Factors Influencing Auction Outcomes: Bidder Turnout, Auction Houses and Market Conditions

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Abstract

This study provides new evidence on the outcomes of auctions of residential real estate, focusing on the effects of bidder turnout, pricing, market conditions and auction houses. The analysis of properties offered for sale by auction in Singapore from 1995 to 2000 shows that several variables are significant in explaining why an auction results in a sale. These variables include the state of the market, the timing of the auction (year), the number of bidders and the auction house. The findings indicate that the probability of a sale is higher for distress sales, for more homogenous properties and for those located in the central region. A sensitivity analysis is provided of how market conditions and the choice of auction house influence the probability of a sale.

Introduction

There is increasing interest in auctions as an alternative to private negotiations for marketing property. Since Vickrey (1961) opened the issue of whether pricing mechanisms matter, considerable effort has been put into the question of how auction revenues would rank under different sets of market expectations and valuations, and whether auctions and private negotiations can be expected to produce equal revenues. Reviews are found in McAfee and McMillan (1987) and Wilson (1992). Kagel (1995) reviews experimental research.

Recent research has focused on comparing revenues from different auction formats to revenues from private negotiations (Dotzour, Moorhead and Winkler, 1998; Mayer 1998; and Allen and Swisher, 2000). Less attention has been paid to the question of the determinants of auction success, defining success as a sale being made. DeBoer, Conrad and McNamara (1992) examine outcomes with a model limited to location and property-specific variables. Anglin (2003) and Mayer (1995) add changes in market conditions and Maher (1989) adds differences in intermediaries. Anglin provides an excellent theoretical treatment of how price

and the probability of sale are related to market conditions. Dotzour, Moorhead and Winkler compare the probabilities of auction sales versus private sales for residential properties in Christchurch, New Zealand.

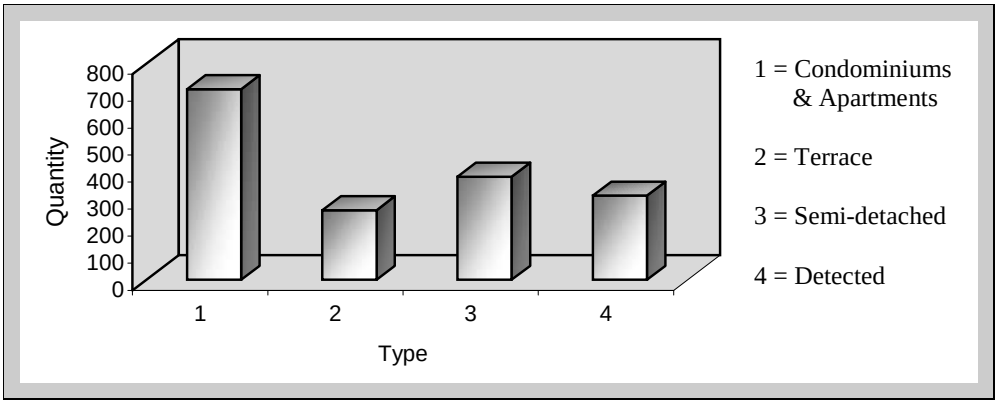
This study extends prior work by estimating a model that includes controls not only for locational and property characteristics, but also variables that measure the impact of ''turnout''—a proxy for the number of bidders at an auction—and the impact of the auctioning house. Interestingly, though there is a large theoretical literature on the importance of the number of bidders (Vickey, 1961; Milgrom, 1979; and McAfee and McMillan, 1987), empirical evidence is thin. Burns (1985), in an experimental setting and counter to expectations, found that fewer bidders resulted in higher average prices. Saidi and Marsden (1992) found a positive correlation between average bid size and the number of bidders at auctions for outer-continental offshore oil leases. More recently, Chen, Liaw and Leung (2003) show that the number of shares tendered by bidders significantly affects the price of auctioned shares in Taiwan. Work on the effect of bidder turnout at real estate auctions is limited to Ching and Fu (2003), who measured the impact of competition on the share prices of companies bidding for land.

Using data from Singapore that includes all auctions of residential property from 1995:Q3 through 2000:Q1, this study finds that the state of the market (economy), the timing of the auction, the potential number of bidders and certain auctioning houses explain the probability of a successful auction. The findings also suggest an underlying trend toward more successful auctions, likely attributable to the increasing acceptance of auctions as a selling mechanism. A marginal effects analysis is included to obtain a clearer appreciation of how market conditions and the choice of auction house influence the probability of a sale.

