Assessing the Performance of Real Estate Auctions

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This article investigates the performance of real estate auctions relative to negotiated sales. It uses a repeat-sales methodology to control for unobserved differences in the quality of auction properties. Properties auctioned in Los Angeles during the 1980s boom sold at an estimated discount of 0%–9%, while sales in Dallas following the oil bust obtained discounts of 9%–21%. This evidence is consistent with the theoretical prediction that the auction discount increases in downturns when a seller trades off a longer expected selling time in a search market against an immediate auction sale. The study finds no evidence of the declining price anomaly.

Real estate auctions have been used in the United States almost exclusively for disposal of property involved in foreclosure or bankruptcy. But in the past twenty years, auctions have gained some attention as an alternative method of marketing real estate. The growth of auctions began in California in the mid 1970s, as some developers found auctions an effective way to sell a project quickly without incurring large carrying costs. In the early 1980s, auctions spread to other parts of the country following the severe regional declines in real estate prices first in the Oil Belt and later in the Northeast. According to one estimate, the dollar volume of property sold at U.S. real estate auctions grew by over 260% between 1981 and 1989, to $26.5 billion (Martin and Battle 1991). Many of the auction sales were conducted by the Resolution Trust Corporation (RTC), FDIC and large banks, allowing these sellers to dispose of large amounts of real estate in a relatively short period of time and reduce their carrying costs, including interest, taxes, physical depreciation, insurance, and continuing marketing costs. In recent years auction activity has slowed as real estate markets have recovered and institutional ownership of residential real estate has diminished.

Practitioners in the U.S. have typically discouraged the use of auctions to sell real estate except in extremely distressed conditions because auctions are perceived as selling real estate at prices that are significantly below

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"market value."[1] In other countries such as Australia and New Zealand, however, real estate auctions are a widely accepted means of selling residential real estate for individual home owners. By one estimate, between 25% and 50% of all properties in Melbourne are listed for sale by auction (Maher 1989). In contrast to the U.S., auctions in these countries are more likely to be used in booming markets and for desirable properties.

Previous studies of the relative returns to selling real estate by auction versus negotiated sales have come to widely varying conclusions. Studies of U.S. sales have found that auctioned real estate transacts at a discount of as much as 33%–37% (Wright 1989; and Gau and Quan 1992). In Australia, however, Lusht (1996) finds that auctioned property sells at a premium. These papers use a similar methodology, first gathering a sample of transactions that includes both auctions and traditional negotiated sales, and then using hedonic price regressions to estimate the difference in sale price that results from using an auction.

This article uses a new data set on auctions from Dallas and Los Angeles and estimates the relative returns to auctions and negotiated sales of real estate. In doing so, this research isolates two possible reasons that previous research has come to such widely varying conclusions: differences in market conditions and omitted variable bias.

First, auctions in Australia take place during high demand time periods and for desirable types of property, whereas the opposite pattern appears in U.S. auctions. Recent theory (Mayer 1994) suggests that auctions should always sell property at a discount (the cost of liquidity) that increases when there are fewer potential buyers in the market. Because auctions obtain a quick sale, in times of low demand they can result in a low sales price because even the best-suited buyer at a given point in time may be poorly matched with the house for sale. By contrast, sellers who choose negotiated sales in a poor market will wait longer for a buyer and thus receive a higher price because the buyer will be better matched to the house and thus be willing to pay a higher price.

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[1] For example, Martin Ginsburg, a New York developer, argues that "basic economics" ensures that auctions will perform poorly in a soft market, because they flood the market with more properties than it can easily absorb. While conceding that auctions might be attractive if they sold properties for small discounts, he predicts that "Unfortunately...15% to 20% discounts are the exception." In addition, Ginsburg and other critics claim that auctions of large projects "taint" a property's image and increase risk for a seller (Ginsburg 1991).

While differences in market conditions can explain variations in the auction discount, they cannot explain why auctioned property should ever sell for a premium (Lusht 1996). If true, auctions could never co-exist with negotiated sales when both have similar direct costs because a seller would always be better off auctioning immediately versus waiting longer for a negotiated sale and obtaining a lower price. Suppose, however, that the sales method for a property was chosen based on that property's attractiveness to the market. If all of the characteristics that make this property attractive were not adequately controlled for in the hedonic regression, the regression would attribute differences in attractiveness to the coefficient for the sales technique. For example, if the U.S. government chooses to auction only its worst properties, low average sales prices at auction could be a result of low unobserved quality, not the poor performance of auctions. The opposite might be true in Australia, where high-quality properties are more likely to be auctioned.

To avoid problems of unobserved quality, this article uses the repeat sales price methodology to estimate the relative return associated with real estate auctions. Consistent with the theory described earlier, the results show that auctions in the boom market of Los Angeles in the late 1980s sell property at a small discount of between 0% and 9%. By contrast, units sold at auctions in Dallas during the oil bust transacted at a much larger discount of between 9% and 21%.

Methodological issues play a role in this analysis. Hedonic estimates using the same sample show much larger auction discounts for Dallas (up to 37%) and smaller discounts (and in some cases even a slight premium) for auctioned units in Los Angeles. Thus, unobserved quality appears to bias hedonic estimates.

The results also show that the type of property sold at auction can affect the relative discount, with auctions of more heterogenous units selling at much larger discounts. For units that appeal to a more homogenous audience, the match between buyer and house has a smaller effect on the final price (Mayer 1994). The seller has less to gain by holding a property on the market waiting for a buyer with a good match, when all buyers have a similar valuation for that unit. This finding may explain why conventional (nonbank, nongovernment) sellers are more likely to auction new condominiums than "one-of-a-kind" properties.

Finally, this article finds little evidence of the "declining price anomaly" in which the earlier a unit sells in an auction, the higher the quality-

adjusted price. This is in contrast to others (Ashenfelter and Genesove 1992; Vanderporten 1992; and Lusht 1994) who look at individual auctions and find statistically significant price declines. The results here are based on a much larger sample than other studies. Also, omitted variable bias may play a role in earlier findings. The latter two studies use hedonic estimates, yet auctioneers usually place the most desirable units at the beginning of the auction. Later results show that hedonic equations provide evidence in favor of the "declining price anomaly," but that this evidence disappears using resale price estimates.

