The Impact of Auction Sales on Residential Sale Prices in New Zealand

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Abstract. **The use of an auction to sell residential real estate in the United States is often associated with distressed sales such as foreclosure, bankruptcy or estate settlement. In other areas of the world, auctions are more commonly used and viewed as a viable, preferred method of selling a house. This article uses hedonic pricing methodology to compare the sale prices of houses in Christchurch, New Zealand sold at auction with those sold by private treaty. The results indicate that in some cases auctions can result in premium sale prices. In none of the cases studied did auctions result in lower prices than private-treaty sales.**

Introduction

In Australia and New Zealand, an auction of real property is viewed as a desirable and viable alternative to utilizing the services of a real estate broker (private-treaty sale). Both buyer and seller are willing participants and view their marketing alternatives with substitutability. Therefore, the auction process and circumstances surrounding the sale are both viewed as rendering ''fair market value.'' Consequently, these markets offer researchers opportunities to compare sales prices obtained from the two marketing choices.

In contrast, auctions of real estate in the United States are most frequently the result of: mortgage foreclosure, tax foreclosure, divorce settlement and estate settlement. These are events associated with owners being under duress or order to sell or transfer title to a third party. Therefore, the circumstances surrounding sale by auction are not comparable to a sell by real estate broker; sales prices often occur at a perceived discount to fair market value. It is difficult to determine to what extent the perceived discount is the result of differences in seller motivation, the dynamics of the auction process or whether auction property as a class are deficient or substandard.[1] Because of these differences, the U.S. market does not offer good opportunities to compare pricing by auction and the private-treaty sale.

The purpose of this study is to compare the performance of auctions and private-treaty sales of residential real estate in Christchurch, New Zealand. Research findings by Lusht (1990, 1996) and Newell, MacFarlane, Lusht and Bulloch (1993) in Sydney,

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Australia support the presence of a sales advantage to auctions of 3%–15%. This study extends this research for a different market and time period, tests for sample selection bias and further examines the interaction of property area in the city and sale by private-treaty or auction with regard to market price.

Theory of Auctions

Academic literature has an abundance of theoretical articles relating to auctions. Some of the comprehensive investigations of auction theory include Wilson (1977, 1992), Engelbrecht-Wiggans (1980), Milgrom and Weber (1982), McAfee and McMillan (1987) and Milgrom (1989). These studies have focused on several issues, including: (1) the expected revenue to the seller from various auction methods; (2) the impact of information on bidding; (3) how the number of active bidders influences the final sales price; (4) the impact of risk aversion among bidders; and (5) strategies for setting a reserve price. In general, research suggests the use of auctions as preferable to private negotiations for selling high-quality, relatively homogeneous properties (Wilson, 1977).

The decision to sell at auction or through private treaty relates to whether the auction maximizes the seller's expected profit. Research indicates that by setting a reserve price, and under a reasonable set of general conditions, auctions are an optimal method of sale (Harris and Raviv, 1981; and McAfee and McMillan, 1988). McAfee and McMillan (1987) cite the ability of an auction to extract a commitment from the seller; the seller cannot renege on a sale price, which reduces indeterminacy for the buyer.

Auctions are beneficial to sellers who desire a quicker sale in contrast to a protracted process of finding the right buyer through a private-treaty sale. Ashenfelter (1989) has written that an auction system permits an uninformed seller to obtain the approximate market value for items they own. In a competitive market with many buyers and sellers, all who are price takers and have perfect information, the object will sell at a price that yields a normal profit and reflects the ''true value'' of the object, and would sell at a price that would be very similar to other houses of similar size and quality.

Milgrom and Weber (1982), in an excellent survey of auction literature, describe four major types of auction sales methods including the English auction, the first-price sealed-bid auction, the second-price sealed-bid auction and the Dutch auction. The English auction has bids that are progressive, ascending, open and oral. In a first-price sealed-bid auction, the buyer has claim to the object auctioned by making the highest bid. The second-price sealed-bid auction also makes claim to the object auctioned by making the highest bid, but only pays the amount of the second highest bid. Because buyers may place higher bids than in a first-price auction, the seller does not necessarily receive a lower price. In a Dutch auction, the auctioneer announces prices in descending order. Auctions of real estate in New Zealand and Australia are

conducted by means of English auction. Neither the second-sealed bid nor the Dutch auction, however, are used for auctioning real estate.

