Pricing in an Illiquid Real Estate Market

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Abstract

Using a repeat sales data set, this paper tests whether a single small seller can influence the selling price of their house. We find that this influence exists and, since the estimated magnitude of the effect is larger than expected, we verify the estimate using several supplementary tests.

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Analyses of real estate markets suffer from a kind of split personality. Despite the usefulness of the perfectly competitive model, many features of a real estate market do not fulfill the textbook ideals of perfect information and price-taking behavior. Recent research on these market imperfections has tended to focus on trying to explain the determinants of time-on-market (TOM),[1] especially determinants such as the list price which a seller can influence. While the time dimension of the market process is important, it is only one aspect of a supposed trade off between time and money. This paper complements existing papers by investigating the link between the variation in list price to variation in the selling price.

Theories which seek to explain the decision to overprice or underprice a property, relative to the market price, usually depend on hard-to-measure details. The simplest ideas have evolved into professional rules of thumb or norms which are convenient for marketing purposes but are descriptive: they do not explain why a buyer should attach any importance to any price published before sale because everybody knows that the selling price will be negotiated. Behavioral theories based on reference points and discounts (e.g. Genesove and Mayer 2001) may provide the beginnings of an explanation but do not predict a unique market equilibrium. Theories with stronger game-theoretic foundations (Chen and Rosenthal, 1996; Yavas and Yang, 1995) make sure that a list price has a real effect but the effect is based on an assumption that is approximately true but routinely violated (including in our data): that the list price is assumed to be an upper bound on the selling price.

A few papers have focussed bargaining in a real estate market. The first was Turnbull and Sirmans (1993) who argued that buyers who move from one city to another and buyers who have little experience have an observably weak bargaining position; if it were possible to extract surplus through bargaining, they would be the most likely victims. Turnbull and Sirmans could not reject the hypothesis that bargaining had no effect. Lambson McQueen and Slade (2004) repeated the study with a larger data set and found a statistically and economically significant

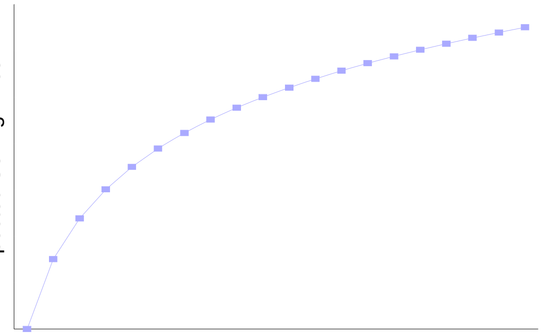
[1] Many other authors have written about the determinants of time-on-market, including but not limited to, Trippi (1977), Miller (1978), Kluger and Miller (1990), Kalra and Chan (1994), Yavas and Yang (1995), Forgey, Rutherford and Springer (1996), Genesove and Mayer (1996), Genesove and Mayer (2001). Papers which specifically focus on ideas such as the Degree of Over-Pricing include Glower, Hendershott and Haurin (1998) and Anglin, Rutherford and Springer (2003).

effect. These papers studied differences in bargaining *position* while bargaining *power* is a separate dimension of the bargaining process that is less well-understood; Harding, Sirmans and Rosenthal (2003) used an ingenious decomposition to find out how bargaining power varied with the characteristics of buyers and sellers. While most analyses focus on sellers, Londerville (1998) studied how buyers can take advantage of a seller with a weak position. And none of these papers investigated the impact of tactics used by a seller during the matching process.

