage and transaction characteristics, foreclosed, short sale and non-distressed property status. In addition, matrix **Z** includes interaction variables of foreclosed properties with property, cash or vacant status, cash sales, brokerage and transaction characteristics to develop a model with strong predictive ability. Also, the model includes dummy variables for month, year and census tract.[8] In the second stage,

[8] While the models for predicting the net selling price and the original listing price versus predicted selling price spread are based on 140 census tracts, the other 2SLS and 2SLS sample selection regressions use postal Zone Improvement Plan (ZIP) codes as location variables to conserve degrees of freedom because the sample size drops from the full sample size of 13,461 observations to 4,308 observations for those properties with a decreased listing price. The predicted net selling price regression has an adjusted R-squared of 88.5 % with almost all non-interaction regression coefficients statistically significant at the 0.01 level, and one-third of interactions reaching statistical significance levels of 0.10 or better.

Table 1 Description of variables

Variable	Description
AGE	The age of the house in years.
BEDRMS	Number of bedrooms In the property
CENTAC	Dummy variable for presence of central air conditioning
CONDTN	Dummy variable for property in poor physical condition
DOM	Days on the market
FIREPL	Dummy variable for presence of a fireplace
FORCL	Dummy variable for a foreclosed property sale
GARAGE	Dummy variable for presence of a garage
LDOM	Natural logarithm of days on the market
LNSP	Natural logarithm of net selling price of the property
LP	Final isting price before property sale
LPCD	Dummy variable for properties with one or more changes in the original listing price
NSP	Net selling price of the property (selling price minus closing costs and point paid by seller)
OCCUPIED	Dummy variable for an occupied property
ORIGLP	Original listing price of the property
OVRPRR	Residuals from the natural log of the ratio of original listing price to predicted selling price regression
PRCCHG	Percentage change in the listing price from the original list price
FEB	Dummy variable for the month of February
MAR	Dummy variable for the month of March
APR	Dummy variable for the month of April
MAY	Dummy variable for the month of May
JUN	Dummy variable for the month of June
JUL	Dummy variable for the month of July
AUG	Dummy variable for the month of August
SEP	Dummy variable for the month of September
OCT	Dummy variable for the month of October
NOV	Dummy variable for the month of November
DEC	Dummy variable for the month of December
SAMEAGT	Dummy variable for the same agent listing and selling a property
SHORTSL	Dummy variable for a short sale
SLDTCASH	Dummy variable for a property sold on cash terms
SLDYR04	Dummy variable for a property sold in 2004 (omitted)
SLDYR05	Dummy variable for a property sold in 2005
SLDYR06	Dummy variable for a property sold in 2006
SLDYR07	Dummy variable for a property sold in 2007
SLDYR08	Dummy variable for a property sold in 2008
SLDYR09	Dummy variable for a property sold in 2009
SLDYR10	Dummy variable for a property sold in 2010
SLDYR11	Dummy variable for a property sold in 2011

Table 1 (continued)

Variable	Description
SLDYR12	Dummy variable for a property sold in 2012
SQFT	Number of heated square feet of the house (in thousands)
TOTBATHS	Total number of baths in the house
TRANSBRK	Transaction broker commission (in percent)

the relative overpricing variable (*OVRPRR*) is estimated by obtaining standardized residuals from the following regression Eq. (3).

$$\ln\left(\frac{ORIGLP_{it}}{\widehat{NSP}_{it}}\right) = \beta' \mathbf{Z} + \varepsilon_{it} \tag{3}$$

The dependent variable is computed as the natural logarithm of the ratio of the original listing price $ORIGLP_{it}$ to the predicted net selling price (NSP_{it}) from Eq. (2) at time t for observation i. [9] The standardized residuals are obtained from Eq. (3) by dividing the residuals by the estimated variance of the least squares residuals suggested using the method by Belsley et al. (1980) to capture not only the variance but also the "leverage" value (h).[10]

Because this study examines the net selling price of properties that have reduced their listing prices, an important statistical problem arises if there are latent influences on the net selling price for properties that have a reduction in the listing price compared to others where the listing price was not changed. The problem is that regression coefficients estimated will have the equivalent of an omitted variable bias, therefore, the regression coefficients will be biased and inconsistent if there is no correction for the problem that the sample of houses that had a listing price reduction are systematically different from those that did not have a listing price reduction. This sample selection problem may not only occur for the net selling price regression, but for other regressions using the selected sample of properties with a dependent variable that has a significant non-zero correlation with the error term of the regression.

[9] The number of observations is 13,461 with the same parameters as Eq. (2). The adjusted R-squared is substantially lower at 8.5 %, However, the residuals from this regression are robust for use as an overpricing variable. While the ratio of the original listing price to the predicted net selling price (from Eq. 2) could be used as a measure of overpricing, it does not provide a mechanism for incorporating the variance of the estimate whereas the standardized residuals from Eq. (3) provide it, and also adjust for the other variables associated with matrix **Z**, with the standardized residuals reflecting the unexplained deviation from an expected deviation of zero.

[10] The standardized residuals are calculated as $u(i)_i = \left[\frac{\frac{e_i}{1-h_{it}}}{\frac{\left[\mathbf{e}'\mathbf{e}-\frac{e_i^2}{1-h_{it}}\right)}{n-K-1}}\right]^{1/2}$, where $h_{it} = \mathbf{x}_i'\left(\mathbf{X}'\mathbf{X}\right)^{-1}\mathbf{x}_i$ for n observations with K parameters.

A simplified regression model for examining the effects of sample selection is:

$$Y_{it} = \boldsymbol{\beta}'\mathbf{X} + \varepsilon_{it} \tag{4}$$

where Y is the dependent variable, β' is the vector of coefficients, $\mathbf{X}$ is the matrix of explanatory variables, and ε_{it} is the error term. [11] If it is assumed that a sample selection problem exists for listing price reduction properties, the general regression model can be written as:

$$E\left[Y_{it}\middle|LPCD_{it} = 1\right] = \boldsymbol{\beta}'\mathbf{X} + \rho\sigma_{\varepsilon}\lambda\left(\gamma'\mathbf{W}\right) \tag{5}$$

where $(u_{it}, \varepsilon_{it})$~bivariate normal $[0, 0, 1, \sigma, \rho]$. The inverse Mills ratio is $(\gamma'\mathbf{W}_{it})$, reflecting the omitted variable bias that would result if the regression is estimated using only properties that were sold. The correlation between Y_{it} and $LPCD_{it}$ is measured by ρ.

An important question is to determine what factors influence the amount of the listing price change. Therefore, for this analysis, the model includes only those observations where the listing price has been changed. [12] The percentage change in the listing price is determined by comparing the original listing price to the final listing price. To understand the effect of a listing price change on the net selling price, a regression model is developed that relates listing price change with matrix $\mathbf{X}$ including property characteristics, occupied or vacant status, cash sales, brokerage and transaction characteristics, foreclosed, short sale and non-distressed property status, overpricing, and controlling for time (month and year) and location. The model is defined as:

$$E\left[PRCCHG_{it}\middle|LPCD_{it} = 1\right] = \beta'\mathbf{X} + \rho\sigma_{\varepsilon}\lambda\left(\gamma'\mathbf{W}\right) \tag{6}$$

where $PRCCHG_{it}$ is the percent price change of the property from the original to the final listing price and the other variables are as previously defined.

A closer examination of the explanatory variables in this model is warranted. Theoretically, standard hedonic model property characteristics should not be necessarily related to listing price changes as these should be ascertained and properly priced by listing agents and sellers. However, research indicates that age and housing square footage are positively related to days on the market, and listing price change is positively related to days on the market as sellers re-price unsold properties. Therefore, if sellers of larger and/or older homes are unable to seller their properties, they may be more compelled to lower the original listing price.

Compared with non-foreclosed properties, sellers of distressed properties may be compelled to lower the original listing price more than non-distressed properties. Foreclosed properties are often held by financial institutions, mortgage companies

[11] In this case, matrix **X** consists of the same variables as matrix **W**.

