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HEDONIC MODEL OF COURT AUCTION RESIDENTIAL HOUSING MARKET IN THE TAIPEI METROPOLITAN AREA

Lin, Vickey Chiu-Chin

Department of Land Economics, National Chengchi University, Taipei, Taiwan, R.O.C.

ABSTRACT

Court auction of real estate in the domestic Residential housing market accounts for a certain level of market share. The high returns ratio, due to the fact that the auction price is always much lower than the market price, has been the driving force behind the entry of investors into the market.

Recently, the emerging real estates auctioned by Taiwan Financial Asset Service Corp., entrusted by Taipei District Court, and by each bank have prompted still further interest. However, what is the price difference between search and auction markets? What are the factors that affect the winning-bid price of court auction residences?

This study applied the Hedonic Price Theory and found out the relation of the attributes of court auction residences in Taipei Metropolitan Area from 2001 to 2003. In addition, this study also adopted the GIS system to find out which spatial factors affect the level of the winning-bid price on court auction residences.

The empirical results confirmed that the market share of court auction housing was larger, the bigger the discount ratio between markets was. The percentage 20 price-difference between the search market and auction market did not exist in 1994, a decade ago; however the bigger return was found in 2002 and 2003. The auction market still grows to be the investor or speculator market, it does not belong to the consumer's market.

Keywords: court auction residential house, Hedonic Price Theory, bid price, spatial factors.

INTRODUCTION

In recent years, the continuous decline in macro-economic conditions has contributed to a slump in the Taiwan real estate market cycle. As a result, there has been a steady increase in mortgage arrears. A large amount of mortgage arrears have been released to the court auction housing market. The court auction of real estate has become a new market that has gradually gathered interest and popularity. Reported by the media, people gradually understand the court auction housing market conditions. The court auction is always the main way for financial institutions to deal with defaulted loans. Upgrading the efficiency of the court auction price always affects the nonperforming loans directly. One of the strongest influences is the higher the bid times and the failure ratios of bids due to the higher price of appraisal and making reserve price. According to the previous references, the higher the reserve price, the

higher the bid price is. Meanwhile, the courts put forward an upper-price to refrain from lower-price bids when they make the first reserve price. Lower bid price will damage the benefit of creditors and debtors. When the courts set up its reserve price (base price) and lower it, they can reduce the times of make bids and avoid breaking down the tender. But whether the bid price will be reduced or not, there is something meaningful on the analyses of the court auction market. It can provide the indicator for the court auction on how to set up the reserve price. The court auction accounts for a certain level of market share in the Taiwan residential housing market. The high returns ratio, due to the fact that the auction price is always much lower than the market price, has been the driving force behind the entry of investors into the market. Recently, the emerging real estates auctioned by Taiwan Financial Asset Service Corp., entrusted by Taipei District Court, and by each bank have prompted still further interest.

Collecting the "real" transaction real estate price is the most critical issue of the real estate search market, and it is also the most difficult part of our research in Taiwan. Much of the real estate price research bias may come from the "not real" transaction price. We might study on the open auction market to gain some pricing information. Real estate price in Taiwan has its special formation background, for example, land shortage, high population density, high priority of owner occupancy, and highly speculative real estate demand, etc. However, what is the price difference between search and auction markets? What are the factors that affect the final bid price of court auction residences?

This study will use the Hedonic Price Theory to find out the relation of the attributes of court auction residences in Taipei city Area from 2001 to 2003. In addition, this study also adopts the GIS system to find out which spatial factors affect the level of the final successful-bid price on court auction residences.