The fundamental barrier to measuring the link between list price and selling price in a market with goods as heterogeneous as housing is that the selling price is influenced by many forces other than bargaining, such as the lot size or neighbourhood amenities, which are not always measured with great precision. Heterogeneity presents a challenge to this research and explains why previous attempts to measure the effects of bargaining in a real estate market have tended to use specialized data sets. We overcome this limitation by proposing a kind of difference-in-differences estimator. By using data on houses that were sold twice and a model which results in a remarkably simple regression equation, we are able to study whether a difference in list price causes a difference in the selling price. We find that over-pricing, to be defined more precisely below, by one percentage point is related to a change in the selling price of about one percent, ceteris paribus. We also find that various common indicators of market conditions, such as interest rates and a measure of excess demand, add surprisingly little explanatory power. These findings are confirmed using a variety of approaches and its robustness is investigated by subdividing the data in several different ways. The concluding section offers some thoughts on what our analysis reveals about several classic questions.

A Simple Model

The process of selling a house has been discussed in detail in many of the papers cited in footnote 1. Briefly, when deciding to try to sell a house, a seller faces a trade off between price and TOM. That trade off depends on the behaviour of a flow of buyers. A lower list price encourages more potential buyers to look at the house sooner, since buyers do not want to buy "over-priced" houses, but a seller may be willing to set a higher list price to ensure that a tough bargaining strategy is more credible and produces a higher selling price on average. Within the



constraints of this “budget set” created by buyer behaviour, shown in Figure 1, the preferences of an individual seller determines a list price with consequences for the expected TOM and for the expected selling price. Eventually, one buyer bids a high enough price that the seller accepts, or the seller gives up and leaves the active market.

More formally, consider a seller (described by the seller’s cost of time z) of a house (described by X). A seller prefers to sell quickly at a high price, which we formally specify by assuming that a seller wishes to maximize

$$W(p^L, X)= E(p^S; p^L, X)- z\, E(TOM; p^L, X). \qquad (1)$$

where $E(. ; p^L, X)$ refers to the expectation at time 0 for a house described by X with a list price of p^L. Without loss of generality, we assume that houses are ranked so that higher X is preferred by all consumers: $\partial E(p^S; p^L, X)/\partial X> 0$. Given X, the optimal list price satisfies

$$\partial W/\partial p^L= \partial E(p^S; p^L, X)/\partial p^L- z\, \partial E(TOM; p^L, X)/\partial p^L= 0. \qquad (2)$$

Thus, $\partial E(p^S; p^L, X)/\partial p^L> 0$ only if $\partial E(TOM; p^L, X)/\partial p^L > 0$: if a seller *can* increase p^L then rationality implies that they *would* raise p^L only if the cost of the extra time on market is balanced by an associated benefit in terms of a higher selling price. In other words, this paper emphasizes the vertical axis in Figure 1 where the papers cited in footnote 1 have emphasized the horizontal axis. Assuming that the second order condition is satisfied, equation (2) implies that there is a one-to-one relationship between the seller’s type z and their decision p^L, given X.

The link between the type of house, X, and p^L, given z, is more complex because the trade off inherent in the decision can change with X. Computing a total derivative shows that

$dp^L/dX > 0$ if and only if $\partial^2 E(p^s; p^L, X)/\partial p^L \partial X > z\, \partial^2 E(TOM; p^L, X)/\partial p^L \partial X$. It might be interesting to formally prove whether a change in the type of house change the list price and selling price equally, $dE(p^s)/dX = dp^L/dX$, or whether it would change the prices proportionately, $(dE(p^s)/dX)/E(p^s) = (dp^L/dX)/p^L$, to maintain a constant average discount. But, because the trade off can change with X, resolving this question in theory depends on equilibrium conditions to determine how buyers sort themselves across different types of buyers.

This model[2] has the advantage of emphasizing the testable link between list price and selling price while ignoring many of the details of the bargaining process. The details are interesting and could be used to refine our conclusions, but our data does not allow us to investigate such questions.

Proposed Estimation Methodology

While this simple model fits with intuition, the analysis must distinguish overpricing due to a seller's bargaining strategy from a change in list price due to a change in the type of house. This issue is serious because most of the variation in the list price across sellers could be due to differences in the types of houses. When the trade off between TOM and selling price is mediated by a Degree of Over-Pricing, DOP, two steps are needed to estimate the determinants of the selling price. The first step derives an estimate of DOP, from the buyer's perspective, from an announced list price for a house described by X, listed at time LT with market conditions characterized by M. The second step uses this estimate to find the effect of list price on selling price using a kind of difference-in-differences estimator.

