An Analysis of the Price Formation Process at a HUD Auction

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Abstract

This study considers whether auctioned properties sell for different prices than they would bring through private negotiation. After reviewing the procedural aspects of the Department of Housing and Urban Development auctions, we compare the observed prices of properties sold at one such auction with predicted market values based on assessment ratios for the region to detect any discount or premium. We also consider whether the order of sale of the auctioned properties affects observed prices. We find that sample properties sell at a significant discount relative to predicted market values and that prices tend to increase as the auction proceeds, holding quality of the properties constant.

"You mean, I won? Now what do I do?"

Comment overheard from a winning bidder at a recent HUD home auction in Florida.

Introduction

To some people, the mention of the phrase "real estate auction" brings to mind fantastic opportunities to purchase properties at deep discounts to their true value. Presumably, properties that appear on the auction block are those that must be sold quickly due to some urgency on the part of the current owner. The perceived urgency associated with the auction concept may lead to the notion that auctioned properties sell for lower prices than they would otherwise bring through more traditional market mechanisms. This study analyzes auction prices and compares them with predicted market values that might be obtained through private negotiations.

The auction mechanism is a frequent research topic, perhaps because auctions, especially those in the English format with oral ascending bids, provide researchers with a first-hand opportunity to observe the price formation process. In an early study on the theory of auctions, Vickrey (1961) discusses some rather strong assumptions that must hold to ensure that the auction mechanism results

in the same price as a non-auction transaction. Subsequently, numerous researchers have considered price formation in auctions in which one or more of Vickrey's assumptions are relaxed. Reviews of this literature are found in McAfee and McMillan (1986) and Wilson (1992).

In recent years, auction research has focused on the microstructure of the price formation process. Studies by Ashenfelter (1989), Ashenfelter and Genesove (1992) and De Boer, Conrad and McNamara (1992), for example, question whether prices of similar items sold in a sequential auction are affected by the order of sale. In other words, are prices systematically higher or lower at the beginning of the auction than they are near the end of the auction, holding other things constant? If the answer is yes, then the expected revenue of an auction may be impacted by the ordering of the assets on the auction block.

Lusht (1994) addresses this issue with respect to real estate auctions using a sample of Australian branch bank properties that were sold at auction in 1988. He finds that prices for the auctioned properties exhibited a significant decline as the auction proceeded, even after accounting for quality differences in the auctioned properties.

More recently, Mayer (1998) examines the relationship between auction prices and predicted sales prices (based on a repeat sales index). Confirming his earlier work (Mayer, 1994), Mayer finds that auctions sell property at a discount, which increases in down markets. Furthermore, he finds that the discount is larger in "scattered-site auctions" than in auctions involving single-site (condominium) properties. Mayer's study finds no evidence of the declining price anomaly.

The objective of this study is to extend the research regarding the auction price formation process through empirical analysis of transaction prices from a recent auction held on behalf of the Department of Housing and Urban Development (HUD). We compare transaction prices from this auction with predicted market values of the auctioned properties calculated using mean assessment ratios for the regions in which the properties are located. The evidence demonstrates that auction prices exhibit discounts relative to predicted market values that vary across subsamples of the data. We then investigate the relationship between sequential order and auction price, holding quality constant, and document that order of sale may indeed impact auction prices. In contrast to the results reported by Lusht (1994) and Mayer (1998), however, we find that prices, after controlling for value, tend to increase as the auction proceeds. We hypothesize that this positive relation between price and order may be attributable to increased aggression (or perhaps desperation) on the part of bidders who see their opportunity to find a bargain slipping away as the auction proceeds.

The remainder of this article is organized as follows. The next section describes the mechanics of a HUD home auction held in Fort Lauderdale, Florida, including details about the quality of legal title conveyed by HUD to purchasers, buyers' obligation to inspect the properties before the auction date, real estate agents' role

in the auction process, earnest money requirements and closing arrangements. The following section presents a comparison of transaction prices from this auction with independent estimates of the value of the auctioned properties to detect any systematic price discounts or premiums. This section also describes the methods used to examine any relationship between transaction price and the order of auction, holding quality of the auctioned items constant. The results of this analysis confirm that order of sale may indeed be a significant price factor, with prices rising as the auction proceeds. The final section is the conclusion.

