A Theory of Land Finance and Investment-Led Growth

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Managing land: a challenge for many governments

Open Letter to Gorbachev (Tideman et al. 1990):

- *"The component of land value that arises from community growth and provision of services [roads, utility networks, etc.] is the most sensible source of revenue for financing public services that raise the rental value of surrounding land."*
  → value of land

- *"Governments of developed nations do not collect [rent of land] nearly as much as they could, and they therefore make unnecessarily great use of taxes that impede their economies—taxes on such things as incomes, sales and the value of capital."*
  → land as public revenue source

- *"Rent cannot be collected publicly simply by selling land outright at auction. ... disposing all of it in a short period would result in an extreme depression in prices ... collecting rent annually provides access to land for persons with limited access to credit."*
  → land sale vs. rent

Outline

1. Some facts
    a. gov’ts gradually supply land to private sector
    b. gov’ts invest in infrastructure during early stages

2. A theoretical framework
    a. mechanism of land finance and investment-led growth
    b. what explains gradual supply?: financial constraints + discretion
    c. better land contract (paper)

Land income is important for recent growth miracles

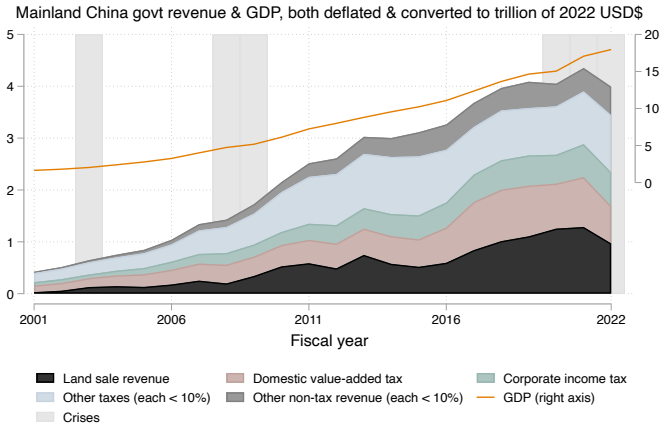


Figure: Mainland China govt revenue

Income tax, VAT, ... well understood; but land sale rarely studied in the literature

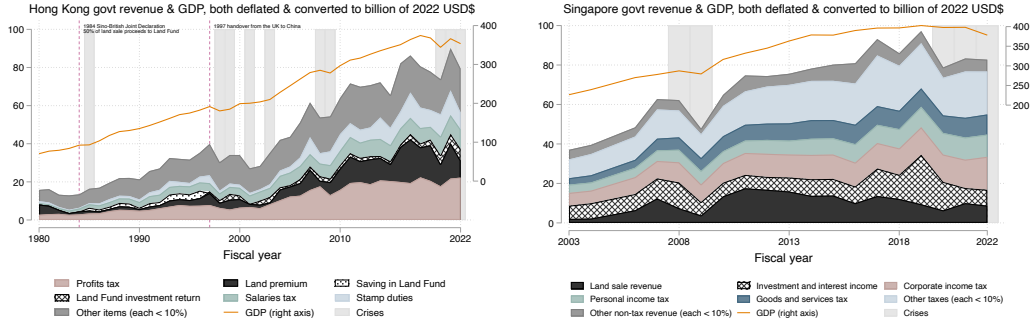
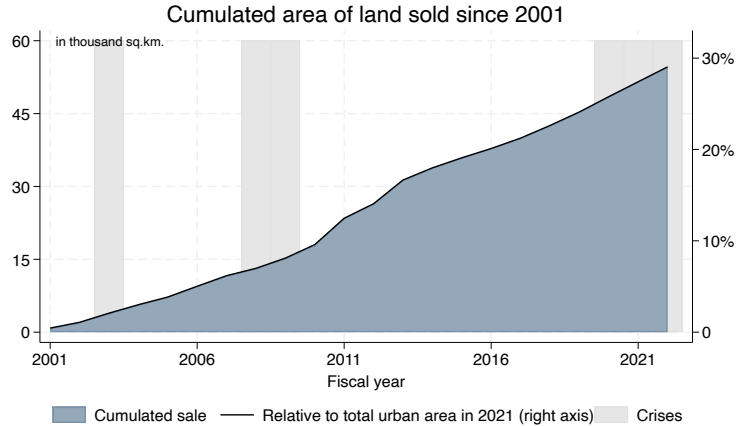