More specifically, we assume that

$$E(\log(p^L)) = X\alpha^L + M\beta^L + g_1(LT) \quad (1)$$

where α^L and β^L are coefficients to be estimated. $g_1(.)$ represents the effects of general inflation and is described more precisely below. When a buyer learns that the list price of a specific house

[2] This simple model can be extended in several other ways if relevant data were available. For example, if each seller were assumed to have a reservation value, W_0, below which they would never sell, then this model could be used to investigate how long a seller remains in the market. For bargaining purposes, this outside option has no

is p^L, they can infer the seller's choice of DOP as the difference from what an average seller is asking:

$$DOP = \log(p^L) - E(\log(p^L); X, M, LT) \quad (2)$$
$$= \log(p^L) - (X\alpha^L + M\beta^L + g_1(LT)).$$

This procedure is consistent with a semi-log specification of the price functions.

Under ideal conditions, DOP could be used as a regressor in a semi-log specification of the selling price equation, such as

$$E(\log(p^S)) = X\,\alpha^S + M\,\beta^S + g_2(ST) + \delta\,DOP \quad (3)$$

ST represents the time of sale and $g_2(.)$ represents the effects of inflation and other general trends in prices over time. If a seller cannot influence the selling price then $\delta = 0$. Unfortunately, conditions are rarely ideal and it is common for some variables describing a house to be omitted from a dataset. These omissions imply that it is unwise to use the residual from an equation explaining list price to explain the selling price.

To avoid this problem, we use a repeat sales data set and focus on what causes a difference in selling prices for the same house. If X does not change between the first and second sale then equation (3) implies the difference in the expected log of selling prices is

$$E(\log(p^S{}_2/p^S{}_1)) = E(\log(p^S{}_2)) - E(\log(p^S{}_1))$$
$$= (M_2 - M_1)\beta^S + g_4(ST_1, ST_2) + \delta\,(DOP_2 - DOP_1) \quad (4)$$

while equation (1) implies that

$$E(\log(p^L{}_2/p^L{}_1)) = (M_2 - M_1)\beta^L + g_3(LT_1, LT_2) \quad (5)$$

where subscripts 1 and 2 denote the first and second sale of the house. $g_3(.)$ and $g_4(.)$ summarize the effects of general inflation. We let DDOP represent the residual generated by equation (5) to see whether a change in difference in DOP between sales changes the difference in the selling prices. By construction, DDOP would equal (DOP_2- DOP_1) if equation (2) were used to estimate DOP_1 and DOP_2 separately. Constructing DDOP in this way also implies that DDOP is orthogonal to the other regressors, including those representing the passage of time. Pagan

effect on the negotiations between a buyer and active seller because an active seller would not take this weaker option.

(1984) argued that using Ordinary Least Squares to estimate a system like equations (4) and (5) would estimate (β^L, β^S, δ) efficiently. The difference-in-differences approach emphasizes the contribution of difference in list prices while limiting the impact of the amenities in the house.[3]

We can reduce this two step process to a single equation, and almost one coefficient to be estimated, if we add some maintained assumptions. Combining equations (2) and (3) implies that

$$E(\log(p^S))= X(\alpha^S- \delta\alpha^L)+ M(\beta^S- \delta\beta^L) + g_2(ST)- \delta\, g_1(LT)+ \delta \log(p^L) \qquad (6)$$

In an market-clearing equilibrium model, the only relevant condition on the market price is that quantity supplied equals quantity demanded and indicators of market conditions other than the general level of prices should be irrelevant: $\beta^L= \beta^S= 0$. If we further assume[4] that the differences between LT_1 and ST_1, and LT_2 and ST_2, are inconsequential, compared to the difference between ST_1 and ST_2, and that the level of list prices changes at the same rate as the level of selling prices (i.e. $g_1(.)= g_2(.)$) then the two stages can combined algebraically into a single regression:

$$E(\log(p^S{}_2/p^S{}_1))= (1- \delta)\, g_4(ST_1, ST_2)+ \delta \log(p^L{}_2/p^L{}_1). \qquad (7)$$

Equation (7) is so simple that it even omits an intercept.