The dominant auction format in Singapore is the English ascending bid auction. An auction has generally been regarded as the last resort method of disposal.[1] The local sentiment towards auction is similar to that in the United States, where auctions are associated with distress properties—foreclosure or mortgagee sales (Asabere and Huffman, 1992). Distress sales are typically initiated by a mortgagee (bank/financial institution). There was a surge in auction sales following the Asian financial crisis of 1998–1999. Although the large majority of auctions remain mortgagee initiated, in the past few years there has been a discernible increase in owner auctions due to a diminution of the stigma associated with auctions. Nonetheless, the number of properties offered at auction is still low, reaching a high of approximately 3.5% of the total number of property transactions in 1998 and 1999.

The data for this study come from 1,654 residential properties that were offered at auction from 1995:Q3 through 2000:Q1. The sample includes auctions of apartments, condominiums, terrace, semi-detached and detached houses (see Exhibit 1). Transaction data were obtained from the ReaLink database, which is compiled by the Singapore Institute of Surveyors and Valuers (SISV).[2] The private Residential Property Price Indexes (RPI) was obtained from the Urban

Exhibit 1 | Distribution of Private Residential Properties (by types) under Auction



Redevelopment Authority of Singapore (URA). The RPI was used to estimate the market value of each property at the time of auction.

Auctions that were successfully transacted (positive outcome) and those that were not (negative outcome) were identified.[3] In Singapore, properties are sometimes repeatedly offered at auction if prior attempts were unsuccessful. The sample includes only the most recent auction attempt, regardless of earlier outcomes.

The Empirical Model

Equation (1) is the empirical model:

$$OUT = f(LRP, SOM, \mathbf{DATE}, \mathbf{LOC}, \mathbf{AH}, \mathbf{TYPE}, VP, DISTR, TEN, TURN), \quad (1)$$

where the dependent variable, outcome of the auction (*OUT*), is given a value of 1 for a successful auction, and a value of 0 otherwise. The explanatory variables are the level of the reserve price (*LRP*), the state of the private residential property market (*SOM*), the date of auction (vector **DATE**), the location of the property (vector **LOC**), the auctioning houses (vector **AH**), type (vector **TYPE**), the tenure of the property (*TEN*), property whether with vacant possession (*VP*), distress sale (*DISTR*)[4] and the turnout (*TURN*) at the auction.

Auction theory suggests that a higher reserve price should increase the selling price, but decrease the probability of sale (McAfee and Vincent, 1992). Supporting evidence that the reserve price in fact affects the probability of sale is found in DeBoer, Conrad and McNamara (1992). Efforts to empirically measure the role

of the reserve price, including the merits of a hidden reserve price (Riley and Samuelson, 1981; and Vincent, 1989), and the identification of an optimal reserve price (McAfee and Vincent, 1992; McAfee, Quan and Vincent, 2002; Eklof and Lunander, 2003; and Li, Perrigne and Vuong, 2003) have been hindered by the fact that the reserve price is often hidden or undisclosed (Toda, Nozdrina and Maddala, 1998). The data in the present study is no exception; it does not include information on the (hidden) reserve prices. A proxy measure is developed called the *level of reserve price* (LRP), which is defined as the difference between the property's estimated market value and the opening bid, divided by the opening bid. The estimated market value is the last transaction price for the auctioned property or the estimated market value of properties most comparable to the auctioned property if there is no previous transaction, adjusted by the price index (RPI).[5] The adjustment uses the RPI from the quarter prior to the auction, as information on the contemporaneous price index is not available at the time of auction.

The motivation for the LRP proxy is that the opening bid provides valuable information as to the reserve price. The undisclosed reserve price should be higher than the opening bid (which is determined by the seller and/or auctioneer). By computing the difference between the market value and the opening bid, the level of the reserve price is captured relative to the estimated market value or conversely, relative to the opening bid. This variable thus controls for the effect of reserve price on the probability of a successful outcome.[6]

Comparables were used to estimate market value when the data did not include information on past transaction prices. This occurred for approximately 20% of the sample. Comparables are transactions of properties similar to the ''subject'' property with respect to the vector of physical and locational characteristics typically associated with value. In most instances, comparables were available in the same general location as the subject property, and the volume of potential comparables made matching other characteristics relatively straightforward.