Figure: Hong Kong and Singapore govt revenue

- Land income also played a role in 19th century US for “internal improvements” in roads, canals, and railways (Feller 1984, Goodrich 1960) Detail
- Being adopted by places in India (Vyas, Vyas and Mishra 2022), Vietnam (Nguyen et al. 2018), Africa (Brown-Luthango 2011, Berrisford, Cirolia and Palmer 2018)...
  $\rightarrow$ focal point of various policy reports by World Bank, UK FCDO... (Peterson and Annez 2007, Peterson 2008, Suzuki et al. 2015, UK FCDO 2015)

Stylized fact 1: gradual land supply to private sector

Gov'ts gradually transfer land to private sector, though they could have supplied more



Notes: 1 sq. km. $\approx$ 0.39 sq. mile; Cambridge, MA $<$ 17 sq. km.

Figure: Mainland China land supply

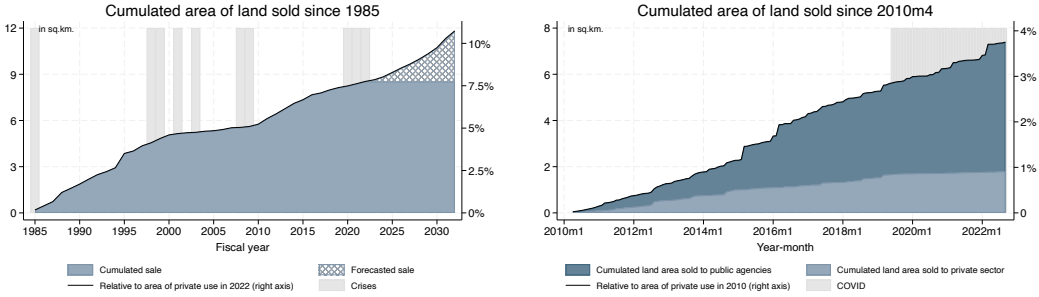


Figure: Hong Kong and Singapore land supply

Stylized fact 2: front-loaded public investment

Gov'ts invest more in infrastructure during early stages of development

Table: GDP growth rate and govt-investment-to-GDP ratio

	(1) g^Y_{5y}	(2) g^Y_{5y}	(3) g^Y_{5y}	(4) g^Y_{5y}	(5) $(I/Y)_{5y}$	(6) g^Y
$(I/Y)_{5y}$	0.16	0.43	0.43			
	(0.05)	(0.08)	(0.08)			
year				-0.15	-0.05	
				(0.01)	(0.01)	
I/Y						0.29
						(0.10)
Observations	293	293	275	293	298	315
R^2	0.03	0.30	0.29	0.74	0.75	0.13
Sample			excl. CHN			
Economy FE		Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

Notes: Data are from IMF Investment and Capital Stock Dataset (IMF, 2021), for Asian growth miracles (Singapore, Hong Kong, Taiwan, Korea, Japan) from 1960 to 2019 and mainland China from 2000 to 2019.

A theoretical framework

1. A growth model with public capital financed by land
2. Optimal policy: front-load investment but maintain steady land supply
3. What explains rising land supply?: financial constraints + discretion
4. Better land contract (paper)

Literature review

1. Optimal fiscal (tax) policy: Ramsey planning (Ramsey 1927), tax smoothing (Barro 1979, Aiyagari et al. 2002), time consistency (Lucas and Stokey 1983, Debortoli, Nunes and Yared 2021), public investment and growth (Barro 1990)
   $\rightarrow$ endogenous need of benevolent govt, financed by land revenue

2. Economics of resources (Hotelling 1931, Solow 1974), resource curse (Sachs and Warner 1995)
   $\rightarrow$ land does not depreciate; land demand/price endogenous to economic growth

3. Coase conjecture (Coase 1972, Stokey 1981, Bulow 1982)
   $\rightarrow$ general equilibrium analysis ("*assume that one person owns all the land in the US*")

4. Lots of attention and work on China's land finance
   - many empirical papers (Zheng et al. 2014, He et al. 2023, Chang, Wang and Xiong 2023, ...)
   - some quantitative models w/ fixed land supply rules (Liu 2018, Jiang, Miao and Zhang 2022)

