List Price Information in Residential Appraisal and Underwriting

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Abstract. **This article examines the usefulness of listing prices as leading indicators of house values and as predictors of the direction of housing markets. With Multiple Listing Service data from a large metropolitan area, we create two price indexes, using first listing price and then selling price as the dependent variable in the hedonic regressions. The market is then geographically and categorically segmented, and Granger causality tests are performed to analyze the leading aspect of list prices in the list price-sales price relationship. We find that different segments of the market perform quite differently over the time period of our study, suggesting that for data-based appraisal purposes care is needed in determining the manner and level of aggregation. We also find, however, that market list prices continue to convey important information about subsequent selling prices in most market segments.**

Introduction

The listing price is the starting point of the home selling process. As the initial signal of home value it performs an important market function from the perspective of both seller and buyer. For the seller, the listing price provides an upper bound for expected offers and eventual selling price in normal markets. Viewed together with house amenities, the list price may also help identify a ‘‘motivated’’ seller. For prospective buyers, the listing price is invariably a key parameter for selecting homes to include in a search, and it strongly influences the buyer’s initial offer and ultimate purchase price. Inasmuch as many current housing markets are characterized by prices that fall as well as rise, listing price may assume increased importance in signaling house values. Because listing chronologically precedes home sales, trends in list prices in a market may indeed be precursors of trends in selling prices in the same market. This notion no doubt influenced the Federal National Mortgage Association (Fannie Mae) proposal to include an analysis of listing prices of comparable unsold homes on the Uniform Residential Appraisal Report (URAR). If listing prices inform subsequent selling prices in a market, the information can be incorporated in the underwriting process, reducing the default risk associated with lending in volatile housing markets.

At the individual house level the information content of listing price as well as the relationship in time to selling price are quite clear. Likewise the potential contribution

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of list prices of comparables to the appraiser's estimate of the subject property's market value is undeniable. But just at a time when the potential usefulness of listing price in the appraisal process is growing with the greater temporal variability in house prices, the importance of the traditional appraisal approach for residential properties is waning, giving way to computer-driven sales comparisons that can greatly expedite the property qualification aspect of loan origination and underwriting.

In a data-based approach, appraisal is accomplished by using historical transaction information for houses in the same market to infer a value for the house in question, but users of this method face an unavoidable trade-off. On the one hand, using as many transactions as possible generally improves the statistical properties of the estimates. On the other hand, using a large number of transactions involves aggregating data both cross-sectionally and longitudinally, over submarkets that may have very different price paths. The listing price-selling price connection is clearly useful for traditional residential appraisals that use near-neighbors in location, time and amenities, but the predictive quality of listing prices for the data-based approach hinges on the suitability of the data for aggregation.

Therefore, the movement toward data-based value determinations raises the important question of what constitutes a market, and makes it important to understand the relationship of listing price to selling price at the aggregate level. This relationship has received very little academic attention. Previous research has focused primarily on the role of the listing price at the individual house level. This article, by contrast, examines the relationship of market listing prices and market selling prices and investigates the relationship within a variety of definitions of the market. Submarkets are defined by location, house size and dwelling age to determine the extent to which aggregation within a category affects the listing price-selling price connection. We find that while categorical subsets of the data produce very different price paths, the listing price-selling price relationship remains relatively stable. Submarket listing prices lead selling prices in the same submarkets. Moreover, listing prices taken from the market as a whole lead selling prices in many of the submarkets. This suggests that the predictive usefulness of listing prices may not be limited to traditional point-in-time, point-in-space appraisals, but rather may extend to the increasingly prevalent data-based appraisals.

The article is organized as follows. In the next section we discuss the role of the listing price in the home selling process, reviewing the theory and empirical evidence at the individual-house and market levels. A search and negotiation process characterizes the listing-selling price relationship for the single home, but the connection at the market level is described within the context of market efficiency. Section three presents our hedonic model of housing values that serves as the basis for a time series of constant quality list prices and sales prices. This section also explains our segmentation of the sample by location and category. Section four describes the Granger causality tests that are employed to analyze the correlation over time between listing price and selling price. The effects of data disaggregation on this relationship are discussed with the results in section five. Finally, in section six, we conclude with the implications of our study on the use of listing price as an element of a data-based model of current house value.

List and Sales Prices

The role of listing price in the home selling process has received considerable attention in the real estate literature. A common thread running through this literature is that list price must be serving as sellers' signals to potential buyers regarding their reservation prices. Perhaps not surprisingly, the precise nature of the signaling device varies from article to article. Belkin, Hempel and McLeavey (1976), in one of the earliest studies, recognize the intuitive conflict between maximizing the selling price and minimizing the time needed to attract a willing buyer. Their interest is in the connection between list price, time-on-the-market and eventual selling price as it applies to individual homes, and in how the relationship changes over various segments of the market.

Buyer and Seller Behavior

More recently, research has been directed at the process itself, examining the role of the list price from the separate points of view of buyers and sellers. Chinloy (1980) and Yavas and Yang (1995), for example, assume that list price provides a perfect signal of seller intent. Chinloy assumes that list price is proportional to selling price, while Yavas and Yang assume an exogenous nonstochastic function describing list price signaling and translating list prices into the set of seller reservation prices. The list price is similar in both models in that it provides a noiseless signal; buyers know with certainty a seller's intent as soon as they observe the listing price.