Description of Variables and Results

We use data on houses that were sold in Windsor Ontario Canada. Each house sold during 1999 was investigated to see if the house had also been sold through the local real estate board between 1990 and 1999. The records were also investigated to select only those houses for which there was no evidence of a major renovation between the sales. If so, the two sales were matched.[5] Table 1 summarizes the 621 observations used in our study. On average, four years elapsed between the sales with the earliest sale being 9 years prior. The data were supplied by the Windsor and Essex County Real Estate Board and is supplemented with data from government statistical bureaus. The data set is limited because it does not include a complete

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[3] Traditionally, applying the differences-in-differences methodology divides the sample into a treatment and a control subsample. In this case the "treatment" is a continuous variable.

[4] This assumption can be justified by either of two arguments that apply to many data sets including ours: if the rate of increase in prices is low or if average time on market (approximately two or three months) for one sale is much smaller than the time between sales (approximately four years, and longer in many cases).

[5] One observation was excluded because of what appears to be a coding error.

description of each house.

Table 1: Descriptive Statistics

Variable	Mean	Std. Deviation
Selling Price #1	112924	41923
Selling Price #2	118785	43237
List Price #1	122671	44258
List Price #2	127898	45880
Time Difference (in days)	1319	684
Market Conditions during the first sale		
FXR (Cdn/US Exchange Rate)	1.37	0.07
UR (Local Unemployment Rate)	9.08	1.53
SALES (#/Month)	424.16	80.73
BALANCE	0.52	0.09
REAL5 (5-year mortgage interest rate minus inflation rate during the preceding year)	6.88	1.60
Generated Regressor		
DDOP	0.00	0.12

We consider three indicators of general economic conditions and two internal indicators of activity in the local housing market.[6] BALANCE measures the balance between entry and exit as the ratio of the number of sales to the number of new listings in a month.[7] BALANCE is often used as a proxy measure of excess demand. As discussed above, our regressions use the *difference* between the values of these variables on the first and second sale.

In 1999, the houses sold at an average discount of 4.5 percent from their list price. The selling price exceeded the list price in 2.2 percent of the cases and the selling price was 10 percent or more below the list price in 2.5 percent of cases. For the first sale, the average discount was similar (5.7 percent) but the distribution was more diffuse: 6.7 percent of cases sold for more than list and 9.7 percent of cases sold at a discount of more than 10 percent. Thus, there is little support for a hypothesis claiming that the list price is chosen as a fixed percentage mark-up over a market price or that the selling price is lower than the list price by a fixed discount factor: differences in the bargaining outcome across buyer-seller pairs are apparent.

To control for general price trends, we use a flexible functional form to represent the passage of time. Information on the dates of the first and second sale are used to compute τ_{ti}, the

[6] Including the Canada-US exchange rate in a study of a housing market may seem odd to but this measure was suggested by informed real estate professionals.

fraction of year t_i that a house was owned by the first buyer and second seller.[8] More precisely, let

$$g_4(ST_{1i}, ST_{2i}) = \sum_t \alpha_t \tau_{ti}.$$

From this expression, α_t represents the estimated rate of increase in price during year t. It is assumed to be fixed for a given year but allowed to vary between years. We use a similar expression for $g_3(.)$. Because of the relatively small sample for the years preceding 1993, we assume that the estimated growth rate of prices is constant between 1990 and 1992.

