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ABSTRACT

A comparison of house prices brought by English auctions and private negotiations produced evidence that the pricing mechanism matters, with the price maximizing choice a function of the level of market interest. In an active market for middle- to high-priced houses, auctions extracted higher prices than private negotiations. However, this result did not hold for houses expected to attract relatively low levels of interest.
A COMPARISON OF HOUSE PRICES BROUGHT BY ENGLISH AUCTIONS AND PRIVATE NEGOTIATIONS IN MELBOURNE*  

Kenneth M. Lusht

The question of whether pricing mechanisms matter was opened by Vickrey (1961), who demonstrated that standard auction formats should produce equal revenues under a set of strong assumptions. Since then, considerable effort has been put into the problem of how auction revenues would rank if one or more of those assumptions were relaxed. Recent surveys are found in McAfee and McMillan (1987a) and Wilson (1992). Kagel (1991) reviews experimental research.

Less attention has been paid to comparisons of expected revenues from auctions (in general) to expected revenues from alternative pricing mechanisms, despite the large number of markets which offer such choices. Empirical work has been limited to comparisons of prices brought by private negotiations and sealed bid auctions, despite the fact the English auction format (open, ascending bids) dominates the use of sealed bids worldwide (estimates of a 3/1 ratio [Cassaday, 1967] are now probably conservative). Most of these studies have involved bond underwritings, with reasonably consistent results. Sealed bids produce lower costs for bond issuers than do private negotiations,1 with the size of the difference related to the level of market interest (Kessel, 1971; Hopewell and Kaufman, 1977; Sorensen, 1979;...

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1 This result is uncomfortable though, because in practice most bond issues are negotiated. Agency problems and differences in the expected variance of bids are possible explanations (Bhagot and Frost, 1986).
Gilley and Karels, 1981; Bhagot and Frost, 1986). Price has also been positively associated with the level of interest in the awarding of military contracts (Yuspheh, 1976), and in the auction of failed banks (Giliberto and Varaiya, 1989).

This study compares prices brought by auctions to prices brought by private negotiations in a Melbourne, Australia, housing market. It is the first comparison of this kind in a market for real assets, and is also the first comparison of the outcomes of English auctions and private negotiations. Three propositions from bargaining theory are tested: 1) auctions should bring different (higher) prices than private negotiations; 2) prices should be associated with the level of market interest; and 3) prices should be associated with the level of seller patience. For the most part, the results support expectations. Average prices from auctions were higher than those from private negotiations, except for houses expected to attract relatively low levels of market interest. Ex ante measures of the levels of seller patience and market interest were also positively associated with price.

Section I describes the Melbourne housing market and compares its institutions to those that theory would suggest to the revenue maximizing seller. Section II discusses the data and methodology. An analysis of the results is in Section III. Section IV is the summary and conclusions.

I. The Melbourne Housing Market

A. Description
In most real estate markets, almost all non-distress sales of residential properties occur as a result of private negotiations. Scotland is an exception, as is Australia, notably Melbourne, where the English auction system coexists with private negotiations. In Melbourne, the percentage of residential properties sold by auction increased during the 1980s, most rapidly from 1983 through 1989. Classified advertising in newspapers indicates that about 50 per cent of detached houses were listed for sale by auction in Melbourne in 1988, compared to about 25 per cent in 1983 (Maher, 1989). Of those listed for sale by auction in 1988, most were sold that way. The remaining were sold privately either prior to the auction date, or after the auction if the reservation price had not been met, or were withdrawn from the market.
The popularity of auctions varies spatially, and as a function of general market conditions. They are generally favoured during periods of strong demand, with the highest ratio of auctions to private sales occurring in the affluent suburbs located within 10 miles of the central business district. During the 1980s there was also a smaller increase in the percentage of properties listed for sale by auction in less affluent markets.

The mechanics of an auction sale are straightforward. The listing agreement specifies the date of the auction (by law the sale must be held within 45 days, with almost all sales scheduled four to six weeks after the listing), an advertising schedule and costs, and the commission agreement. Commissions are regulated. They are based nominally on a sliding percentage of the selling price, but effectively are 2 per cent plus $660 for all but the lowest-priced properties. This percentage is the same for both auctions and private sales. A 'for-sale-by-auction' listing requires the seller to pay advertising costs, which average 1 per cent of the selling price. For a private listing, advertising costs average 1/4 per cent of the selling price, and they are generally paid by the agent (broker). Thus with auction listings, agents save direct advertising costs and they may also profit by purchasing advertising space wholesale and charging individual house sellers at retail.

The listing agreement also includes what is referred to as a reservation price. However, while the existence of this price is public knowledge, the price itself is not, and it may be changed in either direction during the bidding. Thus the reservation price is simply a right of refusal.

Between the dates of the listing and the auction, subagents (salespersons) and agents perform duties similar to those associated with a private sale. The property is advertised and shown to individuals and by open house, and prospective buyers are contacted periodically. A seller may or may not choose to entertain offers for a private sale before the scheduled auction.

