Land Auctions in Singapore

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Introduction

- State-owned land in Singapore is sold to private developers through first-price, sealed bid auctions
- Land may be sold for commercial, industrial, hotel, or residential purposes
- I have data on past sales — site details (size, location, purpose), bids made, the bidders/winner and final sale price
- I am interested to understand the bidding behaviour of real estate developers, study whether land has common/independent private values, and construct a test for collusion

Collecting the data

- I collect auction data from two departments: the Urban Redevelopment Authority (URA) and the Housing Development Board (HDB)[1]
- HDB's bid and sales data are fully available and start from 1990
- URA only provides data on final sales, but a news release made at the time of each auction's close shows the bids Example
- I hand-collected old news releases using internet web archives and manage to gather bid data from 1996 Example
- My dataset consists of 582 auctions with 3,684 observed bids, from 1990 to 2022

[1] Auctions conducted by URA and HDB are identical, but the sites sold by HDB have more conditions attached for developers

Land is sold on lease and subject to zoning

Development Type[2]	# Auctions	(%)	Lease (years)
Residential	369	63.4	99
Commercial	35	6.0	99
Mixed Residential/Commercial	33	5.7	99
White Site	21	3.6	99
Hotel	31	5.3	99
Industrial	73	12.5	30, 45, 60
Others	20	3.4	15, 20
URA	392	67.4	
HDB	190	32.6	
Total	582	100.0	

Table 1: Types of Land Parcels Sold

[2] A white site can be used for any mix of 2 or more residential, commercial, recreational or hotel purposes. Others includes purposes such as hospitals, agriculture, and places of worship.

There is high participation in land auctions

Development Type	# Bids	(%)	Mean	SD	Max
Residential	2588	70.2	9.83	5.17	32
Commercial	155	4.2	7.11	2.71	14
Mixed Residential/Commercial	221	6.0	10.0	3.32	15
White Site	93	2.5	7.00	4.20	15
Hotel	185	5.0	8.52	3.18	15
Industrial	380	10.3	7.98	4.48	18
Others	62	1.7	6.60	3.76	11
URA	2336	63.4			
HDB	1348	36.6			
Total	3684	100.0			

Table 2: Summary Statistics on Bids Received by URA and HDB

It is common for bid envelopes to list more than 1 name

JV	Count	(%)
0	2,323	74.9
1	779	25.1
Total	3,622	100.00

Table 3: Number of bids which have >1 name

JV	Count	(%)
0	438	75.3
1	144	24.7
Total	582	100.00

Table 4: Number of winning bids which have >1 name

The figures above do not show joint ventures that go through a single holding company.

Many bidders only participate once, and a few names win a lot of the time

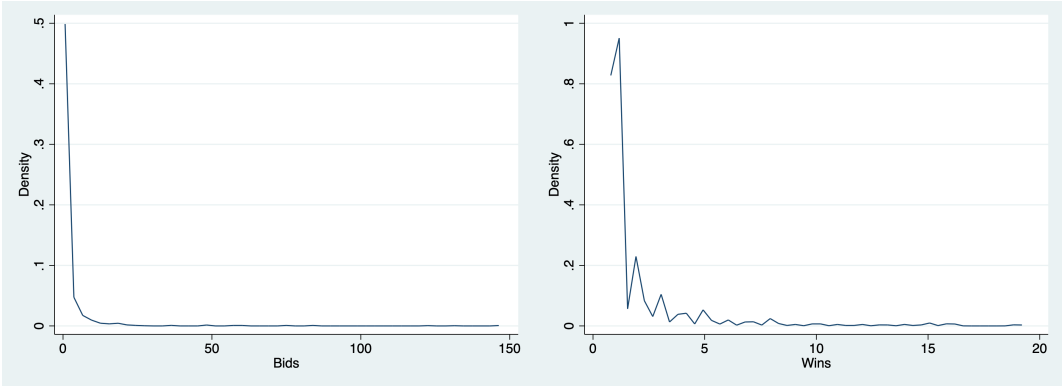

Figure 1: How many times[3] a given name is seen in the data, by bids and wins

[3]For cases where bids/wins belong to 2 or more names, the bids/wins are counted separately for each name in the graphs