In short, the LRP measures the appropriateness of the property's reserve price prior to the commencement of the auction. A positive LRP reflects an opening bid that is lower than market value.[7] The expected sign of the LRP must be discovered empirically. Intuitively, the speculation is that the coefficient will be positive, on the basis that a lower opening bid signals a lower reserve price, which could encourage bidding.

The state of the market (SOM) indirectly affects the sentiment of property buyers and hence affects the probability of a sale. Mayer (1995) explores the role that information and market conditions play in determining the relative performance of various sales techniques, including auctions. Like Asabere and Huffman (1992), he also accounts for market sentiments in his analysis of auction performance. More recently, Anglin (2003) provides a theoretical treatment of how the price/probability relationship changes in response to changes in market conditions.

SOM is a dummy variable given a value of zero if the auction occurred in a quarter following two previous successive quarters of negative growth in the RPI. The use of two successive quarters of RPI growth as a gauge is synonymous with the economic norm that considers an economy in technical recession with two successive quarters registering negative growth.[8] *SOM* is given a value of one for all other patterns of prior RPI growth. The coefficient for *SOM* is expected to be positive.

The timing of auctions has been investigated in two ways. First, the effect of timing as the auction proceeds (Ashenfelter 1989; Ashenfelter and Genesove, 1992; and Lusht, 1994) and second, the effect of time over separate auction attempts (Asabere and Huffman, 1992; and Vanderporten, 1992). A vector of *DATE* dummy variables is created for each year from 1996 through 2000 (*D96*, *D97*, *D98*, *D99* and *D00*).

Location has previously been associated with auction outcomes. Asabere and Huffman (1992) investigated the impacts of physical, locational, time and neighborhood characteristics on the outcomes of auctions of foreclosed properties and found that location mattered. Deboer, Conrad and McNamara (1992) report that as many as three-quarters of surveyed bidders in the auction of land parcels were influenced by the location of the parcel when bidding. More than half of those surveyed also cited neighborhood quality as an important consideration.

To capture location effects (*LOC*), a number of classifications (prime versus non-prime, regions, etc) are explored. Results are reported for properties classified as being in the central and east regions (*DISTCENT* and *DISTEAST*), the default being all other regions (west, north and northeast). Properties in central locations (close to city center) are expected to generate greater interest and participation because they are in limited supply. The east region is also considered a good class residential area.

There have been no prior attempts to quantify the possible influence of the auctioning agent on either the price obtained or the probability of a sale. However, there is casual evidence that agents play a significant role (see Maher, 1989, for a discussion of auction institutions in Melbourne). This prompts a hypothesis that auction houses (**AH**) (agents for sellers in property auctions) may exert a non-trivial influence on auction outcomes. The 'big four' auction houses[9] are identified using dummy variables, with all other auction houses the default. Auction house A has the largest market share, as evidenced in Exhibit 2. Auction house C, though being the smallest of the 'big four,' is well established and has a good reputation. The expectation is an empirical question.

The tenure (*TEN*) of the property may also influence the probability of a sale. Freehold[10] properties are prized possessions in Singapore because all public sales of land now come with (99-year) leasehold estates rather than freehold estates. A dummy variable with a value of one is assigned to freehold status, with leaseholds the default. The coefficient on *TEN* is expected to be positive.

Exhibit 2 | Descriptive Statistics and Variable Definitions

Variable	Representation	Mean	Std. Dev.	Min.	Max.	Remarks
Outcome	*OUT*	0.266	0.013	0	1	Dummy variable = 1 if property is sold in auction; = 0 if otherwise.
Level of Reserve Price	*LRP*	0.0935	0.163	0	0.958	Ratio = (*IP* – *OB*) / *OB*.
State of the Private Residential Market	*SOM*	0.517	0.015	0	1	Dummy variable = 1 if market is not in recession; = 0 if market is in depression
Year Dummies	*D96*	0.070	0.255	0	1	Dummy variable = 1 if auction is in that year.
	D97	0.032	0.178	0	1	Dummy variable = 1 if auction is in that year.
	D98	0.272	0.484	0	1	Dummy variable = 1 if auction is in that year.
	D99	0.469	0.499	0	1	Dummy variable = 1 if auction is in that year.
	D00	0.009	0.095	0	1	Dummy variable = 1 if auction is in that year.
Location of Subject Property	*DISTCENT*	0.225	0.417	0	1	Dummy variable = 1 if property is in central region; = 0 if otherwise.
	DISTEAST	0.296	0.457	0	1	Dummy variable = 1 if property is in east region; = 0 if otherwise.

