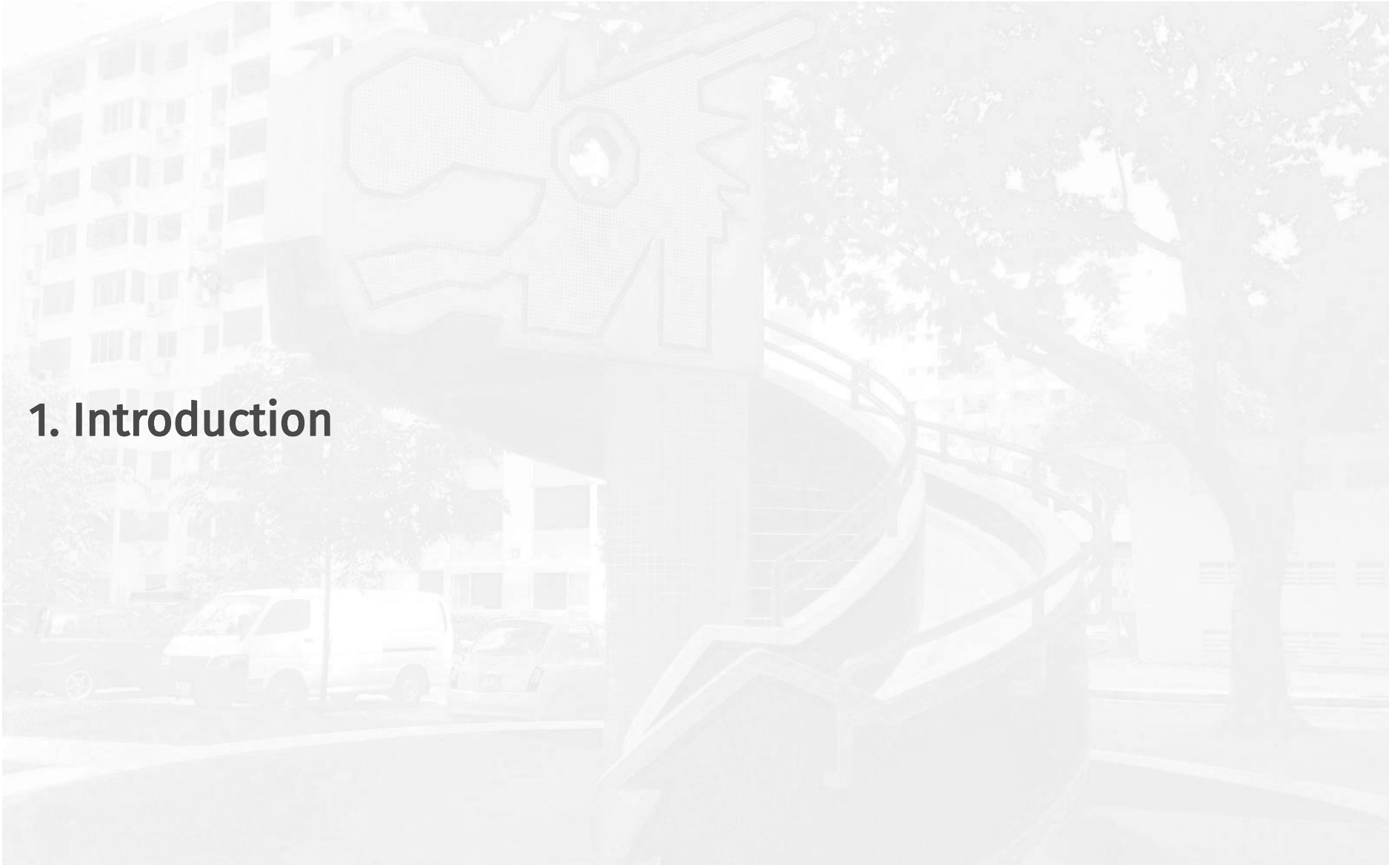# PUBLIC HOUSING AT SCALE

Kwok-Hao Lee* (NUS and Yale), Andrew Ferdowsian (Exeter), Yiying Tan (Princeton), Luther Yap (Princeton)

Opinions expressed herewith do not represent the views of NUS or HDB.