[12] Another interesting research question is the effect of multiple listing price changes and when they occurred. This information would might permit us to further examine the determinants of listing price change and the potential effect on the net selling price. Unfortunately information is not available in the data set at this level of detail.

and investors, and they are often eager to sell the properties to avoid the continuing costs of holding a foreclosed property. These costs include insurance, property taxes, maintenance and the possibility of vandalism and theft arising from unoccupied residences.

Financing and brokerage variables may affect the amount of a listing price change. Properties that are occupied may indicate less financial pressure to lower a listing price because the properties are being utilized. Conversely, vacant properties represent an expensive opportunity cost to the seller, and also, may not show as well to prospective buyers.[13] A number of research studies including Winkler and Gordon (2014) find that cash sales reduce the selling price. They suggest that sellers who ultimately accept cash offers, most often at a discount, may be more interested in a quicker sale as cash sales often reduce days on the market. Also, Winkler and Gordon suggest that agent and transaction costs may also be related to listing price discounts. In cases where the listing agent also sells the property, their research indicates that days on the market may be shorter and because listing prices are often lowered because properties are unsold, SAMEAGT may be negatively related to listing price discount. The relationship of the percent transaction cost (commission) variable could be theoretically positive or negative. Because higher commissions may be paid for properties that are more difficult to sell, this would suggest that high commission cost properties may be ones where sellers lower the listing price. Conversely, a higher commission paid to an agent may increase the incentive to sell a property and makes it less likely that a property's listing price will need to be lowered (Winkler and Gordon 2014).

The central research question investigated in this study is whether a listing price change has a significant effect on the net selling price of a house. The net selling price regression model for properties with a listing price change (decrease) with sample selection is defined as:

$$E\left[LNSP_{it}\middle|LPCD_{it}=1\right]=\boldsymbol{\beta}'\mathbf{X}+\boldsymbol{\delta}\mathbf{PRCCHG}+\rho\sigma_{\varepsilon}\lambda\left(\gamma'\mathbf{W}\right) \tag{7}$$

where $LNSP_{it}$ is the net selling price and $\mathbf{X}$ is the previously defined matrix of variables for property characteristics, property sales type (foreclosed, short sale or non-distressed), cash sale, and time and location. The matrix **PRCCHG** includes the listing price percentage change (*PRCCHG*) and another variable of the interaction of *PRCCHG* with *FORCL*. The percent change in the listing price is endogenous, the variable is estimated using the fitted list price percent change ($PRCCHG_{it}$) from the original to the final listing price using two-stage least squares (2SLS).[14] The coefficients for the fitted list price change variable and *FORCL* interaction are defined as $\boldsymbol{\delta}$ and other variables and their coefficients are as previously defined.

Another specification is tested that in addition to the variables in Eq. (7) includes a matrix $\widehat{LDOM}$ for the natural logarithm of days on the market (*LDOM*)

[13] See Sirmans et al. (1995); Harding et al. (2003); Turnbull et al. (1990).

[14] In the 2SLS models in Eqs. (7) and (8), OCCUPIED, SAMEAGT, TRANSBRK and OVRPRR serve as instruments in the regression. Therefore, the first stage includes all variables in the system. The 2SLS and instrumental variable empirical results are identical using this method.

and a second variable of the interaction of *LDOM* with *FORCL*; many studies have suggested that *LDOM* should be included in a pricing regression. However, similar to listing price change, *LDOM* is an endogenous variable and therefore is estimated using the fitted value of $LDOM\left(\widehat{LDOM}\right)$ from a 2SLS regression. The following regression is estimated:

$$E\left[LNSP_{it}\middle|LPCD_{it}=1\right]=\boldsymbol{\beta}'\mathbf{X}+\boldsymbol{\delta}\mathbf{PRCCHG}+\boldsymbol{\tau}\mathbf{LDOM}+\rho\sigma_{\varepsilon}\lambda\left(\gamma'\mathbf{W}\right) \quad (8)$$

The coefficients for the fitted *LDOM* variable and foreclosure property interaction are defined as $\boldsymbol{\tau}$ and other variables and their coefficients are as previously defined. Because a percent listing price change (*PRCCHG*) may be a signal to potential buyers that the seller is willing to accept a lower price, the ultimate net selling price might be expected to be lower too. Therefore, the important question is whether the seller has also adjusted the final listing price downward, and if so, by how much?

Data

A sample of 14,365 single-family house sales was obtained from the North Alabama Multiple Listing Service for the Huntsville metropolitan area of Madison County, including the cities of Huntsville and Madison. This sample consists of 12,424 non-foreclosed and 1941 foreclosed property sales, respectively, sold between January 2004 and March 2012. Missing and incomplete data reduced the sample to 13,461 of which 11,678 are non-distressed, 1728 are foreclosures and 55 are short sales. From a perspective of listing price change, 8790 properties remained the same, 4308 properties decreased while only 366 properties increased from the original listing price.

Madison County, AL has a population of 343,080, or about 7 % of the population of Alabama. The ethnic composition of the county is 69.7 % White, 24.6 % African-American, 4.7 % Hispanic or Latino, and 1 % other ethnicities. About 12.4 % of residents have income below the poverty level; median household income from 2008 – 2012 is $58,242. The home ownership rate is 70 %, slightly above the national average. The largest employers in the area are the U.S. Army, Huntsville Hospital, NASA and major high-technology and defense-related companies.

Tables 2 and 3 shows descriptive statistics of the total sample and listing price change subsamples. The average net selling price is $150,748 with square footage of 1950. The original listing price is 7.0 % higher than the net selling price at $161,255. The discount from the original to the final listing price is 2.3 % for all properties. About 65.3 % of sellers did not change their listing price while 32.0 % decreased the listing price and approximately 2.7 % increased it. The average discount for sellers who reduced their listing prices is 7.5 %; this compares to a 4.8 % markup for sellers who increased their listing prices. The greatest proportions of downward listing price adjustments were made in 2009 and 2011. Not surprisingly, list price upward adjustments occurred most often during 2005 and 2007, prior to the housing market debacle. The average days on the market (DOM) is 82 days for the entire sample. However, DOM averaged 49 days for the sample of sellers who did not change their listing price,

Table 2 Descriptive statistics of listing price change samples

Variable	Combined sample		Listing price decreased		Listing price unchanged		Listing price increased	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
NSP	150748.300	88011.170	159344.300	93268.780	147241.700	85356.750	133757.900	78495.690
LNSP	11.757	0.592	11.804	0.615	11.738	0.582	11.661	0.525
LP	157351.300	91327.790	167821.700	97507.000	152967.300	88076.630	139362.700	81096.550
ORIGLP	161254.800	94362.470	180484.300	104413.000	152967.300	88076.630	133879.800	78830.170
PRCCHG	2.255	4.780	7.450	5.307	0.000	0.000	−4.770	4.460
LPCD	0.320	0.467	1.000	0.000	0.000	0.000	0.000	0.000
DOM	81.902	350.189	147.346	117.794	49.403	420.723	91.850	147.184
LDOM	3.649	1.343	4.723	0.769	3.118	1.245	3.753	1.343
AGE	27.390	14.075	27.461	14.415	27.319	13.938	28.258	13.277
SQFT	1.950	0.757	2.085	0.805	1.891	0.727	1.780	0.655
BEDRMS	3.380	0.669	3.461	0.693	3.344	0.654	3.284	0.638
TOTBATHS	2.086	0.653	2.166	0.689	2.053	0.632	1.945	0.620
CENTAC	0.966	0.182	0.968	0.175	0.964	0.186	0.964	0.185
FIREPL	0.648	0.478	0.669	0.471	0.642	0.480	0.544	0.499
GARAGE	0.739	0.439	0.741	0.438	0.740	0.438	0.683	0.466
CONDTN	0.008	0.090	0.008	0.091	0.008	0.091	0.003	0.052
FORCL	0.128	0.335	0.154	0.361	0.119	0.324	0.052	0.222
SHORTSL	0.004	0.064	0.008	0.087	0.002	0.048	0.005	0.074
FEB	0.075	0.263	0.082	0.274	0.072	0.258	0.060	0.238
MAR	0.092	0.289	0.093	0.290	0.091	0.288	0.117	0.322
APR	0.081	0.272	0.070	0.255	0.085	0.278	0.117	0.322
MAY	0.099	0.298	0.086	0.280	0.105	0.307	0.093	0.291
JUN	0.108	0.311	0.095	0.293	0.115	0.319	0.104	0.305
JUL	0.102	0.303	0.093	0.291	0.106	0.308	0.117	0.322