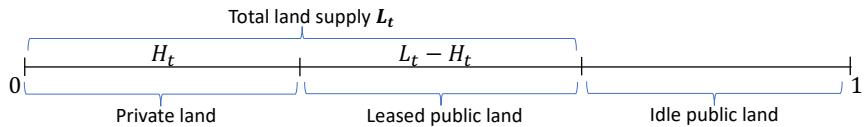
   $\rightarrow$ land finance as policy choice; explain land supply choice

The economy

- Closed economy, fully deterministic, $t \in [0, \infty)$
- Representative household consumes non-durable C_t & housing/land L_t:

$$\mathcal{U}_0 \equiv \int_0^\infty \mathrm{e}^{-\rho t} \left(\ln C_t + \nu \frac{L_t^{1-\sigma} - 1}{1-\sigma} \right) \mathrm{d}t$$

  - H_t amount owned, valued at price P_t; $L_t - H_t$ amount leased at rent D_t
  - I model long-term lease as sale for simplicity



  - Assume $\sigma > 1$ which means inelastic demand for housing/land

- Production uses public capital Z_t as external input

$$Y(Z_t) = AZ_t^{\alpha}N, \quad \text{w/} \quad \alpha \in (0,1)$$

  - All income accrues to HH supplying $N \equiv 1$
  - HH takes Z_t as public good $\rightarrow$ externality

- Resource constraint, w/ depreciation $\delta \geq 0$ (Barro 1990) of capital:

$$Y_t = C_t + \dot{Z}_t + \delta Z_t$$

  define $\chi_t \equiv C_t / Y_t$ as consumption ratio; $1 - \chi_t$ is investment
  - Stylized fact 2: χ_t rises over time

- Core issue (govt budget constraint): fund public capital w/ land sale and lease

- Economy starts w/ H_0, Z_0 & no debt. Assume low $Z_0 \rightarrow$ growth towards steady state

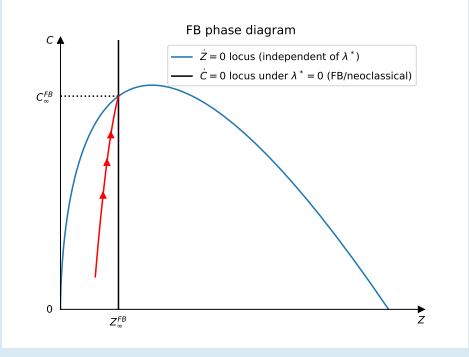
Remarks

1. Only externality: household takes Z_t as given $\rightarrow$ role of benevolent govt
2. Nontrivial time-0 public land ownership: US/HK vs. Singapore/mainland China
3. No other use of land $\rightarrow L_t < 1$ incurs utility loss but may bring in higher revenue
4. No lump-sum tax. Assume away land tax for simplicity
   - In reality, pure land tax virtually non-existent; property tax exists, but it distorts investment in structure and is hard to implement (as it requires pricing off-market houses)
   - In theory, land tax is not distortionary w/ fixed supply (George 1879), but it can be *insufficient* to fund "best outcome" if tax base (total land market value) is low
5. Abstract away from distortionary taxes for simplicity $\rightarrow$ balancing multiple distortions
   - Having land income is better than not having it

First best: max utility, subject to resource constraint

Proposition 1 (FB allocation)

1. *Land supply is maximum,* $L_t^{FB} = 1$
2. *Amount in private hands* H_t^{FB} *indeterminate*
3. $\frac{\dot{C}_t^{FB}}{C_t^{FB}} = Y'(Z_t^{FB}) - (\delta + \rho)$, *identical to neoclassical growth model*



Properties of the economy

- Land rent

$$D_t = \frac{U_{L,t}}{U_{C,t}}$$

  which declines in current supply L_t

- Land price

$$P_t = \int_t^\infty \mathrm{e}^{-\rho(s-t)} D_s \mathrm{d}s = \frac{\int_t^\infty \mathrm{e}^{-\rho(s-t)} U_{L,s} \mathrm{d}s}{U_{C,t}}$$

  which declines in future supply too $\rightarrow$ govt subject to “time inconsistency”

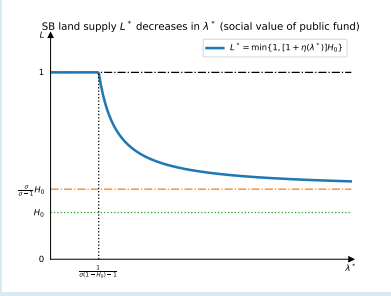
- Land rent and price D_t, P_t both increase in C_t
  $\rightarrow$ growth raises land value, enabling govt investment to aid growth (Tideman et al. 1990)