This article is organized as follows. Previous research comparing auctions to other sales techniques is summarized in Section Two. The next two sections describe the resale price methodology and the data. Section Five presents the major empirical findings, and explores other factors such as sample selection that might affect the analysis. The article concludes with a discussion of the appropriateness of auctions for different types of sellers and across varying market conditions.

Previous Research

The theory of optimal auctions is an area that economists have studied heavily in recent years, offering many strong conclusions about the relative merits of different types of auctions. Yet the literature has paid less attention to how auctions compare as one of a number of ways that a seller can choose to dispose of a particular item, despite the fact that goods such as real estate, wine, art, automobiles and various financial instruments have active auction and search markets from which a seller can choose.

Two recent articles (Adams, Kluger and Wyatt 1992; and Mayer 1994) compare auctions and negotiated sales and find that auctions must always sell property at a discount. Both focus on differences in the timing of sales for these two techniques. Auction sales are restricted to buyers who are in the market in a given period, while negotiated sales allow the seller to search for a buyer over multiple periods. In Mayer, auctions and negotiated sales also differ in terms of their price setting mechanism. For negotiated sales, the model assumes that the buyer and seller split the surplus if a buyer arrives whose valuation exceeds the seller's reservation price. In contrast, auction prices are equal to the valuation of the second highest bidder. In both articles, the prediction that auctions sell at a lower price is due to the fact that in any given period, the highest-valuation buyer will have a lower valuation than can be obtained by waiting for a longer period of time and drawing from a greater number of buyers. By contrast, using a different methodology,

Wang (1993) finds that auctions are preferable for sellers when auctioning costs are zero or the marginal revenue curve is sufficiently steep.

By explicitly modeling the search process, Mayer (1994) develops additional comparative statics. For example, his model predicts that the auction discount will rise in a bust market that is characterized by an increased number of vacant and available units. In a typical search market, a buyer's valuation for a given house is determined by comparing that property with other houses available for sale. Holding the number of buyers fixed, as more houses become available, the auction discount must rise in order to convince a given buyer to choose the house available for sale by auction. This is because a greater number of available houses in the search market means that a buyer forgoes a better (expected) match in order to purchase the auction property.

Mayer also shows that the auction discount falls for homogeneous properties. When houses are similar, the match between buyer and house has a smaller effect on the final price. Thus, the seller has less to gain by holding a property on the market waiting for a buyer with a good match when all buyers have a similar valuation for that unit.

As noted earlier, previous empirical papers that have explored the performance of real estate auctions suffer from potential bias because they use hedonic methods when properties sold at auction are not randomly chosen. In the U.S., the RTC has noted that its choice of a marketing strategy is based in part on a property's appraised value, with low-value properties (under $100,000) being auctioned. Wright (1989) notes that this is probably a serious problem in his sample. The set of auctioned properties appears to be of much lower quality than average, as evidenced by the fact that auctioned properties were much more likely to be designated as "cash-only" sales, in which HUD was unwilling to provide any financing. Without providing any correction for this problem, Wright finds that auctions sell at a discount of up to 37%.

At the other extreme, Lusht (1996) looks at auctions in Australia where higher-quality properties are sold at auction. Lusht includes several variables to control for quality, including subjective measures of condition and location, and uses a sample selection correction to control for endogenous choice of sales technique. However, quality is inherently difficult to measure. In addition, the study does not have any instruments to control for the choice of sales technique and instead relies on functional form for identification.

Evidence on the performance of auctions from markets other than real estate is limited. One possible exception is bond markets, where several studies found that interest costs for auctions with three or more bidders were lower than private placements, but that private placements became cheaper when auctions had fewer than three bidders. (See Kessel 1971; Hopewell and Kauffman 1977; Hendershott and Kidwell 1978; and Sorensen 1979.)

This article also looks for evidence of the "declining price anomaly." Using data from wine and art auctions, Ashenfelter (1989) shows that significant price declines occur over the course of an auction, even for identical cases of wine. He attributes these declines to a combination of risk aversion and quantity constraints among buyers. Ashenfelter and Genesove (1992) find evidence of price declines in two New Jersey condominium auctions by looking at sales that fell through after the auction and comparing the subsequent resale price with the original auction price. Lusht (1994) looks at an auction of commercial property by comparing the sale price with the predetermined reserve price, concluding that properties in later parts of the auction sold at significant discounts. In contrast, Vanderporten (1992) studies a pooled real estate auction using a hedonic regression and finds that the "best buys" are in the middle of the auction.

Methodology

As noted earlier, the hedonic methodology may produce biased estimates of the discount or premium associated with real estate auctions. In this case, an omitted variable (attractiveness, quality) is possibly correlated with an included variable (method of sale) on the right-hand side.

For example, the RTC chose the sales technique based to a great extent on a property's appraised value, with low-value properties (under $100,000) being auctioned. Low average sales prices at auction could be a result of low-quality properties, not the poor performance of auctions. Poor quality, condition and marketability likely contribute to a low appraisal, and these variables are difficult to measure. If they are not included in the hedonic variables, however, the resulting equation will give a biased estimate of the auction premium or discount. The opposite might be true in Australia, where high-quality properties are more likely to be auctioned.

One solution to this problem is to use exogenous variables in a first-stage regression to predict the choice of sales method, and then use the predicted sales choice in the second-stage regression. In this case, however, it is difficult to get data that might help predict a seller's choice of sales method.

Instead, this article uses a resale price index to assess the performance of real estate auctions. To understand the advantages of a resale price index, first consider the usual hedonic model which estimates the sales price of property i at date t as a function of various property attributes, an auction dummy and a dummy for the date of sale.

$$P_{i,t} = X_i\beta + A_{i,t}\alpha + \sum_{s=1}^{S} T_{i,t}^S \theta^S + \epsilon_{i,t} \tag{1}$$

$P_{i,t}$ = Log sales price of property i at time t.

X_i = Vector of hedonic characteristics for property i, including the number of bedrooms, the number of bathrooms, location, quality, and the like.

$A_{i,t}$ = An auction dummy variable. $A_{i,t} = 1$ when property i is auctioned in period t and $A_{i,t} = 0$ otherwise.