The auction is generally held at the property, and is conducted either by an independent auctioneer paid a fee for his services (typically $100-$200), or more commonly by an agent or subagent of the listing firm. The skills required tend to limit those qualified and interested in auctioneering, and there is a measure of status afforded auctioneers within the industry. If the
bidding reaches a level acceptable to the seller, the property is sold. During an auction, it is common practice for the auctioneer to interrupt the bidding to consult privately with the seller. This occurs most often when bidding has slowed. The auctioneer then returns with fresh instructions as to a minimum acceptable price. When a property is sold, a 10 per cent deposit is required with the balance due at settlement, which is typically 60 days from the date of the sale. Contingency clauses are almost never found in the sales contracts that result from auctions, a fact also true for contracts resulting from private negotiations.

Seller (or dummy) bids are legal and routinely used, and the auctioneer reminds attendees of this fact prior to the start of bidding. Seller bids may be made by plants in the crowd or simply taken "off the wall" by the auctioneer. Some auctioneers—generally those who are inexperienced and feel uncomfortable calling out fictitious bids—employ bidders who follow them from auction to auction. Agents claim publicly that while seller bids lubricate the auction process, they do not distort average prices. Privately, however, some admit to a perception that seller bids produce higher prices. And though there is less incentive for a seller to bid once the bidding has reached an acceptable level, this is sometimes done. According to agents, such bids are made when they are expected to bring higher bids without undue risk. The risk is that if the real bidder(s) fails to bid again, the seller bid is revealed. This may alienate the bidder, and at best creates doubt about the actual second-high bid. The result may be a lost or delayed sale, and the final price may be lower than the previous high (actual) bid. Agents claim this scenario occurs frequently enough to serve as a constraint on the practice of seller bids above reserve.

Properties that are offered at auction but not sold are almost never auctioned a second time. They are either taken from the market or offered for sale privately. By law, the agency loses its exclusive right-to-sell thirty days after a failed auction.

B. Marketing Institutions and Theory
Marketing institutions in Melbourne housing markets are strikingly consistent with theoretical predictions about the behaviour of price-maximizing sellers. Auctions are favoured over private negotiations to sell high-quality, relatively heterogeneous properties, and during periods of relatively high levels of
interest and rising prices (Wilson, 1977; Milgrom, 1985). The popularity of auctions in Melbourne increased in the 1980s, a period of strong demand and rising prices, particularly in the affluent suburbs. The trend toward auctions was most noticeable following passage of the Land Sale Act in 1983, which shifted the costs of auction-sale title searches from prospective buyers to the seller. This made auction sales more attractive by eliminating a duplication of information costs that are borne (indirectly) by the seller (French and McCormick, 1984; see also Hausch and Li 1990a, 1990b for extensions with endogenous entry and information acquisition).

When it is decided to auction a property, the English format is almost always used. For the price-maximizing seller, the theoretically proper choice of auction format depends largely on whether bidders are assumed to be risk neutral or risk averse, and on whether bidders' values are assumed to be independent or affiliated. This literature counts two main results. The English format is preferred with risk-neutral participants and affiliated bidding, while sealed bids are preferred with risk-averse participants and independent bidding (Milgrom and Weber, 1982).

In practice, the distinction between independent and affiliated bidding is blurred, and elements of both behaviours affect price-setting. In the case of auctioning houses, while individual preferences may affect private valuations and maximum bids, there are also underlying true market values, and therefore it is likely that information will be conveyed through the bidding process. Thus, the choice of auction format will depend on which effect—affiliated bidding or risk aversion—is expected to dominate. This is an

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2 The independent (or private) values model assumes each bidder knows with certainty the value of the object to him, and that this private value is unaffected by the values assigned by others. The independent values model does relatively better than the affiliated values model explaining bidding behaviour in markets for non-durable consumption items that cannot be resold. Relaxing the independent values assumption to allow bidders' values to be affiliated means that when one bidder assigns a high value to an object, it is likely that other bidders will do the same. This being the case, the bidding process conveys information, with one high bid encouraging others. The affiliated values model (of which the common value model is the polar case) does relatively better explaining bidding behaviour in markets for durable items that can be resold.
empirical question, which, judged by the dominance of the English format world-wide, suggests that affiliated bidding is the answer in most cases. In Melbourne housing markets, agents estimate a 20:1 ratio of English auctions to sealed bids.

Preparation for an auction sale involves intensive advertising, with frequent open houses and individual inspections of the property. The object is to increase the expected price by increasing the number of bidders and the information those bidders have about the property (Holt, 1979; Harris and Raviv, 1981). The empirical results of Nelson (1992), and the experiments of Dyer, Kagel and Levin (1989) and Battalio, Kogut and Meyer (1990) show positive associations between bid levels and the number of bidders.

Though the effect of seller bids has not been analyzed, it is a practice likely to be associated with higher prices. Seller bids (artificially) increase competition, conceal the true number of bidders, and help take advantage of affiliated bidding (Matthews, 1983; Milgrom, 1985; McAfee and McMillan, 1987b). The one apparent anomaly is that while there is almost always a commitment to a publicly revealed right of refusal, there is almost never a publicly revealed reserve price. Though this is inconsistent with the notion that making public all information is to the seller’s advantage (Laffont and Maskin, 1980; Myerson, 1981), it is consistent with seller behaviour in most markets. (See Vincent, 1989, for an analysis of this anomaly.)