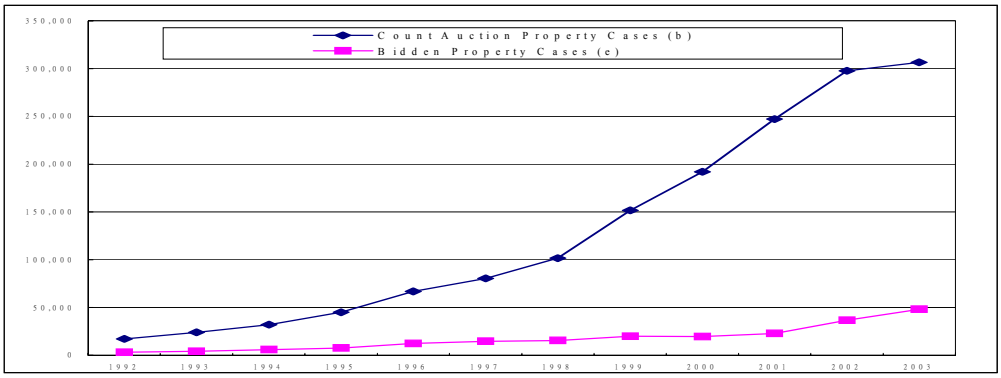
DATA AND DESCRIPTIVE STATISTICS

There are three up to four types of auction markets. Most of the auction market share is the court auction market, the others are (golden), (silvery), (diamond) auction markets, the latter only have a 2% market share on Taiwan real estate market, and most of them deal with the unsuccessful-bid court auction objects which are originally sourced from bank nonperforming loans (NPL). The auctioneers, not the court auction, can be Taiwan Financial Asset Service Corp., entrusted by Taipei District Court, the bank itself, or the auction agent, entrusted by the Bank. The 16 nation courts had 17,000 auction property cases in 1992, however in a decade these have dramatically risen to 306,495 cases. Both Table1 and Figure1 indicate the court auction change from 1.00% in 1992 to 13.75% in 2003 on real estate market share in cases. The successful-bid property cases amount rose from 182(NT$ a hundred million) in 1992 to 1,872(NT$ a hundred million) in 2003 and reached a new high in 2004 of around 3000 (NT$ a hundred million).

Table 1: 1992-2003 Taiwan Area Court Auction Property Cases Statistic Data

(1) Year											
1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
(2) Transaction property cases (a) for taxation goal											
312,796	371,720	464,480	491,884	508,748	466,568	385,969	385,074	321,165	259,494	320,285	349,789
(3)Court auction property cases (b)											
17,000	24,000	32,000	45,000	66,779	80,388	101,633	151,658	192,009	247,131	297,651	306,495
(5)Successful-bid property cases (c)											
3,059	4,167	5,831	7,608	12,250	14,678	15,367	19,810	19,583	22,800	36,661	48,096
(6)Successful-bid property cases amount (NT$ a hundred million)											
182	270	419	534	698	920	838	915	951	820	1,357	1,872
(7)Successful-bid property cases average amount per case (NT$ ten thousand)											
595	648	719	702	570	627	545	462	486	360	370	389
(8)Successful bidding rate (c)/(b)											
18.00%	17.40%	18.20%	16.90%	18.30%	18.30%	15.10%	13.10%	10.50%	9.20%	12.32%	15.69%
(9)Percentage of (c)/(a)											
1.00%	1.10%	1.30%	1.50%	2.40%	3.10%	4.00%	5.10%	6.10%	8.80%	11.45%	13.75%

Figure 1: 1992-2003 the Comparison between Taiwan Area Court Auction Property Cases and Successful-bid (Bidden) Property Cases



We found in Table 2 that the city of Taipei total court auction property cases have 16% of Taiwan count auction market share with cases reaching 47,189 in the year of 2002 and the dollar amount has 32.00% market share which amount attained up to 438.2(NT$ a hundred million).

THE DATA AND ECONOMETRIC MODEL FRAMEWORK

The Hedonic Price Theory, Rosen (1974), is applied to most conventional housing price analyses. As hedonic pricing makes use of utilitarianism to analyze the implicit price of all the characteristics of a multifaceted commodity, when applied to housing, it analysed only the relationship between the attributes, proper for the subject and the price. However, looking at the auction housing market, one discovers that the behaviour of purchasers' paying money, regardless of purchase for consumption or investment, can be reflected by the attributes of housing, auction attributes as well as by the macro environment (such as an economic boom), and the influence of the macro environment is no less important than that of the attributes of the housing itself.

