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# TESTING FOR PRICE ANOMALIES IN REAL ESTATE AUCTIONS

Orley Ashenfelter

David Genesove

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1050 Massachusetts Avenue
Cambridge, MA 02138
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The authors are affiliated with Princeton University and the National Bureau of Economic Research (Ashenfelter) and MIT (Genesove). This paper is a preliminary report of the results of a larger study of condominium real estate auctions and was prepared for presentation at the Meetings of the American Economic Association on January 3, 1992 in New Orleans, in a session entitled "The Empirical Study of Auctions: In Honor of William Vickrey." This paper is part of NBER's research programs in Industrial Organization and Asset Pricing. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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## ABSTRACT

This paper reports on the results of an auction sale of 83 condominium apartment units in New Jersey. At the auction every unit was hammered down, but, unknown to the 2,348 registered bidders, 40% of the sales fell through. Prices in the subsequent sale of condominium units in face to face negotiations resulted in identical units selling for 13% less than they fetched at auction and the discount was largest for those units hammered down early in the auction. These results are inconsistent with the usual predictions from the theory of common value auctions and suggest that uninformed bidders in this auction may have been the subject of a "winner's curse" which generated considerable profit for the seller.

Orley Ashenfelter
Industrial Relations Section
Firestone Library
Princeton University
Princeton, NJ 08543
and NBER

David Genesove
Department of Economics
M.I.T.
Building E52-380A
77 Massachusetts Avenue
Cambridge, MA 02139

# TESTING FOR PRICE ANOMALIES IN REAL ESTATE AUCTIONS

Orley Ashenfelter and David Genesove[1]

In this paper we report the results of a study of condominium prices. Our study compares the prices paid in face to face bargaining with the prices fetched for identical condominium units sold at auction. The results are striking. Our findings indicate that auction prices for identical units were 13% higher than for units subsequently sold in face to face bargaining. Moreover, the price decline obtained by face to face bargainers was not independent of the order in which the units were auctioned. Face to face buyers achieved higher discounts relative to auction buyers who purchased early in the auction. Taken together these results indicate that the optimal strategy for a risk neutral condominium buyer is to make a purchase well after the auction has begun and, ideally, after the auction has been completed!

## I. The Price Decline Anomaly and the Data

We collected the data for this study at an auction of 83 condominium units held near Princeton, New Jersey in April of 1990. Our intention was to record the winning bids and the order in which the units were sold with an eye to determining whether condominium auctions also show evidence of the "price decline anomaly" noted by Ashenfelter (1989) and McAfee and

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[1]Department of Economics, Princeton University, Princeton, NJ 08544 and Department of Economics, MIT, Cambridge, MA 02139, respectively. We thank Kevin Hallock for exemplary research assistance and Alan Krueger and Bruce Vanderporten for helpful comments.

Vincent (1991) for wine auctions. In these auctions it has been established that prices for identical objects are more likely to decline than to increase, which is not what is predicted for the behavior of risk neutral bidders. One possible explanation for this behavior is that bidders are risk averse and early bidders pay a premium to avoid the risk associated with losing out on an item. Wine auctions are ideal for constructing a test of the "price decline anomaly" because identical items are sold consecutively. This permits a direct test of the hypothesis without concern about the possibility that omitted quality characteristics may bias the findings. At the same time, wine is a very specialized commodity and it seems desirable to examine evidence from other markets. The growth in the sale of relatively homogeneous condominium units by auction seems to offer an ideal opportunity for further tests of the price decline anomaly.

Unlike different cases of the same wine, however, condominiums are not identical. Perhaps because the units are heterogeneous, real estate auctions operate by a method different from the usual English auction. (See Vanderporten (1991), for example.) Condominium units are usually sold in a "pooled" or "right-to-choose" auction where all the units are combined together. When the bidding stops the highest bidder may choose the unit desired. The bidding is then re-started and continues until all the units in the pool have been sold. In a "pooled auction" it is inevitable that any heterogeneity in the quality of the units offered in the pool will cause the prices of the items in the pool to decline. In effect, the earlier bidders are buying the right to select superior products and it is natural that they should pay higher prices for them. Price declines are thus a predictable outcome of the pooled auction design and do not, by themselves, constitute an anomaly.