None of this is lost on market participants. There is a perception shared by sellers, buyers, and agents alike that in this kind of environment, auctions are likely to produce higher prices than private negotiations (Maher, 1989a). This perception, however, has not been tested.

II. Data and Methodology

A. Data
To examine the effect of the pricing mechanism, data from the sales of 309 single-family detached houses were obtained from three offices of a property agent in Melbourne. The sample included all of the sales for which complete information could be obtained. The transactions occurred from January 1, 1988, through March 31, 1989, within a market area commonly described as
the inner-eastern suburbs. It is an area of approximately 50 square miles, all within 10 miles of the central business district. The houses were high-middle to high-priced, with selling prices from $140,000 to $425,000. The January 1988–March 1989 time period was one of historically high activity in terms of the number of listings and sales, and one in which house prices escalated rapidly, especially in the sample market.

Table I disaggregates the sample by type of listing and type of sale, with mean selling prices and standard deviations for each category.

According to agents, the percentage of sample houses listed for auction (74 per cent), as well as the percentages of auction listings that sold before auction (12 per cent), at auction (71 per cent), and after auction (17 per cent), are representative of the population of listings and sales in the market area during the study period.

Table I
Listing and Sale Characteristics of Sample

<table>
<thead>
<tr>
<th>HOW SOLD</th>
<th>HOW LISTED</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private</td>
<td>At Auction</td>
<td>Before Auction</td>
</tr>
<tr>
<td></td>
<td>Selling Price</td>
<td>Selling Price</td>
<td>Selling Price</td>
</tr>
<tr>
<td></td>
<td>Mean Stan Deviation</td>
<td>Mean Stan Deviation</td>
<td>Mean Stan Deviation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>80</td>
<td>$244,981</td>
<td>($71,829)</td>
</tr>
<tr>
<td>At Auction</td>
<td>0</td>
<td>163</td>
<td>$247,739</td>
</tr>
<tr>
<td>Before Auction</td>
<td>0</td>
<td>28</td>
<td>$233,914</td>
</tr>
<tr>
<td>After Auction</td>
<td>0</td>
<td>38</td>
<td>$258,243</td>
</tr>
</tbody>
</table>
B. The Empirical Model

House prices are explained using Equation 1, which is estimated in the linear, double-log, and semi-log functional forms.

\[
\text{Selling Price}_i = f (P_{ij}, C_{ij}, A_i, EV_i, N_i, L_{ij}, T_{ij}, D_i, \text{Pat}_i, \text{Int}_i, \text{LS}_{ij}) \\
i = 1, \ldots, n \\
j = 1, \ldots, n
\]

where

\[
\text{Selling Price}_i = \text{the observed selling price for the } i^{th} \text{ property}
\]

\[
P_{ij} = \text{a set of } j \text{ physical characteristics for the } i^{th} \text{ property, including house size, lot size, number of bathrooms, number of rooms, construction material, the presence of storage space, and the parking capacity of the garage}
\]

\[
C_{ij} = \text{a set of five (0 or 1) condition categories}
\]

\[
A_i = \text{the age of the house in years}
\]

\[
EV_i = 0 \text{ or } 1 \text{ variable indicating whether the house was built during either the Edwardian or Victorian periods}
\]

\[
N_i = 0 \text{ or } 1 \text{ variable indicating whether or not the house faces north}
\]

\[
L_{ij} = \text{A set of seven (0 or 1) location categories}
\]

\[
T_{ij} = \text{A set indicating date of sale, divided into five (0 or 1) quarters}
\]

\[
D_i = \text{number of days on market}
\]

\[
\text{Pat}_i = 0 \text{ or } 1 \text{ variable indicating whether the level of ex ante seller patience was judged below normal (0) or normal (or above)}
\]

\[
\text{Int}_i = 0 \text{ or } 1 \text{ variable indicating whether the level of ex ante market interest in the house was judged below normal (0) or normal (or above)}
\]

\[
\text{LS}_{ij} = \text{A set of four (0 or 1) categories indicating how the property was listed and sold}
\]

The first two columns of Table II list the variables and their expected signs, most of which are familiar.
Table II

House Price Regressions \( n = 309 \)