Table2: Taipei (City + County) Area Court Auction Property Cases Bidding Statistic Data

(1) Taipei City + County	2001	2002	2003
(2) Successful-bid property cases	4,816	8,297	4,742
(3) Successful-bid rate	21.00%	23.00%	N/A
(4) Fail-bid cases (Not-close bid)	26,772	33,880	N/A
(5) Withdraw-bid cases	3,760	5,012	N/A
(6) Court auction property cases	35,348	47,189	N/A
(7) The Percentage of (6) in Taiwan area cases	15.00%	16.00%	N/A
(8) The average bidding counts(times)	3.15	2.97	N/A
(9) Bidden Property Cases Amount (NT$ a hundred million)	257.4	438.2	301.7
(10) The Percentage of (9) in Taiwan Area Cases Amount	31.00%	32.00%	N/A

Generally speaking, this theory contains no flaws. It is the selection of attributes that matters to the outcomes. Besides, it is to be considered whether the local housing market status satisfies the basic assumptions of the hedonic price theory, as it directly connects to the results.

However, when evaluating these attributes, most empirical researches strongly rely on the land rent and location theories. As examples, the location evaluation indicators developed by Bender and Hwang (1982), Harrison and Rubinfeld (1976), Kain and Quigley (1975), Nelson (1978), Liu (1986), Ku and Liu (1989) and the others is based on the "negative relation of the rent & distance from the CBD" by Von Thunen (1826) and the "negative relation of the land price & distance from the CBD" in the bid-rent theory by Alonso (1964). Other examples can be found in similar studies about the relation of the accessibility and housing prices by Muth (1969), Mills (1972) and Evans (1973). These researches still cannot propose a practical theory for housing price evaluation.

There is no really free competition in the housing market, therefore, when we are applying the Hedonic Price Theory to the local housing market, it is first to consider whether local markets satisfy the basic assumptions of the theory. Having no other appropriate economic theories to interpret the market situation, the use of empirical statistics are nevertheless a more practical means. Besides, when establishing a model, reselection of attributes that are closer to local practices as to independent variables are needed. Doing so is to make price evaluation more substantiated for local markets.

From reviewing the literature, one discovers that most housing price studies did not include the values that cannot be quantitative (such as timing, location, type, those called "quality" variance). Also, are those attributes (such as area, age of the housing...) included in most foreign countries literature really important factors, which affect the auction housing price? Are they as sensible as conceived? The present research will make a review on these model frameworks with certain examples, in order to establish a more suitable model framework as the foundation for an empirical study.

1. How the auction market works

In the literature reviews (see Table 3), we find the auction market work on different by the rules of sales, and the most of markets the sale rules were the English auction-open called bid, such as Australia, U.S.A, and New Zealand.

In Taiwan, mostly we have the sale rules of the first-price sealed bid on auction market. Some of the auctions have open called bid in the private sale market (such as [silvery], [diamond] auction markets in Taiwan), which have the 2% market share in the auction market. The Taiwan court auctions were viewed as a way to dispose of distressed properties. Most of the properties in court auctions are related to debtor-creditor, amount due of mortgage or nonperforming loans (NPL) mortgage foreclosure, and tax foreclosure. The creditor declares court auction by the law of enforcing performance in court. Buyers bring secret bids to the auction site inside the court room before the fixed period date. This is followed by the execute judge openly announcing the highest winning bid.

The Taiwan court auction methods were more similar to the first-sealed bid auction, the buyer has claim to the object auctioned by making the highest. During the process, buyers did not know the other bids, such as the number of bidder, the bid-price of other bidders. If in the event of the successful bidder defaulting, the court shall have a secondary auction.

In the event of an unsuccessful-bid (it is not close auction, if no bidders reach the base price); the court might have second, third …sub sequential auction. The bid-times may one-shot, two, three or up to eight etc. to win the bid and the court can close the auction. Each next auction will cut down the base price around 20%. The average auction bid times (counts) was 3 to 4 times. The winning bidder would pay the full strike-price within 7 days of the date notification. Sometimes, the court auction is not efficient in time spending to deal with the properties.