Second best: add budget constraint

- Assume benevolent govt can commit to future actions and no financial constraints
- Assume that supplying all land cannot fund FB and land demand is inelastic
  $\rightarrow$ govt budget-constraint multiplier $\lambda^* > 0$: *social value of public fund*

Proposition 2 (SB allocation)

1. *Land supply L_t^* is time-invariant and declines in λ^* (social value of public fund)*



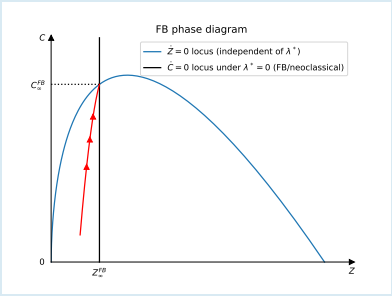
2. *SB policy may feature any amount of land in private hands H_t^* for $t > 0$*

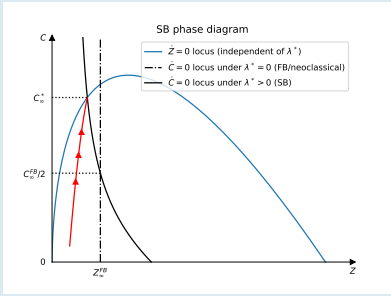
Proposition 2 (cont'd)

3.

$$\frac{\dot{C}_t^*}{C_t^*} = \underbrace{[Y'(Z_t^*)}_{\text{MPK}} - (\delta+\rho)] - \underbrace{\frac{\lambda^*}{\lambda^*+\chi_t^*}\left[\chi_t^* Y'(Z_t^*) + \frac{\dot{\chi}_t^*}{\chi_t^*}\right]}_{\text{wedge due to lower capital}}$$

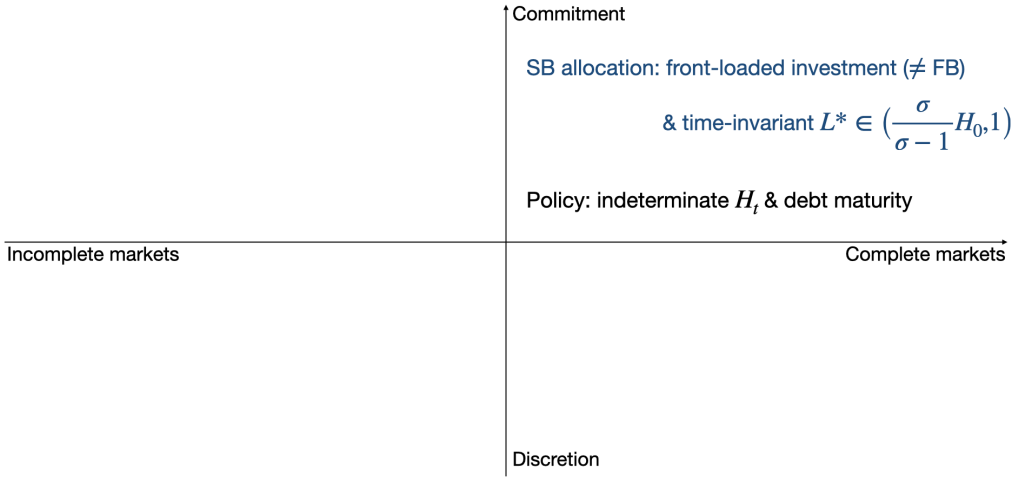
- *Consumption ratio* $\chi_t^* \equiv \frac{C_t^*}{Y_t^*}$ *rises over time* $\rightarrow$ *fact 2 (investment early on)*





4. λ^* *equates land income w/ fiscal expenditure,* $\nu H_0^{1-\sigma}\frac{\eta(\lambda^*)}{[1+\eta(\lambda^*)]^{\sigma}} = \rho\int_0^\infty \mathrm{e}^{-\rho t}[(\chi_t^*)^{-1}-1]\mathrm{d}t$

FB allocation: (C_t, Z_t) identical to neoclassical growth & land supply $L_t \equiv 1$



FB allocation: (C_t, Z_t) identical to neoclassical growth & land supply $L_t \equiv 1$

Commitment

SB (time-invariant L^*)

Policy: specific H_t that increases over time

to substitute borrowing

SB allocation: front-loaded investment ($\neq$ FB)