<table>
<thead>
<tr>
<th>Variable and Expected Sign</th>
<th>Linear Coefficient</th>
<th>(Standard Error)</th>
<th>Double-Log Coefficient</th>
<th>(Standard Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>House Size (sq. ft.)</td>
<td>+</td>
<td>29</td>
<td>(9)**</td>
<td>.1267</td>
</tr>
<tr>
<td>Lot Size (100 sq. ft.)</td>
<td>+</td>
<td>49</td>
<td>(70)</td>
<td>.0605</td>
</tr>
<tr>
<td># Bathrooms</td>
<td>+</td>
<td>10866</td>
<td>(4512)*</td>
<td>.0690</td>
</tr>
<tr>
<td># Rooms</td>
<td>+</td>
<td>1964</td>
<td>(2887)</td>
<td>.0566</td>
</tr>
<tr>
<td>Brick (0, 1)</td>
<td>+</td>
<td>38860</td>
<td>(15474)*</td>
<td>.1335</td>
</tr>
<tr>
<td>Brick Veneer (0,1)</td>
<td>+</td>
<td>3344</td>
<td>(13369)</td>
<td>.0330</td>
</tr>
<tr>
<td>Wood (0, 1)</td>
<td>-</td>
<td>-278</td>
<td>(7249)</td>
<td>-.0138</td>
</tr>
<tr>
<td>Shingle (0, 1)</td>
<td>-</td>
<td>-8939</td>
<td>(7164)</td>
<td>-.0485</td>
</tr>
<tr>
<td>No Storage (0, 1)</td>
<td>-</td>
<td>-4068</td>
<td>(5535)</td>
<td>-.0118</td>
</tr>
<tr>
<td># Cars</td>
<td>+</td>
<td>2671</td>
<td>(3327)</td>
<td>.0023</td>
</tr>
<tr>
<td>Excellent Condition</td>
<td>+</td>
<td>61781</td>
<td>(7613)**</td>
<td>.2038</td>
</tr>
<tr>
<td>Above Average Condition</td>
<td>+</td>
<td>20710</td>
<td>(7215)**</td>
<td>.0719</td>
</tr>
<tr>
<td>Below Average Condition</td>
<td>-</td>
<td>-27651</td>
<td>(6710)**</td>
<td>-.1167</td>
</tr>
<tr>
<td>Poor Condition</td>
<td>-</td>
<td>-28171</td>
<td>(6977)**</td>
<td>-.1380</td>
</tr>
<tr>
<td>Age</td>
<td>-</td>
<td>-210</td>
<td>(159)</td>
<td>-.0229</td>
</tr>
<tr>
<td>Period (0, 1)</td>
<td>+</td>
<td>10474</td>
<td>(7947)</td>
<td>.0347</td>
</tr>
<tr>
<td>North Facing (0,1)</td>
<td>-</td>
<td>-3620</td>
<td>(5292)</td>
<td>-.0027</td>
</tr>
<tr>
<td>Best Location</td>
<td>+</td>
<td>18881</td>
<td>(9088)*</td>
<td>.0709</td>
</tr>
<tr>
<td>Above Average Location</td>
<td>+</td>
<td>19815</td>
<td>(6709)**</td>
<td>.0771</td>
</tr>
<tr>
<td>Slightly Above Average</td>
<td>+</td>
<td>-108</td>
<td>(6302)</td>
<td>-.0001</td>
</tr>
<tr>
<td>Slightly Below Average</td>
<td>-</td>
<td>-22065</td>
<td>(7683)**</td>
<td>-.1089</td>
</tr>
<tr>
<td>Below Average Location</td>
<td>-</td>
<td>-30898</td>
<td>(8569)**</td>
<td>-.1327</td>
</tr>
<tr>
<td>Poorest Location</td>
<td>-</td>
<td>-36222</td>
<td>(11424)**</td>
<td>-.1767</td>
</tr>
<tr>
<td>Sold Second Quarter, '88</td>
<td>+</td>
<td>25316</td>
<td>(7103)**</td>
<td>.1215</td>
</tr>
<tr>
<td>Sold Third Quarter, '88</td>
<td>+</td>
<td>25340</td>
<td>(6806)**</td>
<td>.1196</td>
</tr>
<tr>
<td>Sold Fourth Quarter, '88</td>
<td>+</td>
<td>26660</td>
<td>(7057)**</td>
<td>.1157</td>
</tr>
<tr>
<td>Sold First Quarter, '89</td>
<td>+</td>
<td>55736</td>
<td>(7625)**</td>
<td>.2007</td>
</tr>
<tr>
<td>Days on Market</td>
<td>-</td>
<td>-34</td>
<td>(60)</td>
<td>.0093</td>
</tr>
<tr>
<td>Patience (0, 1)</td>
<td>+</td>
<td>16287</td>
<td>(6378)**</td>
<td>.0741</td>
</tr>
<tr>
<td>Interest (0, 1)</td>
<td>+</td>
<td>8256</td>
<td>(5552)</td>
<td>.0448</td>
</tr>
<tr>
<td>Private List, Sale</td>
<td>-</td>
<td>-17168</td>
<td>(5585)**</td>
<td>-.0557</td>
</tr>
<tr>
<td>Auction List, Sold Before</td>
<td>+</td>
<td>2210</td>
<td>(7730)</td>
<td>.0099</td>
</tr>
<tr>
<td>Auction List, Sold After</td>
<td>-</td>
<td>-10426</td>
<td>(6940)</td>
<td>-.0474</td>
</tr>
<tr>
<td>Constant</td>
<td>-</td>
<td>151973</td>
<td>(19805)</td>
<td>10.7280</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.77 \]
\[ F = 31.58 \]
\[ S_e = $35,872 \]

** significant at 1 per cent level
* significant at 5 per cent level
The default variable for construction is aluminum-vinyl siding. Brick, the preferred construction, is a house with two layers of brick, while brick veneer has only one. Period houses are those that were built during the Victorian or Edwardian periods, and they are expected to bring a price premium. North-facing houses are preferred for exposure to sunlight.