Exhibit 2 | (continued)

Descriptive Statistics and Variable Definitions

Variable	Representation	Mean	Std. Dev.	Min.	Max.	Remarks
Auction House A	*A*	0.357	0.014	0	1	Dummy variable = 1 if property is handled by this **AH**; = 0 if otherwise.
Auction House B	*B*	0.319	0.014	0	1	Dummy variable = 1 if property is handled by this **AH**; = 0 if otherwise.
Auction House C	*C*	0.089	0.008	0	1	Dummy variable = 1 if property is handled by this **AH**; = 0 if otherwise.
Auction House D	*D*	0.209	0.012	0	1	Dummy variable = 1 if property is handled by this **AH**; = 0 if otherwise.
Tenure of Subject	*TEN*	0.830	0.011	0	1	Dummy variable = 1 if property is freehold; = 0 if otherwise.
Number of Turnout	*TURN*	194	2.651	30	450	Number of bidders in attendance.
Terrace House	*TERR*	0.156	0.363	0	1	
Semi-Detached House	*SEMID*	0.231	0.422	0	1	
Detached House	*DETACH*	0.167	0.313	0	1	Dummy Variable for property type
Distress Sale	*DISTR*	.5938	.4913	0	1	Dummy variable = 1 if sale from foreclosure
Vacant Possession	*VP*	.8993	.3010	0	1	Dummy variable = 1 if sale with vacant possession

There is a rich theoretical literature that addresses the association between the number of bidders and the expected price at auction, but with the exception of Burns (1985), there has been little empirical work. Vickrey (1961) shows that under a set of strong assumptions,[11] as the number of bidders increases, the bid that each makes in a multi-unit progressive auction bidding model comes closer to each bidder's valuation or reserve price. McAcfee and McMillan (1987) examine auctions with a stochastic number of bidders, where the probability of observing a certain number of actual bidders depends on the number of potential bidders. Burns (1985), in an experimental setting, tests the reaction of buyers to changes in the number of participants in the market. Contrary to standard expectations, it was found that fewer bidders tend to result in higher prices.

Intuitively, a higher turnout suggests a higher chance of a positive auction outcome. The number of persons attending the auction, the turnout (*TURN*), is used here as a measure of bidder interest. It is recognized that this proxy is subject to some error as it is not possible to unbundle the number attending into those that are potential bidders and those who are simply observers. Nonetheless, agents claim a strong association between turnout and bidding behavior. The coefficient on *TURN* is expected to be positive, as higher attendance should be associated with a higher chance of success.

Other control variables are for property type (terrace, semi-detached and detached houses, default being high-rise apartments and condominiums), whether a distress sale or not (*DISTR*), and whether the property was vacant on the date of the auction (*VP*).

Results and Analysis

The results of the probit estimation of Equation (1) are shown in Exhibit 3. The model is statistically significant and the results indicate that the probability of an auction sale is likely to improve if the auctioned property is a distress sale, the market is not in recession, the auctioning house is either A or C, and there is a relatively high turnout. These results are all consistent with expectations.

Distress properties (*DISTR*) have a higher chance of being sold, as indicated by the highly significant and positive coefficient. This is expected as the sellers of defaulted properties—typically banks and financial institutions—have a higher incentive to attempt to recoup their investments. The flipside are properties put up for auction by owners. Owner-sellers appear to be less anxious to sell, with some only testing the market.

The state of the market (*SOM*) is significant at the 1% level, supporting the expectation that depressed market conditions are associated with dampened demand. The 1998 year dummy variable is also highly significant and negative. This result is not surprising given the poor market sentiments following the Asian financial crisis. The other year dummy variables are not significantly different from the base year (1995). The model is also re-estimated using an alternative

Exhibit 3 | Results from the Binary Probit Model

	Coeff.	Std. Error	*t*-Stat.	*P* Value
Constant	−2.5162**	0.4393	−5.727	0.0000
LRP	0.0104	0.0841	0.123	0.9018
SOM	0.3031***	0.1562	1.940	0.0524
A	0.5164	0.3912	1.320	0.1869
B	0.1551	0.3931	0.395	0.6931
C	0.7329***	0.4077	1.798	0.0722
D	0.3779	0.3898	0.969	0.3324
TEN	0.1650	0.1200	1.375	0.1690
TURN	0.0034**	0.0006	5.252	0.0000
DISTR	0.8188**	0.1103	7.421	0.0000
D96	−0.0824	0.3069	−0.269	0.7883
D97	−0.6124	0.4681	−1.308	0.1908
D98	−0.7068*	0.3085	−2.291	0.0220
D99	−0.0368	0.2700	−0.136	0.8916
D00	0.0547	0.4948	0.110	0.9120
TERR	0.0677	0.1265	0.535	0.5925
SEMID	−0.2227***	0.1208	−1.843	0.0653
DETACH	−0.6398**	0.1508	−4.242	0.0000
VP	−0.0286	0.1603	−0.178	0.8585
DISTCENT	0.2058***	0.1155	1.782	0.0747
DISTEAST	0.0858	0.1026	0.836	0.4031