Table 2 (continued)

Variable	Combined sample		Listing price decreased		Listing price unchanged		Listing price increased	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
AUG	0.089	0.284	0.084	0.278	0.092	0.288	0.074	0.262
SEP	0.082	0.275	0.090	0.286	0.079	0.270	0.063	0.243
OCT	0.081	0.273	0.089	0.284	0.077	0.266	0.096	0.294
NOV	0.066	0.248	0.076	0.265	0.062	0.241	0.044	0.205
DEC	0.065	0.247	0.072	0.258	0.061	0.240	0.077	0.266
SLDYR05	0.143	0.350	0.103	0.304	0.163	0.370	0.139	0.347
SLDYR06	0.158	0.365	0.104	0.305	0.182	0.386	0.210	0.408
SLDYR07	0.146	0.354	0.130	0.336	0.153	0.360	0.186	0.389
SLDYR08	0.109	0.312	0.124	0.330	0.103	0.304	0.090	0.287
SLDYR09	0.110	0.313	0.136	0.342	0.097	0.297	0.104	0.305
SLDYR10	0.093	0.290	0.125	0.331	0.078	0.269	0.060	0.238
SLDYR11	0.092	0.289	0.142	0.349	0.069	0.254	0.057	0.233
SLDYR12	0.022	0.146	0.035	0.183	0.015	0.123	0.019	0.137
SLDTCASH	0.140	0.346	0.142	0.349	0.140	0.347	0.112	0.316
OCCUPIED	0.417	0.493	0.320	0.466	0.466	0.499	0.396	0.490
TRANSBRK	2.945	0.561	2.921	0.508	2.956	0.588	2.956	0.474
SAMEAGT	0.170	0.376	0.153	0.360	0.177	0.382	0.199	0.400
OVRPRR	0.000	0.083	0.009	0.083	−0.004	0.084	−0.007	0.066
N		13,461		4308		8787		366

Table 3 Descriptive statistics of distressed and non-distressed properties

Variable	Non-distressed sale properties		Foreclosed properies		Short sale properties	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
NSP	161431.600	86707.300	79093.180	58224.980	133679.000	85548.480
LNSP	11.855	0.530	11.098	0.565	11.611	0.635
LP	168293.200	89845.390	83880.280	62912.230	142420.000	89666.370
ORIGLP	172085.300	92966.040	88235.760	67371.920	155757.900	96926.840
PRCCHG	1.908	4.230	4.407	6.958	8.190	8.314
LPCD	0.309	0.462	0.384	0.486	0.600	0.494
DOM	85.834	374.953	52.461	58.333	171.964	133.444
LDOM	3.675	1.373	3.438	1.084	4.778	1.066
AGE	26.499	14.178	33.450	11.622	26.055	15.666
SQFT	1.999	0.762	1.616	0.627	2.034	0.831
BEDRMS	3.397	0.674	3.255	0.617	3.564	0.631
TOTBATHS	2.126	0.651	1.811	0.601	2.195	0.569
CENTAC	0.971	0.167	0.926	0.262	0.964	0.189
FIREPL	0.688	0.463	0.376	0.484	0.655	0.480
GARAGE	0.767	0.423	0.549	0.498	0.782	0.417
CONDTN	0.006	0.077	0.024	0.152	0.000	0.000
FORCL	0.000	0.000	1.000	0.000	0.000	0.000
SHORTSL	0.000	0.000	0.000	0.000	1.000	0.000
FEB	0.072	0.258	0.093	0.291	0.127	0.336
MAR	0.090	0.287	0.104	0.306	0.109	0.315
APR	0.082	0.275	0.067	0.250	0.127	0.336
MAY	0.102	0.302	0.080	0.271	0.073	0.262
JUN	0.112	0.315	0.086	0.280	0.018	0.135
JUL	0.104	0.306	0.090	0.287	0.073	0.262
AUG	0.091	0.287	0.076	0.265	0.091	0.290
SEP	0.083	0.275	0.079	0.270	0.091	0.290
OCT	0.080	0.272	0.087	0.282	0.036	0.189
NOV	0.065	0.246	0.071	0.257	0.164	0.373
DEC	0.063	0.243	0.081	0.273	0.036	0.189
SLDYR05	0.150	0.357	0.103	0.304	0.036	0.189
SLDYR06	0.163	0.370	0.124	0.330	0.036	0.189
SLDYR07	0.148	0.356	0.138	0.345	0.000	0.000
SLDYR08	0.107	0.309	0.126	0.331	0.055	0.229
SLDYR09	0.106	0.308	0.134	0.340	0.200	0.404
SLDYR10	0.091	0.287	0.105	0.306	0.200	0.404
SLDYR11	0.084	0.278	0.134	0.340	0.400	0.494
SLDYR12	0.018	0.135	0.042	0.200	0.073	0.262
SLDTCASH	0.113	0.317	0.316	0.465	0.127	0.336
OCCUPIED	0.478	0.500	0.008	0.086	0.418	0.498
TRANSBRK	2.879	0.438	3.391	0.960	2.855	0.448

Table 3 (continued)

Variable	Non-distressed sale properties		Foreclosed properies		Short sale properties	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
SAMEAGT	0.183	0.387	0.080	0.272	0.218	0.417
OVRPRR	0.000	0.051	0.001	0.189	0.000	0.189
N		11,678		1728		55

92 days for those increasing their listing price, and 147 days for those sellers decreasing their listing prices. This suggests that while sellers that decrease their listing prices appear to be responding to the desire to sell their unsold properties, sellers who increase their listing price increase their DOM by 42 days compared to sellers who keep their listing price unchanged. Properties with listing price markups are 16.1 % less expensive with 14.6 % less square footage compared to properties with listing price discounts. As expected, the OVRPRR variable has a mean of zero for the full sample as these are the residuals from the overpricing regression (Eq. 3); the standard deviation is 0.083. The mean is greater than zero (0.009) for the listing price decreased sample and less than zero (−0.004) for the listing price unchanged variable. So while listing price decreased properties are overpriced, listing price unchanged properties are underpriced by about half of the amount that listing price decreased properties are overpriced. Interestingly, listing price increased properties appear underpriced (−0.007) compared to listing price unchanged properties, and even with the increase in listing price, sellers may have been better off starting with a higher listing price instead of increasing it later into the listing period.

Table 3 reports the descriptive statistics for the non-distressed sale properties, foreclosed properties and short sale properties. The average net selling price of foreclosed houses is $79,093, substantially below the net selling price of short-sale properties ($133,679) and non-distressed sale properties ($161,426). While non-distressed property sellers accepted a 4.1 % discount from the final listing price, foreclosed and short sale property sellers accepted larger discounts of 5.7 and 6.1 %, respectively. However, the average change in listing price from the original to final listing price is just 1.9 % for non-distressed properties, compared to 4.4 % for foreclosed properties and 8.2 % for short sales. These findings indicate that non-distressed property sellers had the least discount in their listing price and in the final selling price, while listing prices were adjusted downward the greatest percentage by short sellers, and they also accepted offers from buyers resulting in the largest percentage discount from the final listing price. In essence, they used price change signaling to a larger degree than non-distressed property sellers and even sellers of foreclosed properties. Reasons may include the limited flexibility they may perceive given the constraints on final selling price imposed by lenders and the fact that they will not receive any money at all from the sale, regardless of the discount. However, the average DOM for short sales is 172 days, twice the DOM for non-distressed properties and 3.3 times as long as the DOM for foreclosed properties. This suggests that starting with an excessively high listing price and making large adjustments in the listing and final net selling price may have resulted in the longer average DOM. Short sales can also take long to close which dissuades some potential buyers.