Table3: The literature reviews of the auction markets comparisons

Author	Auction System	Real Estate market type	Real estate type	The method of Evaluation
Lusht, 1996	English auction-open called bid	Australia, The auction market attaints the half of market share in real estate market	Normal asset, Residential housie	Hedonic Price Theory
Dotzour; Moorhead; Winkler, 1998	English auction-open called bid	New Zealand, The auction market attaints fewer of market share	Residential house	Hedonic Price Theory
Mayer, 1998	English auction-open called bid	U.S.A. The auction market attaints fewer of market share	Normal and NPL asset mixed, Residential house	Reaped Sale Method
Marcus,2001	English auction-open called bid	U.S.A. The auction market attaints fewer of market share	NPL by HUD Residential house	Hedonic Price Theory
Quan, 2002	English auction-open called bid	U.S.A	Residential vacancy land	Hedonic Price Theory
Lin, Tsai, Chang,1997	The first-price sealed bid	Taiwan	NPL	Hedonic Price Theory

2. Important Factors Affecting Auction Housing Prices in Taiwan

In an attributes analysis of the auction housing price, one should begin from the angle of a user and draw in the following factors(see Table 4 and Table 5): First, consider the auction attributes, such as bid times auction date, total reserved price (base price), land reserved price, successful-bid total price, handing in over term by term; next finding house internal/ external attribute such as dwelling, building unit characters/neighbourhood, macro (Nation) environment factors dwelling unit, building block, and macro environment factors.

The most important auction market factors were price; there are reservation price, bid price and the winning-bid price. Indeed, the auction price factors need to be studied. Whether the handing in over term by term or not, the process will affect the winning-bid price. The higher price they will chose the handing over term by term. The more bid-times the lower the reservation bid price as well the winning-bid price. The more the number of bidder, the higher the winning-bid price, but this cannot obtained (unobserved in the databank of this study) variable.

The dwelling unit factor refers to the interior condition of a dwelling unit. Generally, one can begin with the proportion of the public facilities, stayed-floor, floor-area, location, management fee, bathroom and toilette, and number of rooms. As there are different standards for public facilities, locations, and management fees, bathrooms and toilettes, and the number of rooms are all dependents of the dwelling unit's total floor-area. One can simplify these factors to floor-area and stayed-floor.

The building block factor refers to the appearance of the entire building above the construction site, i.e. the "type of building". One can examine this factor from the utilization, age of the building and the number of floors. The neighbourhood factor often connects to the location of the building, which can be divided into a major and minor neighbourhood. Major neighbourhood refers to the administration district in which a building is located. As the feature of the administration district is different from that of the distance from the CBD, living standards, and the standards of the neighbourhood, each has its individual development. For example, the six districts that were only included in the Taipei municipality since 1976 have been developing as residential areas, while the old districts are used as commercial areas. Near neighbourhood refers to the convenience of the building to the neighbouring public facilities. For example, the price of a building located beside the main road will be higher than one that is located in an alley. Other factors including corner area, and the distance from bus stations, parks, and markets, are also important attributes relating to accessibility.

Table 4: Court auction housing variable attributes

Attribute Categories	Attribute Contents	Measurement terms	Variables Coding number
Auction Attribute	Auction Characters	Specific Performance Case ID Number	S5
		The Coding of Auction Court	S2
		Bid-times before auction close	SSNO1
		Auction Date	S29D
		Total Reserved Price	STP
		Land Reserved Price	STPP
		Successful-bid Total Price	SLP
		Handing in Over term by term	Pro=1, Handing in Pro=0, Not Handing in Over
House Internal Attribute	Housing Unit Characters	Building Area	HSIZE
		Land Area	SIZE2
		Total Floor Levels	TOTFLOR
		In-Floor Level	FLOOR
	Building Unit Characters	Building Type	SB
		Building Construction Structure	STRUC
		Age	AGE
		Address of Building	ADDR_T
House External Attribute	Macro(Nation) Environment Attribute	GDP	GDP
		Money Supply	M2
		The Top Five Banks Base Lending Rate	RATE
		Consumer Price Index	CPI
		Cathy Real Estate Indicators, Quarterly	MP
		Housing Rental Price Index (Nation)	HRI
		Employment Building Construction	NOP
		Wage of Construction	SALARY
		Housing transaction Contract Tax in Taipei City	TP_TAX
		The Taipei City Land transaction Amount	TP_LBA
		Taipei City Housing Rental Index (2001 = 100)	TP_RI
		Inflation Rate	IR

Table 4: Court auction housing variable attributes (Cont.)

