

Bidding Behaviour in Singapore Government Land Sales

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Introduction

- State land intended for residential development is sold by the Singapore Government every 6 months through a first-price sealed-bid auction
- Successful bidders are given the right to build and sell condominium units; condominium sales may begin before a project is completed
- Due to land scarcity, land parcels that are near to each other may be sold sequentially



Figure 1: Motivating Example: Nearby GLS Sites in Lentor Area, 2021 to 2024

Research Questions

- How do bidders behave in auctions that are spatially correlated? How might strategic bidding occur in GLS auctions?
- What is the effect of strategic bidding in GLS on condominium prices? Should the planner redesign the auction to limit strategic behaviour?

Agarwal et al. (2018):

"... the incumbent winner of a previous auction is more likely to participate in subsequent nearby land sales as compared to the second-highest bidder of the same auction ... We argue that the incumbent deliberately bids up the subsequent land prices to gain pricing advantages to their own parcels."

Key Features of GLS Auctions

- Every January and July, the government announces land it wants to sell; each site is sold via a first-price sealed-bid auction held within the 6-month window
- After an auction is called, interested parties have about 60 days to submit a bid; anyone can participate
- When the auction closes, the government announces all bids received and names of the bidders
- A few days later, the land is awarded to the highest bidder if the bid is above the reserve price (this is never revealed)
- All GLS land is leasehold; residential sites have 99 years of tenure

Data

A. Auctions

- Sample of 283 GLS auctions after 2001 (+ 129 auctions before 2001)
- Gross Floor Area (GFA) allowed, mixed use with commercial, location, bidders, bids, date of auction

B. Bidders

- Jan 2021 to Jun 2024: 138 unique bidders (83 have never won)
- Identify parent-subsidiary links based on common registered business address, stock exchange filings, shareholder financial reports etc...

C. Condominiums

- New condominium sales from 2018 to 2024 (93 projects matched to GLS)
- Location, prices, floor area, floor level, transaction date
- Complete dataset on all condominium transactions is avail. (approx USD 1,500)

D. Distances

- Between pairs of auction sites (land parcels)



Figure 2: All Past and Present Government Land Sale Sites in Singapore

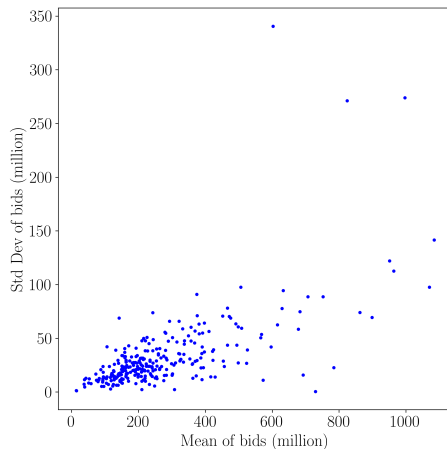
Auction Characteristics

	Period (Days)	Mixed Use	GFA (sqm)	No. of bidders	Price (million)	Price (\$/sqm)
mean	59	0.13	47,819	9.8	322	7,050
std. dev.	33		20,845	4.5	225	3,941
min	26	0	3,308	1	15	1,592
25%	42	0	34,790	7	181	3,891
50%	50	0	47,964	9	256	6,043
75%	64	0	59,607	13	389	9,319
max	364	1	125,997	24	1451	25,733

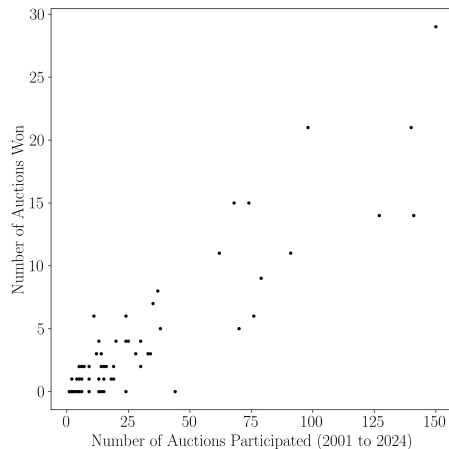
Table 1: Summary Statistics of GLS Residential Auctions, Jan 2001 to Jun 2024