Created: 2023-11-15 Wed 09:50

1. Introduction

1.1. Motivation

- (Un)Affordable housing
    - SF: Housing accounts for 42% of a household's budget
    - HK: 220k people live in shoebox apartments (4' x 6')
    - SG: Median private home price — US$1.2 million
- "Too bad?"
- Motivates government intervention **at scale**
    - Amsterdam, Vienna, Israel, Shanghai, Hong Kong…
    - Today: Focus on **public housing lotteries in Singapore**

1.2. When governments provide public housing...

- People wait **years**...
    - while passing on **acceptable but less desirable goods**
- We have **prescriptions for waitlist design** for the poor (Waldinger 2021)...
- But what about **lotteries**
    - **at scale** (80% of residents in Singapore, 1 million apartments)
    - and how do **intertemporal tradeoffs** matter?

1.3. Some countries with housing lotteries

1.4. In the Singapore program...

1. To **encourage homeownership**
2. the government **builds** (public) housing
3. sold **below market prices**
   - **differentiated** by location and apartment size
   - **possibly resold** on a regulated aftermarket
4. rationed by **quarterly lottery** over each applicant's top choice

1.5. Research questions

1. What are the effects of **changing allocation rules** for public housing?
   - "... we manage the building programme carefully, including allocating new flats in a fair, cost-effective and efficient way." (Mah 2011, 29)
   - **Current rules**: Apply to 1 each period; must accept if win
   - Incentivizes agents to **strategically delay**
   - Consider **alternative mechanism** without this property
2. What are the effects of **building slightly more apartments**?
3. (In progress) How do these levers compare to
   - The **planner's solution**; and
   - Allocating *all* public housing **by price**?

Examine impacts on **vacancy rates**, **wait times**, and **aftermarket prices**

   - (In progress) welfare, affordability, sorting

1.6. Agenda

- Introduce the setting and provide descriptive analysis
- Illustrate key source of inefficiency with theoretical example
- Build **dynamic choice model** over **lotteries** for (new) public housing
- Estimate on **novel data** from the **Singaporean mechanism**
  - (Today) Every **new complex** + agg. apps + aftermarket transactions
  - (Estimation in progress) **Applicant microdata**
- **Recover preferences** for young households & owner-occupiers
  - **Euler CCP methods** drastically simplify estimation
  - Key challenge: **endogenous lottery odds** & **aftermarket prices**
  - Solution: **Cost instruments** + **Policy shocks** to subsidies and OO
- Evaluate counterfactuals
  - (Today) Rule changes; building more housing
  - (In progress) Planner's problem; Allocating by price; Welfare

1.7. Preview of (old) results

1. <u>Building</u> slightly more apartments (10%)…

- …may not alleviate congestion!
  - Some agents wait longer
  - Vacancies rise; aftermarket prices hardly change
- **Inefficiency**: Agents "hold out" for competitive developments
  - Lose future lotteries? Cannot take today's apartments
  - Building more apartments can **worsen** this problem

2. <u>Changing allocation rules</u> for public housing...

- ... complements increasing supply

A strategyproof mechanism eliminating intertemporal risk...

- makes poor/rich households wait 8%/23% less
- reduces vacancies (12% → 7%)
- raises prices on the aftermarket (>12%)
  - **advantages owner-occupiers** over applicants
- If we now build more apartments...
  - Wait times remain low
  - Relieves upward pressure on aftermarket prices