Other articles assign a more direct role for the signaling function of list price, emphasizing list price as an imperfect rather than perfect signal of seller intent. Horowitz (1986) ignores the search aspect of the house purchase process to concentrate on buyer bid behavior. In his model, buyers observe list prices that are assumed to provide exogenous noisy signals about sellers' reservation prices. A higher list price signals to the potential buyer a lower probability of a given bid's being accepted. Buyers set their bids taking into account the stochastic (from the buyer perspective) response of sellers, using the list price as a signal.

Horowitz (1992) later addresses the opposite side of the market, examining sellers' list prices behavior when buyer bid responses to list prices are given by an exogenous buyer reaction function. The seller's list price balances two competing effects on expected sales price. First, because buyers know that any bid equal to list price will be accepted, the buyer reaction function assumes that a lower list price truncates the upper end of the distribution of potential bids. A lower list price therefore reduces expected sales price through this channel. At the same time, though, because buyers know that a lower list price signals that the seller might accept a lower price, the buyer reaction function assumes that a lower list price increases the number of buyers interested in the house, that is, a lower list price increases the probability that a bid will be forthcoming. A lower list price increases the probability of sale, increasing expected sales price through this channel.

Empirically, the foregoing studies employ aggregate data to study the relationship of list price and selling price for the single home. Not surprisingly, at the level of the individual house, listing price is a powerful predictor of selling price. Horowitz (1992), for example, finds that predicted sale price conditional on list price and amenity variables is considerably more accurate than predictions based on the amenity variables alone.[1] The time period of interest in these foregoing studies is the time elapsing from a home's listing to that same home's sale. While the studies cover time periods of various lengths, they are essentially cross-sectional in nature.

The time-series behavior of listing and selling price at the market level is virtually unexplored in either a theoretical or an empirical context. Knight, Sirmans and Turnbull (1994) provide some preliminary evidence that list price leads selling price at that level of aggregation, but their theoretical discussion focuses primarily on the search and selection behavior of individual buyers in the market.

Market List Price and Market Selling Price

When the behaviors of individual buyers and sellers in a housing market are aggregated over a length of time, such that listing and selling prices are seen not as the price of an individual house, but rather as market prices, the leading or predictive character of list price *vis-à-vis* sale price is no longer so strong or obvious. In fact, at the market level, intuitive arguments can be made for each of three possible relationships for listing and selling price: (1) there is no consistent leading or lagging relationship between listing and selling prices; (2) market list price leads market selling price; or (3) market selling price leads market list price.

If housing markets are efficient, then the information imbedded in the listing prices of homes for sale at any point in time will be instantaneously reflected in homes transacting at that same point in time. That is, listing prices and selling prices will react simultaneously to market realities. If this is the case, the past price histories of listing and selling prices cannot be exploited to predict future price paths. The argument for housing market efficiency supports the first hypothesized relationship described above.

Recently, single-family housing markets have become the subject of tests for market efficiency (Case and Shiller, 1989; and Gatzlaff, 1994). The consensus that appears to be emerging from the literature to date, as reported by Gatzlaff and Tirtiroglu (1995),[2] is that short-run returns in many housing markets display positive autocorrelation but that the inefficiency implied by this cannot be exploited because of the high transaction costs associated with buying and selling houses. There is also some evidence that long-run returns may display negative serial correlation.

One theoretical argument against efficiency in housing markets is the high cost of information about the product and the asymmetry of information between buyer and sellers. Sellers are clearly better informed about their own homes than are prospective buyers, but this asymmetry may have little influence at the market level. On average, sellers are also typically better informed about market economic conditions than are buyers. This is because sellers have usually lived in the area for a time, while many buyers have only recently arrived in the area. This information asymmetry may even apply for buyers only moving across town to a new neighborhood. In any event, better information on the part of sellers could permit sellers to respond more quickly to market changes. The result would be market listing prices that lead market selling prices, a result that would support the second relationship discussed.

Though sellers are better informed and could respond more quickly, their psychological attachment to their homes might induce a more sluggish response to market changes, especially those that involve downward adjustments. Even in the absence of emotion, the seller’s immediate response to a change in market conditions would be a revision in expected selling price, not in list price. Listing prices change infrequently, and very seldom in the upward direction. Selling prices may indeed respond first to new information, as both buyers and sellers react by revising reservation prices for a given set of amenities. If this is the case, the third relationship might be observed.

The growth of the secondary market for residential mortgages and the availability of mortgage-backed securities and their derivatives increase the importance of the question of efficiency in housing markets. The value of a mortgage depends in part on the assessment of the probability of default, which depends in turn on the loan-to-value ratio, which itself fluctuates with changes in value of the underlying asset, the house. Transaction costs may prohibit profiting from house price forecasting in the house market itself, but if house prices are predictable, and the predictions are not incorporated in secondary market pricing of mortgage securities, there is ample opportunity for profit in this more liquid market.

Knight, Sirmans and Turnbull (1994) empirically examine the time-series relationship of listing price and selling price using city-level data and find that the market list prices Granger-cause the market sales prices over the housing market cycle. However, areas and neighborhoods within a city have different demographic compositions that may be impacted in very different ways by changes in the local economy. Therefore, what is true for the metropolitan area as a whole may not hold for many segments of the market. The information content of the list price index for sales prices at the more disaggregated level, by house type or geographically defined neighborhoods, remains unresolved. It is to this issue we now turn.

Model and Data

There is, of course, a close relationship between the listing price and the selling price of an individual property. This relationship has little practical use for predictive purposes, however. Once a house has sold, one can predict its selling price with perfect accuracy. But individual houses sell relatively infrequently, and the interval between listing and selling can vary substantially, so piecing together a strictly longitudinal time-series of data is not possible. Therefore, we draw from hedonic pricing theory (Rosen, 1974) to construct constant quality house price indexes that span the entire period of the study, and that are of regular and sufficiently frequent interval.