The Mechanics of a HUD Home Auction

As a result of foreclosure, HUD frequently comes into ownership and possession of properties that were pledged as collateral for FHA-insured mortgage loans. Federal Housing Administration (FHA) insurance is a program in which the borrower purchases insurance that protects the lender in the event that the borrower defaults on the obligation to repay the debt. If the borrower defaults on a FHA-insured loan and the lender acquires title to the property through the foreclosure process, the lender then files a claim with the FHA for reimbursement of any losses and simultaneously conveys title to the property to HUD. HUD then endeavors to sell the property to recover as much of the claim as possible by listing the property with a HUD-affiliated real estate broker in the local area.

When a sufficient inventory of unsold properties accumulates in a given geographic area, HUD may arrange for an independent auctioneer to conduct a public auction of the properties. The frequency of HUD auctions around the country depends on the rate of default on FHA-insured loans that result in lenders acquiring title to the mortgaged properties through foreclosure and local market conditions that may inhibit the sale of the property through the traditional listing arrangement with a HUD-affiliated real estate broker.

On July 10 and 11, 1998, an auction for single-family homes owned by HUD in south Florida was conducted in Fort Lauderdale, Florida at the Radisson Bahia Mar Resort Hotel. The auction began at noon on each of the two days and continued for approximately two hours until the last property on the block for that day was sold. The auction was organized by Larry Lathem Auctioneers, a professional auction company headquartered in Phoenix, Arizona. Each of the properties offered at the auction was sold to the highest bidder. On the first day of auction, seventy-one properties located in Broward and Palm Beach Counties were sold. On the second day, ninety-nine properties located in Miami-Dade County and various counties along the southwestern coast of Florida were sold.

Prior to the auction date, the auctioneer advertised the event to the public by direct mail, newspaper advertisements and the Internet to attract bidders to the auction. A list of properties to be auctioned was provided to the public in advance of the auction date, and potential bidders were encouraged to visit and inspect the properties prior to the auction and to attend a buyer's awareness seminar. At the

seminar, the auctioneer informed the potential bidders of the following general facts regarding HUD auctions.

Properties sold at HUD home auctions are delivered to the buyer with clear title. All liens and other encumbrances of record are eliminated through the foreclosure process before HUD accepts title. The title conveyed by HUD to winning bidders is considered ''good and marketable,'' though buyers may purchase title insurance for additional protection from undiscovered defects in the title.

All auction sales by HUD are final and all homes are sold on an ''as is'' basis. No sales are contingent on the buyer's inspection of the property. Because many of the properties owned by HUD are in less than pristine condition, HUD sometimes sets aside escrow funds to cover the estimated cost of anticipated repairs. Information about the amount (if any) of repair escrow funds available for each property on the auction list is provided to potential buyers. The escrow funds are only available to owner-occupants using FHA-insured financing. Any excess funds remaining in escrow after repairs are completed will be applied to the principal balance, and any cost overages must be borne by the buyer. Investors and owner-occupants using cash or non-FHA financing are not eligible to receive the repair escrow funds.

HUD discloses whether the property is eligible for FHA-insured financing, whether the property was built before 1978 (an indicator of potential lead-based paint on the premises) and whether the property is located in a flood zone. No disclosures or guarantees are made regarding potential code or zoning violations.

To facilitate potential bidders' inspection of the homes on the auction list prior to the auction date, local real estate agents who wish to represent potential purchasers are encouraged to register with HUD prior to the auction and are given a pass key, which permits interior access to all of the homes on the auction list. Real estate agents representing a winning bidder at the auction are entitled to a 3% commission, payable by HUD upon closing. If an agent buys a property for his/her own account, no commission is paid to the agent. The purchaser is not entitled to a discount if the services of a real estate agent are not used.

To register as a bidder at a HUD home auction, potential purchasers must prove that they have either sufficient cash to complete the purchase or have a letter of pre-approved credit from a HUD-approved lender. In addition, all bidders are required to have cash or a cashier's check for $2,000 as earnest money for each property the bidder intends to buy. Unless HUD grants an extension, earnest money is forfeited if the purchaser fails to close on the property within the time limit discussed below. Inability to obtain financing results in forfeiture of the earnest money.

Because clear title is immediately available and because the properties are sold in ''as is'' condition, HUD requires that transactions close within thirty days of the auction date. Closings are arranged by a designated HUD closing agent. HUD pays the closing agent's fee, deed preparation costs and other closing costs

customarily paid by the seller up to 3% of the purchase price. Real estate taxes, water and sewer charges, etc. are prorated to the date of the closing.