Because the sample is drawn from older neighbourhoods (the mean age of the sample houses exceeds 50 years), there are wide variations in condition. Agents claim that in these neighbourhoods, condition and location often dominate size as the characteristics of primary interest to buyers. Houses were placed into one of five condition categories with the assistance of agents. Category one is the best condition and category three, average condition, the default. Again with assistance of agents, the location of each house was ranked from one to seven with category one the best and category four, average location, the default.

The time period of sale is one of five quarters, beginning January 1, 1988, and ending March 31, 1989. January through March 1988 is the default quarter, and prices are expected to rise over time.

The expectation with respect to days on the market is unclear. Prior measures of the relationship between price and selling time have produced mixed results (Miller, 1970; Smith and Sirmans, 1984; Agarwal and Phillips, 1985; Kang and Gardner, 1989), and in this case there is only a small variance in days on the market for houses sold at auction.

Sellers who are more patient should extract higher prices than those who are less patient, given that the greater portion of any surplus flows to the more patient participant (Wilson, 1977; Chatterjee and Samuelson, 1988). Characteristics likely to be associated with ex ante seller patience include wealth, the portion of wealth tied up in the house, whether or not another house has been purchased, and personal factors such as family illness, divorce, and job security. Direct measures of these kinds of variables were not available. Instead, sellers were placed into one of two categories; either they were judged to be of normal (or above) patience, or of below-normal patience. The determination was based on written comments made on listing agreements and data sheets, or in some cases on the opinions of agents familiar with the transactions. The bias was toward the normal category.
Only in what were considered clear-cut cases were sellers put into the below-normal category. On that basis, 52 sellers (17 per cent) were judged to be of below-normal patience.

The ex ante level of market interest is expected to be positively associated with selling price. During the search process, house buyers reveal preferences to agents and this information is used to select houses that are likely to be of interest. When houses are listed for sale, agents can use customer lists and their general market knowledge to judge the likely level of interest. It is also likely the interest variable serves in part as a proxy for omitted variables. Conversations with agents suggest that attributes such as 'curb appeal' (overall attractiveness), which are difficult to measure and which do not appear explicitly in Equation 1, sometimes affect their perceptions of market interest. The strength of the association between unobserved quality and the level of interest is not known, though in this sample of above average quality houses it is likely to be weak.

Judgments about the level of interest were in some cases reflected in comments made on listing agreements and data sheets. When they appeared, the comments tended to be negative. Based on these comments and on conversations with agents, the sample was divided into two categories; normal (or above normal) interest, and below-normal interest. The bias was again toward the normal category, with 68 houses, or 22 per cent of the sample, placed in the below-normal category.

The variables of primary interest indicate how the houses were marketed. There were four joint outcomes possible: 1) listed privately, sold privately; 2) listed for auction, sold before auction; 3) listed for auction, sold at auction; and 4) listed for auction, sold after auction. Listed for auction, sold at auction is the default variable.

Given the high quality and the heterogeneity of the properties in the sample, and the generally high level of market interest at the time, it is expected that houses listed and sold at auction will bring higher prices than those listed and sold privately. Expectations are less clear for houses listed for sale by auction, but sold before or after the auction. Intuition suggests that during periods of rapidly escalating prices it seldom makes sense to sell before an auction, except when the price offered exceeds the seller's expectation of the
auction price. Given that agents have extensive information about market conditions, it is reasonable to believe they are able to make credible judgments about likely prices. Close correlations between auctioneers' estimates of value and selling prices have been found in auctions of wine (Ashenfelter, 1989), art (Abowd and Ashenfelter, 1988), and commercial bank properties (Lusht, 1991).

Thus the expectation is that the prices of houses listed for sale by auction but sold privately before auction will be no lower than, and are likely to be higher than the prices brought at auction. Houses listed for sale by auction but not sold, and then sold privately after auction should bring prices that are no higher than, and are likely to be lower than prices brought at auction. A failed auction puts buyers in a stronger bargaining position, particularly if buyers' valuations are affiliated. If a property is not sold at a high bid of 'x', it is known that the second highest bid is 'x - y', and it is unlikely that subsequent negotiations will produce a price equal to or higher than 'x'. A failed auction also induces impatience in both the seller and the agent, the latter who is now more likely to lose a commission. In the sample, all of the houses were sold privately within five weeks of a failed auction.

The model does not include contract contingencies. None of the auction contracts in the sample included contingencies, and as noted earlier, this tends to be true of the Melbourne market at large, whether a property is sold at auction or by private sale. In the market from which the sample was drawn, agents estimated that contingencies were included in less than 1 per cent of the population of private contracts, and no references to contingencies were found in the sample data files.

C. Results
Equation 1 was first estimated using the full sample of houses. The linear and double log results shown in Table II are similar to those produced by the semi-log form.

The model is generally well-behaved. Referring to the linear form, the independent variables explain 77 per cent of variations in selling prices, and the equation is significant at the 1 per cent level. The two variables with unexpected signs —slightly above average location and north-facing— are not significant.
The period, days-on-market and age variables have the proper signs but are not significant. Inspection of the correlation matrix showed some multicollinearity among the age, period, north-facing and condition variables. The nonsignificance of days on the market is not an unusual empirical result, and as noted, in this case it is likely traceable to the fact that marketing time does not vary much among auction sales.