Table 2 reports the estimated coefficients for equations (4) and (5). The low R^2 in the left hand regression indicates that most of the variation in $\log(p^L{}_2/p^L{}_1)$ is not explained by changes in general conditions, such as inflation; it is idiosyncratic to the seller. The coefficient on DDOP in the right hand regression, i.e. δ, is significantly different from 0 and strongly supports the hypothesis that a seller can influence the selling price of their house.

[7] Some readers may be surprised that the average value of BALANCE is so much less than 1.0: that many of the houses offered for sale do not sell during the listing period. This kind of behavior is seen in many cities.

[8] Summary statistics on these regressors are

	Mean	Std. Deviation
τ_{93}	0.19	0.67
τ_{94}	0.22	0.37
τ_{95}	0.39	0.45
τ_{96}	0.62	0.44
τ_{97}	0.80	0.36
τ_{98}	0.92	0.24
τ_{99}	0.47	0.26

Table 2: List Price and Selling Price Functions

Dependent Variables: $\log(p^L{}_2/p^L{}_1)$ and $\log(p^S{}_2/p^S{}_1)$

	List Price		Selling Price	
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	0.07	3.13	0.09	9.83
τ93	0.01	0.45	-0.01	-1.02
τ94	0.02	0.63	0.01	0.87
τ95	0.01	0.25	0.01	1.09
τ96	0.01	0.51	0.01	0.60
τ97	-0.01	-0.17	-0.01	-0.51
τ98	-0.03	-0.86	-0.07	-4.65
τ99	-0.03	-1.15	-0.02	-2.00
Diff. between FXR	0.12	0.59	0.33	4.00
Diff. between UR	-0.01	-1.93	-0.01	-5.44
Diff. between REAL5	-0.00	-0.25	0.00	1.57
Diff. between SALES	-0.00	-1.47	-0.00	-1.69
Diff. between BALANCE	0.06	1.23	0.05	2.56
DDOP	--	--	0.98	58.43
N. Obs		621		621
R^2		0.073		0.861

For most years, the estimated house price inflation rate is low, roughly equal to the general inflation rate and roughly equal in the two regressions. Only the unemployment rate has a significant effect on the list price but many indicators affect the selling price. A positive coefficient indicates that an increase in the relevant variable increases the second selling price relative to the first: e.g. a higher local unemployment rate during the second sale is predicted to decrease the selling price and a move toward a seller's market (i.e. an increase in DBALANCE) is predicted to increase the selling price. Even so, indicators of market conditions explain little of the variation in the dependent variables: If the indicators are omitted, the R^2 of the two equations falls slightly from 0.073 to 0.063 and from 0.861 to 0.858.

Verifying the analysis

The analysis is based on a simple data set. While it is similar to many other data sets because it omits variables, a reader might worry that the results were biased by one or more of the omissions. Or the coefficient may be so unstable that it varies by location within the city or that it varies over time. This section considered several different tests to confirm. We show that the magnitude of the key coefficient is remarkably stable.

Location

To verify that the previous analysis, we repeated it by dividing the city into 9 different areas. With the exception of one area, the lowest estimate of δ was 0.892 and the highest estimate was 1.151. The estimate for the exceptional area was less than 0.58 but this estimate appears to be sensitive to an outlier, since the estimate rose to 0.75 after excluding one observation, whose DDOP was more than three standard deviations away from the mean.

Time

The issue of variation over time is significant because, even though the estimate reported in Table 2 allowed for time trends and for time-varying indicators of market conditions, the coefficient might be contaminated by inaccurate treatment of a time-varying characteristic. A simple argument might be that any correlation between $\log(p^S{}_2/p^S{}_1)$ and $\log(p^L{}_2/p^L{}_1)$ is spurious, regardless of our intentions to include only those houses with no renovations between the first and second sale, because of some undetected renovations of the houses or some changes in neighbourhood characteristics over time. Spurious correlation between the list price and the selling price may be created by general inflation but it should be a minor issue since the inflation was relatively low during the time period used in this study.