Findings

The findings of the listing price change probit model are shown in Table 4.[15] Listing price increase transactions are excluded from this analysis leaving only those properties with unchanged and decreased listing prices.[16] The model coefficients on the left side include property characteristics, quarter and year time dummy variables, and the model coefficients on the right side adds cash sale, occupancy, brokerage and overpricing variables. The log likelihood of the two models are statistically significant at the 1 % level. The McFadden pseudo R^2, a calculation of fit based on the constants only and model log likelihoods, is 5 and 7 %, respectively, for the two models. Although the fit does not appear high, many model coefficients are strongly statistically significant.

Almost all of the coefficients in Table 4 have their expected signs. Larger houses as measured by square feet have a higher probability of a listing price change. Properties that are sold under distress such as short sales or foreclosures have a higher chance of a listing price change. In addition, the probability of a listing price change is higher in the last 3 months of the year when sales are often weaker. The year dummy coefficients indicate that the probability of a listing price change is lower in the stronger economic time period of 2005–06 and became more likely in subsequent years as the economy slowed, the housing debacle occurred and the economy slowly recovered. Properties that are occupied, have the same listing and selling agent, and those offering higher commissions have less chance of a listing price change. Conversely, properties that are initially overpriced are more likely to have a listing price change.

The probit model coefficients cannot be directly interpreted. Instead, it is necessary to calculate the marginal effects, or the partial derivatives of the model with respect to the explanatory variables. These are calculated at the mean for continuous variables, and for dummy variables, they are estimated assuming a change in the dummy variable from 0 to 1. The marginal effects are reported in the far right hand side of Table 4, and these estimates can be easily interpreted. Using the full variable model, a 1000 square foot increase in house size increases the probability of a listing price change by 11.1 %. Short sale properties have a 17.4 % increase in the probability of having a listing price change compared to non-distressed properties. Occupied houses have a 14.8 % decrease in the probability of a listing price reduction compared to unoccupied houses. Brokerage characteristics appear to matter as well. A one percentage point increase in the transaction (commission) costs reduces the probability of a listing price decrease by 2.5 %.

Table 5 reports the listing price change regressions for properties having a listing price reduction; the dependent variable is the percentage discount from the original to the final listing price. The three models shown are M1 (property characteristics only),

[15] These models are estimated using a cluster specification based on census tract location. This approach is frequently used when observations occur in groups that may be correlated. The parameters are unchanged but asymptotic covariance matrix is adjusted.

[16] There are an insufficient number of properties with listing price increases to conduct a robust empirical analysis.

Table 4 Listing price change probit model dependent variable: LPCD

Variable	Probit Model 1		Probit Model 2		Marginal Effects	
	Coeff.	T-Value	Coeff.	T-Value	Model 1	Model 2
Constant	−0.9341***	−7.76	−0.5406***	−4.13	–	–
AGE	0.0002	0.16	−0.0012	−1.11	0.0001	−0.0004
SQFT	0.2877***	9.53	0.3115***	9.17	0.1029	0.1109
BEDRMS	0.0120	0.44	0.0080	0.27	0.0043	0.0028
TOTBATHS	−0.0625*	−1.84	−0.0636*	−1.87	−0.0224	−0.0227
CENTAC	0.0213	0.39	0.0183***	0.33	0.0076	0.0065
FIREPL	−0.0481	−1.58	−0.0303	−0.96	−0.0172	−0.0108
GARAGE	−0.1027***	−3.08	−0.0952***	−2.89	−0.0368	−0.0339
CONDTN	−0.0420	−0.30	−0.0822	−0.58	−0.0150	−0.0293
FORCL	0.1637***	4.30	0.0377	0.79	0.0586	0.0134
SHORTSL	0.4590***	2.71	0.4876***	2.76	0.1642	0.1736
FEB	−0.0706	−1.17	−0.0794	−1.33	−0.0253	−0.0283
MAR	−0.1454***	−2.69	−0.1475***	−2.77	−0.0520	−0.0525
APR	−0.2200***	−3.78	−0.2036***	−3.47	−0.0787	−0.0725
MAY	−0.2369***	−3.65	−0.2139***	−3.27	−0.0848	−0.0762
JUN	−0.2293***	−3.63	−0.1989***	−3.15	−0.0820	−0.0708
JUL	−0.2085***	−3.59	−0.1802***	−3.07	−0.0746	−0.0642
AUG	−0.1501***	−2.91	−0.1297**	−2.45	−0.0537	−0.0462
SEP	−0.0310	−0.46	−0.0173	−0.25	−0.0111	−0.0062
OCT	−0.0072	−0.12	0.0114	0.19	−0.0026	0.0041
NOV	0.0272	0.44	0.0508	0.81	0.0097	0.0181
DEC	−0.0003	0.00	0.0144	0.22	−0.0001	0.0051
SLDYR05	−0.0763*	−1.82	−0.0755*	−1.78	−0.0273	−0.0269
SLDYR06	−0.1443***	−3.61	−0.1589***	−3.91	−0.0516	−0.0566
SLDYR07	0.1010**	2.03	0.0940**	1.98	0.0361	0.0335
SLDYR08	0.3194***	6.35	0.3021***	6.09	0.1143	0.1076
SLDYR09	0.3906***	7.65	0.3742***	7.37	0.1397	0.1332
SLDYR10	0.4777***	9.83	0.4503***	9.77	0.1709	0.1604
SLDYR11	0.6162***	11.87	0.5883***	11.41	0.2205	0.2095
SLDYR12	0.6179***	8.19	0.5935***	7.78	0.2211	0.2113
SLDTCASH	–	–	−0.0518	−1.24	–	−0.0185
OCCUPIED	–	–	−0.4151***	−13.43	–	−0.1478
SAMEAGT	–	–	−0.0804**	−2.41	–	−0.0286
TRANSBRK	–	–	−0.0688***	−3.71	–	−0.0245
OVRPRR	–	–	1.2371***	6.08	–	0.4405
Pseudo R^2	0.05		0.07			
Log-Lik.(Model)	−7859.63***		−7688.11***			
Clustering Groups	140		140			
N	13,095		13,095			

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

M2 (M1 with cash sale, occupancy, brokerage and overpricing variables) and M3 (M2 with sample selection correction). The models include location fixed effects and heteroscedasticity adjustment using the White (1980) method (M1 and M2). The log likelihood of all models and the location structural variables are statistically significant at the 0.01 level; the adjusted R^2 is about 24 %. Consistent estimates are obtained by a regression of ρ on **X** and λ. The coefficient of $\lambda(\gamma' \mathbf{W})$ is not statistically significant at the 0.10 level indicating insufficient evidence of the presence of a sample selection problem.

The findings in Table 5 indicate that almost all the property characteristic variables and many of the year dummy variables are significantly related to listing price percentage changes. The coefficients are readily interpretable for all models, although for brevity, only M2 coefficients will be interpreted. In M2, ten additional years of age increases the listing price discount by 0.53 %. The listing price discount rises by 0.83 percentage points per 1000 square feet of house space in M3. Listing price discounts are 3.3 and 6.3 percentage points higher, respectively, for foreclosed and short sale properties.[17] From 2008 to the first quarter of 2012, the listing price discount increased from 0.57 to 2.66 percentage points. Properties with cash sale transactions have a 0.63 percentage point lower listing price change. Also, the listing price change for an occupied house is a statistically significant 1.3 percentage points less compared to vacant properties, and a one percentage point increase in the commission fee is associated with a 0.37 percentage point listing price discount. In addition, consistent with expectations, property overpricing is positively related to the percentage listing price decrease indicating that higher initial overpricing results in a larger listing price discount.[18]

Table 6 reports the findings of the net selling price regressions. All models include time and location (zip code location) fixed effects. The adjusted R^2 is 87 % in the least squares model; the model and location fixed effects are statistically significant at the 0.01 level. Model M1 uses OLS estimation. Although the listing price change coefficient has the correct sign, indicating that the net selling price should decrease as the listing price discount increases, 2SLS coefficients should be estimated because *PRCCHG* is endogenous. Therefore, Model M2 is estimated using 2SLS with OCCUPIED, SAMEAGT TRANSBRK and OVRPRR serving as instruments for the listing price change.[19] The M3 model reports the findings for the M2 model with correction for sample selection bias. The sample selection coefficient is statistically significant at the 0.01 level.