Real Estate Auctions

Maher (1989) describes the significant change in the proportion of auction versus private-treaty sales from 1959–86 in Melbourne, Australia. His research indicates that the real estate industry has exerted influence to effect a movement towards sale by auction; the purported reason given by industry representatives is for greater professionalism among real estate agents and to achieve a better means of determining a true and fair price for property. Maher suggests that auction sales benefit the real estate industry, yet place the buyer at a clear disadvantage. The industry claim of a higher relative sales price for properties sold at auction in comparison to private-treaty sale, Maher notes, has not been demonstrated, and he therefore calls for research into the pricing question.

Lusht (1990) compared the sales price of houses sold at auction with those sold by private treaty in Melbourne, Australia. He found that properties sold by private treaty sold for 5.6% less than similar homes sold at auction. The results also indicated that the auction premium existed only for houses with high levels of ''market interest,'' while no sale-price differential was observed for houses with low levels of market interest. Lusht's data included only homes in the upper price ranges and all were sold by the same real estate company.

Newell, MacFarlane, Lusht and Bulloch (1993) studied the housing market in Sydney, Australia. The authors observed that the median sales price of auctioned properties was 3.6% higher than the median sales price of properties sold by private treaty. This observed ''premium'' was less than the 6.5% measured by Lusht. The lower premium compared to Lusht was attributed to market conditions at the time of the sample, however, this study's average price results were not adjusted for quality differences.

A recent study by Lusht (1996) compares the sales prices of house sales brought by 163 auctions to prices from 80 private-treaty sales in Melbourne, Australia for the fifteen-month period beginning January 1988. His results produce no evidence of selection bias, and therefore, he applies ordinary least squares regression. The findings indicate that auctions produced about an 8% price premium when evaluated at the mean. A potential problem with the sample obtained for this study is that it consists of only high-middle to high-priced homes located in a specific market area, therefore, the price differential would be biased if the percentage selling price differential varies by area or home value.

Based on the aforementioned studies of auctions, we test the following hypotheses:

H_o: Higher priced and unique residential properties that are sold by auction sell for the same price whether sold by auction or by private treaty.

H_a: Higher priced and unique residential properties that are sold by auction sell for a higher (or lower) price if sold by auction than by private treaty.

How the Auction Works

The properties analyzed in this study were sold by brokers who offer both auction and private-treaty sales services. The broker may encourage an auction if the owner is ''motivated'' to sell the property, willing to accept a price that the auction bidders will offer. A seller who chooses a private-treaty sale usually pays a commission of 3.5%–4%. A seller who chooses auction pays the same sales commission rate, but also pays an advance marketing fee ranging between $NZ1,000 and $NZ2,000. Individual companies may reimburse sellers for unused advertising. Some private-treaty sellers are also invited to supplement the advertising budget above that contained in the commission rate. The concept of charging auction sellers the same commission rate and a higher fee for advertising is used in the U. S. as well. Sellers who choose the auction are willing to pay the higher fees for the following reasons: (1) the extra advertising may expose the property to more potential buyers, increasing the chance that the high value buyer will become aware of the property; and (2) the auction often results in a quicker closing date, which reduces the owners' holding costs. A seller may accept a lower price at auction because of the reduced holding costs due to the quick closing of the transaction.[2]

A New Zealand property listed for auction will typically be heavily advertised for three to four weeks prior to the auction. During this period, potential buyers are shown the property and are encouraged to make offers. However, the owner is advised not to make a counter-offer, because this would effectively place a ceiling on the bidding at the auction. The seller's reservation price (or right of refusal price) is often not disclosed to the auctioneer until the day of the auction, and sometimes not until the bidding has reached its maximum. At this time, the auctioneer may halt the bidding to consult with the owner to determine if the property will be sold. The auctioneer can make ''seller'' bids on the owner's behalf as many times as he feels prudent, but usually only before the auction reaches the seller's reservation price. The winning bidder must present a check for 10%–20% of the purchase price on the day of the auction.

Data

Sales information from Christchurch, New Zealand was gathered to test the research hypotheses. A federal government agency known as Valuation New Zealand (VNZ) maintains a database of all real estate transactions that occur in the country. VNZ is responsible for the ad valorem assessment of property values for general property taxes. Information from VNZ was combined with Multiple Listing Service data and primary research of newspaper archives to create the data set for statistical analysis.