An incentive program is available to encourage purchasers to close their transactions within fifteen days of the auction. For properties with auction prices above (below) $25,000 HUD provides a cash rebate of $900 ($450) if the closing occurs within fifteen days. The rebate is divided equally between the lender and the real estate agent (if both are used). If no lender is used, the purchaser may collect the lender's portion. If no real estate agent is used, HUD retains the agent's share of the rebate.

The earnest money deposit of $2,000 is payable at the auction, with the full balance of the purchase price due on closing. If the purchaser is using a FHA-insured loan to fund the transaction, HUD imposes strict downpayment limits. For owner-occupants, the minimum downpayment is 3% of the purchase price. For investors, the minimum downpayment required for a single-family property is 25% of the purchase price. If the purchaser is not using a FHA-insured loan, the downpayment requirements depend on the loan terms negotiated between the lender and the borrower.

Although the details provided here pertain to a specific HUD auction held in Florida, the arrangements are similar to those employed at other HUD auctions. Of course, unique characteristics of this auction may limit the generality of our analysis.

Analysis of Transactions at a Recent HUD Home Auction

For each property sold at the auction, the auction price was recorded in a database, along with the location of the property (address, city, county), number of bedrooms, number of bathrooms, whether the property was constructed prior to 1978, flood zone status, and whether the property is eligible for FHA-insured financing.[1] Descriptive statistics for the data are shown in Exhibit 1.

Detecting whether auction prices are systematically higher or lower than the price that would result in a non-auction situation requires an accurate estimate of the price each property would bring in an alternative market mechanism. One possible proxy of market value that is readily available is the assessed value of the property as determined by the local property assessor. Using assessed value as a proxy for market value, however, raises several important concerns.

First, assessments are performed annually and may not accurately represent the value of the property on the date of the auction due to changes in market conditions or changes in the condition of the property. Second, there may be a tendency among assessment officers to make ''conservative'' estimates of value to reduce assessment appeals. Third, as Goolsby (1997) finds for owner-occupied homes in various counties in the state of Washington, the use of standardized adjustment premiums and discounts for certain property features by assessors may result in consistent biases in the assessment process.[2]

Exhibit 1 | Mean Values for Data from Auction Sample, with Geographic and Day of Sale Subsamples

	Full Sample	Broward County	Miami-Dade County	Palm Beach County	West Coast	Day 1	Day 2
Auction Price ($)	59,653 (20,821)	63,170 (18,062)	62,293 (21,220)	54,067 (19,499)	29,000 (7,324)	61,069 (18,651)	58,258 (22,815)
Predicted Market Value ($)	72,562 (23,562)	78,046 (22,582)	72,949 (23,910)	68,003 (19,888)	44,032 (10,182)	75,728 (22,252)	69,444 (24,555)
Discount Relative to Predicted Market Value (%)	−17.45 (15.13)	−18.20 (12.27)	−13.45 (17.02)	−21.54 (12.67)	−34.21 (4.75)	−18.97 (12.35)	−15.97 (17.41)
Auction Price minus Predicted Market Value ($)	−12,920 (10,576)	−14,876 (11,100)	−10,656 (11,264)	−13,936 (6,704)	−15,031 (3,829)	−14,659 (10,214)	−11,187 (10,720)
Bedrooms	2.65	2.66	2.69	2.67	2.25	2.66	2.64
Bathrooms	1.77	1.86	1.78	1.67	1.38	1.81	1.73
Constructed prior to 1978[a]	0.51	0.50	0.55	0.27	0.75	0.45	0.58
Flood Zone	0.60	0.72	0.66	0.27	0.13	0.62	0.59
FHA-insurable	0.66	0.60	0.67	0.67	1.00	0.62	0.71
Number	131	50	58	15	8	65	66

Note: Values in parentheses are standard deviations.

[a] Properties constructed prior to 1978 are identified by HUD as potentially having lead-based paint on the premises.

To address these concerns, we obtain predicted market value from assessed value for each property, *i*, by dividing that property's assessed value by the mean assessment ratio for the property class.[3] Exhibit 2 provides summary statistics for the data used to calculate the mean county assessment ratios. The mean assessment ratios for sales during the month preceding the auction for Broward County, Miami-Dade County, Palm Beach County and West Coast counties are 82.4%, 95.1%, 79.4% and 78.7%, respectively.