The coefficients in the M3 regression are consistent with expectations. The age coefficient indicates that house prices decrease about 0.4 % per year of age. The net selling price increases 35 % per thousand square feet of heated space. Property prices are about 12 % higher for houses with central air conditioning; a fireplace and garage results in average of 9 and 10 % higher prices, respectively.[20] Properties in poor

[17] These estimates are consistent with the mean change in listing price of 4.4 and 8.2 %, respectively, for foreclosed and short sale properties.

[18] Unfortunately, because the OVRPRR variable is estimated as a standardized residual from the overpricing regression, it does yield easily interpretable coefficients.

[19] Adjusted R^2 are not reported for the 2SLS models because the variance of the dependent variable cannot be properly decomposed so that the R^2 has no natural interpretation.

[20] The regression dummy coefficients for the natural logarithm of net selling price regressions provide reasonably accurate estimates of the percentage change. The precise percentage change for the dummy variable coefficients can be more accurately estimated using $y = (e^x - 1)*100$, where x is the coefficient and y is the percentage change.

Table 5 Listing price change regressions dependent variable: PRCCHG

Variable	M1: LS Fixed Effects		M2: LS Fixed Effects		M3: LS Fixed Effects	
	Coeff.	T-value	Coeff.	T-value	Coeff.	T-value
Constant	6.5608^{***}	8.09	5.8353^{***}	6.38	2.6363	0.82
AGE	0.0585^{***}	7.19	0.0528^{***}	6.51	0.0509^{***}	6.33
SQFT	0.8180^{***}	4.40	0.8293^{***}	4.53	1.3731^{**}	2.45
BEDRMS	-0.3985^{***}	−2.70	-0.3879^{***}	−2.65	-0.3628^{**}	−2.51
TOTBATHS	−0.0792	−0.39	−0.0675	−0.34	−0.1845	−0.81
CENTAC	-0.9460^{*}	−1.92	-0.9932^{**}	−2.03	-0.9504^{**}	−2.31
FIREPL	-0.6204^{***}	−3.05	-0.5068^{**}	−2.49	-0.5509^{***}	−2.81
GARAGE	-0.4570^{**}	−2.14	-0.4393^{**}	−2.07	-0.6169^{**}	−2.39
CONDTN	3.1814^{***}	2.98	2.8813^{***}	2.78	2.7170^{***}	3.39
FORCL	3.9487^{***}	15.18	3.2517^{***}	11.73	3.3034^{***}	13.88
SHORTSL	6.3235^{***}	6.68	6.3321^{***}	6.77	7.1054^{***}	6.32
FEB	−0.2991	−0.75	−0.2429	−0.61	−0.3886	−0.99
MAR	-0.7607^{**}	−2.03	−0.6827	−1.84	-0.9399^{**}	−2.17
APR	−0.0541	−0.13	0.0300	0.08	−0.3441	−0.65
MAY	−0.4463	−1.18	−0.3205	−0.86	−0.7146	−1.35
JUN	-0.7421^{**}	−2.03	−0.5994	−1.65	-0.9623^{*}	−1.92
JUL	-0.6118^{*}	−1.65	−0.4419	−1.20	−0.7642	−1.60
AUG	−0.4912	−1.32	−0.3558	−0.97	−0.5851	−1.37
SEP	−0.0635	−0.16	−0.0025	−0.01	−0.0238	−0.07
OCT	−0.3503	−0.95	−0.2056	−0.56	−0.1757	−0.48
NOV	−0.2912	−0.75	−0.1778	−0.46	−0.0750	−0.19
DEC	0.1391	0.34	0.2657	0.65	0.2970	0.78
SLDYR05	−0.1879	−0.66	−0.1359	−0.48	−0.2876	−0.84
SLDYR06	−0.2705	−0.92	−0.1820	−0.62	−0.4961	−1.14
SLDYR07	0.3288	1.20	0.4196	1.54	0.6072	1.75
SLDYR08	0.4992^{*}	1.72	0.5741^{**}	1.99	1.1555^{*}	1.81
SLDYR09	1.3061^{***}	4.57	1.3163^{***}	4.62	2.0267^{***}	2.70
SLDYR10	1.5677^{***}	5.23	1.5742^{***}	5.30	2.4251^{***}	2.76
SLDYR11	1.9070^{***}	6.55	1.8876^{***}	6.55	2.9698^{***}	2.72
SLDYR12	2.7174^{***}	4.89	2.6629^{***}	4.75	3.7370^{***}	3.26
SLDTCASH	–	–	0.6340^{***}	2.68	0.5389^{**}	2.33
OCCUPIED	–	–	-1.3110^{***}	−8.93	-2.0939^{***}	−2.69
SAMEAGT	–	–	0.0761	0.38	−0.0792	−0.32
TRANSBRK	–	–	0.3666^{**}	2.49	0.2402	1.27
OVRPRR	–	–	2.6687^{***}	2.58	4.5808	2.19
λ	–	–	–	–	2.7149	1.03
Adjusted R^2	0.22		0.24		0.24	
F-Test (Model)	30.80^{***}		29.90^{***}		29.30^{***}	
Location FE	13		13		13	
N	4308		4308		4308	

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

Table 6 Net selling price regressions without DOM of listing price reduction properties dependent variable: Ln(Net selling price)

Variable	LS fixed effects		2SLS fixed effects		2SLS FE sample sel.	
	Coeff.	T-Value	Coeff.	T-Value	Coeff.	T-Value
Constant	11.0090***	246.82	10.8298***	186.57	11.3854***	67.90
PRCCHG	−0.0116***	−13.16	0.0158***	3.20	−0.0203*	−1.79
PRCCHG*FORCL	−0.0075***	−3.52	−0.0457***	−7.75	−0.0275**	−2.52
AGE	−0.0043***	−11.42	−0.0059***	−11.57	−0.0039***	−4.01
SQFT	0.3914***	41.93	0.3683***	33.12	0.3544	19.07
BEDRMS	−0.0279***	−3.96	−0.0163**	−1.98	−0.0327**	−2.29
TOTBATHS	0.0573***	5.77	0.0599***	5.31	0.0674***	3.60
CENTAC	0.1353***	4.85	0.1538***	4.94	0.1173***	2.95
FIREPL	0.0946***	9.48	0.1045***	9.16	0.0921***	4.97
GARAGE	0.0884***	8.42	0.0948***	7.89	0.0961***	5.24
CONDTN	−0.1758***	−3.86	−0.2178***	−3.80	−0.1316*	−1.68
FORCL	−0.2138***	−8.69	0.1160*	1.91	0.0181	0.17
SHORTSL	−0.1357**	−2.59	−0.3178***	−4.86	−0.1478	−1.49
FEB	−0.0030	−0.17	0.0051	0.25	0.0088	0.26
MAR	−0.0034	−0.19	0.0217	1.07	0.0173	0.51
APR	0.0313	1.61	0.0460	2.11	0.0733**	1.99
MAY	0.0264	1.50	0.0374*	1.87	0.0586*	1.68
JUN	0.0266	1.54	0.0515**	2.58	0.0590*	1.72
JUL	0.0334*	1.94	0.0513**	2.57	0.0624*	1.83
AUG	0.0280	1.51	0.0520**	2.45	0.0551	1.59
SEP	0.0213	1.16	0.0298	1.42	0.0308	0.91
OCT	0.0438**	2.51	0.0563***	2.82	0.0461	1.35
NOV	0.0340*	1.79	0.0398*	1.89	0.0288	0.82
DEC	0.0162	0.83	0.0092	0.42	0.0194	0.54
SLDYR05	0.0311**	2.22	0.0327**	2.02	0.0397	1.36
SLDYR06	0.1258***	8.80	0.1236***	7.92	0.1420***	4.79
SLDYR07	0.2052***	16.07	0.1965***	13.50	0.1922***	6.90
SLDYR08	0.2330***	18.12	0.2278***	15.34	0.1923***	6.30
SLDYR09	0.2093***	16.17	0.1864***	11.92	0.1648***	5.39
SLDYR10	0.2123***	15.73	0.1769***	10.35	0.1552***	4.85
SLDYR11	0.1649***	12.65	0.1252***	7.29	0.0936***	2.76
SLDYR12	0.1867***	7.90	0.1493***	5.02	0.1334***	2.72
SLDTCASH	−0.0585***	−4.77	−0.0547***	−3.78	−0.0320	−1.52
λ	–	–	–	–	−0.2222***	−3.47
Adjusted R^2	0.87		–		–	
F-Stat. (Model)	678.70***		–		–	
Location FE	13		13		13	
N	4308		4308		4308	