$T_{i,t}$ = A $S \times 1$ vector of time dummy variables, where S equals the number of time periods in the sample. $T_{i,t}^s = 1$ when $s = t$ (whether the sale is by auction or negotiation) and $T_{i,t}^s = 0$ otherwise.

The hedonic model estimates the coefficients (β, α and θ) even though not all the hedonic variables (X's) are observed, under the assumption that the observed Xs are uncorrelated with the omitted variables.

Alternatively, Case and Shiller (1987) have proposed using the repeat sales methodology to estimate a market price index which controls for unobserved differences between properties and the changing mix of properties sold over the real estate cycle. A resale price index is created by taking the above equation, using only data on houses that sold more than once in the sample period, and differencing the data to net out the individual effects from each house (the $X_i\beta$ terms). The repeat sales methodology assumes that the vector of coefficients (β) on the Xs does not change over time. The resulting equation has only dummy variables on the right-hand side. If property i sold in period t and again in period $t + \tau$, the equation would be written as follows:

$$(P_{i,t+\tau} - P_{i,t}) = A_i'\alpha + \sum_{s=1}^{S} T_i^S \theta^s + \epsilon_i' \tag{2}$$

A_i' ($\equiv A_{i,t+\tau} - A_{i,t}$) = auction dummy variable. $A_i' = 1$ if property i is auctioned in period $t + \tau$, $A_i' = -1$ if the property is auctioned in period t and $A_i' = 0$ if auctioned at both dates, or not auctioned at all.

T_i' $(\equiv T_{i,t+\tau} - T_{i,t})$ = an $S \times 1$ vector of time dummy variables, where S equals the number of periods in the sample. $T_i'^s = -1$ when the first sale occurs at time $s = t$, $T_i'^s = 1$ when the second sale occurs at time $s = t + \tau$ and $T_i'^s = 0$ otherwise.

Following Case and Shiller (1987), this article uses the weighted repeat sale index (WRS) to estimate Equation (2), taking into account possible heteroskedasticity in the errors.[2] They posit that errors in measuring price differences should increase with the time between sales. This would give additional weight to observations with a greater time between sales. Reweighting the observations has a small effect on the estimated quarterly coefficients, and almost no effect on the auction dummies.

If all of the hedonic characteristics (the X's) are observed and properties sell exactly twice, then the estimated coefficients α and θ should be the same using both methods.[3] However, if some unobserved hedonic characteristics are correlated with auctions, then the hedonic estimates will be biased, with the sign of the bias depending on the unobserved quality of auctioned properties.

Coefficients from the two methods may also vary because they use different samples. Many properties sell only once during a given period of time and thus would be excluded from a resale price index. However, units that sell more than once may have a different expected rate of appreciation than units that sell only once in the sample period. For example, Clapp and Giacotto (1992) find that appreciation rates between single-sale and multiple-sale properties can vary over the short run, but are quite similar for time horizons of more than three years. Later empirical work will show that variation in samples has little effect on differences in the estimated auction coefficients between the hedonic and repeat sales methodology.

As Case and Shiller (1987) note, the WRS does not include depreciation, and this limits its comparison to hedonic indices. In comparing the different estimation techniques, it is important that depreciation be handled

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[2] This article assumes, as do Case and Shiller (1989) and the entire literature on repeat sale price indexes, that the composite error term, ϵ', satisfies the assumptions in the Gauss Markov theorem.

[3] See Case and Shiller (1987), Shiller (1991), Case, Pollakowski and Wachter (1991), Shiller (1991), Haurin and Hendershott (1991), Shiller (1991), Clapp and Giacotto (1992) and Goetzmann (1992) for more detailed discussions of the relative merits of the various methods of estimating resale price indexes.

consistently. Otherwise, differences in age and depreciation between auctioned and nonauctioned properties could bias the auction coefficient. To correct for this deficiency, this study uses the following model to control for changes due to depreciation:

$$(P_{i,t+\tau} - P_{i,t}) = T'\theta + A'\alpha + N\nu + \epsilon' \tag{3}$$

N = a dummy variable representing a new property (less than 5 years old). $N = 0$ if the property is new at the time of both sales or not new at the time of both sales. $N = -1$ if the property is new in the previous sale and not new at the second sale.

Consistent with Equation 2, ν can be interpreted as the premium for new properties in the sample. An alternative way to control for depreciation is to use a variable representing the difference in the property's age between sales, or to use dummy variables for the age of the property. The results below are robust to these alternative methodologies.

The Data

This study focuses on real estate sales in Dallas and Los Angeles during the mid to late 1980s. This is truly a tale of two cities, as is clear from Figures 1 and 2. From 1982 to 1985, both cities had a post-recession boom. In 1985, however, the oil bust hit Dallas and in the next five years real single-family home prices fell 30% and real condominium prices fell almost 60%. The fact that condominium prices fell so much further than the prices of single-family homes is striking, but not limited to Dallas. Case, Shiller and Weiss, Inc. data shows a similar pattern in Los Angeles and San Francisco around the 1982 recession and in Boston during the recent downturn. In these three cities, however, the magnitude of the difference in depreciation rates between condominiums and single-family homes is not as severe as in Dallas. Lack of financing, overbuilding, and the "second-class" perception of condominiums are possible explanations for this phenomenon. Over this same time period, real estate prices in Los Angeles continued to rise, with real condominium prices increasing over 25%.

Data from these two cities allow a comparison of the performance of auctions in boom and bust markets. The first U.S. (non-foreclosure) real estate auctions were held in California beginning in the mid 1970s, with most sales occurring in good market conditions. In Los Angeles, the auction sample includes condominium sales between the end of 1981 and 1987 and

Figure 1 ■ Real price index for Los Angeles condominiums.

This figure shows a quarterly price index for Los Angeles condominiums from 1970 to 1991. The index is calculated using the weighted repeat sales method and is shown in real terms, with an index value of 100 in 1970. The coefficients are taken from the regression results reported in Table 3.