2. Setting

2.1. The Singaporean housing market
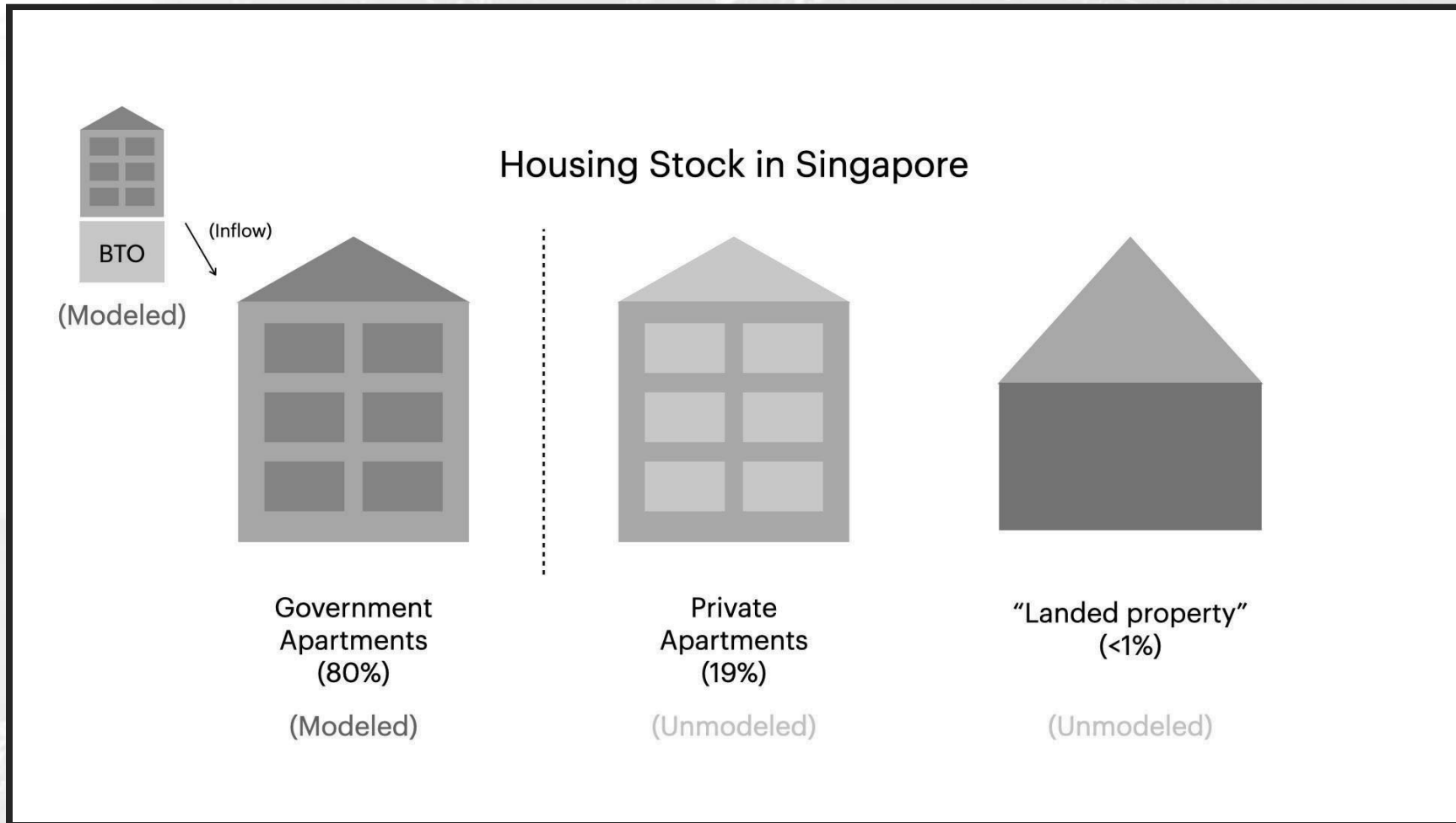
2.2. Historical context

80% of Singaporean households live in government housing

- 2021: 1.1m apartments, est. value S$440b

Build-to-order (BTO) mechanism, new government apartments (2001-today)

- S$6.3b/year (US$4.7b/year)
- Administered by the Housing and Development Board (HDB, 1960-today)
  - "Sells" *99-year leases* to households assigned new apartments
  - Intermediates resale on (after)market

Government objective: Provide "affordable, quality public housing option"

- Encourage homeownership
- "Affordable": $\leq$ 4x applicant yearly income
- Minimize vacancies
- ... and other objectives

2.3. Eligibility for the mechanism

Applicants apply for BTO as a **family unit** (typically a married couple)

- One must be a Singapore citizen; the other a citizen/PR
- Both aged $\geq$ 21 years
- Do not own real estate in Singapore or overseas
- Income $\leq$ S$144,000 a year (60th percentile)

<u>Priority</u>: Focus on "first-timers."