Based on the data provided in Exhibits 1 and 2, prices observed at the auction for the full sample are 17.45% less than predicted market values, on average. Dividing the full sample into geographic subsamples reveals that the discount from market value ranges from a high of 34.21% for properties on the West Coast to only 13.45% for properties located in Miami-Dade County. Sales that occurred on the first day of the auction exhibit an implied discount from market value of 18.97%, while sales that occurred on the second day of the auction exhibit a discount of 15.97%.

Difference in Means Tests

The descriptive statistics suggest that auction prices are consistently below predicted market values, though the magnitude of the differences varies across subsamples. A paired *t*-test permits testing for systematic differences between auction prices and predicted market values.[4]

The results of applying this test to the mean of the difference between auction prices and market values for the various subsamples are shown in Exhibit 3. The results indicate that the mean differences between auction price and market value for the full sample and all subsamples are significantly different than zero. These results suggest that auction prices examined in this study are systematically lower than prices observed in non-auction transactions.

Exhibit 2 | Mean Values for Data from Control Sample of Non-auctioned Sales

	Broward County	Miami-Dade County	Palm Beach County	West Coast
Control Sample Sales Price ($)	145,534 (109,417)	184,263 (206,459)	196,404 (291,079)	146,231 (202,377)
Control Sample Assessed Value ($)	119,853 (90,238)	175,247 (19,345)	155,849 (229,461)	115,020 (135,148)
Control Sample Assessment Ratio (%)	82.4	95.1	79.4	78.7
Control Sample Size	2,016	1,463	1,204	738

Note: Values in parentheses are standard deviations.

Exhibit 3 | Results from Means Tests Applied to Auction Data to Detect Significance of Discounts within Subsamples

	Full Sample	Broward County	Miami-Dade County	Palm Beach County	West Coast	Day 1	Day 2
Auction Price Discount Relative to Predicted Market Value (%)	17.45	18.20	13.34	21.54	34.21	18.97	15.97
t-Statistic for Difference from Zero	13.21*	10.48*	6.02*	6.59*	20.39*	12.38*	7.45*

*Significant at the 5% level or higher.

Comparisons across the various subsamples may also provide insight regarding potentially systematic differences between auction prices and market values. Specifically, we are interested in whether the difference between auction price and market value from one subsample differs from the difference between auction price and market value from certain other subsamples. Such comparisons require a pooled *t*-test rather than a paired *t*-test because the samples are drawn from different populations.[5]

The results of applying this test statistic to the means of the differences between auction prices and market values for various combinations of the subsamples are shown in Exhibit 4. The tests suggest that auctioned properties located in Miami-Dade County sold at significantly smaller discounts and those on the West Coast of the state sold at significantly greater discounts than properties in the other subsamples considered.

There are at least two possible explanations for the differences in the discounts by subsample. First, because county assessors are elected officials in Florida, they are subject to influence by their constituents. Consequently, assessment ratios vary by county, which should lead to differences in discounts by subsample. A second potential source of the differences by subsample is differences in demand. Although this auction occurred in a robust economy, there may have been some difference in the level of economic activity by region. If this were the case, then the results could be affected by these differences, consistent with Mayer (1994, 1998).

Testing for a Relationship Between Auction Order and Price

To further investigate the microstructure of the price formation process, we employ a framework similar to that used by Lusht (1994) in his investigation of Australian branch bank auction prices. The objective of this portion of the analysis is to test

Exhibit 4 | Results from Pooled *t*tests Applied to Auction Data to Detect Significant Differences between Implied Discounts from Market Values across Subsamples.