Following Knight, Sirmans and Turnbull (1994), our model of house value is relatively parsimonious, consisting of structural information, the age of the residence and a dummy variable for time to capture the effects common to the market as a whole.[3] We choose the linear functional form (Arguea and Hsiao, 1993) and employ two hedonic regressions to track quarterly house prices over the sample period, the first using listing price as the dependent variable and the second using selling price. In the equations that follow, it should be noted that the time dummy refers to the time of listing for the model with list price as the dependent variable and to time of sale for the selling price model. The two models are written as follows:

$$LISTPR=\beta_0+\beta_1\,LIVAREA+\beta_2\,OTHAREA+\beta_3\,AGE+\beta_4\,BATHS+\sum_{t=1}^{T}\gamma_t D_t \quad (1)$$

and

$$SELLPR=\beta_0+\beta_1\,LIVAREA+\beta_2\,OTHAREA+\beta_3\,AGE+\beta_4\,BATHS+\sum_{t=1}^{T}\gamma_t D_t, \quad (2)$$

where:

LIVAREA = Square feet of living area;
OTHAREA = Square feet of other covered area (*e.g.*, garages, carports, covered patios);
BATHS = Number of bathrooms;
AGE = Age (in years) of the residence at the time of sale; and
D_t = Dummy variable marking (1) the listing of the property in quarter *t* for model (1), and (2) the sale of the property in quarter *t* for model (2).

The listing date is inferred from the selling date of the sold property and the number of days on the market. Thus our sample suffers from selection bias in that only properties that were listed and subsequently sold are included; those that were listed but failed to sell are omitted. This is a bias that we are unable to avoid.

Note also that the data matrix of independent variables for each of the two models is essentially the same with respect to the structural and age variables. Some differences occur near the beginning and end of the sample period. In the early quarters, there are homes in the selling price hedonic regression that were listed before the study period began. Likewise, at the end there are properties that appear in the listing price regressions but sold after the study period's end and thus are not included in the selling price regressions. Unless a property listed and sold within the same quarter, however, the listing and selling observations are differentiated by the time dummy, allowing the list price index to lead the sales price index and potentially to convey predictive information about sales price.

Knight, Sirmans and Turnbull (1994) utilized Multiple Listing Service (MLS) data for single-family residences in Baton Rouge, Louisiana that sold between January 1, 1985 and December 31, 1992, examining a total of 12,308 observations. They found that for the metropolitan area as a whole, list prices Granger-caused selling prices. We wish to determine whether these results hold when the information is disaggregated geographically or categorically. We therefore extend the time period of the study through the end of 1994, but limit the scope to four distinct MLS areas in Baton Rouge.

Exhibit 1 provides the summary statistics. There is considerable variation across geographic area in price, size and age. The expected relationship between size and price emerges; the areas with larger homes, on average, have higher listing and selling prices, on average. Age and price do not follow the predicted pattern, however. Note that Area 52 has the oldest homes, but the highest selling prices. Area 43 is by far the most active of the areas, accounting for about the same number of sales as the other three areas combined.

For each of these four areas, we separately examine the relationship of listing price and selling price over time. There are 8525 observations of list price data and 9,091 observations of selling price data. We disaggregate these data in four ways to individually examine the time-series relationships of selling price and listing price. First, acknowledging the importance of location, we separate the data by MLS area. We then classify the data by price and by size, analyzing the upper and lower quartile of the data by these two categories. Finally, we split the data by age, classifying homes five years old or less as newer homes, and those over fifteen years of age as older homes. Clearly, some of the categories by which we disaggregate are highly correlated. In particular, price and location, and size and price are closely connected. However, the notion driving our study is that aggregating data over the metropolitan area disguises a great deal of heterogeneity across properties. We wish to discover whether aggregate price paths accurately represent the component price paths and if not, what is the most useful means of disaggregating the data to provide list price-sales price relationships with predictive content.

Granger Causality Tests

Do listing prices in one quarter convey information to prospective buyers regarding bidding and to prospective sellers regarding the size of the bid that should be accepted in subsequent quarters? If so, transaction prices will be affected, and lagged values of listing prices can be used to explain current values of selling prices. Or do prospective sellers key on previous selling prices of comparable homes when they set the price at which they offer their home for sale? If so, lagged values of selling prices will help to explain current values of listing prices.

Exhibit 1
Summary Statistics for House Transactions by MLS Area Baton Rouge, Louisiana 1985–1994

	Area 11	Area 41	Area 43	Area 52	All Four Areas
Panel A: Listing Price					
Mean	68905	69533	110961	137342	103275
Std. Dev.	29347	17936	47605	67652	52695
Min.	25000	27000	26500	25000	25000
Max.	355000	165000	424900	465000	465000
Panel B: Selling Price					
Mean	66146	67061	107140	130902	99335
Std. Dev.	28130	17442	45493	64353	50259
Min.	25000	25000	26500	25000	25000
Max.	355000	160000	424900	450000	450000
Panel C: Living Area					
Mean	1598	1699	2089	2293	1996
Std. Dev.	486	412	566	742	619
Min.	812	797	900	700	700
Max.	4635	4287	4926	4951	4951
Panel D: Other Covered Area					
Mean	574	646	794	769	735
Std. Dev.	312	280	278	355	309
Min.	0	0	0	0	0
Max.	1999	1958	1986	1983	1999
Panel E: Baths					
Mean	2.0	2.0	2.3	2.4	2.2
Std. Dev.	0.5	0.3	0.4	0.7	0.5
Min.	1.0	1.0	1.0	1.0	1.0
Max.	4.0	4.5	5.5	5.5	5.5
Panel F: Age					
Mean	13.9	15.7	8.6	18.0	12.3
Std. Dev.	9.9	8.2	6.1	15.9	10.3
Min.	0.0	0.0	0.0	0.0	0.0
Max.	85.0	46.0	78.0	87.0	87.0
Panel G: Days on Market					
Mean	78.1	93.0	78.3	89.0	82.8
Std. Dev.	100.2	99.1	91.5	101.6	96.1
Min.	0	0	0	0	0
Max.	917	886	856	958	958
Total Transactions	1164	1590	4633	1704	9091