The mere fact that prices may be expected to decline in a pooled auction does not mean

that a price decline anomaly is not also present. Indeed it has sometimes been suggested that auctioneers use devices like the pooled auction to make it more difficult for buyers to perceive the presence of anomalies that may cast doubt on the integrity of the auction process. The question is, how much would we have expected prices to decline because of unit heterogeneity? If prices decline more than would be expected, then we have evidence for the declining price anomaly.

Our econometric design for solving this problem is simple: (1) First we determine the relationship between the auction price and the order of sale, and (2) then we track down subsequent resales of the same condominium units in face to face bargaining. If the price decline anomaly was truly a result of the auction mechanism, then any relationship between the auction bid price and the order of sale (at the auction) would disappear when the item was resold. If, on the other hand, the relationship between the auction price and the order of sale was due to an omitted quality characteristic, then the subsequent price in face to face bargaining would still be related to the order of sale at the auction held earlier. In the intermediate case, we may subtract out the relationship between quality and the order of sale by using the relationship between these two variables under face to face bargaining. In practice the observed price decline may be due to both unobserved quality differences and anomalous price declines, and below we separate these two econometrically.

When we began this project we expected that it would take several years before all of the condominium units sold at auction were resold in face to face bargaining. Much to our surprise, while checking (at the tax assessor's office) the sale prices for all the condominium units "hammered down" at the auction we discovered that 37% of the units had not, in fact, been sold

at the "hammer price." Instead, these 31 units had all been sold at discounts from the bid prices at which they had been hammered down in the auction. In a series of subsequent interviews we learned that these units had typically been resold to another buyer after the original auction sale "fell through." Although we were able to interview only a small number of these subsequent buyers it appears that they typically constituted a group of registered, but unsuccessful bidders who were subsequently contacted by the auction company to negotiate a sale in the week following the auction. In short, many of the identical units for which successful bids were established at the auction were resold in face to face bargaining a few weeks after the auction. (The average sale dates were three weeks apart.) This provides a remarkable opportunity to compare the prices of identical objects sold at virtually the identical time by two different pricing mechanisms.

## II. The Empirical Results

Table 1 shows the history of prices in the Colonnade Pointe condominium development outside Princeton, New Jersey. Rather than adjust the prices for square footage we have separated and reported the data for the three different type units (Arbor, Belvedere, and Cloister) in this development. Units within these groups are identical except for their location, which may differ because of the floor the unit is on or because of the view. As the table indicates, during the period October 1987 through the fall of 1989 about one-half of the 252 units in this development were sold at prices very close to the list prices at which the units were originally put on the market. In the period from the Fall of 1989 until the auction in April 1990 the market for these units deteriorated, and another 10% of the units were sold at prices which averaged

**Table 1: A Price History of the Development**

| | ARBORS | BELVEDERES | CLOISTERS |
|---|---|---|---|
| Asking Price | $127,000 | $139,000 | $149/150,000 |
| N | 40 | 80 | 132 |
| | Period I: October 1987 - Fall 1989 | | |
| Mean Price | $127,155 | $139,062 | $149,520 |
| Stand. Deviation | $285 | $384 | $3,242 |
| N | 24 | 33 | 75 |
| | Period II: Fall 1989 - April 29, 1990[1] | | |
| Mean Price | $111,990 | $119,866 | $126,103 |
| Stand. Deviation | 0 | $2,478 | $2,333 |
| N | 2 | 8 | 17 |
| | The Auction Bids[2] | | |
| Mean Bid | $88,923 | $97,371 | $112,171 |
| Stand. Deviation | $1,115 | $5,100 | $5,199 |
| N | 13 | 35 | 35 |
| | The Auction Sales | | |
| Mean Price | $91,052 | $99,951 | $115,405 |
| Stand. Deviation | $564 | $4,633 | $5,311 |
| N | 5 | 23 | 23 |
| | The Later Sales[3] | | |
| Mean Price | $81,500 | $86,636 | $97,917 |
| Stand. Deviation | $1,852 | $2,111 | $4,866 |
| N | 13 | 11 | 12 |
| Discount[4] | .11 | .12 | .15 |

1/ The three Belvederes and four Cloisters not offered at the auction but with closing dates after the auction day are excluded.
2/ The model units, one of each type, are excluded.
3/ One Belvedere offered at the auction has no recorded sales price and is excluded.
3/ As there was a three percent commission levied on the high bidder and payable to the auction house, the discount is calculated as 1 - (sale price/(bid*1.03)). The mean is taken over the sample of units that "fell through".

some 10% to 15% lower than the list prices. At the auction the bid prices averaged some 20% to 30% below the original list prices. Finally, about 12% of the units were resold after the auction at an average discount of 13% from the bid prices, or a discount of some 30% to 40% from the original list prices. It is our impression that the overall movement in these prices is a fair reflection of general movements in real estate prices for properties of this kind.