	Broward County vs. Other	Miami-Dade County vs. Other	Palm Beach County vs. Other	West Coast vs. Other	Day 1 vs. Day 2
t-Statistic for Differences in Discounts Relative to Predicted Market Value across Subsamples	−0.47	2.68*	−1.11	−8.30*	1.14

*Significant at the 5% level or higher.

the null hypothesis of no impact on transaction prices as a result of the order in which properties are offered at the auction, holding property quality constant. We estimate the following equations:

$$Y_i = f(Order_i, Assessed_i, Escrow_i, County_{i,j}), \quad (1)$$

$$i = 1, \ldots, n \qquad j = 1, \ldots, m$$

$$Y_i = f(Order_i, PMV_i, Escrow_i, County_{i,j}), \quad (2)$$

$$i = 1, \ldots, n \qquad j = 1, \ldots, m$$

where:

Y_i = Auction price for the ith property;
$Order_i$ = Order of auction; the first property to sell = 1, the second = 2, etc.;
$Assessed_i$ = Assessed value of the ith property;
PMV_i = Predicted market value of the ith property;
$Escrow_i$ = Escrow for anticipated repairs; and
$County_{i,j}$ = Miami-Dade, Palm Beach, West Coast; dummy variables equal to one for the location of the ith property, zero otherwise.

Assessed value is included in the specification shown in Equation (1) and predicted market value is included in the specification shown in Equation (2) to control for variation in property quality in the way Lusht used the seller's reported "reserve price" to address quality differences. We also control for the availability of an escrow account to cover anticipated repairs. Systematic differences by county are addressed through the use of county dummy variables, with Broward as the omitted county. We estimate an additional equation with alternative proxy variables to control for quality differences across the auctioned properties. This equation is:

$$Y_i = f(Order_i, Bed_i, Bath_i, LBP_i, FZ_i, Insurable_i, Escrow_i, County_{i,j}), \quad i = 1, \ldots, n \qquad j = 1, \ldots, m \quad (3)$$

where:

Y_i = Auction price for the ith property;
$Order_i$ = Order of auction;
Bed_i = Number of bedrooms;
$Bath_i$ = Number of bathrooms;
LBP_i = Possibility of lead-based paint hazard (construction prior to 1978);

FZ_i = Whether the property lies in a flood zone;
$Insurable_i$ = Whether the FHA-insured financing is available on the property;
$Escrow_i$ = The amount of escrow fund for anticipated repairs;
$County_{i,j}$ = Miami-Dade, Palm Beach, West Coast; dummy variables equal to one for the location of the ith property, zero otherwise.

We fit each of these equations using ordinary least squares to the full sample of transactions and to subsamples containing properties auctioned on the first and second days of the auction. The results are shown in Exhibits 5 and 6.

As shown in Exhibit 5, estimates of the parameters of Equations (1) and (2) with the full sample of transactions indicate that auction prices are positively and significantly related to order of sale, controlling for property quality and for differences by county. To demonstrate the economic significance of the results, consider the following example. For the twenty-fifth property auctioned, a Broward County house with two bedrooms, two baths, and an assessed value of $66,470, the estimated coefficient for order in Equation (1) implies a positive effect on transaction price of $3,654. Thus, order of sale is significant both statistically and economically.[6] The results for Equation (3) in Exhibit 5, however, fail to support the significance of order of sale when more detailed control variables are used. Examination of the adjusted R^2 and F-Statistics for the three equations shows that the variation in the auction prices is better explained by Equations (1) and (2) than by Equation (3), which includes more detailed control variables.

Exhibit 6 shows order of sale is significantly related to auction price on the first day of the auction in Equations (1) and (2), but order of sale is not significant in any specification for the sample of transactions occurring on the second day of the auction.

The significance of escrow on auction prices in Exhibits 5 and 6 is also of interest.[7] Estimates of the parameters in Equations (1) and (2) with the full sample and with the subsample for the first day of the auction indicate that buyers are willing to pay a premium for properties offering escrow accounts to cover anticipated repairs. For the full sample, the estimated coefficient indicates that the transaction price is increased by nearly the full amount of the escrow account.

Testing for a Relationship Between Auction Order and Discount Relative to Market Value

The previous section tests whether prices are affected by order of sale for the various subsamples, but does not directly address whether the difference between market value and auction price is impacted by order of sale. To consider whether the discount (or premium) relative to predicted market value is related to order of sale, we estimate the following equations:

Exhibit 5 | Testing the Full Sample for the Impact of Sequential Order on Auction Prices using OLS Regression