Notes: The nob is 1,154. The log-likelihood function is −553.118.
* Significant at the 0.05 level.
** Significant at the 0.01 level.
*** Significant at the 0.10 level.

date variable (indexed by quarters from 1995:Q3), and the coefficient turns out to be positive and significant. This supports the casually observed trend toward more frequent use of auction as a marketing mechanism.

The 'big four' auction houses do not exert similar effects on auction outcomes. Auctioning house C has a positive impact on the probability of success, and is significant at the 10% level. Turnout (*TURN*) is significant at the 1% level. This is the first empirical support for theoretical expectations, and is a particularly important result when coupled with the findings of prior work that showed a positive association between turnout and the price of auctioned land (Ching and Fu, 2003).

The results also show that semi-detached and detached houses have a lower probability of sale. This could be attributed to the higher prices of these properties as well, as greater atypicality associated with larger properties. Viewed differently, the empirical evidence shows that more homogenous properties (apartments and condominiums) are more likely to be auctioned, a result consistent with the prediction in Mayer (1998). Properties in the central region have a higher probability of being sold relative to those in other regions, though only weakly significant at the 10% level.

Level of reserve price (*LRP*) is positive but not significant. The positive coefficient means that the larger the difference between the market value and the opening bid

Exhibit 4 | Marginal Effects

	Coeff.	Std Error	*t*-Stat.	*P* Value
Constant	−0.5139	0.0933	−5.511	0.0000
LRP	0.0020	0.0174	0.116	0.9077
SOM	0.0625***	0.0323	1.937	0.0527
A	0.1066	0.0806	1.322	0.1860
B	0.0320	0.0810	0.395	0.6929
C	0.1510***	0.0839	1.799	0.0720
D	0.0781	0.0804	0.971	0.3314
TEN	0.0342	0.0247	1.381	0.1674
TURN	0.0007**	0.0001	5.241	0.0000
DISTR	0.1696**	0.0222	7.651	0.0000
D96	−0.0172	0.0633	−0.272	0.7853
D97	−0.1263	0.0958	−1.318	0.1874
D98	−0.1456*	0.0632	−2.303	0.0213
D99	−0.0078	0.0557	−0.140	0.8887
D00	0.0108	0.1021	0.105	0.9160
TERR	0.0144	0.0262	0.550	0.5823
SEMID	−0.0455***	0.0250	−1.825	0.0680
DETACH	−0.1319**	0.0307	−4.301	0.0000
VP	−0.0059	0.0330	−0.178	0.8584
DISTCENT	0.0417***	0.0241	1.729	0.0838
DISTEAST	0.0177	0.0211	0.838	0.4021

Notes: Marginal effects evaluated at mean values.
* Significant at the 0.05 level.
** Significant at the 0.01 level.
*** Significant at the 0.10 level.

(implying a lower reserve price relative to market value), the higher the likelihood of a successful auction. The tenure status of the property (*TEN*) and vacant possession (*VP*) are not significantly associated with the probability of success, although the signs are in the expected direction. One possible explanation is that tenure and possession differences may be completely captured in prices paid.

An LM test for heteroscedasticity was conducted by conditioning the error term on property characteristics (**TYPE**, *TEN* and *VP*). No heteroscedasticity was detected.

Marginal Effects

Exhibit 4 shows the marginal effects of changes in the level of the explanatory variables. It shows the marginal effects of all variable evaluated at their means (with standard errors and significance levels). The probability of a sale increases marginally for every unit change in the level of reserve price when evaluated at the mean LRP. In contrast, the probability of a sale increases by 0.07% for every unit change in turnout, evaluated at the mean turnout of 190. Given the substantial variation in turnout (minimum of 30, maximum of 450), the result strongly supports the idea that turnout is critical to success.