Notes: Mixed Use = 1 for residential projects with commercial shops; GFA: Gross Floor Area;
Price refers to amount paid by highest bidder, in constant 2019 Singapore Dollars

Auction and Bidder Heterogeneity

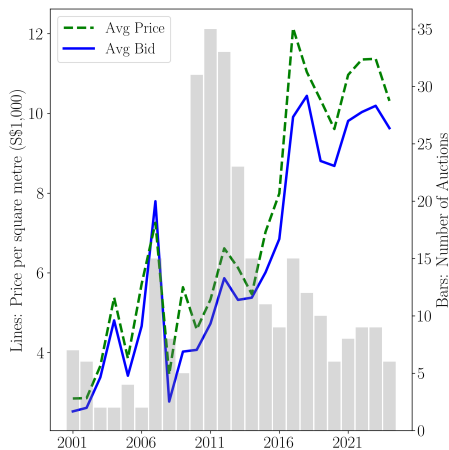


(a) Auctions

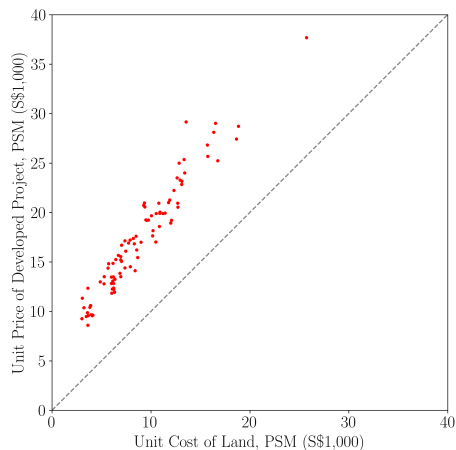


(b) Bidders

Government Land Sales and Property Prices



(a) Government Land Sales, 2001-2024



(b) Condo Price vs. Land Cost

How Might Strategic Bidding in GLS Auctions Occur?

- After winning an auction, developers typically start to sell condominium units (during the construction period)
- Construction takes 2 to 3 years and other land parcels nearby may go on sale
- A developer may have an interest in the value of the next closest GLS site (and the prices of the condominium built there); Agarwal et al. (2018) argue this is a likely cause of strategic bidding
- To study this, I define auction A_1 is related to auction A_2 if:
 - Euclidean Distance $(A_1, A_2) \leq 5$ km, **and**
 - A_2 is called **after** A_1 in ≤ 2 years
 - About 90% of auctions in the sample are linked after I apply these criteria
- Observe all repeat participation by bidders across all auctions
 - About 77% of bids in the sample

Distance (km)	No. Months	Rep. Part.	Prev. Win	Prev. RU	Prev. Win / Rep. Part.
2	6	117	49	48	0.42
	12	233	92	91	0.39
	24	470	171	172	0.36
3	6	225	93	96	0.41
	12	460	180	186	0.39
	24	860	300	312	0.35
4	6	328	128	134	0.39
	12	660	248	254	0.38
	24	1231	417	432	0.34
5	6	445	165	182	0.37
	12	893	317	341	0.35
	24	1655	546	581	0.33

Table 2: Repeated Participation Across Related GLS Auctions

Specify Strategic Behaviour in Bid Function

- Let bid_{it} denote the bid of i in auction t , and
Let \mathcal{R}_t denote the set of *all bidders in past auctions related to t*

$$\log(bid_{it}) = \beta_0 + \beta_1 \log(GFA_t) + \beta_2 \mathbb{1}(i \in \mathcal{R}_t) + X_t' \gamma + \varepsilon_{it}$$

- GFA_t denotes the *Gross Floor Area* for sale in auction t
- $\mathbb{1}(i \in \mathcal{R}_t) = 1$ if bidder i participated in a related auction before t , 0 if else
- X_t are controls for other auction-level characteristics
(no. of bidders, tender period, auction administrator, mixed use site)
- Year, location, and bidder fixed effects are included (not shown)
- Study two samples: (i) all bids, (ii) losing bids