Obviously, listing prices and selling prices have a close relationship from period to period, and it is difficult to know the direction of the relationship. Granger causality tests provide a means of testing for causation in relationships such as these where correlation is clearly high, but it is unclear which variable is dependent upon the other. When two variables are related, the first is said to Granger-cause the second if two conditions hold: (1) the past values of the first variable are significant when the second variable is regressed on those past values as well as its own past values; and (2) when the regression is reversed, the second variable is not significant in explaining the first.

In our study, we wish to examine the direction of causation in the listing price-selling price relationship. To do so, we employ two regressions:

$$SEL\hat{L}PR_t = \alpha_1 SEL\hat{L}PR_{t-1} + \beta_1 LIS\hat{T}PR_{t-1} + \mu_t, \tag{3}$$

and

$$LIS\hat{T}PR_t = \alpha_2 LIS\hat{T}PR_{t-1} + \beta_2 SEL\hat{L}PR_{t-1} + \mu_t, \tag{4}$$

where the hats over the regression variables indicate that these are the hedonic index values for *LISTPR* and *SELLPR* in quarters t and $t-1$, respectively.

Knight, Sirmans and Turnbull (1994) studied these relationships for the Baton Rouge metropolitan area from 1985 through 1992, and found that listing prices could in fact be said to Granger-cause selling prices. That is, they found that β_1 was significant in equation (3), while β_2 was insignificant in Equation (4). We extend the period of the study by eight quarters, and examine heterogeneously categorized subsets of the data, to see if a similar conclusion is possible at a lower level of data aggregation.

Results

Price Indexes

Regressions of listing price and selling price on the hedonic variables described in section three were used to produce house price indexes for the forty quarters of our study. Some of these indexes are graphed as Exhibits 2–4, which compare the paths of listing and selling prices for three categories of data heterogeneity. As a representative illustration, Exhibit 2 shows the difference in price change over the ten-year period for two distinct MLS areas within the city. While the same basic pattern emerges for both areas, it is clear that prices in Area 43 did not fall as much as in Area 41 in the period of falling prices, quarters 1–19, and rose much more steeply in the period of rising prices, quarters 20–40.

We see a similar disparity in price paths for high priced homes relative to low-priced homes in the four MLS areas of our study. To prepare Exhibit 3, we categorized homes as high-priced if the selling or listing price respectively fell into the top quartile of homes and as low-priced if the prices fell in the lower quartile.[4] There is considerable volatility in these indexes, particularly that of high-priced homes, and

Exhibit 2
Hedonic Price Indexes Listing and Selling Prices—Area 41 vs. Area 43 Homes