	Bid (S$ mil)	PSM (S$ per m^2)	Site Area (m^2)
Residential (N: 2588)			
Mean	180	4415	17.6
SD	142	3162	10.9
Commercial (N: 155)			
Mean	396	7213	11.6
SD	414	3627	9.5
Mixed (N: 221)			
Mean	324	8795	11.4
SD	254	3970	7.0
Hotel (N: 185)			
Mean	112	6547	5.0
SD	104	3947	3.6

Table 5: Average Bid Amounts[4] by Type of Development Sold

[4]Prices in nominal dollars

	N	Mean	Min	Max
Residential	352			
Bid spread		15.6	768	216.9m
PSM spread		354.9	0.01	2569.1
Commercial	26			
Bid spread		52.7	2.8m	302.5m
PSM spread		1126.4	178.9	2852.3
Mixed	28			
Bid spread		26.3	0.6m	152.8m
PSM spread		723.9	91.8	3247.3
Hotel	25			
Bid spread		16.2	0.6m	62.0m
PSM spread		891.1	51.3	2551.6

Table 6: Spread (S$)[5] between 1st and 2nd bids, by development type

[5] Prices in nominal dollars

I can use OLS to control for auction-level heterogeneity

- The bid-level regression for bid i in auction t looks like

$$\begin{aligned} bid_{it} = \beta_0 &+ \beta_1 SiteArea_t + \beta_2 SiteArea_t^2 + \beta_3 TenderPeriod_t + \beta_4 NumberBids_t \\ &+ \sum_{k=0}^{4} \beta_{6+k} \cdot \mathbb{1}\left(DevType_t\right) \times FloorArea_{kt} \\ &+ \alpha_i + \lambda_t \cdot \mathbb{1}\left(PlanningArea_t\right) + \delta_t \cdot \mathbb{1}\left(Year_t\right) + \varepsilon_{it} \end{aligned}$$

- $\sum(\cdot)$ interacts a dummy $\mathbb{1}(\cdot)$ for each type with the relevant floor area measure (*Ind* uses the *Gross Plot Ratio*; the rest use *Gross Floor Area*)
- I cluster standard errors at the bidder-level and omit all observations from *Others*; the OLS sample covers 562 auctions with 3,622 observed bids

VARIABLES	(1) Bid ($m)	(2) Bid ($m)	(3) Bid ($m)	(4) Bid ($m)
Site Area (1000m2)	2.634***	2.474***	6.357***	5.500***
	(0.273)	(0.357)	(0.428)	(0.575)
Site Area Squared			-0.0340***	-0.0319***
			(0.00403)	(0.00605)
Tender Period (Days)	0.221***	0.0676	0.203***	0.0679
	(0.0597)	(0.0486)	(0.0545)	(0.0448)
No. Bids	-4.167***	-1.489**	-3.793***	-1.278**
	(0.603)	(0.653)	(0.589)	(0.647)
1.Resi X GFA	1.640***	1.666***	1.298***	1.406***
	(0.155)	(0.224)	(0.151)	(0.225)
1.Comm X GFA	5.843***	5.978***	5.541***	5.771***
	(0.368)	(0.900)	(0.357)	(0.877)
1. Hotel X GFA	-1.836***	0.888	-2.084***	0.745
	(0.628)	(0.944)	(0.647)	(0.937)
1. White Site X GFA	4.007***	2.511***	3.822***	2.359***
	(0.410)	(0.532)	(0.411)	(0.526)
1. Ind X GPR	-36.43***	-20.67***	-41.40***	-26.68***
	(3.716)	(5.248)	(3.648)	(5.364)
Constant	4.570	-6.940	-65.52***	-53.74
	(21.87)	(33.21)	(22.34)	(34.14)
Bidder FE	No	Yes	No	Yes
Location FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3,622	3,622	3,622	3,622
R-squared	0.730	0.929	0.740	0.932