Sellers judged to be of normal (or above normal) patience extracted prices that were on average $16,287 higher (7.4 per cent) than prices extracted by less patient sellers. The difference is significant at the 1 per cent level. Properties expected to generate at least normal levels of market interest produced prices that averaged $8,256 higher (4.5 per cent) than the prices produced by properties expected to generate below-normal interest. The difference is significant at the 5 per cent level in the double-log model, but is not significant in the linear model.

The marketing variables have the expected signs. The highest prices were produced by auction listings sold before auction, followed in order by auction listings sold at auction, auction listings sold after auction, and finally, private listings sold privately. The differences between private sales and both sales before auction and sales at auction are significant at the 5 per cent level. A private sale produced a price that averaged 5.6 per cent less than an auction sale, or 4.6 per cent net of the average 1 per cent advertising costs to the seller.

Houses sold before auction brought a 1 per cent price premium over houses sold at auction, which in turn brought a 4 per cent premium over those sold after auction, evaluated at their respective mean sale prices. However, interpretation of the differences between auction prices and before or after auction prices is muddled by the fact that while before and after auction sales are private, they are influenced by the institutions associated with an auction listing. Also, the fact that a sizable percentage of the houses offered at auction were not sold introduces the possibility of an econometric bias traceable to bidder self-selection, where the probability of bidding on a given house (and in turn the probability of it being sold) is influenced by its characteristics (Heckman, 1979). To avoid the problem, before and after
### Table III

**House Price Regression, Selected Variables**

<table>
<thead>
<tr>
<th></th>
<th>(1) Original Model</th>
<th>(2) Private Listing and Sale, or Auction Listing and Sale at Auction</th>
<th>(3) Original Model, Plus Interaction Terms for Marketing Forms and Level of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 309 (from Table 2)</td>
<td>n = 243</td>
<td>n = 309</td>
</tr>
<tr>
<td>Interest</td>
<td>8,256</td>
<td>5,715</td>
<td>19,142**</td>
</tr>
<tr>
<td>Private List and Sale</td>
<td>-17,168**</td>
<td>-21,467**</td>
<td>21,515</td>
</tr>
<tr>
<td>Auction List, Sale Before</td>
<td>2,210</td>
<td></td>
<td>22,557</td>
</tr>
<tr>
<td>Auction List, Sale After</td>
<td>-10,426</td>
<td></td>
<td>-48,424**</td>
</tr>
<tr>
<td>Interest x Private Sale</td>
<td></td>
<td></td>
<td>-46,752**</td>
</tr>
<tr>
<td>Interest x Sale Before Auction</td>
<td></td>
<td></td>
<td>-27,589</td>
</tr>
<tr>
<td>Interest x Sale After Auction</td>
<td></td>
<td></td>
<td>41,781*</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.77</td>
<td>.79</td>
<td>.78</td>
</tr>
<tr>
<td>( F )</td>
<td>31.6</td>
<td>30.2</td>
<td>31.7</td>
</tr>
</tbody>
</table>

### Auction Price Minus Alternative Price, Contingent on Interest Level

<table>
<thead>
<tr>
<th></th>
<th>Private Sale</th>
<th>Sale Before Auction</th>
<th>Sale After Auction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (or Above) Interest</td>
<td>25237</td>
<td>5032</td>
<td>6643</td>
</tr>
<tr>
<td>Below Normal Interest</td>
<td>-21515</td>
<td>-22557</td>
<td>48424</td>
</tr>
</tbody>
</table>

**significant at 1 per cent level

* significant at 5 per cent level
auction sales were discarded, leaving in the sample only those houses that were either listed and sold at auction, or listed and sold privately. The top panel of Table III shows the linear coefficients for the variables of primary interest for the original estimation (Column 1) and the reestimation without the before and after auction sale 'hybrids' (Column 2).

The conclusions are unchanged. Auctions produced higher prices than did private sales, and higher levels of market interest produced higher prices.

D. Interactions

Given the fact that the dominant marketing mechanism in Melbourne housing markets is determined largely by the kinds of properties offered and the general level of market activity, there arises the question of whether the price premium extracted by auctions holds generally, or whether there are interactions at the micro level between the marketing mechanism and transaction-specific characteristics such as the size or condition of the house, or the levels of seller patience and market interest.

The nature of the sample makes the statistical strength of any association of price to interactions of physical or functional characteristics and marketing variables an empirical question. That is, because all of the sample houses are middle- to high-priced, the characteristics of individual houses may systematically exceed the minimum heterogeneity or quality hurdle for an auction to produce a price premium.

With respect to interactions involving seller patience, Milgrom (1985) shows that a seller who is in a weak bargaining position relative to potential buyers can do as well as a strong bargainer by conducting an auction. It follows that an impatient seller (a relatively weak bargainer) should do better by auction than by negotiation. Apparently, however, this outcome is not obvious to house sellers in Melbourne. In the sample, 24 per cent of patient sellers and 32 per cent of impatient sellers listed for sale privately. Thus while theory predicts higher prices for impatient sellers through auction, in this case market behaviour suggests indifference.