	Full Sample (Equation 1)	Full Sample (Equation 2)	Full Sample (Equation 3)
Intercept	−804.39 (3,309.87)	−517.67 (3,290.55)	29,983.00** (9,119.45)
Order	146.15** (60.40)	146.83** (60.32)	157.10 (124.87)
Assessed Value	0.93** (0.04)	–	–
Predicted Market Value	–	0.75** (0.03)	–
Bed	–	–	8,071.99** (2,722.29)
Bath	–	–	1,984.65 (2,747.00)
LBP	–	–	−943.56 (3,258.52)
FZ	–	–	472.76 (3,892.27)
Insurable	–	–	7,040.47 (4,931.58)
Escrow	0.97** (0.40)	0.96** (0.40)	−0.05 (1.39)
Miami-Dade	−8,175.11 (5,119.81)	−8,593.59* (5,117.74)	−13,463.00 (9,930.29)
Palm Beach	−6,257.54** (2,778.54)	−7,678.04** (2,735.47)	−14,281.00** (7,264.70)
West Coast	−16,332.00** (2,980.34)	−17,096.00** (2,968.19)	−39,000.00** (6,510.39)
Adj. R^2 (%)	82.63	82.71	24.24
F-Statistic	104.04**	104.66**	5.16**
Number	131	131	131

Notes: The dependent variable is auction price. The standard errors of the coefficients are in parentheses and have been corrected for heteroskedasticity following White (1980).
*Significant at the 10% level or higher.
**Significant at the 5% level or higher.

Exhibit 6 | Testing Daily Subsamples for the Impact of Sequential Order on Auction Prices using OLS Regression

	Day 1 Sample (Equation 1)	Day 1 Sample (Equation 2)	Day 1 Sample (Equation 3)	Day 2 Sample (Equation 1)	Day 2 Sample (Equation 2)	Day 2 Sample (Equation 3)
Intercept	−239.59	−67.75	38,865.00**	−7,903.60	−7,894.13	1,198.28
	(3,846.84)	(3,803.89)	(12,325.46)	(10,979.72)	(10,979.04)	(18,042.18)
Order	173.01**	174.49**	258.92	125.83	125.90	116.48
	(71.26)	(70.96)	(226.00)	(86.57)	(86.57)	(147.52)
Assessed Value	0.89**	–	–	0.96**	–	–
	(0.06)			(0.05)		
Market Value	–	0.73**	–		0.78**	–
		(0.05)			(0.04)	
Bed	–	–	4,224.84	–	–	14,183.00**
			(3,080.11)			(3,500.34)
Bath	–	–	1,323.12	–	–	2,405.13
			(3,370.05)			(4,432.76)
LBP	–	–	2,784.58	–	–	−1,172.65
			(4,607.51)			(4,797.11)
FZ	–	–	−4,085.76	–	–	4,767.15
			(5,980.78)			(4,522.97)
Insurable	–	–	11,516.00	–	–	6,171.34
			(7,174.22)			(6,588.68)
Escrow	1.50**	1.49**	−0.96	0.42	0.42	0.07
	(0.48)	(0.50)	(1.88)	(0.61)	(0.61)	(1.78)
Miami-Dade	–	–	–	–	–	–

Exhibit 6 | (continued)

Testing Daily Subsamples for the Impact of Sequential Order on Auction Prices using OLS Regression

	Day 1 Sample (Equation 1)	Day 1 Sample (Equation 2)	Day 1 Sample (Equation 3)	Day 2 Sample (Equation 1)	Day 2 Sample (Equation 2)	Day 2 Sample (Equation 3)
Palm Beach	−8,176.37** (3,138.33)	−9,558.51** (3,036.29)	−17,932.00 (11,304.83)	–	–	–
West Coast	–	–	–	−7,058.65* (4,244.59)	−7,479.46* (4,234.58)	−21,631.00** (8,525.83)
Adj. R^2 (%)	83.16	82.25	7.34	82.92	82.92	36.84
F-Statistic	74.08**	75.13**	1.63	79.92**	79.88**	5.74**
Number	65	65	65	66	66	66

Notes: The dependent variable is auction price. The standard errors of the coefficients are in parentheses and have been corrected for heteroskedasticity following White (1980).

*Significant at the 10% level or higher.