- 95% of apartments in desirable neighborhoods reserved for them

2.4. Apartment types

- Unit of analysis: Housing development, (location, apartment size) pair
- **Apartment types**
    - *3(4)-room*: 2(3) bedrooms, 1 living room
    - *5-room*: 3 bedrooms, 1 living room, 1 dining room
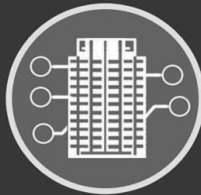
3. Data and Descriptive Facts

3.1. Data: The universe of public housing transactions

- Mechanism (scraped): 403 developments, 900k+ apps (2010-2023)
    - Application rates, prices, quantities, nearby amenities
    - For now: Restrict to 195 developments over 20 periods (2012-2015)
- New revision of this paper uses **Government microdata**
- Secondary market (data.gov.sg): 610k transactions (2000-2023)
    - Month/year transacted, location, price, year built

5. Model: Outline of Public Housing Market

- New apartment supply exogenous;
- Owner-occupiers sell or not;
- Applicants enter one lottery, apply to clearinghouse, wait, or exit

5.1. <u>Dynamic equilibrium</u> model of housing choice

Every period, **new housing developments** arrive exogenously.

Existing owner-occupiers

- Infinite horizon, perfect foresight through 2023
- Given the prices they face, either
    1. Sell off their apartment (**terminal**); or
    2. Continue living in it
- Key trade-off: Sell today vs. sell at higher price tomorrow

5.2. Young households

- Infinite horizon, perfect foresight
  - Differ by income, applicant age, family structure
  - (In progress: Persistent tastes for, e.g., the west/east)
- Given prefs, prices and odds of success over developments, either
  1. Apply for one development within the mechanism;
  2. Apply to clearinghouse;
  3. Wait (live with family); or
  4. Exit to secondary market
- Key trade-off: Success odds vs. desirability

Markets clear via lottery odds (1°) and prices (2°)