Attribute Categories	Attribute Contents	Measurement terms	Variables Coding number
		Building Type	SB1 = 1 ， first floor O.W. =0 SB2 = 1 ， high rising Buildings O.W. =0 SB3 = 1 ， apartments O.W. =0
		Building Construction Structure	SC1 = 1, RC, SRC etc. O.W.= 0 SC2 = 1, Brick, Iron, Wooden, Soil etc. O.W. =0
		Quarterly Season	Q1 = 1, 1st season O.W. =0 Q2 = 1, 2nd season O.W. =0 Q3 = 1, 3rd Season O.W. =0 Q4 = 1, 4th season O.W. =0
		Location	LA=1, land high price areas O.W. =0

Note: Location variable defined by the official land present value lot media price, the district lie on the higher lot media price than referred as high price area in Taipei city. LA=1, there are half of the 12 district located on high price area such as Chung-Chen, Chung-Shen, Shung-Sha Tan-An, Sin-Yi and Sin-Lin district.

Table 5: Spatial factors description

Variables	**Contents**
SDIST	The distance from small Regional park
BDIST	The distance from big Regional park
STDIST	The distance from station of the rapid transit system
S_101DISt	The distance from101 high-rise building or Sin-Kua department store in the main Train station whichever place is closer.
Dummy variables	**Contents**
SCDIST	The small Regional park of circle radius within 500 meter, SCDIST = 1, O.W. SCDIST=0
BCDIST	The big Regional park of circle radius within 500 meter, BCDIST=1, O.W. BCDIST = 0
SCTDIST	The distance from station of the rapid transit system of circle radius within 500 meter, SCTDIST = 1, O.W. SCTDIST=0
S_101CDIS	The 101 high-rise building or Sin-Kua department store in the main Train station of circle radius within 500 meter whichever place is closer, S_101CDIS = 1, O.W. S_101CDIS=0

In the macro neighbourhood factor, all the elements can reflect to the "timing" factor, in which the response to timing is very important during the housing market booms.

3. Establishment of Model Frameworks

There are four types of Model shown in the literature reviews for hedonic price model function forms. The major difference between the model and the multiple regression is that the model is established to find out the linear or nonlinear relationship between a target variable and other "quality" variables, while the multiple regression model is

used to find out the linear relationship between a target variable and other independent variables of "quantity".

The aim of the analysis is to establish a relationship formula, in order to examine the degree of influence that each "quality" item causes to the target variable. Each independent variable of "quality" consists of several categories, and it is to be assumed that each sample within an independent variable must choose only one category, that is, the dummy value of the chosen category is 1, while the dummy value of the rest of categories is 0.

Like the general multiple regression, a hedonic price model makes use of the OLS to find out the better fitted model. The four types of Model are: linear-linear form, semi-log form, log-log form, and flexible functional form such as Box & Cox (1964). Since the Box & Cox flexible functional form was between linear and log-linear form, and while the other power functions(besides the linear and log form) have no meaningful paramaters, we chose the fuction forms linear-linear, log-log, and semi-log. Their related literature reviews are shown in Table 6. In our empirical study we chose the most uses in Taiwan housing price study of semi-log form.

Table 6: Related literature reviews for hedonic price model function forms

Hedonic Price Model			
(Function Form)	Authors	Authors	Authors
Linear-Linear	Kun, P.C.(1989)	Chang, C.O.(1999)	
Log-Log	Dhrymes(1971)	Case, Pollakowski,	Wachter(1991)
Semi-Log	Dhrymes(1971)	Nelson(1978)	Chang, L.G.(1994)
	Griliches(1971) Bryan, Colwell(1982) Chang, Liu(1993) Lin,C.C.(1990)	Sinyi House Real Estate Cathy Real Estate	Price Indicator (1994) Indicators, Quarterly (2003)
	Blackley, Follain,	Lee(1986)Thibodeau(1989)	Chang, C.O.(1995)

THE EMPIRICAL ANALYSES

In Table**7** we found the court auction data from 2001Q1-2003Q4, the total are 3,016 cases. We used 90% in-sample data for regression analysis, the 10% out-sample for post forecast. Outlier have been adjusted the data by Lin (1996) empirical results which show the DFFITS outlier removal better method. The final data we used in the study are shown in table 7.