**Significant at the 5% level or higher.

Exhibit 7 | Testing for the Impact of Sequential Order on Auction Discount Relative to Predicted Market Value using OLS Regression

	Full Sample (Equation 4)	Full Sample (Equation 5)	Day 1 Sample (Equation 4)	Day 1 Sample (Equation 5)	Day 2 Sample (Equation 4)	Day 2 Sample (Equation 5)
Intercept	−0.250**	−0.255**	−0.257**	−0.290**	−0.346**	−0.272**
	(0.033)	(0.076)	(0.034)	(0.065)	(0.164)	(0.064)
Order	0.002**	0.002*	0.002*	0.001*	0.002	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Bed	–	0.013	–	0.026	–	0.014
		(0.020)		(0.022)		(0.021)
Bath	–	−0.008	–	−0.011	–	−0.006
		(0.018)		(0.019)		(0.018)
LBP	–	0.018	–	0.014	–	0.031
		(0.028)		(0.028)		(0.026)
FZ	–	−0.028	–	−0.001	–	−0.017
		(0.026)		(0.028)		(0.025)
Insurable	–	0.004	–	0.013	–	−0.018
		(0.039)		(0.043)		(0.040)
Escrow/Market	1.000**	0.967**	1.406**	0.226	0.778	0.749*
	(0.385)	(0.438)	(0.548)	(0.618)	(0.553)	(0.456)
Miami-Dade	−0.104	−0.090	–	–	–	–
	(0.086)	(0.083)				
Palm Beach	−0.118**	−0.120**	−0.127**	−0.041	–	–
	(0.046)	(0.045)	(0.044)	(0.040)		

Exhibit 7 | (continued)

Testing for the Impact of Sequential Order on Auction Discount Relative to Predicted Market Value using OLS Regression

	Full Sample (Equation 4)	Full Sample (Equation 5)	Day 1 Sample (Equation 4)	Day 1 Sample (Equation 5)	Day 2 Sample (Equation 4)	Day 2 Sample (Equation 5)
West Coast	−0.306**	−0.314**	–	–	−0.190**	−0.243**
	(0.058)	(0.057)			(0.065)	(0.037)
Adj. R^2 (%)	17.07	15.35	12.37	1.16	16.74	12.99
F-Statistic	6.35**	3.36**	4.01**	1.19**	5.36**	3.43**
Number	131	131	65	65	66	66

Note: The dependent variable is auction price − predicted market value / predicted market value. Standard errors are in parentheses and the coefficients have been corrected for heteroskedasticity following White (1980).

*Significant at the 10% level or higher.

**Significance at the 5% level or higher.

$$Discount_i = f(Order_i, Escrow_i, County_{i,j}) \quad (4)$$
$$i = 1, \ldots, n \qquad j = 1, \ldots, m$$
$$Discount_i = f(Order_i, Bed_i, Bath_i, LBP_i, FZ_i, Insurable_i,$$
$$Escrow_i, County_{i,j}), \qquad i = 1, \ldots, n$$
$$j = 1, \ldots, m \quad (5)$$

where:

$Discount_i = Auction\ Price_i - Predicted\ Market\ Value_i / Predicted\ Market\ Value_i$; and
$Escrow_i = Escrow_i / Predicted\ Market\ Value_i$.

Again, we fit each of these equations using ordinary least squares to the full sample of transactions and to two subsamples containing properties auctioned on the first and second days of the auction. The results are shown in Exhibit 7.

The estimates of the parameters of Equation (4) and Equation (5) indicate that the discounts relative to predicted market value are positively and significantly related to order of sale, with the exception of the estimate for Equation (4) for the day two subsample. For the full sample, both specifications indicate that the premium is greater for properties that include an escrow account for anticipated repairs. With the sample of transactions occurring on day one, escrow is positively related to the discount in Equation (4), but in the alternative model, escrow is no longer significant. For the second day of the auction, escrow is significant in Equation (5), but not in Equation (4).

Conclusion

The perception that auctions present buyers with extraordinary opportunities to acquire assets at deep discounts to value may be fueled by the notion that assets are placed on the auction block when their current owners face an urgent need to dispose of the assets regardless of price. The results demonstrate that auction prices are persistently below predicted market values, though there is some variation in the magnitude of the discount across geographic subsamples. Although the purpose of HUD auctions is to dispose of property in a timely manner, it cannot be assumed that they coincide with distressed markets. This auction, held on July 10 and 11, 1998, takes place in a robust economy, both nationally and locally.

This study reviews the procedural aspects of auctions held to rid HUD of properties acquired as a result of borrower defaults on FHA-insured home

mortgages. Using data from transactions at a recent such auction held in south Florida, we consider whether prices observed at the auction differ significantly from predicted market values. Taking a closer look at the price formation process, we also test the data to consider whether auction prices are related to the order in which properties at the auction were offered for sale.