7. Estimation: Outline
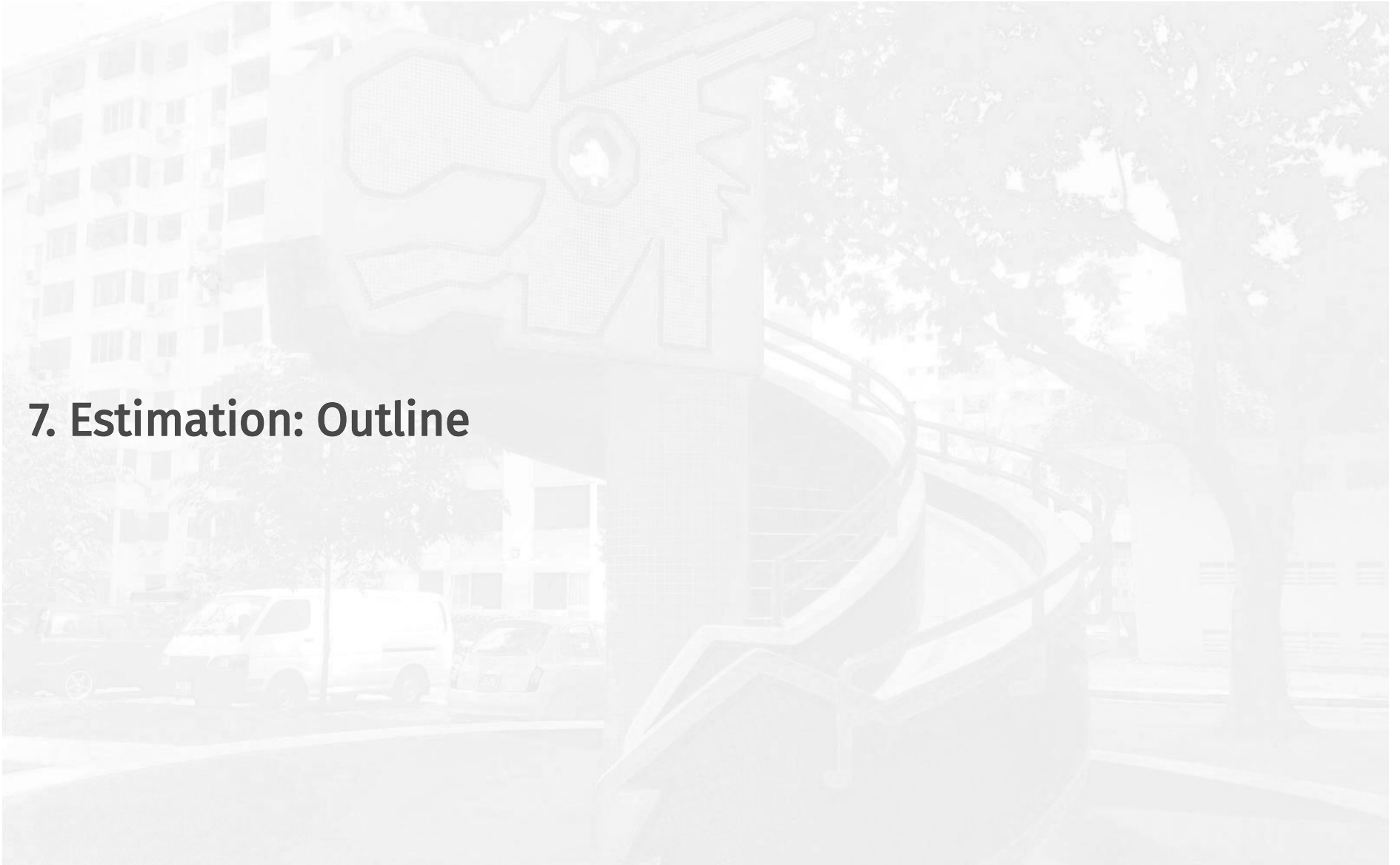
7.1. Where we are headed

Want to recover...

- young household preferences and flow wait utilities (demand) and
- how likely existing homeowners move when home prices rise (supply).

(FAST FORWARD: COUNTERFACTUALS) (FAST FORWARD: ESTIMATION DETAILS)

8.5. Full demand results

Parameters	Estimate	S.E.
Constant	-2.698***	1.050
Distance to downtown	-0.143***	0.0470
Distance to metro stop	-0.729***	0.163
Distance to SAP school	0.0291	0.0389
4-room flat	1.987***	0.305
5-room flat	1.426***	0.499
Price	-0.855***	0.291
Resale price	0.569**	0.232
Subsidized development price	-3.433**	1.373
Wait cost (Poor)	-1.972***	0.346
Wait cost (Rich)	-2.611***	0.202
N	195	

9. Counterfactuals

(FAST FORWARD: COUNTERFACTUAL OUTCOMES)

9.1. Overview of counterfactuals

Today: With old estimates, compare supply increase with new rules.

- Supply: 10% supply increase in oversubscribed projects
- New rules: Applicants submit preferences over (future) projects and exiting; **lottery over applicants** clears the market

In progress: Batching; planner's problem; "better" pricing; welfare

- New rules: Run BTO every 6 months (Ferdowsian, Lee, and Yap 2023)
- Planner's problem: Maximize utilitarian welfare s.t. applicants only matched to developments after they "become active"
- Pricing: BTO + Δ prices s.t. in each development, applicant:capacity is 1:1

9.2. Changing allocation rules

Eliminate intertemporal risk through a **variant of RSD**!

1. Given guess of aftermarket prices, all agents truthfully list their preferences over (eligible) developments and exiting

2. At random, each agent assigned preferred development with capacity

In simulations, find aftermarket prices to clear the market.

9.3. Comparing counterfactual outcomes

Outcome/CF	Baseline	Build: +10%	Δ rules	Combined
Vacancies	12%	16%	7%	10%
Wait times	Poor: 1.5 years	↑ 0.4%	↓ 8%	↓ 8%
	Rich: 10 months	↓ 3%	↓ 23%	↓ 23%
Aftermarket prices	S$460k	↓ 0.02%	↑ 12%	↑ 9%