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

condition sell for an average of 13 % less than properties in better condition. Property prices are higher in spring and summer; for example, prices are 7.3 % higher in April compared to January. The coefficients for year of sale indicate rising prices through 2008 followed by slightly declining prices.

The primary interest variable, the percentage change in listing price from the original listing price, shows substantial change in the coefficients from OLS to 2SLS, and also, from 2SLS to 2SLS with sample selection correction. The negative listing price discount coefficient for the M1 model indicates that a one percentage point increase in the discounting of the listing price decreases the net selling price by 1.2 %. For foreclosure properties, the interaction coefficient (*PRCCHG*FORCL*) is negative and statistically significant at −0.0075. Therefore the combined effect is −0.0191 or −1.91 %. The 2SLS indicates an unexpected positive listing price discount coefficient, suggesting a 1.6 % higher net selling price which is inconsistent with expectations. For foreclosure properties, however, the combined effect is −0.0299 or a −2.99 % decrease per one percentage point discount in the listing price. Correcting for sample selection bias, a one percentage point increase in the listing price discount decreases the net selling price by a statistically significant 2.03 %, and for foreclosure properties, by an additional 2.75 %.

Because the estimated sample selection coefficient is negative, the expected net selling price conditional upon a listing price discount is lower than the expected net selling price conditional upon no listing price discount. From Table 2, recall that the mean net selling price was $159,344 for listing price change properties versus $147,242 for listing price unchanged properties. The negative lambda coefficient indicates the direction of the bias such that the mean net selling price of listing price change properties would be even higher if it were not for the sample selection process associated with a listing price change.

The findings of the net selling price regression model including the effect of DOM are shown in Table 7. The adjusted R^2 is 87 % in the least squares model; the model and location fixed effects are statistically significant at the 0.01 level. The *LDOM* coefficient is positive for Models M2 and M3; this is consistent with conventional search theory that a longer time on the market increases the house price. The 2SLS *LDOM* coefficient is 0.13 suggesting that the net selling price increases 0.13 % per 1 % increase in DOM. The 2SLS findings corrected for sample selection bias, shown in Model M3, indicates a larger elasticity of 0.18 % per 1 % change in DOM. The property characteristic variable coefficients are substantially similar to those reported in Table 6.

The findings of the listing price percentage discount (*PRCCHG*) coefficient in Table 7 are of particular interest. A 1 % reduction in the listing price reduces the net selling price by 1.1 % in the base M1 model. The finding of the *PRCCHG* coefficient in the 2SLS model (M2) in Table 7 is negative but not statistically significant, although the PRCCHG*FORCL interaction coefficient indicates a 2.7 % greater discount per one percentage point listing price discount compared to non-foreclosure properties which are essentially at zero. However, the 2SLS model controlling for sample selection bias (Model M3) shows that the effect of the listing price change for all listing price discount properties is −0.0298, or a 2.98 % change in the net selling price per one percentage point discount in the listing price. The PRCCHG*FORCL interaction coefficient of −0.0119 is not statistically

Table 7 Net selling price regressions with dom of listing price reduction properties dependent variable: Ln(Net selling price)

Variable	M1: LS fixed effects		M2: 2SLS fixed effects		M3: 2SLS FE sample sel.	
	Coeff.	T-Value	Coeff.	T-Value	Coeff.	T-Value
Constant	11.0239***	219.85	10.3115***	54.13	10.4200***	30.01
LDOM	−0.0034	−0.65	0.1335***	2.87	0.1811***	2.97
PRCCHG	−0.0114***	−12.41	−0.0023	−0.28	−0.0298***	−3.39
PRCCHG*FORCL	−0.0076***	−3.56	−0.0270***	−3.05	−0.0119	−1.25
AGE	−0.0043***	−11.44	−0.0050***	−8.43	−0.0036***	−5.05
SQFT	0.3918***	41.74	0.3607***	33.01	0.3540***	26.26
BEDRMS	−0.0278***	−3.95	−0.0240***	−2.78	−0.0361***	−3.47
TOTBATHS	0.0573***	5.76	0.0607***	5.46	0.0644***	4.73
CENTAC	0.1353***	4.85	0.1467***	4.84	0.1232***	4.25
FIREPL	0.0946***	9.48	0.0993***	8.69	0.0893***	6.61
GARAGE	0.0883***	8.42	0.0941***	7.90	0.0929***	6.93
CONDTN	−0.1761***	−3.87	−0.1852***	−3.32	−0.1204**	−2.11
FORCL	−0.2148***	−8.68	0.0294	0.44	−0.0316	−0.40
SHORTSL	−0.1360***	−2.58	−0.2305***	−3.54	−0.0951	−1.29
FEB	−0.0029	−0.16	−0.0031	−0.15	−0.0052	−0.20
MAR	−0.0029	−0.17	−0.0066	−0.29	−0.0213	−0.77
APR	0.0315	1.62	0.0341	1.53	0.0432	1.51
MAY	0.0264	1.50	0.0350*	1.71	0.0431*	1.66
JUN	0.0264	1.53	0.0485**	2.40	0.0486*	1.94
JUL	0.0330*	1.91	0.0603***	3.00	0.0669***	2.69
AUG	0.0277	1.49	0.0568***	2.66	0.0585**	2.32
SEP	0.0207	1.12	0.0502**	2.27	0.0578**	2.21
OCT	0.0432**	2.47	0.0768***	3.69	0.0781***	2.90
NOV	0.0336	1.77	0.0496**	2.32	0.0468*	1.78
DEC	0.0157	0.80	0.0313	1.36	0.0446	1.64
SLDYR05	0.0307**	2.19	0.0465***	2.69	0.0542**	2.48
SLDYR06	0.1248***	8.59	0.1673***	7.27	0.1909***	7.01
SLDYR07	0.2042***	15.89	0.2365***	11.23	0.2499***	8.89
SLDYR08	0.2325***	18.04	0.2496***	14.63	0.2418***	8.70
SLDYR09	0.2086***	16.09	0.2238***	10.58	0.2312***	7.33
SLDYR10	0.2117***	15.66	0.2172***	9.50	0.2262***	6.77
SLDYR11	0.1647***	12.63	0.1473***	7.67	0.1463***	4.82
SLDYR12	0.1865***	7.88	0.1736***	5.88	0.1839***	4.67
SLDTCASH	−0.0588***	−4.80	−0.0407***	−2.75	−0.0223	−1.42
λ	–	–	–	–	−0.1086*	−1.80
Adjusted R^2	0.87		–		–	
F-Stat. (Model)	663.60***		–		–	
Location FE	13		13		13	
N	4308		4308		4308	

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

significant therefore no additional listing price discount can be ascertained for foreclosure properties.