The first step in the data gathering process was to identify all houses that were sold by auction in the Christchurch area during the time period from September 1991

through December 1992. Library research was done to discover every house that was advertised to be auctioned during this time period. In addition, five local brokers who are active in the auction business were interviewed; and they supplied lists of all the properties that they had recently sold by auction. Sales data were used to confirm whether or not the advertised properties actually sold on or before the auction date. Consequently, the data set contains virtually all properties sold at auction in the Christchurch area during the time period considered. The next step was to identify which areas of Christchurch had the most auction activity, to determine whether the auction sales were uniformly distributed geographically. This analysis revealed that four areas of the city contained the majority of auction transactions. These areas of town are broadly referred to as ''Northwest Christchurch,'' the ''Hills,'' ''St Albans'' and the ''Shirley'' area. The Northwest area includes stately, well-kept older homes nearest the city center, and also contains newer homes that are built closer to the suburban fringe. This area is the most expensive with a mean home price of approximately $NZ200,000. The Hills area contains many high-priced homes built on the foothills of east suburban Christchurch that may have magnificent views of either Christchurch and the mountains to the west, or views of the ocean to the east. The mean price of these homes is only about 5% less than the Northwest area, therefore, these areas are comparably priced. St. Albans and Shirley areas consist of moderately priced urban areas located in north and east Christchurch respectively. Homes in St. Albans sell for approximately one-third less than the Northwest area, while Shirley area homes sell for about one-half the price of Northwest area homes. As expected, homes in the Northwest and Hills areas have a greater proportion of homes with quality fixtures and construction than homes in the St. Albans and Shirley areas.

The data set contains all properties sold by auction and private-treaty during the sixteen-month period from September 1991 through December 1992 in the Northwest, Hill, St Albans and Shirley areas. The complete data set contains 5,344 residential transactions including 158 auction sales.

Methodology

A hedonic pricing model was created to test the above hypotheses. The model was specified as:

$$\ln(SP_i) = \beta' x_i + \varepsilon_i, \tag{1}$$

where SP_i is the selling price of property i in $NZ, x_i is the vector of property and market variables, β' is the vector of regression coefficients and ε_i is the disturbance term. The vector of property and market variables (x_i) is described as follows:

House Size = The total house size measured in square meters. VNZ rounds their measurement to the nearest 10 square meters.[3]

Lot Size = The land area of the property measured in hectares (one hectare contains 10,000 square meters).

Age = The decade in the twentieth century when the principle structure was built. VNZ does not record the actual age of the property, only the decade in which it was built.

Quality A = A binary variable which equals 1 when VNZ staff classified the property as ''*A*,'' having a superior design and first class quality of fixtures and fittings. Quality *A* = 0 otherwise.

Wall Cond. = A binary variable which equals 1 if VNZ staff classified the exterior walls to be in good condition. *Wall Cond.* = 0 otherwise.

Wall Type = Binary variables for wall types *B* (brick); *C* (concrete), *F* (fibrolite), *G* (glass), *R* (roughcast), *S* (stone), *W* (wood) and *X* (combination). Wall type *C* is the default.

Auction = A binary variable, where *Auction* = 1, if property was reported to be sold by auction. *Auction* = 0 denotes a sale by private treaty.[4]

Interest = The mortgage interest rate in New Zealand during the month of auction or private-treaty sale.

Area = Geographical section of Christchurch, NZ; Northwest section (*Area* 1), St. Albans, (*Area* 2), Shirley (*Area* 3) and Hills (*Area* 4). *Area* 1 is the default.

AreaInt = Interaction variable of *Area* and *Auction* variables; *AreaInt1* = *Area* 1 * *Auction*, *AreaInt*2 = *Area* 2 * *Auction*, *AreaInt*3 = *Area* 3 * *Auction*, *AreaInt*4 = *Area* 4 * *Auction*.

A possible problem associated with empirical tests Equation (1) concerns sample selection bias (see Haurin and Hendershott, 1991; and Jud and Seaks, 1994). Sample selection occurs, for example, if individuals self-select a particular treatment such as selling a property by auction or by private treaty.

That is, the selling price of a property cannot be observed using the alternative marketing choice. If the marketing choice is correlated with omitted pricing variables, then the price differential may be attributable to the marketing mechanism. Because the conditional expectation is that the error terms will not equal zero, coefficients suffer from a selectivity bias. One solution to this problem is the two-stage Heckman (1979) procedure of first estimating a profit equation to explain marketing choice, and then applying a regression including a selectivity variable estimated from the first-stage).[5]

Empirical Results

The descriptive statistics presented in Exhibit 1 show the means for the entire sample and auctioned properties. These statistics show that the average sales price for the group of auctioned properties was higher than private-treaty properties. Auctioned properties were larger, had more land, were older and more likely to have premium materials and architecture. Taking the antilogs of the sales prices in Exhibit 1 indicates a difference of approximately $NZ50,000. The auction transactions represent approximately 3% of the total market volume in these areas during the time period of this study. The dummy variables for the four areas indicate the first three areas represent between 26% and 31% of the sample, while *Area* 4 represents about 17%.