With respect to interaction terms that include the level of market interest, the results of the initial model estimation support the accepted notion that auctions should produce higher prices than private negotiations in normal (or above)
interest markets. The expectation for below-normal interest properties is less clear. While it does not necessarily follow that if auctions produce higher prices for normal or above interest properties, they will then produce lower prices for below-normal-interest properties, this seems to be the expectation in markets where auctions are used primarily to market low-interest properties. Auctioneers in the United States commonly predict auction prices for problem properties that are 10 per cent-30 per cent below market (or appraised) values, and discounts of this magnitude have been found in the auction of distressed residential lots (Gau, et. al. 1991). Sorensen's (1979) comparison of the issuing costs of municipal bonds, though from a different kind of market, provides some insight. Lower net costs were obtained by negotiation when market (bidder) interest was relatively low, while lower costs were obtained by competitive bidding when market interest was relatively high. This is the kind of result expected here.

The sizes of the marketing mechanism subsamples (n = 80, 28, 163, and 38 respectively for sales that were private, or before, at, or after auction) do not permit the strategy of combining each of the marketing variables with all of the other variables in a single model, allowing the data to determine which interactions matter. Instead, a number of specifications were tried with various combinations of terms that combined the marketing variables with other variables that included house size, lot size, age, period, location, time of sale, seller patience, and market interest.

The only interaction terms that were significant at the 5 per cent level in a majority of the specifications were those that included the level of market interest, and they were included in the final specification. The linear coefficients for selected variables are shown in the top panel of Table III, Column 3. The bottom panel of Table III is a contingency table that shows average price differences between auctions and alternative mechanisms as a function of whether the property was expected to attract normal- or below-normal interest.

Clearly the marketing mechanism matters for normal (or above) interest properties. For below-normal interest properties, the results are mixed. There are no significant differences between auction and private sale prices, or between auction and before auction sale prices. However, the difference between auction and after auction sales for below-normal interest properties
is significant, and is much larger than the differences for any other marketing form, regardless of the level of interest. The phenomenon of a sharp drop in price after a failed auction has been observed in other markets (Ashenfelter, 1989), likely the result of a strengthening of the bargaining position of buyers.

The finding that the price premium extracted by auctions is not contingent on the level of seller patience is puzzling, though again, apparently not surprising to sellers, recalling that 24 per cent of patient sellers and 32 per cent of impatient sellers listed for sale privately. One explanation is marketing time, with impatient sellers listing privately in order to sell quickly or to ensure a target date. But this seems a weak argument, given that an auction must be held within 45 days, and the fact that an auction listing does not preclude a sale before auction. Ex post, the average time on the market was 35 days for auctions, 42 days for private sales. Two other explanations seem more plausible. First, following Chatterjee and Samuelson's (1988) model of bargaining with incomplete information, it may be that because negotiations in this market are conducted by agents, the fact of seller impatience is masked in a sufficient percentage of cases to produce approximately the same average result as is obtained through auctions. Second, there is the lack of commitment to a reserve price and the practice of periodically halting the bidding while the auctioneer and seller confer about pricing strategy. These are institutions that introduce elements of bargaining into the auction process, perhaps eroding the protection offered by auctions to relatively weak bargainers.

E. Is the Marketing Choice Endogenous?
If the marketing choice is endogenous, the interaction results do not provide much insight into which, if any, variables may be driving the choice. The only terms that tended to be significant were those that included the level of market interest, and as in the case of seller patience, there is evidence that the perceived level of interest did not affect the choice of listing. That is, 82 per cent of the private listings in the sample were normal-interest properties, compared to 80 per cent for auction listings. Seller selectivity (Heckman, 1979) was formally tested with the probit model, using the listing choice (private or auction) as the dependent variable, and the same independent variables as in Equation 1, omitting days on the market. None of the variables were significant, with only 53 per cent of the observations correctly
classified. Note also that the possibility of an endogenous link between the marketing choice and any of the variables in Equation 1 is not troubling with respect to simultaneity, as the system is recursive.

F. Omitted Variables
A potentially more serious problem is that the marketing choice may be associated with pricing variables omitted from Equation 1. If this is so, price differences attributable to the omitted variables may have been improperly attributed to the marketing choice. For example, Hansen (1986) found that the association between the auction format and the selling price of timbering rights (Mead, 1967, Mead, et. al, 1981) largely disappeared when variables were included that proxied for such things as bidders' timber reserves.

Ideally, the possibility would be tested by adding quality-controlling variables to the model, as in Krueger and Summers' (1988) analysis of inter-industry wage differentials, or by using exogenous variables in a first stage regression to predict the marketing choice, and then using the predicted choice in a second stage regression. Additional data to instrument for marketing choice are unavailable. The two most likely candidates are market interest on the demand side and seller patience on the supply side. As pointed out, however, they do not affect the choice, and in any case an argument can be made that they belong on the right side of the pricing equation. This leaves only casual evidence that omitted variables are not a serious empirical issue. First, it is likely that the interest variable at least weakly proxies for omitted variables. Second, if omitted variables are an issue, the empirically interesting cases are first, if there are omitted variables which negatively affect price and are also positively associated with the choice of a private sale, and second, if there are omitted variables which positively affect price and are also positively associated with the choice of an auction. However, given the interaction result that private negotiations produce prices at least equal to those from auctions for low-interest properties, the speculation that either of those cases exists requires the unlikely assumption that they disappear for low-interest properties and reappear for normal-interest properties.