Index value in 1970 = 100
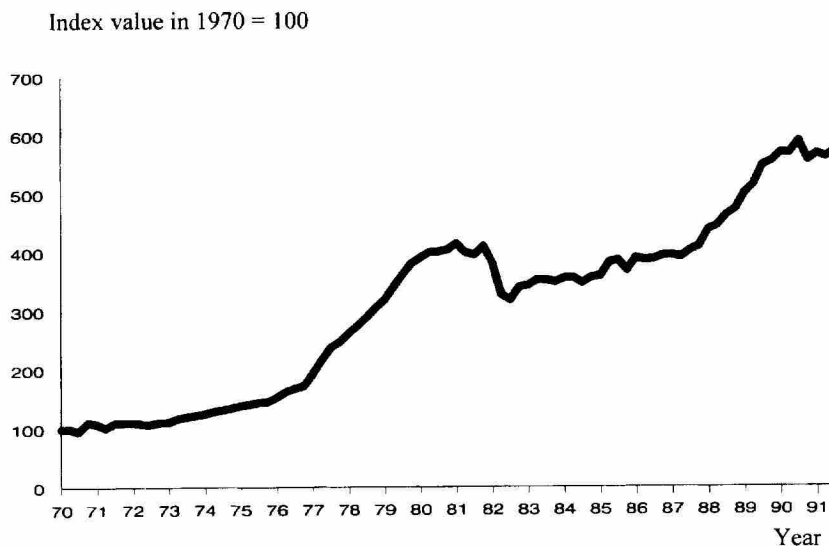
is mostly concentrated in the period between 1983 and 1986.[4] Auctions arrived later in Dallas, mostly as a mechanism for troubled financial institutions to quickly dispose of large amounts of distressed real estate.[5] The Dallas auctions occurred between 1985 and 1990, as the real estate market was falling, and include both single-family homes and condominiums.

Because the method of sale is not reported separately, auction data was obtained from several auction firms based on sales that these firms conducted in the two counties. The surveyed firms agreed to give information on all auctions conducted in those cities rather than choosing their best sales. The

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[4] A few auctions in the sample date from 1981 and 1982, when the Los Angeles market suffered a slight decline. If these auctions are removed, the auction discount falls slightly from the reported results. This further strengthens the conclusion that the auction discount percentage rises in a down market.

[5] The number of Texas commercial banking organizations fell by 16%, from a high of 1,261 in 1986 to a low of 1,019 in 1990. The number of savings and loan institutions fell even further, declining by over 60% (Clair 1991).

Figure 2 ■ Real price indexes for Dallas single-family homes and condominiums.

This figure shows a quarterly price index for Dallas single-family homes and condominiums from 1979 to 1991. The index is calculated using the weighted repeat sales method and is shown in real terms, with an index value of 100 in 1979. The coefficients are taken from the regression results reported in Table 4.

Index value in 1979 = 100
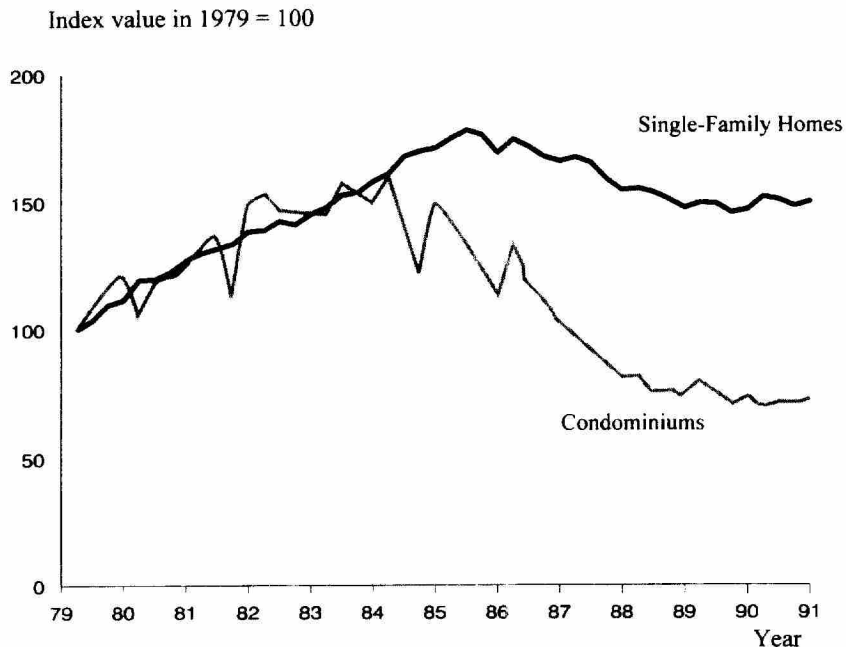
auction data were then merged into the county records to obtain a data base that contained information on auction and nonauction properties, including multiple sales of the same unit. The resulting data set contains records on condominium sales in Los Angeles from 1970 to 1991 and both condominium and single-family home sales in Dallas from 1979 to 1991. Very few Los Angeles single-family homes were in the auction sample, so these units were not included. The data collection and merging process is described in more detail in the Appendix.

All of the auctions in the sample were conducted using an open outcry English-style technique. Most units were advertised with a posted minimum acceptable bid. In a few cases, the reserve price was unpublished. In these cases, the seller reserved the right to reject or renegotiate the highest bid at auction, although in practice, very few bids were rejected or renegotiated.

The sample includes two types of sales, auctions of units at a single-site and auctions where the units are scattered over a large geographic area. Single-site auctions involve a large number of condominiums from a development, which are usually new and unoccupied. The seller in this case is a developer or bank wishing to sell all remaining units at one time and reduce holding costs. In fact, some builders in the Southern California market build almost exclusively for sale at auction. Scattered-site auctions are commissioned by an institution such as the Federal Deposit Insurance Corporation (FDIC), the Resolution Trust Corporation (RTC) or a private bank and contain hundreds of properties in as many as five or six counties and three states. Typically, scattered site sales involve older units that were obtained through the foreclosure process. Commercial land and structures are auctioned alongside single-family homes and condominiums.

Tables 1 and 2 give a summary of the mean values and standard deviations for the complete sample, as well as for the set of auction properties. These tables suggest that the properties that are auctioned are very different from the average properties sold over the sample period. Auction properties tend to be smaller, both in terms of square feet and the number of bathrooms, and they sell for lower prices. (Sales prices are deflated to 1990 dollars, using the weighted repeat sale index reported later. Also, the reported age is the age of the property on the date of sale.) The evidence supports the notion that even in Southern California, where auctions are better received

Table 1 ■ Sample means for Los Angeles condominiums.