Dep. Var. log(bid)	(1)	(2)	(3)	(4)
log(GFA)	0.927*** (0.016) (0.021)	0.923*** (0.016) (0.021)	0.923*** (0.016) (0.021)	0.922*** (0.016) (0.021)
$\mathbb{1}(i \in \mathcal{R}_t)$		0.066* (0.037)	0.067* (0.037)	0.070* (0.037)
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ previously winner			0.061 (0.040)	
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ previously runner-up				0.047 (0.040)
Constant	9.176*** (0.228)	9.099*** (0.232)	9.105*** (0.232)	9.107*** (0.232)
Observations	2,139	2,139	2,139	2,139
R-squared	0.882	0.882	0.882	0.882

Controls X_t , year, location, and bidder fixed effects are included

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Results from OLS Regression (All Bids)

Dep. Var. log(bid)	(1)	(2)	(3)	(4)
log(GFA)	0.927*** (0.017)	0.922*** (0.017)	0.922*** (0.017)	0.921*** (0.017)
$\mathbb{1}(i \in \mathcal{R}_t)$		0.092** (0.040)	0.092** (0.040)	0.096** (0.040)
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ previously winner			0.089** (0.042)	
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ previously runner-up				0.068 (0.042)
Constant	9.185*** (0.311)	9.074*** (0.314)	9.076*** (0.315)	9.081*** (0.314)
Observations	1,856	1,856	1,856	1,856
R-squared	0.889	0.890	0.890	0.890

Controls X_t , year, location, and bidder fixed effects are included

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Results from OLS Regression (Losing Bids)

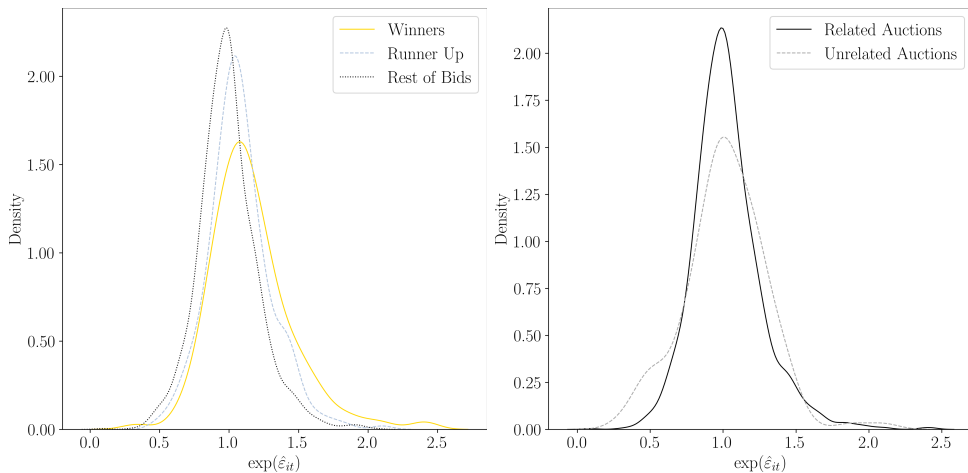


Figure 5: Distribution of Homogenised Bids (OLS Residuals from Table 3, Col. 1)

Summary of Findings + Future Work

1. GLS auctions are spatially correlated; bidding behaviour is different (bids are higher) in cases of repeated participation in spatially correlated auctions
2. Among losing bids, the previous winner of a related auction tends to bid 9% higher if they participate in the subsequent auction

For Discussion:

- Is the empirical analysis enough to show strategic bidding?
- Next steps:
 - Replication of Agarwal et al. (2018)? For all pairs of sequential auctions (A_1, A_2) , estimate probit model of $\Pr(i \in A_2 | i \in A_1)$ between winners and runner-ups
 - What happens if we change GLS participation rules?

Agarwal, S., Li, J., Teo, E., & Cheong, A. (2018). Strategic sequential bidding for government land auction sales – evidence from singapore. *The Journal of Real Estate Finance and Economics*, 57(4), 535-565.