Table7: The Empirical study In/Out Sample data on the Taipei city court auction houses /Adjusted by outlier checking

Year	In Sample Data	Out Sample Data	Outliers for Adjusting
2001	584	65	34
2002	1,019	110	71
2003	1,111	127	65

Based on the data banks from the private company [Tom-Ming], we have limit on the possible data factors. The selected-factors list in Table 4 and Table 5. There are micro variables and macro variables. To avoid the multicollineary, we chose the macro variable limitation. The GDP presented the macro variable. The model we used in the empirical is as follows; in this model we have 14 RHS independent variables:

$$Y_i = \beta_0 + \beta_1 ssno1_i + \beta_2 stp_i + \beta_3 pro_i + \beta_4 hsize_i + \beta_5 size2_i + \beta_6 sb1_i + \beta_7 sb2_i + \beta_8 age_i + \beta_9 sc1_i + \beta_{10} totflor_i + \beta_{11} floor_i + \beta_{12} floor2_i + \beta_{13} la_i + \beta_{14} gdp_i + \varepsilon_i$$

Y_i : ith Court Bid Price after log transformation ; $\beta_0 \sim \beta_{15}$: Hedonic Price Model Regression Coefficients ; ε_i : Error Term, we have $\varepsilon_i \sim N(0, \sigma)$

The models have been chosen by three criteria (see Table 8 and Table 9). One is the experience rules T value significance; the other rules are the bigger AdjR2 and the smaller Root Mean Squared Errors. The indicators found the better models the criteria exhibit in Table8. The Table 9 shows the better models results from the year 2001 to 2003. We found the important factors such as handing over term by term, the total reservation price, house total size and lot size, location and macro factor GDP have significance in winning-bid price. The positive contribute factors show as handing over term by term, both size factors and location. The others were vague in the direction for winning-bid price.

Table 8: $AdjR^2$、 root MSE comparison between model 1 and model 2

$AdjR^2$			
Year	2001	2002	2003
MODEL 1	0.9360	0.9235	0.9170
MODEL 2		0.9253	0.9173
Root MSE			
MODEL 1	0.1140	0.1197	0.1348
MODEL 2		0.1162	0.1340

Table 9: The estimate of the better fitted model (consider the auction price modelling)

Variables	Expected Sign	Taipei City		
		2001	2002	2003
Intercept		4.9214**	5.4498**	4.9115**
ssno1	-	-0.0132**		0.0040
stp	+	0.0017**	0.0018**	0.0018**
pro	+	0.0217*		
hsize	+	0.0032**	0.0033**	0.0020**
size2	+	0.0016**	0.0012**	0.0022**
sb1	+	0.0268		0.0317**
sb2	+	0.0189	0.0165	0.0252**
age	-	-0.0005	-0.0026**	
sc1	+	0.0150		0.0677*
totflor	+	0.0018	-0.0030**	
floor	-	-0.0093		-0.0010
floor2	+	0.0009		
la	+	0.0255**	0.0346**	0.0462**
gdp	+	0.0001	-0.0001*	0.0001*
Adj R^2		**0.9360**	**0.9253**	**0.9173**

Note：* indicated significance level 10% ** defined significance level 5%

Table 10 shows the 10% out-sample forecast model results. The best fitted model was selected by the value criteria RMSE, MAPE, AS-Ratio mean, variance and Hit Ratio ：

1. Root Mean Squared Errors，RMSE $RMSE = \sqrt{\sum_{i=1}^{n} e_i^2 / n}$ $e_i = y_i - \hat{y}_i$

The smaller RMSE is the better result is.

2. Mean Absolute Percentage Errors, MAPE $MAPE = \frac{\sum_{i=1}^{n} |e_t / y_t|}{n} * 100\ \%$ $(y_t \neq 0)$

$e_t = y_t - \hat{y}_t$; MAPE not over 5%~15% were better.

3. Assessment Ratio，AS RatioAS Ratio = $\hat{y} / y$

AS Ratio indicated the assessment fair, the value more close 1 was better. The variance of AS Ratio not over 15%~20% was better.

4. .Hit Ratio. $HitRatio = \frac{n}{N} * 100\ \%$; n：the number of hit the range，N：sample size

Hitting Range=$y-y(\alpha) \leq \hat{y} \leq y+y(\alpha)$

where Y represents the actual value，α are the significant levels：5%、10%、20%，If the forecast value fall in the hitting range defined 1, otherwise defined 0. Added up the '1' the sum ratio to the total sample defined Hit Ratio. The higher ratio defined the small gap between the actual value and the forecast value. The final results show in Table 11.