	All Properties		Auction Properties	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Real Sales Price (1979$)	174,605	116,078	138,516	57,488
Square Footage	1,277	614	1,039	331
Full Baths	1.80	0.60	1.79	0.69
Half Baths	0.37	0.49	0.03	0.17
Bedrooms	2.19	0.81	1.75	0.67
New Unit (< 5 years old)	0.53	0.50	0.35	0.48
Age	7.00	7.96	9.40	6.86
Number of Observations	124,420		285	

This table presents sample means of various unit characteristics for the Los Angeles condominiums. Sales prices are deflated by the weighted repeat sale index calculated later in the article to provide a constant means of comparing sales prices.

Table 2 ■ Sample means for Dallas single-family homes and condominiums.

	All Properties		Auction Properties	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Single-Family Homes				
Real Sales Price (1979$)	104,316	104,932	66,332	75,431
Square Footage	1,719	771	1,645	959
Full Baths	1.91	0.71	1.82	0.75
Half Baths	0.21	0.42	0.22	0.43
Garage/Carport	0.91	0.29	0.77	0.42
Age	18.32	15.60	17.53	17.22
Neighborhood Cost Factor	1.30	0.28	1.23	0.34
Number of Observations	139,480		234	
Panel B: Condominiums				
Real Sales Price (1979$)	47,051	52,949	23,932	21,860
Square Footage	1,062	405	808	241
Full Baths	1.44	0.60	1.17	0.40
Half Baths	0.21	0.42	0.12	0.33
Garage/Carport	0.09	0.28	0.01	0.09
Age	8.69	8.02	5.89	6.23
Number of Observations	10,423		235	

This table presents sample means of various unit characteristics for the Dallas single-family homes and condominiums. Sales prices are deflated by the weighted repeat sale index calculated later in the article to provide a constant means of comparing sales prices.

than in most parts of the country, auctioned units are bunched at the low end of the market.

Empirical Evidence

As expected, the WRS equations show that auctions sell property at a discount that varies significantly across the two cities. The auction coefficient in Los Angeles (Column 1, Table 3) shows that auctions sell property at a small 1% discount, an estimate that is not statistically different from zero at conventional confidence levels. By contrast, auctions in Dallas (Column 1, Table 4) sell units at a much larger discount that ranges between

Table 3 ◼ Weighted repeat sale regression results for Los Angeles condominiums.

Variables	(1)		(2)		(3)	
	Coef	t-Stat	Coef	t-Stat	Coef	t-Stat
New	.03	6.1	.03	6.2	.03	6.1
Minimum Price	−.01	0.6				
Minimum Price: Single-Site			.04	1.3		
Minimum Price: Scattered-Site			−.10	2.7		
Top Third					−.01	0.1
Middle Third					.01	0.1
Bottom Third					−.03	0.9
R^2	.64		.64		.64	

The dependent variable for the repeat sale equations is the difference in log prices between the second and first sale. The table shows only the coefficients on the auction variables and a dummy variable for new properties, which can be interpreted as the log discount (or premium) associated with a given type of auction sale or a new property. All equations also contain dummy variables for the quarter of sale, where the dummy equals −1 if the first sale took place in a given quarter, 1 if the second sale took place in a given quarter, and zero otherwise. The quarterly coefficients are graphed in Figure 1. All regressions have 17, 891 observations.

19% and 21%, depending on the type of auction.[6] This result is consistent with the prediction (Mayer 1994) that the auction discount percentage should be higher in a bust market (Dallas) than in a boom market (Los Angeles).[7]

In column (2), the results are decomposed by sale type. Interestingly, single-site auctions perform much better that scattered site auctions. In Los Angeles, the coefficient suggests that single-site auctions actually obtain a slight premium of 4%, although the coefficient has a t-Statistic below 1.3. By contrast, scattered site auctions obtain a discount of almost 10%, a result that is statistically different from zero with more than 95% confidence. In Dallas, single-site auctions also perform better than scattered site sales, although both types of auctions obtain discounts (9% versus 21%, respectively) that are much larger in magnitude than in Los Angeles.

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[6] For example, the coefficient on unpublished reserve, scattered site auctions is −.24, suggesting a discount of $(1 - \exp(-.24)) = .21$, or 21%.

[7] The auction coefficients can be interpreted as the average discount within each city during the sample period. Sample size constraints do not allow separate estimates of the auction coefficient by year.

Table 4 ■ Weighted repeat sale regression results for Dallas single-family homes and condominiums.

Variables	(4) Coef	(4) t-Stat	(5) Coef	(5) t-Stat	(6) Coef	(6) t-Stat
New (Single-Family)	.04	12.6	.04	12.6	.04	12.6
New (Condominium)	.05	2.7	.05	2.5	.05	2.7
Unpublished Reserve: Scattered-Site	−.24	7.6	−.24	7.6		
Minimum Price	−.21	4.3				
Minimum Price: Single-Site			−.09	0.8		
Minimum Price: Scattered-Site			−.23	4.3		
Top Third					−.22	5.8
Middle Third					−.22	4.4
Bottom Third					−.23	4.7
R^2	.40		.40		.40	

The dependent variable for the repeat sale equations is the difference in log prices between the second and first sale. The table shows only the coefficients on the auction variables and a dummy variable for new properties, which can be interpreted as the log discount (or premium) associated with a given type of auction sale or a new property. All equations also contain dummy variables for the quarter of sale, where the dummy equals −1 if the first sale took place in a given quarter, 1 if the second sale took place in a given quarter and zero otherwise. Single-family homes and condominiums have separate time dummies and different estimated weights in the WRS equation. This is equivalent to stacking the regressions for the two groups with the restriction that the auction coefficients are equal. The quarterly coefficients are graphed in Figure 2. All regressions have 28,154 observations.