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2: Regression of Bids on Auction Characteristics Equation

I run another specification in logs

- The bid-level regression for bid i in auction t looks like

$$\begin{aligned}\log bid_{it} = \beta_0 &+ \log \beta_1 SiteArea_t + \beta_2 TenderPeriod_t + \beta_3 NumberBids_t \\ &+ \sum_{k=0}^{4} \beta_{4+k} \cdot \mathbb{1}\left(DevType_t\right) \times \log FloorArea_{kt} \\ &+ \alpha_i + \lambda_t \cdot \mathbb{1}\left(PlanningArea_t\right) + \delta_t \cdot \mathbb{1}\left(Year_t\right) + \varepsilon_{it}\end{aligned}$$

- I cluster standard errors at the bidder-level

	(1)	(2)
VARIABLES	log(Bid)	log(Bid)
log (Site Area)	0.979***	0.800***
	(0.0204)	(0.0318)
Tender Period	0.00114***	0.000839***
	(0.000237)	(0.000286)
No. Bids	-0.00690**	-0.00419
	(0.00273)	(0.00395)
1.Resi X log(GFA)	0.0489***	0.0339***
	(0.00530)	(0.00976)
1.Comm X log(GFA)	0.0722***	0.0723***
	(0.00995)	(0.0172)
1.Hotel X log(GFA)	0.0291***	0.0260**
	(0.00842)	(0.0131)
1.White Site X log(GFA)	0.0994***	0.0739***
	(0.00888)	(0.0149)
1.Ind X log(GPR)	-1.090***	-0.761***
	(0.0865)	(0.152)
Constant	7.125***	8.567***
	(0.267)	(0.403)
Bidder FE	No	Yes
Location FE	Yes	Yes
Year FE	Yes	Yes
Observations	3,622	3,622
R-squared	0.827	0.937

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3: Regression of Bids on Auction Characteristics Equation

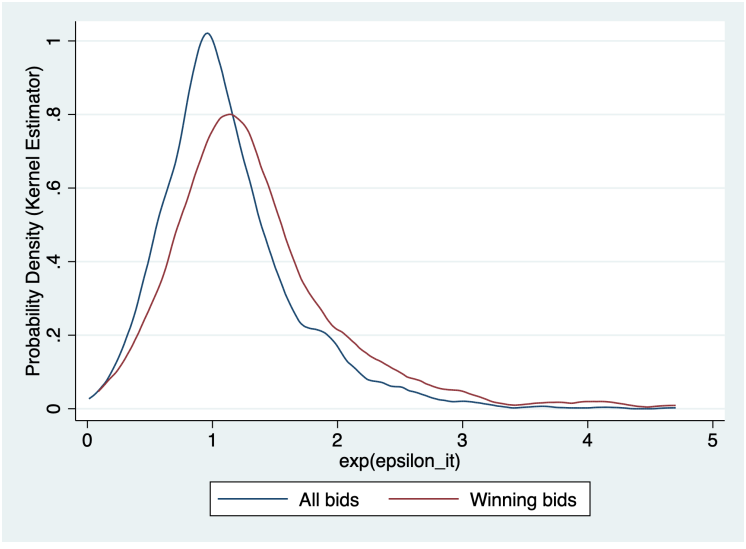

Figure 4: $\exp(\hat{\varepsilon}_{it})$ from log regression (1)