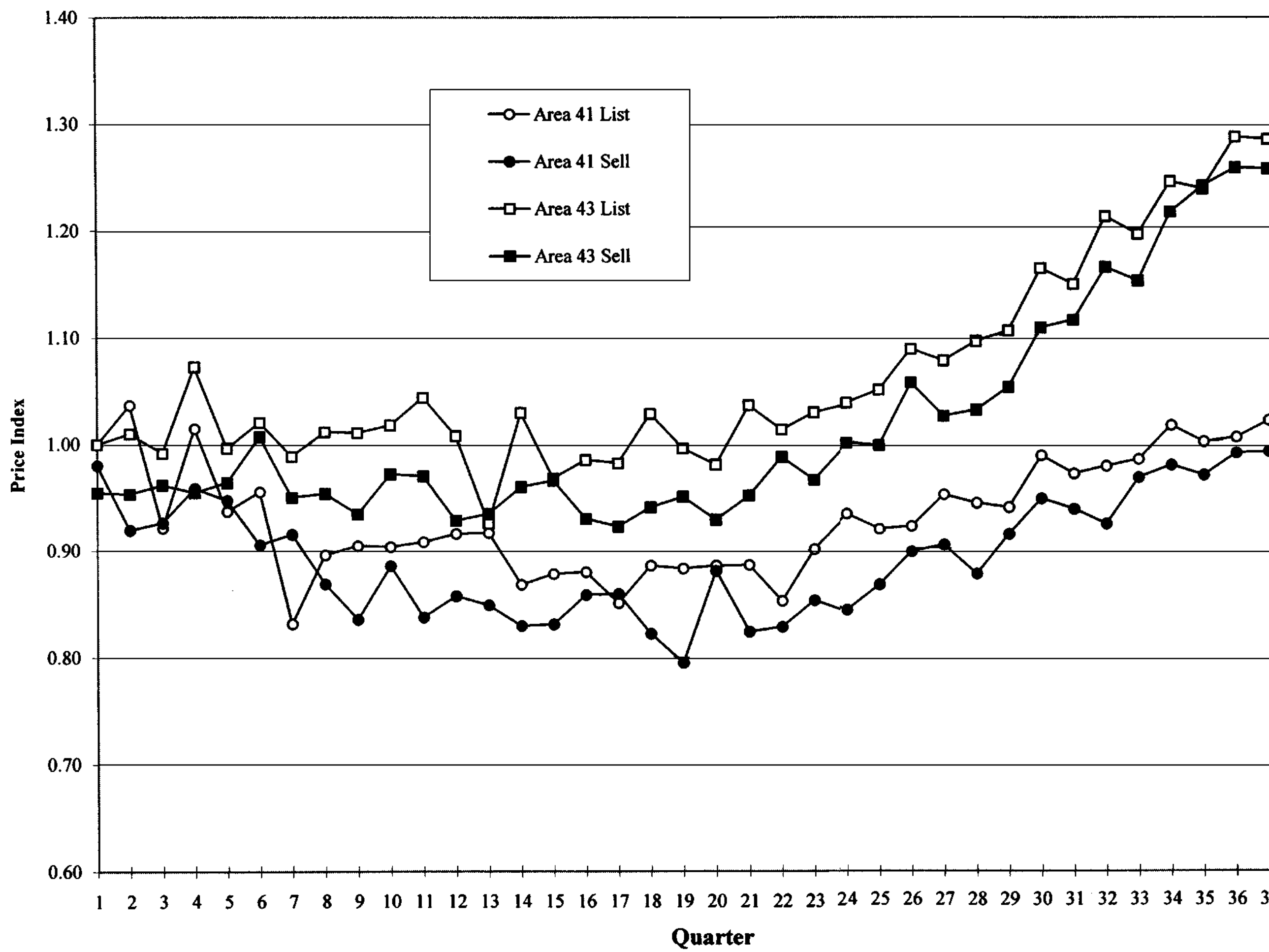


Exhibit 3
Hedonic Price Indexes Listing and Selling Prices—Higher Priced vs. Lower Priced Homes