Bourassa, Haurin, Haurin, Hoesli and Sun (2009) studied whether the prices of different types of houses appreciate at different rates within a single city. They suggest three reasons and find evidence to support all three. These reasons are not relevant to our study because the average *nominal* price of a house in the city rose at about the rate of consumer price inflation, 28 percent in the 9 years covered by our data, compared to their data in which the average *real* house price increased by as much as 50 percent over 7 years.[9]

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[9] More precisely, suppose that equation (3) above is modified to allow for an interaction terms which shows how the value of a house's amenities varies with market conditions:

$$E(\log(p_i{}^S)) = X_i\, \alpha^S + M_{ST}\, \beta^S + g_2(ST) + \delta\, DOP + X_i\, M_{ST}\, \gamma^S$$

where the subscripts have been added for clarity. If a similar expression is also used for the list price then DDOP can again be estimated as a residual but the coefficient on this estimate reported in Table 2 might be contaminated by omitted variable bias (specifically $X_i\,(M_{ST2} - M_{ST1})$ would be omitted). Limitations in our data set do not allow us to investigate this question directly but we think that this issue is minor for two reasons. First, in our case, we have already noted that the indicators appear to be less important than general inflation and, regardless of the coefficient estimates, contribute little to the overall goodness of fit in the regression. Second, even if an interaction term affects a selling price significantly, the level of an indicator is not important for our analysis. The fact that our

A more complex argument might be based on the argument, made by Clapp and Giacotto (1992, p. 302) and others, that analysis based on repeat sales data sets is biased by the fact that certain types of houses are more likely to be sold twice within a given period of time. If a house is sold frequently because it is a "lemon", then any signalling activities involving the list price could be important but these activities should not differ systematically between the first and second sales. If selection is caused by one segment of the market being more liquid than others, then any estimate of the impact of bargaining in that segment should underestimate its impact for a typical house. If all segments of the market are perfectly competitive then $\delta = 0$ and the process of selection should not bias the focus of our test.

To investigate these issues further, we divided the observations into subsets according to the date of the first sale. Analysing data with a common year of first sale emphasizes the cross-sectional variation and the final row in this table shows that variation in the independent variable is large relative to the estimated local house price inflation rates shown in Table 2. Since our use of annual subsamples implies that any difference in market conditions between the sample year and year of the second sale (1999) will be roughly constant within a subsample, we regress $\log(p^S_1/p^S_2)$ on only $\log(p^L_1/p^L_2)$ and a constant.

Table 3 uses data from the four years having relatively large numbers of observations. The estimates of δ and R^2 are comparable to what was reported in Table 2. Further, no time trend is apparent in these estimate of δ, the variance of DDOP varies little over the years and inspecting the data shows that the distribution of DDOP is not bimodal. These facts are relevant because, if there had been undetected renovations, the probability of occurrence would increase with the time between the first and second sale.

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analysis focuses on differences in selling prices implies that the degree of omitted variable bias in the regression depends on the correlation between the included variables and the *difference* in market conditions between the first and second sale. Table 3 shows that grouping the data by common years of sale has little qualitative effect on the coefficient of interest.

Table 3: Variation amongst Houses Sold during the Same Year

Sample Year (prior to 1999)	2 years prior		3 years prior		4 years prior		5 years prior	
μ	0.002	(0.4)	0.015	(3.2)	0.016	(3.5)	0.007	(1.3)
δ	1.129	(27.1)	0.948	(25.4)	0.950	(25.0)	1.023	(27.7)
R^2	0.882		0.831		0.839		0.873	
N. Obs.	100		133		122		113	
St. Dev. of $\log(p^L{}_2/p^L{}_1)$	0.113		0.107		0.103		0.103	

Price Range

To study the issue raised by Clapp and Giacotto further, we isolated the high-value houses (in this case, houses with a list price above $130,000 in 1999). These houses represent about one-third of the sample. Using the same two-step procedure as above, we found that the estimated value of δ was 0.87 and that it was significantly different from 0. We conclude that segmentation has little effect on the link between over-pricing and selling price.