The data from the auction sale in which we are primarily interested are plotted in Figure 1 in panels A-C. Every unit was "hammered down," and the bid prices (indicated with the symbol "+") at the auction are displayed in the order in which we recorded them. (In fact, the Cloister and Belvedere units were sold in two separate "pools" and the second pools began with units 25 and 17; this accounts for the two spikes in panels A and C in the Figure.) Units actually sold at the auction were sold at these bid prices. However, 31 of the units hammered down were not, in fact, sold at the bid prices. Also displayed in Figure 1 are the prices (indicated with the symbol "O") for the units which were resold after the auction. As the Figure indicates, the units that were resold in face to face bargaining fetched prices substantially below their bid prices at the auction.

There are three important findings of our research that are readily observable in Figure 1. First, the bid prices typically declined as the auction progressed. Second, the prices of the items resold after the auction show little or no relationship with the order in which the units were sold in the auction. Note also that the units that were resold are scattered randomly through the auction. Finally, as indicated in Panel D of Figure 1, the price discount for subsequent resales was largest for those units sold earliest in the auction. In sum, these data provide strong evidence that the early auction buyers paid a premium for the units they purchased that does not

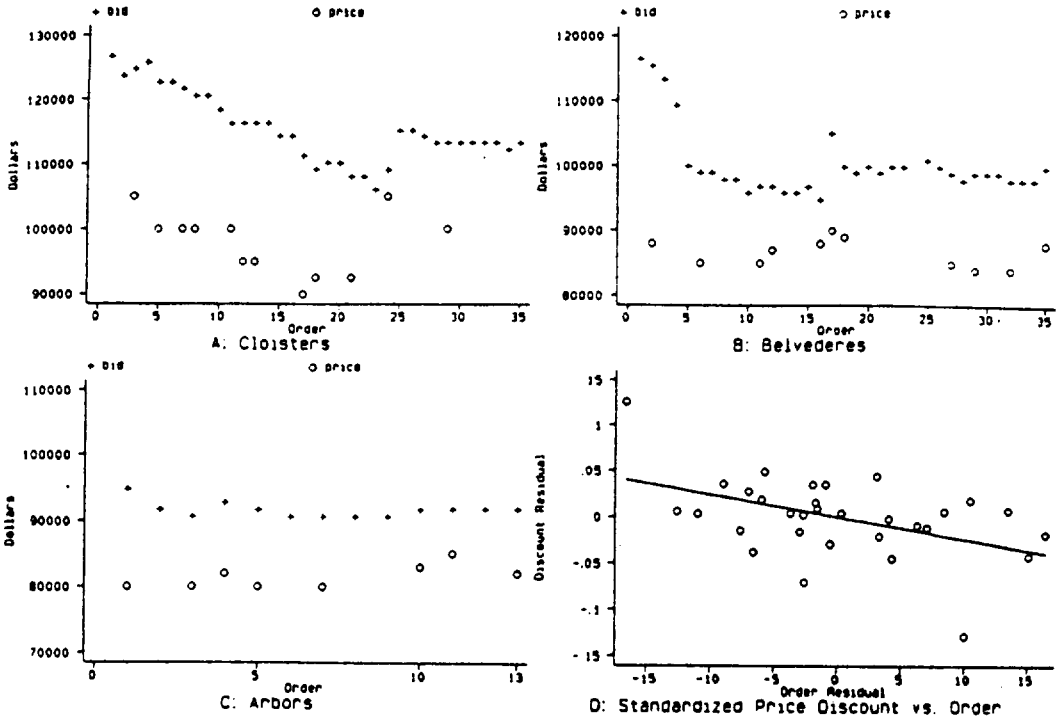


Figure 1: Bid and Prices vs. Order, by Type of Unit

reflect their higher quality, at least as judged by resale prices.

