

# Bidding Behaviour in Singapore Government Land Sales

Christopher Saw

6 November 2024

## 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-subsidary 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)

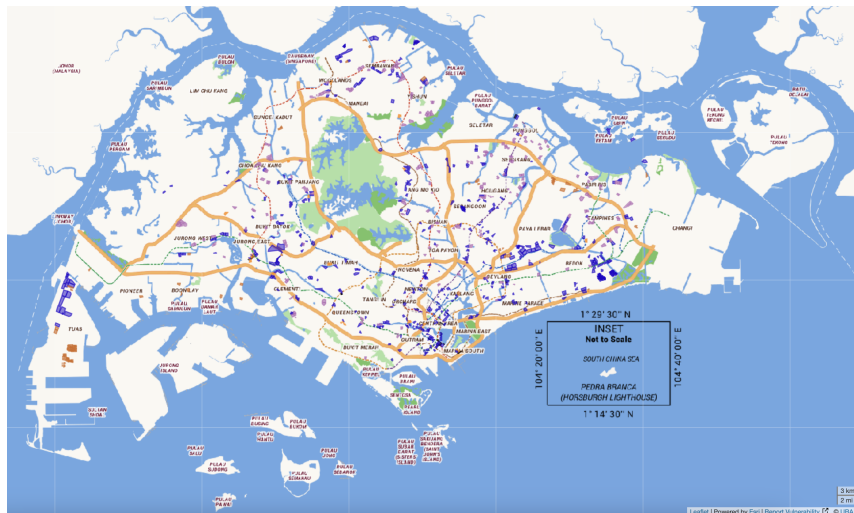


Figure 2: All Past and Present Government Land Sale Sites in Singapore

## Auction Characteristics

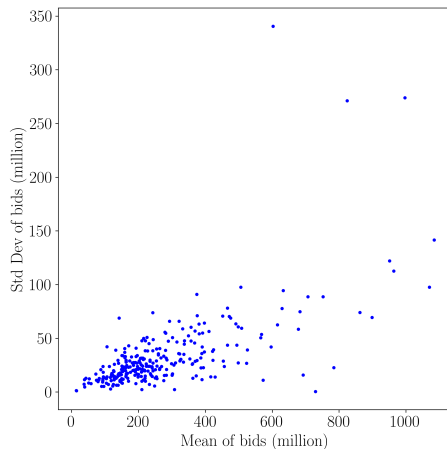
	Period (Days)	Mixed Use	GFA (sqm)	No. of bidders	Price (million)	Price (\$/sqm)
mean	59	0.13	47,819	9.8	322	7,050
std. dev.	33		20,845	4.5	225	3,941
min	26	0	3,308	1	15	1,592
25%	42	0	34,790	7	181	3,891
50%	50	0	47,964	9	256	6,043
75%	64	0	59,607	13	389	9,319
max	364	1	125,997	24	1451	25,733

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

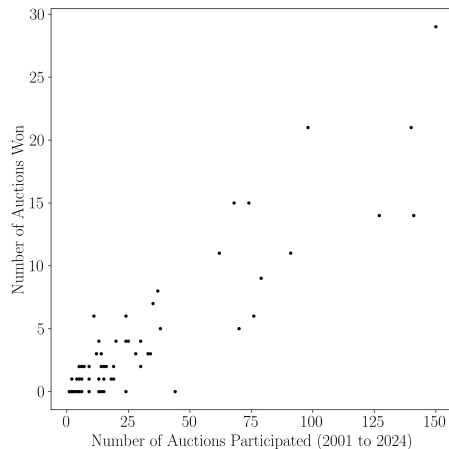
Notes: Mixed Use = 1 for residential projects with commercial shops; GFA: Gross Floor Area;  
Price refers to amount paid by highest bidder, in constant 2019 Singapore Dollars



# Auction and Bidder Heterogeneity

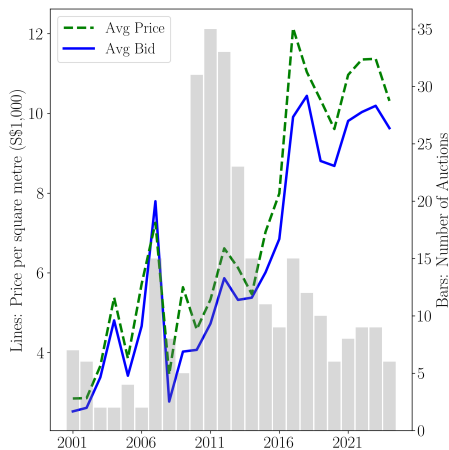


(a) Auctions

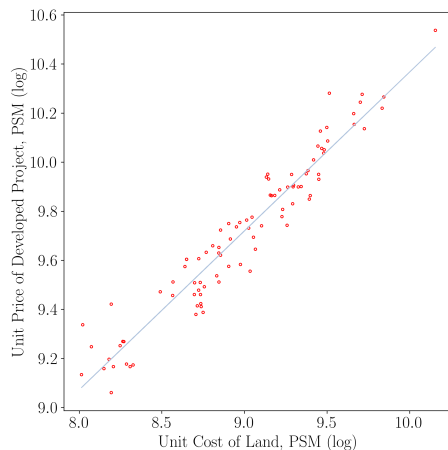


(b) Bidders

# Government Land Sales and Property Prices



(a) Government Land Sales, 2001-2024



(b) Condo Price vs. Land Cost (Log-Log)

## 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  $\leq 2$  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  $t$*

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

- $GFA_t$  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
- $\mathbf{X}_t$  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)

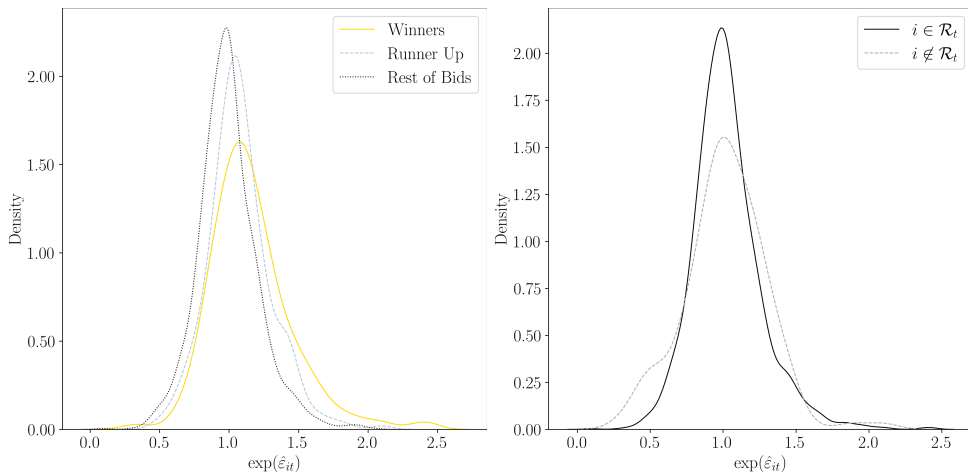
Dep. Var. log(bid)	(1)	(2)	(3)	(4)
log(GFA)	0.927*** (0.017)	0.922*** (0.017)	0.922*** (0.017)	0.921*** (0.017)
$\mathbb{1}(i \in \mathcal{R}_t)$		0.092** (0.040)	0.092** (0.040)	0.096** (0.040)
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ previously winner			0.089** (0.042)	
$\mathbb{1}(i \in \mathcal{R}_t) \times i$ 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.