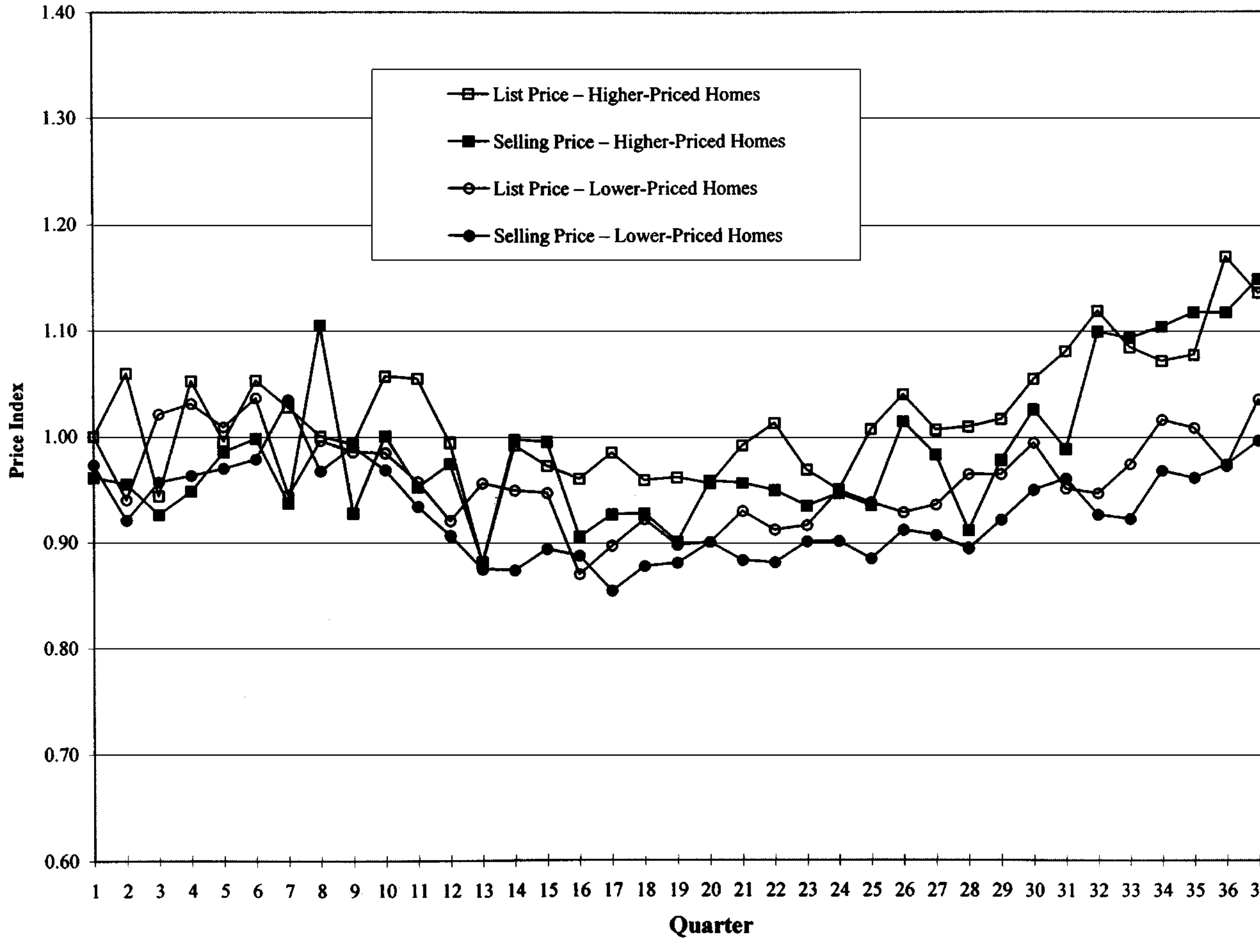
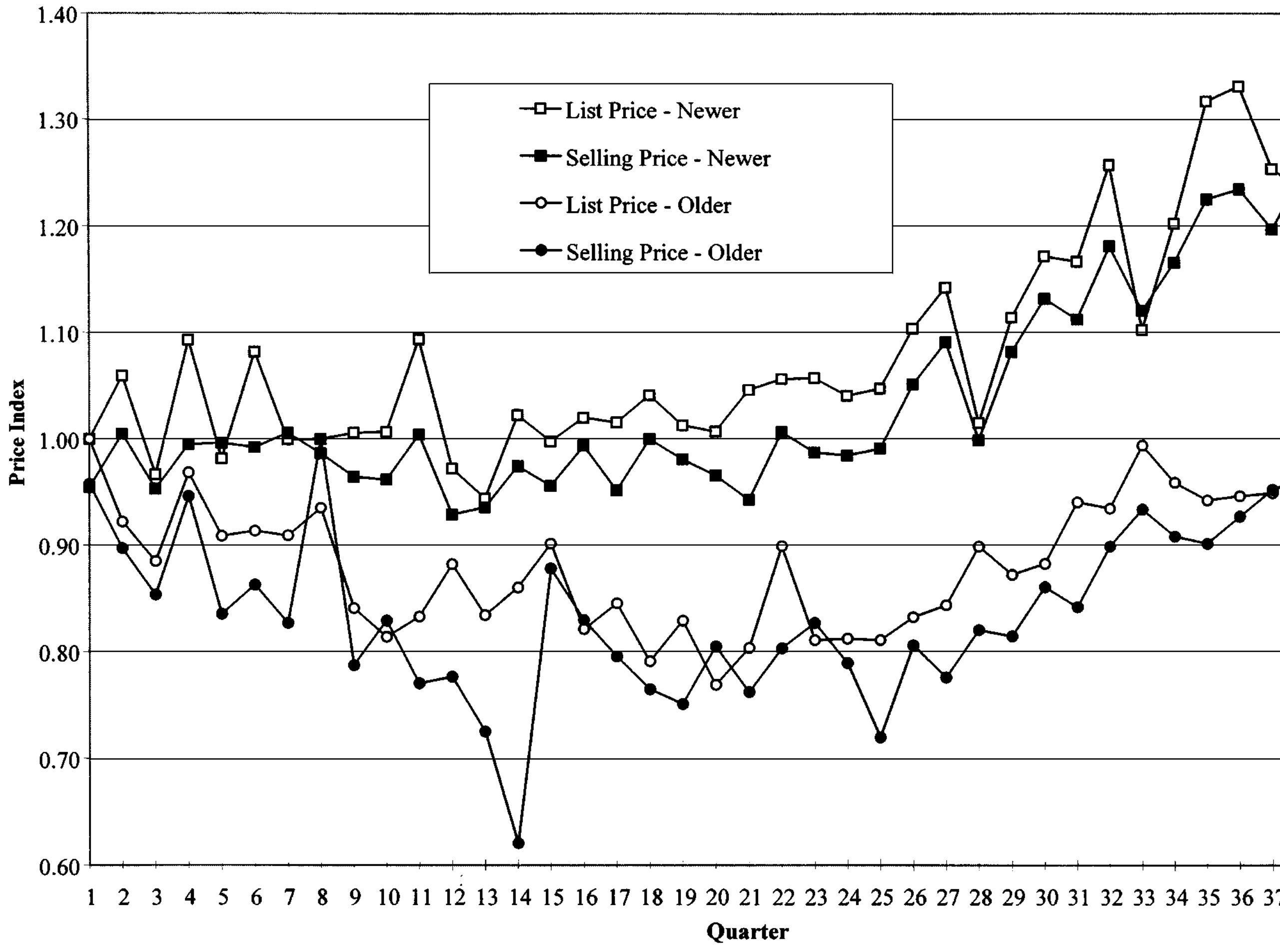


Exhibit 4
Hedonic Price Indexes Listing and Selling Prices—Newer vs. Older Homes



the gap in price performance for the two categories only becomes apparent in the 30th and subsequent quarters. Nevertheless, high-priced homes end the ten-year period selling at prices 18% higher than 1st quarter list prices, while low-priced homes end the period selling at virtually the same prices as at the beginning of the period.

Exhibit 4 classifies the price performance of the homes by age, with ''new'' homes being those five years old or less, and ''old'' homes being those older than fifteen years of age. In this case, the difference in time trends of prices for the newer and older homes is apparent early in the sample period. There is an almost immediate gap as selling prices for the newer homes fall below their starting point in only a few quarters of the time series and after the 21st quarter ratchet upward fairly quickly to finish about 30% higher. Selling prices of the older homes, on the other hand, start falling right away and though they rise steadily after the 25th quarter, never fully regain their starting value. The difference between old and new homes is quite stark, especially in light of the fact that the calculated appreciation difference is after controlling for the differences in house age in the hedonic equations.

The similarity of results shown in Exhibits 2–4 should not be too surprising. House prices are highly correlated with location, as are residence ages. Thus many of the higher priced homes were from Area 43, while many of the lower priced homes were located in Area 41. Likewise, a disproportionate share of the newer homes were in Area 43, where mean residence age was 8.6 years, as compared with Area 41 with a mean age of 15.7 years.[5] Therefore, the results shown in Exhibits 2–4 are somewhat repetitive, but nevertheless serve to reinforce an important point: house price appreciation paths can be quite heterogeneous within a metropolitan area, and the heterogeneity remains regardless of the basis on which the market is segmented.