Robustness checks are conducted for the net selling price model with DOM, and the findings are reported in Tables 8 and 9. In Table 8, non-foreclosure and foreclosure properties are assumed to follow different days on the market. In Table 3, foreclosure properties have an average DOM of 52 versus 86 days for non-distressed properties. Therefore, the functional relationship of DOM and the net selling price may be different for these samples. Because of the presence of sample selection bias the focus of attention is on M3 which is the 2SLS, fixed effects specification with sample selection bias correction. The findings indicate the *LDOM* coefficient of 0.0570 is positive through not statistically significant. However, *the LDOM*FORCL* interaction variable is statistically significant at the 0.01 level, indicating that for foreclosure properties, the net selling price increases 0.39 % more that non-distressed properties per one percentage change in DOM. The listing price discount coefficient of −0.0193 indicates that the net selling price decreases by 1.93 % per a one percentage listing price discount; although the foreclosure property interaction with *PRCCHG* is negative at −0.0130 and it is not statistically significant. The other coefficients are similar to those reported in Table 7.[21] In Table 9, the findings are reported when including the overpricing variable in the net selling price regression including and excluding *LDOM*. For model M2 (without DOM), the effect of *PRCCHG* is −0.0339 or a 3.39 % decrease per one percentage point change in the listing price discount; this increases by 2.47 % for foreclosure properties. For the *LDOM* model (M3), the *LDOM* coefficient is not statistically significant, however, the LDOM*FORCL interaction is a statistically significant 0.22. The effect of the listing price discount is −0.0348, and for the foreclosure properties, the additional effect is −0.0176. These estimates are similar to the M2 model, although they are substantially larger than the listing price discount effect in Table 8. In addition, the overpricing variable is positive and strongly statistically significant; for foreclosure properties, the net effect of overpricing (including the interaction) remains positive at 0.5123. The findings of the other coefficients are largely similar to Table 8. To isolate the effect of foreclosure in M3 at the mean, it is necessary to applying the listing price decrease sample means for *LDOM*, *PRCCHG* and *OVRPRR* interactions with *FORCL*, and adding these to the −1.0139 *FORCL* coefficient results in a net effect of foreclosure of −0.09 or about −9 % for model M3. Applying the means to the *FORCL* interactions in model M2 (without DOM), the effect of foreclosure is slightly higher at −0.16.

Implications and Conclusion

There has been a substantial amount of literature examining the effect of listing prices but comparatively few studies of the effect of listing price changes on selling price. Studies often treat listing price changes as an exogenous event, when in fact, it is endogenous. As such, estimates of the effect of listing price changes on the selling price

[21] The *FORCL* coefficient of −1.8383 appears unjustifiably large, however, evaluating the LDOM and PRCCHG interactions with FORCL at the listing price decreased sample means for these variables, the net effect is −0.07.

Table 8 Net selling price regressions with DOM and foreclosure interactions dependent variable: Ln(Net Selling Price)

Variable	M1: LS fixed effects		M2: 2SLS FE sample sel.		M3: 2SLS FE sample sel.	
	Coeff.	T-Value	Coeff.	T-Value	Coeff.	T-Value
Constant	11.0735***	223.63	10.7892***	47.09	10.9888***	28.97
LDOM	−0.0141***	−2.73	0.0164	0.28	0.0570	0.84
LDOM*FORCL	0.1043***	5.64	0.4193***	4.87	0.3934***	4.91
PRCCHG	−0.0110***	−11.91	0.0110	1.09	−0.0193**	−2.04
PRCCHG*FORCL	−0.0104***	−4.77	−0.0285***	−2.64	−0.0130	−1.32
AGE	−0.0043***	−11.44	−0.0055***	−8.32	−0.0039***	−5.25
SQFT	0.3919***	41.82	0.3644***	31.36	0.3557***	25.35
BEDRMS	−0.0281***	−3.99	−0.0207**	−2.24	−0.0338***	−3.12
TOTBATHS	0.0579***	5.86	0.0627***	5.45	0.0673***	4.75
CENTAC	0.1362***	4.89	0.1589***	4.85	0.1315***	4.36
FIREPL	0.0929***	9.36	0.1001***	8.55	0.0883***	6.29
GARAGE	0.0860***	8.24	0.0890***	7.20	0.0889***	6.37
CONDTN	−0.1824***	−3.89	−0.2559***	−3.61	−0.1810***	−2.99
FORCL	−0.6466***	−8.10	−1.8931	−4.61	−1.8383***	−4.88
SHORTSL	−0.1381***	−2.56	−0.2921***	−3.78	−0.1439*	−1.85
FEB	−0.0035	−0.19	−0.0009	−0.04	−0.0017	−0.06
MAR	−0.0023	−0.14	0.0101	0.40	−0.0031	−0.11
APR	0.0317*	1.65	0.0346	1.49	0.0490*	1.65
MAY	0.0244	1.40	0.0291*	1.39	0.0411	1.52
JUN	0.0256	1.50	0.0454**	2.14	0.0478*	1.83
JUL	0.0326*	1.92	0.0542**	2.57	0.0623**	2.41
AUG	0.0273	1.49	0.0480**	2.12	0.0505*	1.92
SEP	0.0177	0.97	0.0231**	0.99	0.0306	1.10
OCT	0.0412**	2.38	0.0565**	2.50	0.0557**	1.96
NOV	0.0324*	1.73	0.0406*	1.85	0.0360	1.31
DEC	0.0158	0.81	0.0212	0.86	0.0341	1.20
SLDYR05	0.0291**	2.08	0.0343*	1.88	0.0427*	1.88
SLDYR06	0.1187***	8.20	0.1240***	4.57	0.1485***	5.02
SLDYR07	0.2031***	15.82	0.2086***	8.30	0.2194***	7.34
SLDYR08	0.2294***	17.94	0.2195***	10.90	0.2069***	6.95
SLDYR09	0.2102***	16.27	0.2010***	8.14	0.2029***	6.09
SLDYR10	0.2119***	15.79	0.1897***	7.02	0.1924***	5.43
SLDYR11	0.1661***	12.83	0.1315***	5.91	0.1237***	3.88
SLDYR12	0.1887***	8.05	0.1456***	4.32	0.1527***	3.68
SLDTCASH	−0.0555***	−4.54	−0.0465***	−2.90	−0.0272*	−1.66
λ	–	–	–	–	−0.1366**	−2.17
Adjusted R^2	0.88		–		–	
F-Stat. (Model)	656.90***		–		–	
Location FE	13		13		13	
N	4308		4308		4308	

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

Table 9 Net selling price regressions with overpricing and foreclosure interactions dependent variable: Ln(Net selling price)