Exhibit 1
Summary Statistics

	Total Sample		Auction Properties	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
ln (*Property Sales Price*)	11.77	0.43	12.10	0.50
ln (*House Size*)	4.85	0.37	5.13	0.36
ln (*Lot Size*)	0.06	0.06	0.08	0.06
Age	5.54	2.40	4.80	2.70
Quality A	0.13	0.33	0.34	0.48
Wall Cond.	0.60	0.49	0.54	0.50
Wall Type B	0.24	0.43	0.18	0.38
Wall Type C	0.32	0.47	0.17	0.38
Wall Type F	0.02	0.14	0.02	0.14
Wall Type R	0.09	0.28	0.10	0.29
Wall Type S	0.01	0.10	0.01	0.08
Wall Type W	0.28	0.45	0.46	0.50
Wall Type X	0.05	0.21	0.07	0.26
*TD*1	0.06	0.24	0.03	0.16
*TD*2	0.06	0.24	0.08	0.28
*TD*3	0.06	0.23	0.07	0.26
*TD*4	0.04	0.19	0.02	0.14
*TD*5	0.07	0.26	0.04	0.19
*TD*6	0.08	0.27	0.08	0.28
*TD*7	0.07	0.25	0.05	0.22
*TD*8	0.05	0.22	0.06	0.23
*TD*9	0.06	0.23	0.04	0.19
*TD*10	0.06	0.24	0.08	0.28
*TD*11	0.07	0.25	0.08	0.27
*TD*12	0.05	0.22	0.02	0.14
*TD*13	0.06	0.24	0.06	0.24
*TD*14	0.41	0.20	0.05	0.22
*TD*15	0.06	0.23	0.10	0.29
*TD*16	0.04	0.19	0.13	0.33
Area 1	0.26	0.44	0.46	0.50
Area 2	0.32	0.46	0.12	0.33
Area 3	0.27	0.44	0.15	0.36
Area 4	0.17	0.37	0.20	0.40
Area 1**Auction*	0.01	0.12		
Area 2**Auction*	<0.01	0.06		
Area 3**Auction*	<0.01	0.07		
Area 4**Auction*	0.01	0.08		
Auction	0.03	0.17		
Interest	10.27	0.89		

Probit Results

The probit selection model results are shown in Exhibit 2. This model has a dependent variable of whether a property is auctioned ($z_i = 1$) or sold by private treaty ($z_i = 0$) and three continuous variables as well as fifteen time dummy (TD_i) variables. From

Exhibit 2
Probit Selection Model Results

Variable	Coeff.	*t*-Stat	Marginal Effect	*t*-Stat
Constant	−6.43	−9.8		
ln (*House Size*)	0.84	6.4	0.04	6.7
Quality A	0.23	2.1	0.01	2.2
Wall Cond.	−0.29	−3.3	−0.01	−3.3
*TD*2	0.67	3.3	0.03	3.6
*TD*3	0.58	2.8	0.03	2.9
*TD*4	0.16	0.5	0.01	0.5
*TD*5	0.20	0.8	0.01	0.8
*TD*6	0.50	2.5	0.02	2.6
*TD*7	0.35	1.6	0.02	1.7
*TD*8	0.58	2.7	0.03	2.8
*TD*9	0.35	1.5	0.02	1.5
*TD*10	0.63	3.1	0.03	3.3
*TD*11	0.59	2.9	0.03	3.1
*TD*12	0.10	0.4	<0.01	0.4
*TD*13	0.50	2.3	0.02	2.4
*TD*14	0.58	2.5	0.03	2.6
*TD*15	0.71	3.5	0.03	3.7
*TD*16	1.02	0.2	0.05	5.2
Log-Likelihood	−633.22			
Restr.(Slopes = 0) Log-Likelihood	−711.98			
$\chi^2(18)$	157.53			
LM Statistic	4792.46			

previous research, auctioned properties appear to be higher priced and more unique. Therefore, continuous variables to measure these characteristics include the natural log of house size, the binary variable of premium quality of property improvements as evaluated by VNZ staff and quality of wall condition. Time dummy variables hold constant extraneous market influences that might prompt sellers in any given month to choose one method of sale versus another.