The results indicate that prices observed at this auction are significantly lower than predicted market values, though the mean discount varies significantly across geographic subsamples. In particular, properties located in Miami-Dade County sold for significantly smaller discounts from predicted market value and those located on the West Coast sold for significantly greater discounts than those in the other subsamples.

The order in which the properties were sold at auction is positively and significantly related to auction prices, suggesting that those who purchased properties later in the auction were more likely to pay a higher price relative to market value than those who purchased earlier in the auction. The indicated price increase as the auction proceeds stands in contrast to Lusht's (1994) findings of an inverse relationship between prices and order of sale and De Boer, Conrad and McNamara (1992) and Mayer's (1998) findings of no price effect associated with order of sale.

Although it is possible that these results could be attributed to an omitted variable such as an ordering strategy on the part of the auctioneer, our analyses failed to find evidence of any such variable. Other variables that could influence the auction price include whether the closing date occurs within fifteen days of the auction, whether the purchaser uses FHA-insured financing and whether the purchaser was an investor or owner/occupant. These variables, however, are unavailable to the authors. In addition, the magnitude of any impact is expected to be economically small.

We hesitantly suggest that the positive relationship between price and order of sale might be attributable to increased aggression on the part of buyers who went through the hassle of preparing to bid at the auction, but began to get nervous as the inventory of properties on the block grew smaller as the auction proceeded. Perhaps, in the spirit of Mayer (1994, 1998), the relation between demand and supply at the auction for a specific subsample influenced the level of aggression on the part of buyers. When we divide our full sample into day one and day two subsamples, we find evidence that order of sale is also positively related to price in the day one subsample, but find no evidence suggesting that buying later in the second day of the auction results in any significant price effect. Overall, the results of the analysis presented here suggest that the ''best'' deals were enjoyed by those who bought early in the auction.

Endnotes

[1] Some 290 properties were advertised for sale at the auction, but a substantial number of them were withdrawn from the auction for undisclosed reasons prior to the sale date. Of the 170 properties sold at the auction, 39 were eliminated due to incomplete data records.

[2] In his study of assessment error in the valuation of owner-occupied housing in Washington, Goolsby's (1997) proposes a more detailed method of correcting for assessment bias than the method employed here. His method addresses specific property features that may impact the direction and magnitude of assessor bias. Application of Goolsby's detailed method is the subject of an intended future research study by these authors.

[3] Predicted market value for property i is calculated as: $PMV_i = \frac{AV_i}{E(AR)}$ $i = 1, \ldots n$, where AV_i is the assessed value for the property i and $E(AR)$ is the mean county assessment ratio calculated using transaction prices and assessed values for a sample of single-family homes that sold within the month prior to the auction in the same county as property i.

[4] To test the null hypothesis of no difference between auction prices and market values, we use the following statistic $t = \frac{d}{s/\sqrt{n}}$ where d and s represent the mean and standard deviation, respectively, of the difference between auction prices and market values, and n is the number of pairs considered. The statistic is distributed as Student's t with $n - 1$ degrees of freedom, and the null hypothesis is rejected when the statistic is greater than the corresponding critical value from the t-table. This paired t-test assumes that the population of the differences is normally distributed.

[5] The following statistic permits testing of the null hypothesis of no difference between auction prices and market values across subsamples: $t = \frac{x - y}{\sqrt{S^2(1/m + 1/n)}}$ where $S^2 = \frac{(m - 1)S_x^2 + (n - 1)S_y^2}{(m + n - 2)}$. In this test statistic, x and y represent the means of the differences between auction price and market value from the two subsamples being compared, S_x and S_y represent the standard deviations of the differences from each sample, and m and n represent the number of observations in each sample. The statistic is distributed as Student's t with $n + m - 2$ degrees of freedom, and the null hypothesis is rejected when the statistic is greater than the corresponding critical value from the t-table. The pooled t-test assumes populations to be independent and identically distributed with equal variances.

[6] Sirmans, Diskin and Friday (1995) find some evidence of a negative relation between assessed value/market value ratios and the market values of properties. Tests indicate that our results cannot be attributed to this relation. We thank an anonymous referee for drawing our attention to this possibility.

[7] We thank an anonymous referee for the suggestion to consider the effect of the repair escrow account.

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