& time-invariant $L^* \in \left(\frac{\sigma}{\sigma-1}H_0, 1\right)$

Policy: indeterminate H_t & debt maturity

Incomplete markets — Complete markets

SB (time-invariant L^*)

Policy: specific $H_t \leq \frac{\sigma-1}{\sigma}L^*$ & debt portfolio

to incentivize future governors

Discretion

FB allocation: (C_t, Z_t) identical to neoclassical growth & land supply $L_t \equiv 1$

Commitment

SB (time-invariant L^*)

Policy: specific H_t that increases over time

to substitute borrowing

SB allocation: front-loaded investment ($\neq$ FB)

& time-invariant $L^* \in \left(\frac{\sigma}{\sigma-1}H_0, 1\right)$

Policy: indeterminate H_t & debt maturity

Incomplete markets

Complete markets

DD (welfare < SB): increasing H_t, L_t (as in reality)

→ cross-sectional evidence

& remedy: land contract design

SB (time-invariant L^*)

Policy: specific $H_t \leq \frac{\sigma-1}{\sigma}L^*$ & debt portfolio

to incentivize future governors

Discretion

Conclusion and future directions

This paper makes three contributions

1. A model to understand land finance and public investment
2. An explanation for rising land supply: discretion + financial constraints
3. A design of land contracts as remedy, which links supply to public good provision

Future research may address

1. Stochastic growth
2. Cyclical fluctuations
    - Collateral constraint + land finance may create financial accelerator through govt
3. Spatial/urban: competition among local governments
4. Distribution/inequality

Thanks for your time!

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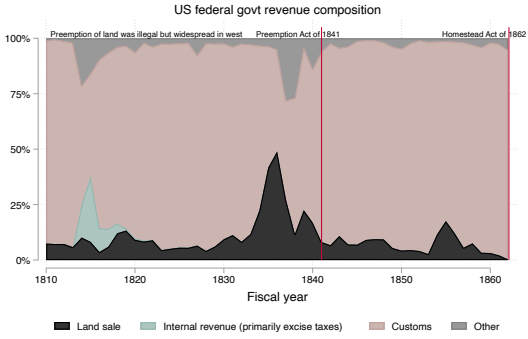
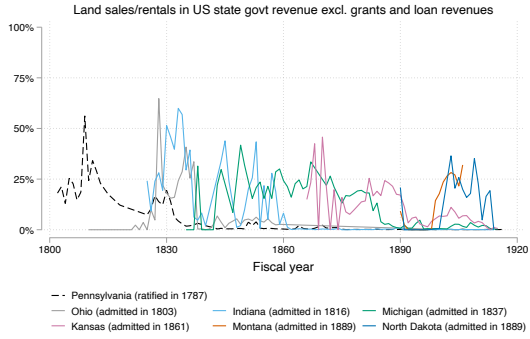
Backup materials

Figure: Land sale in govt revenue (US in 19th century)

(a) Federal



(b) Selected states (PA + Midwest)



- Both federal & state govts profited from land, in a century of “internal improvements”; Since 1850s, federal govt also granted $\geq$ 150 million acres of land ($\approx$ 5% of total area)
- Today, the US govts still own nearly 40% of the land nationwide ($\geq$ 15% in NJ, NY, PA)

Double deviation: no borrowing + successive governors

SB (present-value budget constraint, one λ^*) $\rightarrow$ DD (time-t budget constraint, variable λ_t^{DD})

Proposition 3

1. *supply* $L_t^{DD} = \left[1 + \eta\left(\lambda_t^{DD}\right)\right] H_t^{DD}$, *sale* $\dot{H}_t^{DD} = \frac{\mathcal{U}_{L,t}^{DD}}{\left(\partial \mathcal{U}_L^{DD}/\partial H\right)_t} \frac{\dot{\lambda}_t^{DD}}{\lambda_t^{DD}}$, *when* $L_t^{DD} < 1$
2. *additional wedge between private return* ($\frac{\dot{C}_t^{DD}}{C_t^{DD}} + \rho$) *and net MPK, arising from* $\dot{\lambda}_t^{DD}$
3. *roughly, amount in private hands* H_t^{DD} *and total supply* L_t^{DD} *both* $\uparrow$
   a. *low depreciation rate* $\delta \rightarrow$ *saturation* ($L_\infty^{DD} = 1$)
   b. *high depreciation rate* $\delta \rightarrow H_t^{DD}, L_t^{DD} \uparrow$ *during convergence*