The probit model results in Exhibit 2 indicate a statistically significant log-likelihood value for restricted slopes; this is evidenced by a $\chi^2 = 157.53$. A Lagrange Multiplier (LM) test for homoskedasticity reveals a large LM, therefore, a correction procedure is conducted which corrects the standard errors and *t*-values.[6] However, all continuous variables and most time dummy variables are statistically significant. As anticipated, more expensive properties and those with higher quality fittings and fixtures are more likely to sell by auction. The time dummy variables indicate the probability of sale appears to be cyclical; months following September 1991 are all positive, with the probability of an auction sale relative to private-treaty sale becoming stronger into the following year. This trend is consistent with anecdotal evidence that brokers are increasingly prompting potential sellers to sell by auction. Interest rates were declining fairly consistently each month from 11.8% in September 1991 to 8.9% by December 1992 to 8.9% by December 1992.[7]

Sample Selection Regression Results

The sample selection equations are shown in Exhibit 3 for the private treaty and auction samples.[8] For the private treaty and auction samples, the adjusted R^2 are 64% and 69%, respectively. Perhaps the most important aspect in Exhibit 3 relates to λ; the null hypothesis is that $\lambda(\gamma' w)$ is zero or that sample selection bias is nonexistent. The low *t*-value for both samples (-0.9) for the private-treaty sample and -0.8 for the auction sample) indicates failure to reject the null hypothesis with a good degree of confidence. Therefore, a regression estimation without sample selection bias correction is appropriate.[9]

Regression Pricing Results

Exhibit 4 reports the generalized least squares results (GLS) for the entire sample with values for the auction variable. Both GLS regressions reported in this exhibit have statistically significant *F*-values and good adjusted R^2s of 79%. The χ^2 of the Breusch and Pagan (1979) Lagrange Multiplier test indicates a heteroskedasticity problem in the data. The White (1980) procedure was applied to obtain the true variance for the least squares estimator. In Exhibit 4, GLS Regression 1 assumes a common dummy variable for all areas, while GLS Regression 2 permits separate estimates for auction by area.

Exhibit 4 reports the important pricing effects of a sale by auction versus by private treaty.[10] The *Auction* variable in Regression 1 is approximately 1.8%, which suggests

Exhibit 3
Sample Selection Regressions

	Private-Treaty Sample		Auction Sample	
Variable	Coeff.	*t*-Stat	Coeff.	*t*-Stat
Constant	7.98	126.7	8.21	10.5
ln (*House Size*)	0.75	52.6	0.73	6.1
ln (*Lot Size*)	0.74	11.7	1.13	3.0
Age	0.18E-03	3.6	−0.13E-03	−0.4
Quality A	0.22	16.6	0.18	2.6
Good Wall Cond.	0.11	14.1	0.21	3.0
Wall Type B	0.06	6.1	0.15	1.9
Wall Type F	0.01	0.6	0.23	1.3
Wall Type R	−0.04	−3.1	0.06	0.7
Wall Type S	0.07	2.3	0.14	0.5
Wall Type W	<0.01	0.3	0.06	0.9
Wall Type X	0.06	3.3	0.07	0.6
Interest	0.24E-04	2.0	0.25E-03	1.6
λ	0.08	0.9	0.09	0.8
$\wedge\sigma_\varepsilon$	0.24		0.30	
$\wedge\rho$	0.12		0.10	
Adj. R^2	0.693		0.639	

Note: For the private-treaty sample, $n = 5186$. For the auction sample, $n = 158$.

Exhibit 4
Generalized Least Squares Regressions

	GLS Regression 1		GLS Regression 2	
Variable	Coeff.	*t*-Stat	Coeff.	*t*-Stat
Constant	8.74	104.3	8.75	104.3
ln (*House Size*)	0.64	35.9	0.63	35.8
ln (*Lot Size*)	0.83	8.2	0.84	8.2
Age	0.98E-04	2.1	0.97E-04	2.1
Quality A	0.16	12.4	0.16	12.2
Wall Cond.	0.09	14.7	0.10	14.7
Wall Type B	0.02	3.3	0.02	3.4
Wall Type F	<0.01	0.1	0.77E-03	<0.1
Wall Type R	−0.05	−4.1	−0.05	−4.1
Wall Type S	0.09	3.8	0.10	3.9
Wall Type W	−0.02	−2.6	−0.02	−2.6
Wall Type X	0.01	0.4	0.01	0.5
Interest	0.20E-04	2.3	0.19E-04	2.2
St. Albans (*Area* 2)	0.24	29.3	0.24	28.9
Shirley (*Area* 3)	0.35	40.3	0.35	39.6
Hills (*Area* 4)	0.02	2.5	0.03	2.5
Auction	0.02	0.8		
*AreaAuc*1			0.06	1.9
*AreaAuc*2			0.05	0.8
*AreaAuc*3			0.03	0.8
*AreaAuc*4			0.09	2.1
Breusch-Pagan χ^2	383.43		361.56	
F-Value	1234.48		1042.00	