More formal tests of these hypotheses are contained in Table 2. Column (1) of the table reports a regression of the logarithm of the bid price on dummy variables indicating the unit type and the numerical order in which the unit was sold. The data indicate that the bid price declines about .27% per unit sold, or about 10% from the beginning of the auction to the end. Column (2) reports the bid price regression for those units actually sold at the auction, while column (3) reports the bid price regression for those units that were not sold at the auction. These two regressions have virtually identical coefficients ($F=.3$ for a test of their difference), which indicates that there is no connection between the bidding behavior of the auction participants and the reason the sale was not finalized. (In fact, a probit function fit to explain the probability that a sale falls through indicates no statistically significant relationship with the condominium type or the order of sale.)

Column (4) of Table 2 contains the regression of the logarithm of the actual price of the resold units on the order in which the same units were hammered down at the auction. If the declining bid prices reflected in the "order" coefficient in column (3) were a result of unobserved quality differences only, then the coefficient of the order variable in column (4) should be the same as it is in column (3). In fact, the coefficient of the "order" variable in column (4) is only -.06% per sale and it is not significantly different from zero, indicating that no more than 25% of the price decline is due to unobserved quality differences. As must be the case, the regression in column (5) indicates that the bid price/sold price discount is greater for the units hammered down earliest in the auction. Finally, the regression in column (6), which is an unrestricted version of the regression in column (5), indicates (as must be the case since the order of sale is

**Table 2: The Auction and Later Sales**

| | All Auction Units | Auction Sale Units | Later Sale Units | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dependent Variable: | Bid | Bid | Bid | Price | Bid/Price | Bid |
| Constant | 11.68 | 11.68 | 11.67 | 11.50 | .17 | 6.82 |
| | (.01) | (.01) | (.02) | (.02) | (.02) | (2.12) |
| Arbor | -.26 | -.27 | -.25 | -.19 | -.07 | -.17 |
| | (.01) | (.02) | (.02) | (.02) | (.02) | (.04) |
| Belvedere | -.14 | -.15 | -.13 | -.12 | -.01 | -.08 |
| | (.01) | (.01) | (.02) | (.02) | (.02) | (.03) |
| Order | -.0027 | -.0027 | -.0030 | -.0006 | -.0024 | -.0028 |
| | (.0004) | (.0005) | (.0008) | (.0008) | (.0009) | (.0008) |
| Price | | | | | | .42 |
| | | | | | | (.18) |
| $R^2$ | .87 | .86 | .89 | .83 | .34 | .91 |
| Sample size | 82 | 51 | 31 | 31 | 31 | 31 |

Standard errors in parentheses.

uncorrelated with sale price) that the bid price is correlated with the order in which the unit was hammered down even after controlling for the price at which the unit was ultimately sold.

## III. Implications

The data in this paper indicate that 37% of the condominiums hammered down in the auction we attended were not, in fact, sold. These units were sold a few weeks later in face to face bargaining, but at considerably lower prices than the identical units fetched at the auction. Moreover, the discounts these resold units fetched were greater for those units hammered down earlier in the auction, confirming the "declining price anomaly."

We think these empirical results should surprise most economists. After all, more than 14,000 people visited the 83 units on sale, and fully 2,348 people registered as bidders. Moreover, the condominium units on sale, which are located on U.S. Highway 1 behind a shopping mall, constitute a small fraction of the thousands of similar housing units located in the same area. Finally, many of these units were purchased by investors for the purpose of resale and those bought for occupancy will no doubt be sold by their owners within a few years. In short, the bidders in this "common value" auction (where it is not known, at the time of the auction, the price an item will fetch in its subsequent use or sale) should have been expected to pay prices similar to the prices the units would fetch when they were resold. The high prices that auction bidders paid for these condominiums opens up the possibility that they were the subject of a "winner's curse" (where buyers construct point estimates of the value of a property and fail to shade their bids in anticipation of estimation error, as in Kagel and Levin [1986]).

More fundamentally, these data indicate that the market mechanism had a substantial

effect on the prices at which these condominiums were sold and they raise some deep questions about the strategies and information the bidders brought to this auction. After the fact, it is obvious that the optimal strategy for a bidder would have been to tie up a condominium with a high bid, and then renege on its sale and renegotiate a lower price. The evidence from this auction indicates that few, if any, buyers followed this strategy. We suspect that most buyers did not engage in this strategy because they were not aware of it. This suggests that the auction seller has a considerable informational advantage over the buyers in a real estate auction, and that this advantage may have been put to good use in recent years to generate auctioneer profits at the expense of uninformed buyers.

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