The difference in premia between the single-site and scattered-site sales is quite pronounced in both cities. These auctions can be expected to have different discounts, for several reasons. The single-site auctions involve newer units designed to appeal to a wide audience with similar preferences. Buyers of scattered-site units that are older and less contemporary might have much more dispersed preferences over those properties. Mayer (1994) suggests that homogeneous properties have a lower auction discount because there is less to be gained if the seller holds out for a buyer who really likes the unit. In addition, scattered-site auctions are more difficult to market, given their diverse set of properties. Single-site auctions can more easily focus on buyers of a particular type of property in one location. The larger discount for scattered-site units could also be partially due to measurement error. Some of these properties may have been in poor shape after having been previously occupied by owners who were evicted. All auction units

were accompanied by an appraisal, and units in poor condition were removed from the sample. Because the included condition variable is an imperfect measure of changes in condition, some bias could still occur.

Interestingly, the Los Angeles WRS regressions show that properties in single-site auctions sell at a premium of 3.5%, although the coefficient is still not significant at conventional levels. The WRS in Los Angeles was also run with separate dummies for the four largest single-site auctions, to see if one particular auction was driving the auction coefficient estimate. The coefficients for the four auctions were remarkably stable, ranging from 3% to 7% premiums, although none were significant at the 5% level.

The suggestion that some properties at auction actually sell at a premium is surprising, particularly because that result would suggest that most developers would be better off selling their projects quickly at an auction, gaining cost savings *and* price increases. One explanation is that most of the single-site auctions took place early in the sample period at a time when auctions were beginning to receive a lot of attention, in the media as well as with potential buyers. Consequently, bids might have been higher than anticipated. It is also possible that this type of auction in a boom market attracted inexperienced buyers who were susceptible to overbidding, as in the "winner's curse."[8] Neither of these phenomena should be expected to continue in the long-run.

Unpublished reserve sales sell at a quite similar prices to sales with a published minimum price. In principle, units with a published reserve price should obtain slightly higher prices because the published reserve gives some information to potential bidders regarding the seller's actual estimate of value for a property and because the bid at auction is the final sales price. By contrast, sellers at unpublished reserve auctions can negotiate further with the highest bidder if the owner is unwilling to sell at the price of the winning bid. In practice, however, both published and unpublished reserve prices are set so low as to provide little information to sellers and not place a binding constraint on bids.

Even in a very poor real estate market, the estimated discount for Dallas auctions (between 9% and 21%) is much lower than the discount found by

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[8] The "winner's curse" occurs when bidders fail to account for the possibility that they have overestimated a property's value when placing a bid. See Mead, Moseidjord and Sorensen (1984), Kagel and Levin (1986), Hendricks and Porter (1988), Theil (1988), Gilberto and Varaiya (1989), Milgrom (1989) and Vandell and Riddiough (1992) for more information on "winner's curse."

other hedonic studies including research by Gau and Quan (1992), who looked at land sales near Austin, Texas, and Wright (1989), who studied HUD auctions. As noted in the methodology section, the hedonic regression potentially suffers from an unobserved variables problem that could affect the auction coefficients.

Estimates from hedonic equations (Tables 5 and 6) provide strong evidence of such a bias. In addition to the reported auction coefficients, the hedonic equations also contain variables for property attributes—listed in Tables 1 and 2—the condition of the property, zip code of location and quarter of sale. Nonetheless, unobserved quality may still be a problem, especially for scattered-site auctions. Properties in scattered-site auctions come from portfolios of large institutions, many of whom choose units to be auctioned because they are less desirable and harder to sell. In Dallas, the estimate of the discount for property sold at an unpublished reserve auction increases from 21% to 31% using the hedonic estimates. Whereas the hedonic estimates suggest that the unpublished reserve auctions have a larger discount than minimum-price auctions, WRS estimates show no difference between the two sales types. Again, this finding could be explained by the fact that many unpublished reserve sales consisted of government properties that were of lower quality than the units in minimum-price auctions, mostly conducted for private banks.

Table 5 ■ Hedonic regression results for Los Angeles condominiums.

Variables	(7)		(8)		(9)	
	Coef	t-Stat	Coef	t-Stat	Coef	t-Stat
Minimum Price	−.06	2.9				
Minimum Price: Single-Site			.01	0.2		
Minimum Price: Scattered-Site			−.24	6.0		
Top Third					−.11	2.6
Middle Third					−.08	2.0
Bottom Third					−.15	4.0
R^2	.66		.66		.66	

The dependent variable for the hedonic equations is the log sales price. The table shows only the coefficients on the auction dummy variables, which can be interpreted as the log discount (or premium) associated with a given type of auction sale. All equations also contain dummy variables for the quarter of sale and variables for a large number of unit characteristics. The regressions have 124,419 observations.

Table 6 ■ Hedonic regression results for Dallas single-family homes and condominiums.

Variables	(10) Coef	(10) t-Stat	(11) Coef	(11) t-Stat	(12) Coef	(12) t-Stat
Unpublished Reserve: Scattered-Site	−.37	19.1	−.37	18.9		
Minimum Price	−.19	6.8				
Minimum Price: Single-Site			.02	0.4		
Minimum Price: Scattered-Site			−.31	8.9		
Top Third					−.27	10.8
Middle Third					−.33	12.7
Bottom Third					−.35	11.4
R^2	.99		.99		.99	

The dependent variable for the hedonic equations is the log sales price. The table shows only the coefficients on the auction dummy variables, which can be interpreted as the log discount (or premium) associated with a given type of auction sale. All equations also contain dummy variables for the quarter of sale and variables for a large number of unit characteristics. Single-family homes and condominiums have separate time dummies and separate variables for unit characteristics. This is equivalent to stacking the regressions for the two groups with the restriction that the auction coefficients are equal. All regressions have 149,903 observations.

Although the WRS and hedonic methods generate similar price indexes, the hedonic method uses data from a much larger sample of properties. Resale properties are older, smaller and less expensive than properties that sell only once, and they may have different appreciation rates. (See Clapp and Giacotto 1992; and Case and Mayer 1996.) To test this view, the hedonic index was run on the subsample of properties that sold more than once in the sample. Although not reported here, the auction coefficients are remarkably similar for hedonic regressions run using the whole sample and the repeat sale subsample. For example, the estimated coefficient for unpublished reserve auctions increases from −0.37 to −0.38. The minimum price coefficient goes from −0.31 to −0.34 while the single-site coefficient is virtually unchanged. The Los Angeles equations behave in a similar fashion, showing no significant change in the auction coefficients when the hedonic equation is run only on properties that sell more than once.