Note: For GLS Regressions 1 and 2, the $n = 5344$

that the pricing differential between auction sales and private-treaty sales of houses is not statistically significant. The results in Regression 2 are somewhat more enlightening, however, as the interaction of the *Area* variables with the *Auction* variable produces different effects of an auction sale for the four areas. Only the *Area* 3 (Shirley) parameter is negative, however, it is not statistically significant. The other lower-priced area is St. Albans (*Area* 2), and the regression parameter is not statistically significant. The two highest-priced areas, *Area* 1 (Northwest) and *Area* 4 (Hills), are statistically significant. These parameters convert to a pricing difference of 5.9% and 9.5 %, respectively, relative to private-treaty sales prices. The parameters for the various areas produce changes in sales price relative to the Northwest area (*Area* 1) which are consistent with those reported in Exhibit 1, however, they are adjusted for the other variables in the regression. The sales price for homes in *Area* 4, for example, is about 2.4% lower than *Area* 1. These findings suggest the need to examine sales price effects of auction versus private-treaty sales carefully; an aggregated approach may not capture it.

Summary and Conclusions

This study is based upon a sample of over 5,344 sales in the Christchurch, New Zealand. The results show that auction volume was heaviest in four major geographical areas of the community. In these areas, 3% of the properties were sold at auction. A probit model reveals that the probability of an auction sale versus private-treaty sale is strongly influenced by house size, quality, and condition. The probability of an auction sale increased from September 1991 through December 1992, which was during a period of declining interest rates. In two of the four areas, no difference was observed between the sales price of properties sold at auction and similar properties sold by private treaty. In *Area* 1 and *Area* 4, which include highly priced, unique and desirable homes, a premium was observed for those that sold at auction. This premium ranged from 5.9% to 9.5%. These results are consistent with the results of previous research done in Melbourne, Australia. Even with higher marketing fees of $NZ1,000 to $NZ2,000, the net amount received by the seller is still more under auction for higher-priced, more unique properties.

The results indicate that auctions are most successful for unique, desirable houses in the higher price ranges. Uninformed bidders may overbid for such properties because they are unaware of the prices and/or availability of other properties that have sold in the same area. It is also possible that an informed buyer may overbid for the property and purchase it at a price higher than their estimate of the true value. This would be more likely to occur in the higher priced houses purchased by wealthy individuals who have less financial constraints and can afford to pay more than they know they should simply because they want to have the property. An informed buyer may also unintentionally overbid for a unique property because sales evidence on comparables is scant or nonexistent. In the absence of a distribution of property prices for comparable unique houses, the informed buyer must estimate the true value based on inadequate pricing information; the estimate is likely to deviate substantially from the true value. The auction process, however, assists in the dissemination of valuable pricing information to potential bidders.

It is also interesting to note that no premium or discount for auctions occurred in the other two areas of Christchurch. Even in areas where sales prices are below average, no discount was incurred by property owners who elected to sell by auction. These results are consistent with French and McCormick (1984), who suggest that a seller is more likely to choose a negotiated sale over an auction when there is not much dispersion in the true value of the asset across the potential buyers, or if the owner can identify the highest valued user in advance. In the more moderate price ranges, there is more market activity, more comparable sales information and more close substitutes. Hence, risk-averse bidders may feel less pressure to win the auction; because if they do not, it is likely that another similar house is for sale or soon will be.

Auctions are being used regularly in several areas of the world to sell residential real property. The results of this study indicate that auctions can be an effective way to market and sell residential properties. In Christchurch, New Zealand, some owners

are selecting the auction method as the preferred method of selling their house. The results of this research suggest that they are making a good choice.

Notes

[1] Research by Ashenfelter and Genesove (1992), Vanderporten (1992), Deboer, Conrad and McNamara (1992) and Mayer (1993) examines real estate auctions in the U.S.

[2] In the U.S., the auction rules may demand a 20% downpayment in cash on the day of the auction, with the remainder due in cash at closing within seven days. This compares favorably to the 30–45 days required to close a sale by private treaty. Buyers are usually qualified prior to the auction and must have a letter of credit or check for the downpayment.

[3] The number of bathrooms is another variable that is often incorporated in hedonic pricing models for single-family houses. However, many houses in Christchurch have only one bathroom. Only in the recent years has it become more common to build houses with more than one bathroom.