Variable	M1: LS fixed effects		M2: 2SLS fixed effects		M3: 2SLS FE sample sel.	
	Coeff.	T-Value	Coeff.	T-Value	Coeff.	T-Value
Constant	11.0321***	261.48	11.2615***	105.10	11.3967***	35.46
LDOM	–	–	–	–	−0.0207	−0.37
LDOM*FORCL	–	–	–	–	0.2212***	2.87
PRCCHG	−0.0127***	−15.90	−0.0339***	−4.71	−0.0348***	−4.31
PRCCHG*FORCL	−0.0068***	−3.44	−0.0247***	−3.67	−0.0176**	−2.06
OVRPRR	1.5977***	4.64	1.6682***	19.53	1.6787***	18.67
OVRPRR*FORCL	−0.9415***	−2.61	−1.0241***	−9.44	−1.1664***	−9.43
AGE	−0.0044***	−13.07	−0.0032***	−5.29	−0.0030***	−4.74
SQFT	0.3894***	43.60	0.3940***	35.20	0.3923***	33.48
BEDRMS	−0.0218***	−3.35	−0.0300**	−3.50	−0.0320***	−3.55
TOTBATHS	0.0439***	4.82	0.0449***	4.03	0.0468***	4.00
CENTAC	0.1302***	4.88	0.1061***	4.47	0.1088***	4.38
FIREPL	0.0937***	10.30	0.0794***	7.17	0.0768***	6.61
GARAGE	0.0898***	9.33	0.0814***	7.43	0.0794***	6.91
CONDTN	−0.2353***	−2.88	−0.1505***	−3.17	−0.1639***	−3.27
FORCL	−0.2391***	−10.69	0.0382	0.59	−1.0139***	−2.75
SHORTSL	−0.1274***	−3.00	−0.0165***	−0.27	−0.0114	−0.18
FEB	−0.0023	−0.14	−0.0045	−0.22	−0.0073	−0.34
MAR	0.0052	0.34	−0.0010	−0.05	−0.0026	−0.11
APR	0.0284	1.64	0.0434**	1.97	0.0416*	1.70
MAY	0.0268*	1.69	0.0280*	1.34	0.0256	1.15
JUN	0.0291*	1.91	0.0264	1.29	0.0240	1.11
JUL	0.0278*	1.78	0.0248**	1.22	0.0252	1.18
AUG	0.0308*	1.87	0.0326**	1.58	0.0286	1.32
SEP	0.0126	0.76	0.0163**	0.81	0.0079	0.34
OCT	0.0437***	2.80	0.0390*	1.92	0.0332	1.41
NOV	0.0311*	1.82	0.0238*	1.14	0.0203	0.90
DEC	0.0215	1.22	0.0237	1.12	0.0245	1.05
SLDYR05	0.0303**	2.19	0.0285	1.63	0.0274	1.46
SLDYR06	0.1200***	8.98	0.1171***	6.55	0.1105***	4.53
SLDYR07	0.1938***	15.62	0.1965***	11.81	0.1939***	7.86
SLDYR08	0.2242***	18.34	0.2246***	12.18	0.2124***	8.47
SLDYR09	0.1998***	16.33	0.2150***	11.65	0.2121***	7.69
SLDYR10	0.2075***	16.39	0.2214***	11.41	0.2160***	7.35
SLDYR11	0.1553***	12.76	0.1731***	8.37	0.1671***	6.25
SLDYR12	0.1545***	7.35	0.2001***	6.84	0.1928***	5.63
SLDTCASH	−0.0528***	−4.61	−0.0275**	−2.19	−0.0267**	−1.99
λ	–	–	−0.0644	−1.53	−0.0840	−1.51
Adjusted R^2	0.89		–		–	
F-Stat. (Model)	794.00***		–		–	
Location FE	13		13		13	
N	4308		4308		4308	

*Statistically significant at the 0.10 level

**Statistically significant at the 0.05 level

***Statistically significant at the 0.01 level

would not be accurate. This study investigates the determinants of listing prices changes, and also the effect of listing price changes on the net selling price using a 2SLS approach. In addition, it corrects for the possibility of a sample selection bias associated with listing price change properties. Perhaps the most noteworthy conclusion of this study is that a statistically significant effect of a downward listing price change on the price of residential property appears to persist even after correcting for the listing price change endogeneity and the sample selection bias associated with properties where the listing price has been changed. Therefore, the effect of listing prices on residential real estate selling prices appears to be influenced by both listing price change endogeneity and to a lesser extent on sample selection bias. Our findings of listing price changes are consistent with a signaling effect occurring when listing prices are changed. Properties with excessively high listing prices usually take longer to sell, and when sellers decide to decrease the listing price, a signal is sent that these sellers may be willing to drop their reservation prices.

A comparison of properties where the seller left the listing price unchanged with those that reduced the listing price offers some interesting insight into pricing. Properties where the sellers reduced the listing price have 18.0 % higher original listing prices compared to properties where the listing price is unchanged, and this narrows to 9.7 % higher when comparing the final listing prices, and 8.2 % higher in net selling prices. The average size house of the listing price decrease sample is also 10.3 % larger. Another measure of initial overpricing is the mean standardized residual from the overpricing regression. While the overall sample mean for the overpricing variable is at 0, the listing price decrease variable is positive while the listing price unchanged and listing price increased properties have negative means indicating the properties are as a whole not overpriced. This suggests that listing price changes appear to be most often driven by overpricing.

The decision to decrease listing price appears to be related to house size, the economic environment, and whether or not the property is a distressed sale. Listing price discounts occur more frequently for larger houses, perhaps because there may be fewer buyers and more latitude for the seller to decrease the price. Decreased listing prices are also less likely to occur in stronger economic times such as 2005–06, and more likely to occur during and after a housing market debacle such as 2008–09. Properties that are vacant are more likely to have the listing priced reduced than those that are occupied. Brokerage characteristics can matter as well, as sellers who pay higher transaction costs (commissions) and where the listing agent also ultimately sells the property have a lower probability of lowering the listing price.

Focusing on the sample of properties where the listing price was reduced, house size is strongly positively related to the percent listing price reduction. Also, the listing price reduction is higher during poor economic conditions and when properties are vacant. Properties that have amenities such as central air conditioning, a fireplace and garage have lower listing price reductions, while properties that are older and those in poor condition show a higher listing price reduction.

The effect of discounting the listing price on the net selling price indicates that treating a listing price change incorrectly as an endogenous variable underestimates the impact of a listing price change. For example, a one percentage point change in the listing price reduces the net selling price by 1.16 % in the OLS equation; this compares to a statistically significant 2.03 % estimated reduction using a 2SLS exogenous listing price and an additional 2.75 % for foreclosure properties. With the addition of DOM into the net selling price regression, however, the 2SLS analysis shows that once DOM is held constant the effect of a 1 % reduction in the listing price decreases the net selling price by 3 % with no statistically different effect for foreclosure properties. Therefore, the seller that wants to maintain the same time on the market should expect a lower net selling price when discounting the listing price. If non-distressed and foreclosure properties are assumed to have different DOM profiles, and the mean DOMs for each sample suggests this may be the case, the effect of a one percentage point listing price discount is −1.9 % on the net selling price with no statistically different effect for foreclosure properties. If overpricing is directly included in the net selling price model, the effect of the listing price discount is −3.5 % and an additional −1.8 % for foreclosure properties.

The practical implications of the regression analysis are evident when applying particular descriptive statistics in Table 2 to the regression coefficients in Table 6. The average percentage reduction in the listing price is 7.45 % based on the original listing price. If this percentage reduction flowed through to the net selling price, the seller would have a loss of $11,871. Using least squares fixed effects (M1) the estimated loss would be $13,770 or a difference of $1990 compared to the mean percentage reduction.[22] Without controlling for DOM (model M3 in Table 6), the net effect of a listing price change would be $24,098. But including days on the market in the analysis, the 2SLS findings for M3 in Table 7 indicate that the estimated loss would be $35,376, or $23,505 more than applying the mean percentage reduction at 7.45 %. If the DOM profiles for foreclosure and non-distressed properties are assumed to be different, and there is evidence that this may be the case, the effect at the mean percentage reduction would be $22,911 or $11,040 more than the mean reduction at 7.45 %. In general, the findings indicate that the effect of given listing price discount translates to twice to three times the impact on the net selling price.

Therefore, an important conclusion from this study is that to accurately measure the effect of a listing price change on the net selling price, it is essential to consider the listing price change as an exogenous variable, and also, to incorporate a sample selection methodology. In summary, applying this methodology, the effect of a listing price reduction on the net selling price is statistically significant, whether or not DOM is included in the analysis.

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[22] The estimated loss is determined by multiplying the mean percentage change in the listing price (7.45 %) by the M1 coefficient in Table 6 (1.16 %) as the estimated effect on the net selling price is 1.16 % for each percentage reduction in the listing price. Therefore, the estimated loss based on the mean net selling price is y = $159,344 × (7.45 % × 1.16), and y = $13,771 compared to a loss of $11,871 at the 7.45 % average.

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