The Declining Price Anomaly

The WRS equations show little evidence of price declines over the course of the auction in either Los Angeles or Dallas. Column (3) in Tables 3 and

4 includes dummy variables for whether a unit was in the first, second or final one-third of the units sold at auction. The coefficients in each of the cities are nearly identical. This result is in contrast with several papers described in the introduction that find a significant decline in prices over the course of the auction. One reason for this disparity can be found by looking at the hedonic coefficients in column (3) of Tables 5 and 6. In Dallas the hedonic coefficients show a significant price decline after the first third of the auction, whereas the discount is constant in the WRS model. The difference between the top third and middle third coefficients in the hedonic regression is significant at the 4% level using an F-test.

Once again, the difference between these two methods may be due to the selection problem. Auctioneers profess that they put desirable properties at the beginning of an auction to attract healthy competition and higher prices, which they hope will carry through to some of the less desirable units that follow. Hedonic estimates that cannot control for all of the characteristics that make a property desirable may find that order has a large effect on prices because order is correlated with desirability.

Another possible explanation for the difference between the results in this study and others is that the sample used in this research includes many scattered-site sales. Given that units in a scattered-site sale appeal to widely varying types of buyers, it would be surprising to find price declines over the course of the auction for these units. For example, an expensive single-family house might be sold immediately after a cheap condominium located in another state.

Figure 3 plots price residuals for each unit sold in a single-site auction in Los Angeles and Dallas and still finds no evidence of the declining price anomaly. The residual is defined as the (actual) price at auction minus the predicted price, where the predicted price is computed by indexing the subsequent sale price of that property to the auction date using the WRS price index. The residuals is then divided by the auction sales price to get a percentage discount or premium at auction. Finally, the mean discount for each auction is subtracted off, giving a corrected auction discount with an expected mean of zero. Figure 3 plots the corrected discount against the order percentile, for each auction. The trend line shows no evidence of a price decline over the course of the auction. In fact, prices are quite flat.

While unobserved quality could explain the results in studies that use a hedonic methodology, Ashenfelter and Genesove (1992) present evidence of price declines in two single-site condominium auctions by looking at resales of properties whose auction sale fell through. They find that auction prices

Figure 3 ■ Corrected auction discount for single-site auctions with trend line.

This figure plots price residuals for each unit sold in a single-site auction in Los Angeles and Dallas. The residual is defined as the (actual) price at auction minus the predicted price, where the predicted price is computed by indexing the subsequent sale price of that property to the auction date using the WRS price index computed in Tables 3 and 4. The residual is then divided by the auction sales price to get a percentage discount or premium at auction. Finally, the mean discount for each auction is subtracted off, giving a corrected auction discount with an expected mean of zero. The figure plots the corrected discount against the order percentile, for each auction. The trend line shows no evidence of a price decline over the course of the auction (the declining price anomaly).
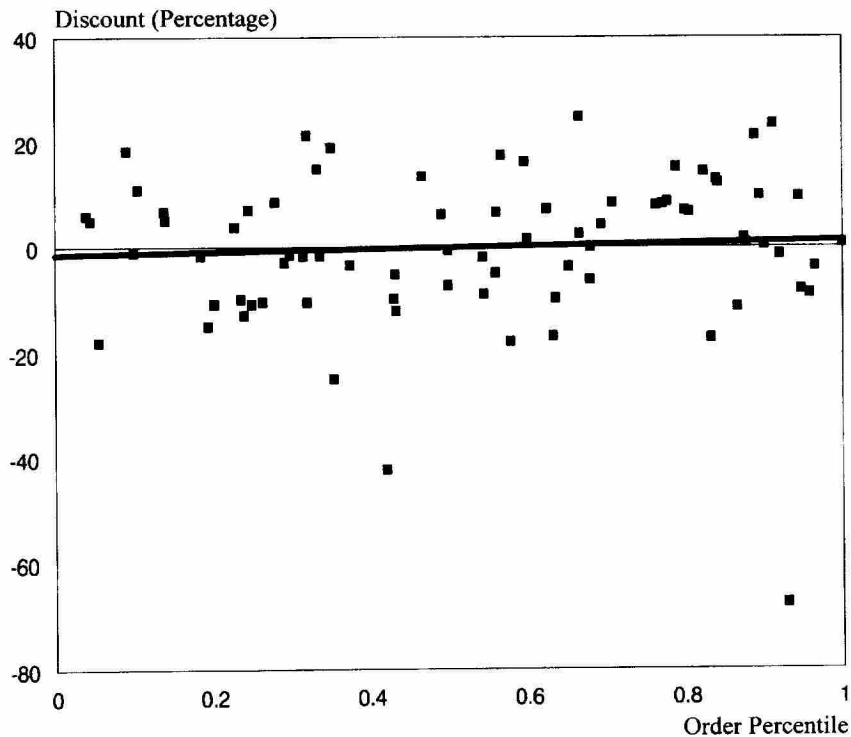
decline with order much more steeply than the subsequent resale prices. There are several ways to reconcile the above findings with those of Ashenfelter and Genesove. The declining price anomaly may only be present in some auctions or that it is a small effect relative to the noise from repeat sales long after the auction. This is consistent with Ashenfelter's (1989) finding that prices at wine auctions sometimes rise, although declines are twice as likely as increases. If the order of magnitude of the price declines is small relative to the variance in resale prices, it might require a

significantly larger sample to find statistically significant evidence of the declining price anomaly. Another possibility is that cash-constrained developers use a one-price-per-unit strategy for quickly selling condominiums that have fallen through at auction. This scenario suggests that sales by the developer immediately following an auction might not be equivalent to sales in subsequent years and might be biased towards finding price declines.

Conclusion

This research shows that auctions in Los Angeles during the real estate boom of the mid 1980s sold property at a discount that ranged between 0% and 9%, while similar sales in Dallas during the real estate bust of the late 1980s produced discounts between 9% and 21%. This evidence is consistent with a theory (Mayer 1994) that predicts that auctions sell property at a discount, which increases in down markets. This study also finds evidence that scattered-site auctions sell at a larger discount than the more homogeneous sales of single-site condominiums. Finally, no evidence was found of price declines over the course of an auction, even for single-site auctions.