Finally, the author inspected 50 of the sample properties, 40 of which had been listed for sale by auction, the remaining 10 listed for private sale. No discernible patterns of physical or locational differences were found. Listing and selling agents had similar observations.
G. The Puzzle of Market Segmentation

There remains the question of why a substantial percentage of sellers of normal-interest properties choose private listings, and why a similar percentage of sellers of below-normal interest properties choose auction listings. One explanation for private listings of normal-interest properties is that the expected variance of price is lower for private sales. Ex post however, this was not the case. The coefficient of variation for the selling prices of houses listed privately was 0.2932, compared with 0.3036 for houses listed for sale by auction. For houses sold privately (including sales before and after auction), the coefficient was 0.2956, compared with 0.3056 for houses sold at auction. While these differences are in the direction hypothesized, they are statistically trivial.

At the extreme, there is the risk of a no-sale. If the expectation was that a larger percentage of auction listings than private listings would end in a no-sale, this would be an explanation for the choice of a private listing. However, surveys indicate that neither sellers nor buyers feel the chances of a sale are influenced by the marketing choice (Maher, 1989a). At the same time, those surveys provide other explanations for the choice of a private sale for normal-interest properties. The most important is that 37.3 per cent of sellers considered the commitment to pay advertising costs a disadvantage of an auction listing. In addition, 31.3 per cent of sellers found the auction process too stressful, and 18.1 per cent feared the ultimate impact of a failed auction. Given these perceptions and the lack of prior evidence on price differences, the dominant strategy is likely to be less than transparent.

With respect to explaining the choice of an auction listing for a below-normal interest property, there is the fact that an auction listing comes with a target date for sale, reducing perceived uncertainty about the variance of time on the market. It is also likely that a below normal interest state-of-the-market may not be as obvious to a seller as it is to an agent, and there may be reasons for an agent to conceal this information or to minimize its importance. First, an indication by an agent that there is likely to be a low level of interest could jeopardize the chance to list the property. Second, the additional revenue available to an agent from shifting advertising costs to a seller (and perhaps retaining advertising discounts) may exceed the reduced commission from a lower price. The fact that the percentage of properties listed for sale by
auction and the percentage listed privately are approximately the same, regardless of the agent's opinion of the level of market interest, is indirect evidence that this may occur.

A related agency issue is the impact of brokers' impatience. A defining characteristic of private negotiations is the sequential bidding process which forces the seller to accept or reject offers as they arrive. A decision is made to sell, despite a positive probability that a higher offer will be forthcoming, when the costs of waiting exceed the expected increase in price. The net revenue to the agent is also affected by the seller's accept or reject decision. An acceptance guarantees a (known) commission, while a rejection may or may not lead to a higher price and a higher commission, and may mean additional costs for advertising and other marketing efforts. Each rejection also increases the chance that no sale will be made. Because the agent's commission is a small fraction of the selling price, and because the agent bears the marketing costs of a private sale, the expected value of rejecting an offer in hopes of a higher bid is greater for a seller than for an agent. Therefore, an agent may encourage the acceptance of an offer for a private listing that might be rejected if it were made prior to an auction. This line of reasoning may also help explain the large difference in prices brought at auction and after auction, as well as the high percentage of houses that sell shortly after a failed auction. Because agencies lose the exclusive right-to-sell 30 days after a failed auction, they have incentive to produce an offer and acceptance before then. Geltner, et al (1991) arrive at a similar conclusion with respect to conflicts of interest between sellers and agents when adjustments to prices are made as private sale listing agreements near expiration.

IV. Summary and Conclusions
Three propositions from bargaining theory were tested: 1) auctions should produce different (higher) prices; 2) prices should be associated with the level of market interest; and 3) prices should be associated with the level of seller patience.

A comparison of prices brought by English auctions to prices brought by private negotiations produced evidence that the pricing mechanism matters, with the price-maximizing choice a function of the level of market interest.
Prices were also associated with the level of seller patience, regardless of the marketing mechanism.

In a sample of 309 houses sold from January 1, 1988, through March 31, 1989, in suburbs of Melbourne, Australia, houses expected to generate at least normal levels of interest which were listed for sale by auction and sold either before or at auction brought a statistically significant price premium over houses listed and sold privately, and over houses that went unsold at auction, but were sold later privately. For houses expected to generate below-normal levels of market interest, there was not a statistically significant difference in the prices brought by auctions and private sales, though prices from private sales were significantly higher than prices brought by sales after auction.

The analysis raises a number of questions, including the rationales of the relatively high percentage of sellers who appear to make suboptimal marketing choices, the impact of the use of seller bids, and the use of secret reserve prices, contrary to accepted auction theory. The agency issues surrounding the marketing choice would seem a particularly promising area for future research.
References


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