[4] Properties were classified as sold by auction if they sold under one of the following three circumstances: (1) they sold the day of the auction; (2) they sold prior to the auction; or (3) they sold within a week after the advertised auction date. Interviews with the brokers most actively involved in auctions revealed that an auction can lead to a sale of the property prior to the sale or immediately after an auction occurs. The phenomenon of auction selling differs from conventional agency listing (private treaty) in at least one important aspect. The asking price is known in a private-treaty sale, but not so in the auction process. While the intentions of potential auction buyers are canvassed by the vendor's agents prior to the auction day, at no time are the buyers aware of an exact price. It is part of the skill of the listing broker to persuade buyers that individually they stand a good chance of being the successful bidder, given that final selling price will not be determined until the auction. This encourages the participation of more bidders at the auction, which is encouraged by the vendor because it can help to create a sense of urgency amongst the serious bidders. When a house sells before auction day, the same circumstance is present. Auctions are often advertised with the inclusion ''unless sold by private treaty beforehand.'' So the purchaser who offers an amount in this manner, before auction day, does not know what figure the vendor had in mind. Most auctioneers are very careful not to disclose any of the vendor's thoughts at this stage, and the vendor does not counter offer, because that then puts a ceiling on the eventual selling price. Sometimes properties do not sell immediately on the fall of the hammer, but within a few days after the day of the auction. Consequently, properties that sold prior to or immediately after the advertised auction date, were classified as having been sold at auction along with the properties that were sold on auction day.

[5] More formally, if a selection variable z^* is not observed but determines whether a property is sold by auction or private treaty, estimates of least squares coefficients will be biased (Greene, 1993). However, the sign of z^* can be inferred even through the magnitude cannot. If a property is auctioned, $z^* > 0$, while $z^* \leq 0$ if the property is sold by private treaty. A probit model can be utilized to estimate the probability of an auction or private-treaty sale as follows (Greene, 1993:710):

$$z = \gamma' w_i + \mu_i \tag{2}$$

$z_i = 1$ if $z > 0$
$z_i = 0$ if $z \leq 0$
$\text{Prob}(z_i = 1) = \Phi(\gamma' w_i)$,
$\text{Prob}(z_i = 1) = 1 - \Phi(\gamma' w_i)$, where Φ = cumulative normal distribution.

The error terms from Equations (1) and (2), (μ_i, ε_i), are assumed bivariate normal [0,0,1, σ_ε, ρ], where ρ is the correlation between ρ and z. Least squares, using only observed values of $z = 1$, produces inconsistent estimates of β. By utilizing the two stage process of estimating λ from the probit equation and applying least squares to x and λ produces consistent estimates (Greene, 1993:709). If z_i and w_i are observable for a random sample of properties, but sales prices are observable only when $z_i = 1$, then the model becomes:

$$E[SPi \mid z_i = 1] = \beta' x_i + \rho\sigma_\varepsilon\lambda(\gamma' w) \tag{3}$$

where $\lambda(\gamma' w_i)$ is the inverse of the Mills ratio which is $\phi(\gamma' w_i)/[1 - \Phi(\gamma' w_i)]$; ϕ is the normal density function and Φ is the normal distribution function. The λ_i is the sensitivity correction that would be missing in the least squares regression, therefore, leading to inconsistent estimates of parameters.

The sample selection model is estimated by the Heckman two-step procedure as described by Greene (Greene, 1993: 711). In the first stage, a probit equation is estimated to obtain estimates of γ. In the selected sample, $\phi(\gamma' w_i)/\Phi(\gamma' w_i)$ is computed for each observation. Estimates of β and $\beta_\lambda = \rho\sigma_\varepsilon$ is obtained by a least squares regression of x and λ on SP_i.

[6] Heteroskedastic estimators are unbiased and consistent, however, the variance matrix is inappropriate as the standard errors of model parameters are incorrect.

[7] The marginal effects column shows the estimated percentage change in the probability of a property being auctioned for a given unit change in an independent variable. A 1% increase in house size, for example, increases the probability of sale by auction 3.8%. Houses with quality A ratings of fittings and fixtures are about 1.1% more likely to sell by auction.

[8] The sample selection methodology reported in Exhibit 3 excluded the *Auction* variable. It is theoretically possible to include the treatment effect (*Auction*) in the sample selection equation, and use a probit model using all observations. In this case, if a selection bias were present, λ would capture the variation that would otherwise be embedded in the Auction parameter. Barnow, Cain and Goldberger (1980) discusses the possible approaches as well as the empirical problems associated with including the treatment variable in the sample selection equation. The primary problem in this study is collinearity in the second-step regression. That is, the independent variables in the probit model such as sales price, quality of fittings and fixtures, wall condition and time dummy variables are also strongly correlated with sales price. To avoid collinearity, the problems of including the treatment variable with λ in the sample selection regression is additional variables that adequately explain the choice of an auction or private-treaty sale, but that are not strongly correlated with sales price. However, as evidenced in this study and others, auctioned properties are more likely to be expensive, more unique homes. Many seller characteristics (such as income and education) would not resolve this problem because they would be correlated with sales price. Consequently, our analysis took the approach of first testing for a sample selection problem.