The findings suggest that auctions are a viable sales strategy for sellers that can take advantage of the economies of scale in holding a large auction. Total commission and advertising costs for an auction can be up to 2% lower than selling units individually through private negotiations. Developers of single-site properties should find auctions quite attractive given the small discounts obtained at these types of sales. It is not surprising that some California developers even build projects with the intent of selling all the units by auction. For individual owners who are willing to live in their property until sale and have no urgent reason to move (such as a job transfer or children in school), auctions appear much less attractive.

Although discounts increase in down markets, so does the average time to sale for negotiated sales. This is important for institutions like large banks or the FDIC that face holding costs averaging as much as 1% to 2% per month and average sales times that can exceed a year for many types of property. In addition, this article probably overestimates the auction discounts for large institutions with high holding costs. These institutions price their properties aggressively in order to reduce sale times, resulting in lower prices than might be obtained by a private seller who is living in a property and thus has lower holding costs. At the other extreme, Genesove and Mayer (1997) show that constrained sellers actually increase their asking price relative to other sellers, accepting a longer time-to-sale in return for a higher selling price. Salant (1991) also presents a model in which the length

of time a seller has to sell a property affects the reservation price and the decision of whether to use a broker.

Auctions may also be attractive at times when market prices are changing quickly and owners have difficulty setting an asking price. This point is especially true in booming markets when owners may have a tendency to underprice their property. Underpricing manifests itself in multiple offers at or above the asking price. In that case, owners already use some form of an auction to allocate the property to the highest valuation buyer.

This article suggests much scope for future research on the more general question of whether the timing of sales of large amounts of real estate can affect prices in a market. In particular, can large sellers "flood" a market, bringing down prices and reducing its own revenue? From the perspective of a large seller, what is the opportunity cost of selling at auction? Does such a seller normally sell at a discount to market? If so, how much? Finally, how does time-on-the-market vary with market conditions? This article provides a baseline that can be used to perform simulations of the decision facing an owner of large amounts of real estate.

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Appendix
Description of the Data

Extensive information about condominium sales in Los Angeles County between 1970 and the third quarter of 1991 was obtained from the Damar Corporation in Los Angeles. The Dallas data come from the Dallas County Appraisal District (DCAD), which collects information on all of the county's real estate in order to calculate tax appraisals. These data sets contain observations on the sales price and date as well as various property characteristics for properties sold during the sample period. They also include information on a property's condition and quality.

The Damar data were gathered mostly from county records as well as from members of the Society of Real Estate Appraisers, who fill out detailed information on all sales. Although the data are quite extensive, they do not contain information on all sales and frequently are missing variables for particular sales. Although the missing data may limit the variables that can be used in the hedonic estimations, there is no reason to believe that the data omissions are systematic in a particular way that might bias the empirical results.

The DCAD also collects sales prices but this variable is incomplete because Texas law does not require parties to a real estate transaction to report the final sales price. Given the importance of current prices in determining an accurate assessment, the DCAD attempts to collect sales prices from the various county groups involved with real estate. These sources include the local Multiple Listing Service, the appraisers, other groups of real estate professionals and any other source that collects prices. Because of the lack of reporting, it is impossible to determine how complete the data are, but the DCAD is confident enough to use them for tax appraisal purposes. To

the extent that biases exist, it is likely a result of the under-reporting of private transactions that do not involve a realtor or a bank appraisal. Also, because properties are not inspected every year, some variables are not filled in for all units, including the condition variable, which exists only for a subset of properties.

Information on auctions was obtained in visits to one or more firms that conducted auctions in Dallas and Los Angeles in the 1980s. The Los Angeles sample contains information on 21 English-style auctions between 1981 and 1987, with all auctions conducted as absolute sales above previously published minimum prices that varied by property. Ten of these sales were scattered-site auctions, while the remaining eleven were single-site auctions. The seller in these cases was a developer or bank wishing to sell all remaining units at one time.

The Dallas sample contains data on 21 English-style auctions, most of which were scattered-site auctions. One auction was a single-site sale of 185 units in a condominium complex, with a published minimum price. All but two of the auctions maintained some type of reserve price. The other two auctions were absolute, with all properties selling at the highest bid, regardless of price. Of the reserve auctions, some utilized a published minimum price, above which the highest bid was always accepted. These are referred to as minimum bid sales. The other auctions had an unpublished reserve, meaning that the seller reserved the right to reject the highest bid. Most minimum bid sales were conducted by private banks, whereas government sales tended to have unpublished reserve prices.

The auction information was merged into the transaction data sets by hand, using the property's address to identify matched resales. In the combined data set, properties were matched on house number, street name, unit number and city, although some Los Angeles units were missing data on city and zip code. Given the potential of mismatches or changes in a property's condition, the resale price data were filtered to ensure that for all matched sales, the unit in both sales contained the same reported number of rooms, bedrooms, bathrooms and square footage and was in a similar reported condition.[9] Finally, observations were deleted if they showed appreciation or depreciation of more than 500% over five years, on the grounds that these observations were either mismatches or coding errors. However, deletions

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[9] A property's condition was reported as poor, fair, average, good or excellent. Following Case and Shiller (1987), all resales that reported changes of more than one group up or down were deleted to ensure that the estimated index was not biased as a result of unobserved depreciation or appreciation in the base properties.

on the basis of excess appreciation or depreciation had no effect on the reported results.

Using recent appraisal forms, all auction properties were removed from the sample if they were in poor condition, on the grounds that these properties were likely to be fixed up before a subsequent resale or had been allowed to deteriorate substantially from a previous sale. Either of these possibilities would lead to an artificial downward bias on the coefficient for the auction price. For example, consider a property that is purchased at auction in poor condition and renovated. The subsequent sales price would rise even with no appreciation in the rest of the market. Without a control for the change in condition, the price increase would be attributed to a low auction price. Despite these efforts to control for changes in auction properties, the improvement bias may still cause the WRS to overestimate the discount associated with auctions. The appraisal reports suggest that most auction properties are in worse than average condition because of remaining vacant for a period that can be as long as several years. Also, many of these units were previously foreclosed upon, leading their former owners to stop doing preventive maintenance when they realized they would lose their homes. Some previous owners even stripped their homes of all appliances.