Table 10: The estimate of the better fitted model (consider the spatial factors for auction price model modelling)

Variables	2001		**Variables**	2002		**Variables**	2003	
TYPE	PARMS		_TYPE_	PARMS				
Intercept	4.9071	**	Intercept	5.4767	**			**
SSNO1	-0.0122	*	SSNO1	-0.0001		SSNO1	0.0071	
STP	0.0017	**	STP	0.0018	**	STP	0.0019	**
PRO	0.0244	**	PRO	0.002		PRO	0.002	
HSIZE	0.0034	**	HSIZE	0.0034	**	HSIZE	0.0022	**
SIZE2	0.0014	**	SIZE2	0.0011	**	SIZE2	0.0015	**
SB1	0.0283		SB1	0.015		SB1	0.0286	
SB2	0.0188		SB2	0.0273	**	SB2	0.0373	**
AGE	-0.0008		AGE	-0.0021	**	AGE	0.0004	**
SC1	0.0142		SC1	0.0553		SC1	0.0478	
TOTFLOR	0.0013		TOTFLOR	-0.0042	**	TOTFLOR	-0.0015	**
FLOOR	-0.0099		FLOOR	-0.0018		FLOOR	-0.0059	
FlOOR2	0.0009	*	FlOOR2	0.0002		FLOOR2	0.0003	
LA	0.0319	**	LA	0.035	**	LA	0.047	**
GDP	0.0001	*	GDP	-0.0001	**	GDP	0.0001	**
SDIST	-0.0001	*	SDIST	-0.0001	**	SCDIST	0.0121	
BDIST	-0.0001	**	BDIST	0.00		BCDIST	0.0169	*
STDIST	0.00		STDIST	00.00		STCDIST	0.0135	
S_101DIS	0		S_101DIS	0		S_101CDIS	0.0375	**
Adj-RSQ	**0.9372**		**Adj-RSQ**	**0.9239**		**Adj-RSQ**	**0.9241**	

Table 11: The out-sample criteria for the estimate of the better fitted model (consider the spatial factors for auction price model modelling)

Out-Sample Size	65	108	114
Criteria	2001	2002	2003
RMSE	109.77	146.3	184.28
MAPE	10.62%	12.24%	14.89%
AS_R_AVG	1.0003	1.1636	1.0484
AS_R_cv	13.98%	14.32%	17.25%
Hit Ratio			
5%	31%	26%	24%
10%	51%	50%	50%
20%	89%	88%	75%

In additional, we added the spatial factors which adopt the GIS system come the distance with the significance signs. The signs include 101 high-rise building, small and big regional Park, the rapid transit system and Sin-Kua department store in the main Train station. The better fitted model was show in Table10 and Table11. We also set up the search market model by the data from the transaction sale cases from official transaction sale data banks (see Table 12). We found the mutual factors such as house size (hsize /Builarea) and location (la); the factors more contribute to the search market price given by house type (Type), the road width (Road_w) the house total-floor level (Totflor), house stay-floor level and the macro factors such as GDP and construction employer salary (Salary). The less contribute to the search market price found as land zoning and house age. In additions, the auction housing characters put in the deepest contributes in housing modelling. Especially the reservation bid price have the deepest effect on auction price. Some of spatial factors did put significant effect on pricing auction market such as the distance factors from park (SDIST/ BDIST) and 101 high-rise building areas (S_101CDIS). The rapid transit system may not significant in this study, it is surprise result. We suggest check the modelling or the GIS system measurement on the distance for further research in the spatial factors side.

Table 12: The estimate of the better fitted model (consider the search market price modelling)

Variables	Expected Sign	Taipei City					
		2001		2002		2003	
Intercept		5.52	**	5.89	**	4.91	**
Builarea	+	0.0084	**	0.0084	**	0.0087	**
Floor	-	-0.0133	**	-0.0125	**	-0.0068	**
Age	-	-0.0017		-0.0025	**	-0.0035	
Totflor	+	0.0079	**	0.0006		0.0049	*
Road_w	+	0.001		0.0032	**	0.0017	**
La	+	0.1955	**	0.1922	**	0.1971	**
Zoning	+	-0.0447	*	-0.0216			
Type	-	-0.0605	**	-0.098	**		
Gdp	+	-0.0002	**	0		0.0003	**
Salary	+	0.0001	**	-0.0001	**	0.000	
ADJ R^2		**0.75**		**0.74**		**0.74**	

Note：* indicated significance level 10% ** defined significance level 5%

We evaluate the housing price respectively by year and by types. The model results defined the standard housing price based by 2001 housing characters. The standard housing price evaluated in both tables in nominal and real price (see Table 13 and Table 14).