[9] The correlation of the disturbance term in the regression and the selection criterion is 0.1 and 0.1 for the private treaty and auction samples, respectively; both are quite small.

[10] The results in both regressions also indicate sales price is positively related to house size, lot size, the presence of quality fittings and fixtures, and more expensive extensive wall construction such as brick and stone. The interest rate variable is positive and statistically significant; a plausible explanation for this finding is that higher interest rates coincide with greater economic activity and inflated prices. The logged variables such as house size are interpreted in terms of percentage change; for example, a 1% change in home size is associated with a 0.6% increase in sales price. The influence of binary variables is converted by $\exp(D) - 1$, where D denotes the dummy variable parameter. For example, houses with high quality fittings and fixtures increase the sales price by about 17%, and houses rated with good exterior wall condition sell for about 10% more than those rated lower.

References

Ashenfelter, O., How Auctions Work for Wine and Art, *Journal of Economic Perspectives*, 1989, Summer, 23–36.

Ashenfelter, O. and D. Genesove, Testing for Price Anomalies in Real Estate Auctions, *American Economic Review*, 1992, 501–05.

Barnow, B. S., G. G. Cain and A. S. Goldberger, Issues in the Analysis of Selectivity Bias, in Earnest W. Stromsdorfer and George Farkas, editors, *Evaluation Studies Review Annual*, 5, Beverly Hills, CA: Sage, 1981.

Breusch, T. and A. Pagan, A Simple Test for Heteroscedasticity and Random Coefficient Variation, *Econometrica*, 1979, 47, 239–54.

DeBoer, L., J. Conrad and K. T. McNamara, Property Tax Auction Sales, *Land Economics*, 1992, February, 72–82.

Engelbrecht-Wiggans, R., Auctions and Bidding Models: A Survey, *Management Science*, 1980, 26:2, 119–42.

French, K. R. and R. E. McCormick, Sealed Bids, Sunk Costs, and the Process of Competition, *Journal of Business*, 1984, 57:4, 417–41.

Greene, W.H., *Econometric Analysis*, second edition, New York: Macmillan Publishing Company, 1993.

Harris, M. and A. Raviv, A Theory of Monopoly Pricing with Demand Uncertainty, *American Economic Review*, 1981, 71, 347–65.

Haurin, D. R. and P. H. Hendershott, Housing Price Indexes: Issues and Results, *The Journal of the American Real Estate and Urban Economics Association*, 1991, 19:3, 259–69.

Heckman, J., Sample Selection Bias as a Specification Error, *Econometrica*, 1979, 47:1, 153–161.

Jud, G. D. and T. G. Seaks, Sample Selection Bias in Estimating Housing Sales Prices, *Journal of Real Estate Research*, 1994, 9:3, 1–10.

Lusht, K. M., Auctions Versus Private Sales of Houses: A Description and Empirical Analysis of Melbourne, Australia Market, Working Paper, The Pennsylvania State University: Philadelphia, PA, 1990.

——, A Comparison of Prices Brought by English Auctions and Private Negotiations, *Real Estate Economics*, 1996, 24, 517–30.

Maher, C., Information, Intermediaries and Sales Strategy in an Urban Housing Market: The Implications of Real Estate Auctions in Melbourne, *Urban Studies*, 1989, 26, 495–09.

——, Assessing the Performance of Real Estate Auctions, Working Paper, MIT Center for Real Estate: Cambridge, MA, 1993.

McAfee, R. P., Search Mechanisms, *Journal of Economic Theory*, 1988, 44, 99–123.

McAfee, R. P. and J., Auctions and Bidding, *Journal of Economic Literature*, 1987, 25, 699–738.

Milgrom, R. P., Auctions and Bidding: A Primer, *Journal of Economic Perspectives*, 1989, 3, 3–22.

Milgrom, P. R. and R. J. Weber, A Theory of Auctions and Competitive Bidding, *Econometrica*, 1982, 50:5, 1089–121.

Newell, G., J. MacFarlane, K. Lusht and S. Bulloch, Empirical Analysis of Real Estate Auction Versus Private Sale Performance, Working Paper, University of Western Sydney: Hawkesbury, Austrailia, 1993.

Vanderporten, B., Timing of Bids at Pooled Real Estate Auctions, *Journal of Real Estate Finance and Economics*, 1992, 5, 255–67.

Wilson, R., A Bidding Model of Perfect Competition, *Review of Economic Studies*, 1977, 44, 511–18.

——, Strategic Analysis of Auctions, Aumann and S. Hart, editors., in *The Handbook of Game Theory*, Amsterdam: North Holland, 1992.

White, H., A Heteroskedastic-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica*, 1980, 48, 817–38.

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