Because the auction house variables (A, B, C and D) are dummy variables, the marginal effects reported in Exhibit 4 are not meaningful. To better evaluate the effect of the auction house on the probability of sale, the marginal effects were recomputed for each auction house separately by assigning a value of 1 to the auction house of interest and zero to the rest. The results are reported in Exhibit

Exhibit 5 | Marginal Effects for Auction Houses and State of the Market

Variables	Coeff.	Std. Error
A = 1, other **AH** = 0	0.1140***	.0884
B = 1, other **AH** = 0	0.0373***	.0953
C = 1, other **AH** = 0	0.1329	.0868
D = 1, other **AH** = 0	0.0582	.0628
SOM = 0	0.0416*	.0208
SOM = 1	0.0877***	.0465

Notes:
AH = Auction Houses
SOM = State of the Market
* Significant at the 0.05 level.
** Significant at the 0.01 level.
*** Significant at the 0.10 level.

5. It is clear that auction houses A and C have the higher marginal impact. A property that is auctioned by auction house C has more than a 13% greater chance of being sold than if the property is not with house C. The next highest marginal effect is 11% for auction house A. The marginal effects for auction houses B and D are again insignificant.

Exhibit 5 also shows the marginal effect of the state of market (*SOM*). When the property market goes through two consecutive quarters of negative growth, the probability of a sale drops by about 50%. Further analysis (results available on request) show that the marginal effects for turnout and distress properties across different states of the market do differ (turnout: 0.097 for *SOM* = 1 compared to 0.046 for *SOM* = 0; distress: 0.238 for *SOM* = 1 compared to 0.113 for *SOM* = 0) though both variables are still highly significant. In contrast, the marginal effects for *LRP* remain insignificant for both states of the market.

Conclusion

This paper extends prior work on the probability of sale at auction by using a much richer set of explanatory variables. The findings indicate that bidder turnout and market conditions matter, as does the choice of auctioning agent. The findings also indicate that distress properties are more likely to sell, and a sale is more likely in markets not in decline.

This study is relevant for banks that foreclose properties, as most foreclosures occur when the real estate market is not performing well. The immediate implication is that the chances of selling a property successfully in an auction under poor market conditions are rather low. Hence banks or sellers should bear in mind that the previous empirical evidence on the size of auction discounts should be conditioned on a positive outcome or sale at the auction. In other words, the expected sum recoverable for a distressed property depends not only on the expected selling price at the auction, but also on the probability of an auction sale.

Finally, the marginal effect analysis detailed here demonstrates that bidder turnout—as an indicator of market interest—is also an important determinant of a positive auction outcome.

Endnotes

[1] Auctions are often announced well in advance through the press and interested parties are invited to inspect the properties. Typically, an auction session would comprise of at least half a dozen properties, depending on the auction house conducting the auction.

[2] SISV records and tracks all private property transactions in Singapore.

[3] Another measure of success would be whether the property not sold at auction was subsequently sold through private negotiations. This question is addressed in another paper in progress.

[4] A distress sale is defined as an auction put up by a financial institution that has foreclosed on the property. We are unable to identify properties put up for auction by owners who are financially distressed.

[5] Such a proxy assumes a rational seller who is willing to accept the current market price that is index-adjusted. This assumption may be violated in practice. We thank an anonymous reviewer for pointing this out.

[6] The opening bid was not used as the reserve price (as in DeBoer, et al., 1992) as it is not uncommon to see properties receiving bids above the opening bid to be withdrawn from the auctions. There were 275 observations where the property was withdrawn even when the last bid, exceeding the opening bid, was submitted.

[7] If the market value is lower than the opening bid, *LRP* is defined as zero. This affects less than 10% of the data. By doing this, a truncation error is introduced, but negative *LRP* is not very meaningful in any case (*i.e.*, a negative *LRP* means that the reserve price is higher than the estimated market value or that the estimated market price is inaccurate). As a robustness check, the results are qualitatively unchanged when LRP is not truncated at zero.

[8] The *RPI* was also used to proxy for *SOM*, and similar results were obtained. Unemployment rate is not used as a proxy for the state of the market as it normally lags the property market.

[9] The big four auction houses are labeled A through D in this paper representing Colliers Jardine, DTZ Debenham Tie Leung, Knight Frank and Jones Lang LaSalle (not in corresponding order).

[10] Properties in perpetuity and with 999 year leases are generally considered freehold in Singapore.

[11] The assumptions are linear utility, homogeneous expectations and a rectangular distribution of individual valuations.

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