Table 13: Court auction residential housing price 2001-2003 (in nominal price)

Year	2001	2002	2003	1992	1993
Nominal Price				**	**
Existing House Market Price (EHMP)	553.11	566.86	557.51	684.68	699.74
Auction House Successful-bid Price (AHFBP)	416.69	453.38	472.90	594.64	687.75
Auction House Successful-bid Price Added Spatial factor (AHFBP/Spatial)	433.62	450.52	456.96	N/A	N/A
Year	2001	2002	2003	1992	1993
Discount ratio(/Premium)	(a-b)/b%			**	**
AHFBP vs. EHMP	32.74%	**25.03%**	**17.89%**	15.14%	1.74%
AHFBP/ Spatial vs. EHMP	27.56%	25.82%	22.00%	N/A	N/A

Note: ** 1992-1993 Data result was referred by Lin, Tsai, Change (1994)

Table 14: Court Auction Residential Housing Price 2001-2003 VS 1992-1993(in Real Price)

Year	2001	2002	2003	1992	1993
CPI-Deflator (Base=2001)	100.00	99.80	99.60	83.91	86.38
Real Price				a	a
Existing House Market Price (EHMP)	553.12	568.01	559.73	815.96	810.04
Auction House Successful-bid Price (AHFBP)	416.70	454.30	474.78	708.66	796.16
Auction House Successful-bid Price Added Spatial factor (AHFBP/Spatial)	433.63	451.43	458.78	N/A	N/A

Note: ** 1992-1993 Data result was referred by Lin, Tsai, Change (1997)

The percentage of auction housing is larger the bigger the discount ratio between markets. 20% difference between the search market and auction market does not exist in 1994, the decade ago, however the bigger return found in 2002 and 2003. The auction market still raised to the investor or speculator market, it not belongs to the consumer's market. By auction theory we might pre-sight the factors of the competition-bids, the information level, or the different machines in auction market, there might bring the big-gap between the search market and auction market, or between base auction price and bid-price. We need further study to find the factors.

CONCLUSIONS

According to the above analyses, the conclusion of this study is as follows:

1. In both markets, auction and search market found have common factors in house attributors on price, such as house size and location; the factors more contribute to the search market price given by house type, the road width the house total-floor level, house stay-floor level and the macro factors such as GDP and construction employer salary. In addition, the auction housing characters put in the deepest contributes in housing modelling. Especially the reservation bid price have the deepest effect on auction price. Some of spatial factors did put significant effect on pricing auction market such as the distance factors from park and 101 high-rise building areas.

2. Location and house size are the important variables in every submarket as expected. The influence of the stayed-floor at the same time should not be ignored in each market. If one considers location to be the horizontal accessibility (to the CBD) indicator, stayed-floor to be the vertical accessibility (to the first floor) indicator, house size (Floor-area) or land size to be the profitability of space, one will realize that the space size of a city is the most influential factor of the real estate price. In general, the greater the floor-area we have, the higher the total price have.

3. The coefficients of type-category of each submarket model can reflect the quantitative change from the standard values, which can be applied to real estate price estimation.

4. In the search market model the ADJ R^2 is only about 75.00%; its explanatory power is quite inferior to that of the auction price model with an ADJ R2 of 93%. These indicated that the existing housing market (search market) contains a lower explanatory power. When using such information, the results of this study should be with caution.

5. The market share percentage of auction housing is larger the bigger the discount ratio between markets. 20% difference between the search market and auction market does not exist in 1994, the decade ago, however the bigger return found in 2002 and 2003. The auction market still raised to the investor or speculator market, it not belongs to the consumer's market. The big-gap between the search market and auction market might explain by the theory of auction. We need further study to find the factors.

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