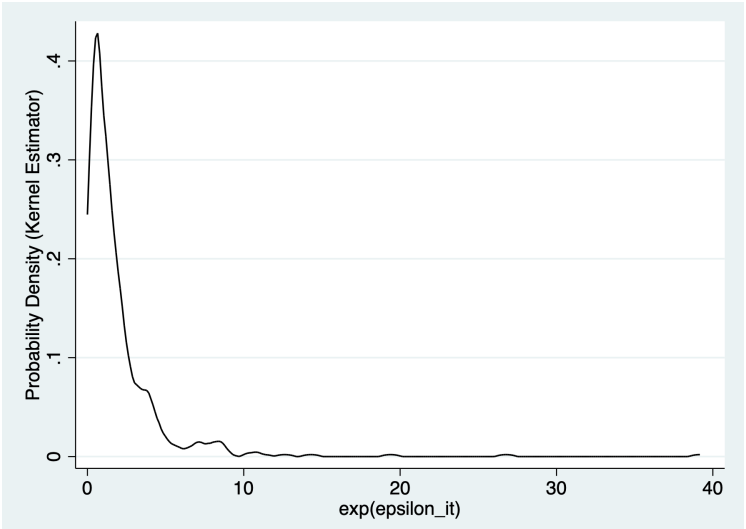

Figure 5: $\exp(\hat{\varepsilon}_{it})$ from (1), with $\log(BidSpread)$ as LHS variable

Issues

- It is unclear how to deal with bidder heterogeneity
  - Bid i in Auction 1 could be submitted by (X, Y, Z)
  - Bid i' in Auction 2 could be submitted by (X, Y), or (W, Z)
- Am curious to think about cases where (X, Y) are bidding together in Auction 2 but competing with each other in another Auction
- There could also be unobserved (from this dataset) relationships between bidders in the data due to parent companies, holding companies, subsidiaries etc.
  - Bid j in Auction 1 submitted by R
  - Bid j' in Auction 2 submitted by S
  - R and S share the same parent company P (unseen from this data)
  - OR R is actually a holding company for joint venture by A and B (also unseen)
- Am thinking of getting more data on firm ownership to uncover such links

LAND PARCEL AT BUKIT TIMAH LINK

ALLOWABLE DEVELOPMENT	:	**RESIDENTIAL**
SITE AREA	:	**4,611.1 m²**
MAXIMUM PERMISSIBLE GFA	:	**13,834 m²**
DATE OF LAUNCH	:	**31 AUGUST 2022**
DATE TENDER CLOSED	:	**3 NOVEMBER 2022**
LEASE PERIOD	:	**99 YEARS**

RANKING	NAME OF TENDERER	TENDERED SALE PRICE ($)	TENDERED SALE PRICE IN $PSM OF GFA
1	Bukit One Pte. Ltd.	200,001,888.00	14,457.27
2	Winchamp Investment Pte. Ltd.	172,888,888.00	12,497.39
3	Sims Park Pte Ltd	161,777,000.00	11,694.16
4	Sing Holdings Limited	155,200,000.00	11,218.74
5	TID Residential Pte. Ltd.	138,485,000.00	10,010.48

Figure 6: Example of Press Release Annex A (Bid Information) Back

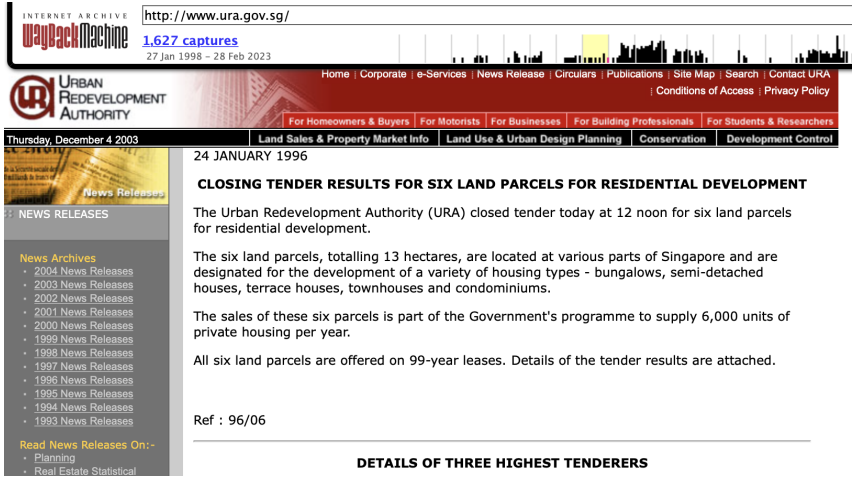

Figure 7: Getting Bid Information from 1996 Back