Single Equation Estimator

Finally, we estimated equation (7). The left hand pair of columns in Table 3 confirms the findings of Table 2. As expected, the coefficient on $\log(p^L{}_2/p^L{}_1)$ differs from 0 and is close to 1. This analysis has an unexpected complementary result that reinforces the confidence in the estimate: the other coefficients are statistically and economically close to zero, as would be expected if δ were close to 1.

Table 4: Evidence for Rejecting Price-taking Behaviour

Dependent Variable: $\log(p^S{}_2/p^S{}_1)$

	Coefficient	t-statistic	Coefficient	t-statistic
τ93	0.0014	0.40	0.0125	1.3
τ94	-0.0007	-0.07	0.0563	2.1
τ95	0.0062	0.62	0.0151	0.6
τ96	-0.0035	-0.38	-0.0030	-0.1
τ97	0.0073	0.66	0.0137	0.5
τ98	0.0041	0.46	-0.0272	-0.9
τ99	0.0030	0.40	-0.0105	-0.5
$\log(p^L{}_2/p^L{}_1)$	0.987	59.14	--	--
Constant	--	--	0.0882	4.0
N. Obs		621		621
R^2		0.858		0.063

Though this regression should not be regarded as a strong test of the value of δ, because the regression equation is justified by numerous assumptions that are not tested directly, the *difference* in R^2 between the regressions reported on the left and right hand sides of this table shows that including $\log(p^L_2/p^L_1)$ adds substantial explanatory power. Multicollinearity amongst the regressors in the left hand columns is not an issue since the R^2 of the left hand equation reported in Table 2, which involves all of these variables and more, is less than 0.1.

Implications

Our research implies that a single seller can raise or lower the price of their house relative to competing sellers. Using a kind of difference-in-differences methodology, we found that an increase in the Degree of Over-Pricing by one percentage point increased the selling price by about one percent. Since Table 2 includes variables which control for local market conditions and the general rate of inflation and since the data set includes only houses with little or no renovation between sales, the only remaining difference between the two sales of each house should be the identity of the seller. Our conclusion is confirmed by estimating the relationship using various partitions of the data and in different ways.

Evidence that a seller can raise their own selling price does not prove that a seller benefits by raising their list price in this or any other market. As noted in footnote 1 and as illustrated in Figure 1, a seller must trade off the advantages of a higher selling price against the disadvantages of a longer TOM and the possibility of not selling to any buyer. And, to make their list price credible, sellers must bargain wisely with a willing buyer to achieve a selling price that is acceptable to both the buyer and the seller. These concerns can be economically significant since Anglin (1994) reported that 30 to 50 percent of negotiations ended without a transaction and Anglin, Rutherford and Springer (2003) noted that about 40 percent of house listings ended without a sale.

The *difference* in R^2 between the two regressions reported in Table 4 shows that including some information on the list price adds substantial explanatory power. The analysis uses ordinary least squares even though the logic used to derive the key equation suggests that the distribution of errors may be more complex than is usually assumed. Regardless of any inefficiency in the estimators, the large t-statistics on δ reported here suggest that our conclusion is unlikely to be reversed. Another potential weakness of this analysis is that it relies on a common approximation to produce a simple regression equation. The nature of the approximation does not restrict the effects of omitted variables, since the number of variables used as X in equation (1) is unrestricted, but future research may refine this analysis by studying whether the Degree of Over-Pricing varies with market conditions or the type of house.

Though we estimate a link between the selling price and the list price, a formal test of behaviour, optimizing or otherwise, requires a data set which includes information on both aspects of the trade off. A more direct test of this hypothesis would be to combine a study of bargaining or pricing behavior with a study of TOM to test whether a seller is passing up better opportunities. Unfortunately, this kind of test would also require an econometric methodology which combines the two dimensions of the selling process shown in Figure 1 at the same time as it separates the omitted variable problem from the bargaining problem. The simpler method proposed in this paper has the advantage that it can be repeated with commonly available data sets.

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