Granger Causality

Exhibit 5 reports the results of the Granger causality tests for each of the subsets of data. Panel A shows the results of regressing selling price on the one-quarter-earlier values of selling price and listing price. Note that listing price is significant at the 1% level in all but three of these regressions. Listing price does convey important information about subsequent selling price in each category with the exceptions of Area 43, newer homes and smaller homes.

From Panel A we see that the first requirement for Granger causality holds in the majority of cases. That is, in a regression that includes lagged values of selling prices and listing prices, lagged values of listing prices are significant in explaining current selling price. In Panel B, we examine the second requirement for Granger causality. Here we regress current listing price on lagged values of selling and listing price, and see that previous selling prices are significant at the 5% level or better in all but two categories, older homes and larger homes.

Therefore, the strict requirements of Granger causality, that lagged listing price explains selling price but lagged selling price not explain listing price, are met in only two categories: older homes and larger homes. Interestingly, causality runs in exactly

Exhibit 5
Granger Causality Regressions

Category	Constant	Lag1Sell	Lag1List	Adj. R^2
Panel A: Dependent Variable=Selling Price				
Area 11	318	0.16	0.80	.65
	(<0.1)	(1.0)	(4.8)*	
Area 41	−44	0.54	0.44	.79
	(<−0.1)	(3.9)*	(3.1)*	
Area 43	−7219	0.74	0.32	.95
	(−1.4)	(4.2)*	(1.6)	
Area 52	−28126	0.33	0.85	.84
	(−2.4)**	(2.3)**	(4.8)*	
Newer Homes	6225	1.18	−0.22	.83
	(0.7)	(5.0)*	(−1.0)	
Older Homes	5771	−0.05	0.92	.46
	(0.5)	(−0.2)	(3.8)*	
Higher-Priced Homes	−102	0.30	0.68	.58
	(−0.0)	(1.6)	(2.9)*	
Lower-Priced Homes	1744	0.47	0.48	.75
	(0.4)	(3.9)*	(3.9)*	
Larger Homes	−33969	0.184	0.99	.84
	(−2.3)**	(1.0)	(4.23)*	
Smaller Homes	3578	0.77	0.17	.78
	(0.7)	(4.0)*	(0.8)	
All Homes	−15169	0.67	0.47	.92
	(−1.7)	(3.4)*	(1.8)	
Panel B: Dependent Variable=Listing Price				
Area 11	20446	0.39	0.32	.43
	(2.3)**	(2.2)**	(1.7)	
Area 41	11309	0.69	0.17	.70
	(1.8)	(4.4)*	(1.0)	
Area 43	13349	0.93	−0.01	.92
	(2.3)**	(4.5)*	(<−0.1)	
Area 52	26526	0.35	0.47	.70
	(2.1)**	(2.4)**	(2.5)**	
Newer Homes	13654	1.53	−0.57	.72
	(1.2)	(4.8)*	(−1.9)	
Older Homes	23105	−0.07	0.79	.50
	(2.4)**	(−0.5)	(4.3)*	
Higher-Priced Homes	41232	0.36	0.41	.55
	(2.2)**	(2.1)**	(2.0)**	
Lower-Priced Homes	16406	0.36	0.36	.44
	(2.3)**	(2.1)**	(2.0)	
Larger Homes	13050	0.30	0.64	.78
	(0.9)	(1.6)	(2.8)*	
Smaller Homes	19983	0.73	−0.04	.64
	(3.3)*	(3.5)*	(−0.2)	
All Homes	20038	0.54	0.28	.86
	(2.3)**	(2.8)*	(1.1)	

Values are estimates (*t*-Statistics in parentheses). Regressions are Equations (3) and (4) using hedonic index values for current and lagged selling and listing prices.
*Indicates significance at the 1% level.
**Indicates significance at the 5% level.

the opposite direction for newer homes and smaller homes. In these categories, selling prices Granger-cause listing prices. In most cases, though, it seems clear that the transmission of information flows both ways, perhaps reflecting the negotiation process between buyer and seller and the complex manner in which bids and offers for residential property are formed.

We are also interested in the usefulness of aggregate level listing data for predicting subsequent selling prices at the disaggregated level. To examine this, we once again performed Granger causality tests, this time using a hedonic index for all of the data to get quarterly estimates of list price. The current and lagged values of listing price in Equations (3) and (4) are thus created with a hedonic regression, Equation (1), using all of the data, while the current and lagged values of selling price in Equations (3) and (4) are developed using the various subsets of the data for the regressions identified by Equation (2). Exhibit 6 reports the results of these Granger causality tests.

As seen in Panel A of Exhibit 6, listing price lagged by one quarter is significant in all but two cases, Area 43 and newer homes. This represents an improvement over using the subsets of data to form estimates of list price; aggregate lagged listing price is significant in explaining the current selling price of smaller homes, while this was not the case when listing price was estimated with the small home subsample. Also, except for larger homes and lower priced homes, adjusted R^2 is the same or better using aggregate data for list price.

In Panel B of Exhibit 6, aggregate listing price is the dependent variable, and is regressed on lagged values of aggregate listing price and disaggregated selling price. For only three of the subsets—Area 41, Area 43 and newer homes—is selling price significant in explaining listing price. Thus, except for Area 43 and newer homes, aggregate listing price can be said to Granger-cause disaggregated selling price. For those two subsets, the chain of causation appears to run in the opposite direction.