10. Conclusion
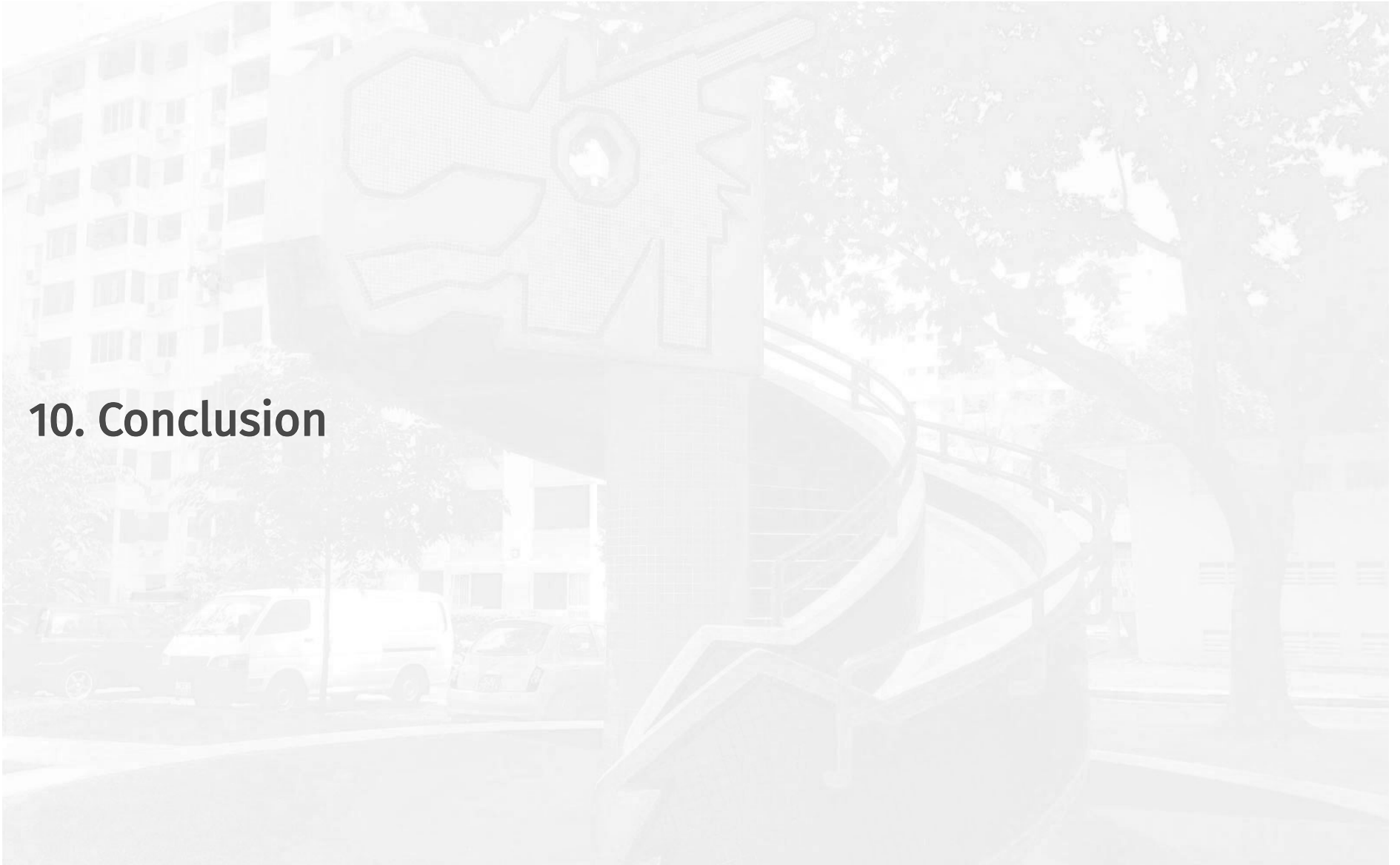
Main takeaways

- **Increasing supply** is **not a panacea** for congestion
  - **Demand response** can eclipse the supply increase
- **Better rules** can **improve allocation outcomes**...
  - but may **redistribute**
- Changing rules **complements** increasing supply!

Next steps: Welfare, Planner's problem, Pricing

Future research: Optimal public housing location; Use lottery variation to study outcomes

Thank you! (kwokhao [at] nus [dot] edu [dot] sg)