There exists a possible explanation for the different behavior observed for homes in Area 43 and newer homes. As noted previously, most of the newer homes in the sample are located in Area 43, so we would expect a high correlation in the performance of newer homes relative to that of Area 43. Also, Area 43 had the greatest number of transactions, more than the three other areas combined, and more than double that of any other single area in the sample. If neither lagged listing price nor lagged selling price were significant in explaining subsequent selling price, an appealing argument of greater market efficiency resulting from more frequent transactions could be made. However, lagged selling price is significant, so we speculate that in this submarket with greater activity buyers and sellers adjust their expected selling prices more quickly than the sticky, discrete adjustments in listing price can be made.

Conclusion

This study offers evidence from which two conclusions may be drawn. First, from Exhibits 2–4, it is quite clear that different segments of the market follow appreciation

Exhibit 6
Granger Causality Regressions
List Price Data Taken from Full Sample

Category	Constant	Lag1Sell	Lag1List	Adj. R^2
Panel A: Dependent Variable=Selling Price				
Area 11	−15795	−0.16	0.91	.71
	(−1.9)	(−0.9)	(5.9)*	
Area 41	4290	0.36	0.38	.82
	(0.9)	(2.5)**	(4.1)*	
Area 43	911	1.07	−0.07	.95
	(0.1)	(10.6)	(−0.4)	
Area 52	−44255	0.25	1.41	.84
	(−3.2)*	(1.6)	(5.0)*	
Newer Homes	−9938	0.69	0.48	.84
	(−0.8)	(4.5)*	(1.9)	
Older Homes	3289	0.06	0.73	.47
	(0.3)	(0.4)	(4.1)*	
Higher-Priced Homes	1534	−0.02	1.6	.66
	(0.1)	(−0.1)	(4.3)*	
Lower-Priced Homes	9187	0.62	0.12	.71
	(2.0)	(5.5)*	(2.8)*	
Larger Homes	−65509	0.23	1.86	.08
	(−2.9)*	(1.2)	(3.8)*	
Smaller Homes	774	0.69	0.17	.81
	(0.2)	(6.6)*	(2.7)**	
Panel B: Dependent Variable=Listing Price				
Area 11	2667	−0.07	1.02	.83
	(0.4)	(−0.4)	(7.5)*	
Area 41	−3452	0.61	0.64	.86
	(−0.5)	(2.9)*	(4.8)*	
Area 43	19519	0.32	0.48	.87
	(2.5)**	(3.4)*	(3.0)*	
Area 52	6909	0.10	0.81	.83
	(0.9)	(1.1)	(5.2)*	
Newer Homes	9878	0.24	0.61	.86
	(1.4)	(2.6)**	(4.1)*	
Older Homes	3522	−0.03	0.99	.83
	(0.5)	(−0.3)	(9.9)*	
Higher-Priced Homes	3417	−0.03	1.01	.83
	(0.5)	(−0.3)	(6.8)*	
Lower-Priced Homes	−2117	0.18	0.93	.83
	(−0.2)	(0.7)	(10.2)*	
Larger Homes	8682	0.07	0.80	.83
	(1.0)	(0.9)	(4.2)*	
Smaller Homes	2877	0.04	0.95	.83
	(0.4)	(0.25)	(9.0)*	

Values are estimates (*t*-Statistics in parentheses). Regressions are Equations (3) and (4) using hedonic index values for current and lagged selling and listing prices.
*Indicates significance at the 1% level.
**Indicates significance at the 5% level.

paths that are substantially different from each other. Second, in spite of the dramatic differences in price trends across market segments, listing price appears to be useful in predicting subsequent selling price for almost all geographical and categorical subsets of our data. There is reason to exercise caution about the level of aggregation in making inferences about price trends, but listing price should not be ignored regardless of the level of aggregation.

This article supports the results of previous studies in which listing prices of homes in a city-wide market were found to be helpful in explaining subsequent selling prices in those markets. Impressively, for our sample, we find that the aggregate listing data are useful in explaining selling prices in a variety of market segments, even more useful in many cases than listing data from that segment itself. Collecting and using list price data to predict selling prices in housing markets appears to be a worthwhile effort.

Notes

[1]The model conditional on list price produces a root-mean-square error of $2,960 compared with $11,283. Also, the model that includes list price explains 98% of the variation in sale price for the data of that study.

[2]They review tests of market efficiencies in the real estate literature. They survey not only housing market tests, but also those for income-producing properties and for urban and rural land.

[3]Many previous studies have incorporated a time-on-the-market variable as an adjustment mechanism for overpricing on the part of some sellers. The reported sign of the variable is inconsistent in previous studies, however, and recent research finds ambiguity (Yavas and Yang, 1995) and insignificance (Horowitz, 1992) for a time-on-market variable.

[4]The top quartile included listing prices ranging from $112,000–$465,000 and selling price from $119,000–$450,000. The bottom quartile ranged from $25,000–$84,900 in listing prices and $25,000–$66,350 in selling prices. We also categorized houses by size. The high correlation of size with price led to near identical results, not reported here, but are available from the authors.

[5]Area 41 occupies a more accessible location in the urban area relative to Area 43, being closer to major employment and shopping centers. The development of Baton Rouge has followed the leap-frog-in-fill pattern coupled with gradual outward expansion (Turnbull, 1988). This development pattern leads naturally to the house age and size (house price) distributions over the areas examined in this study.

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