Like Father Like Son?
Social Engineering and Intergenerational Mobility in Housing Consumption

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Motivation

- Most studies focus on intergenerational mobility in income or wealth (Corak 2013; Chetty et al., 2020; Fan et al. 2021)

- Consumption more directly connected to consumers' utility & material well-being than other measures (Charles et al., 2014)

- Lack of quality data on expenditure records of parents & children

Research question: Intergenerational mobility in housing consumption and impact of large-scale social engineering programs

Why housing consumption?

- Largest household consumption good

- Co-move with other individual/household expenditures b/c substitution effect under budget constraint

    - A prominent component—human-capital investment—important channel for intergenerational transmission (Mogstad, 2017)

- An asset that stores value; provide access to home equity which affects consumption behaviors (Agarwal and Qian, 2020)

Singapore as a Laboratory: Large-scale Social Engineering Programs

Public Housing Programs

- Home Ownership for the People Scheme; homeownership of 87% by 1990; more than 2 million benefit

- Affordable at subsidized prices with generous grants; up to 80,000 SGD (59,510 USD) for first-time buyers

- Criteria of new public housing is household income ceiling 14,000 SGD (10,414 USD) per month; can sell at full market prices after 5 years of min occupation period

Public Education System

- 6-year compulsory national primary school $\rightarrow$ 4-5 years of secondary school $\rightarrow$ post-secondary school

- considerable variations in quality of primary schools

- Use primary school quality measured by cumulative take-up rate by Phase 2B (3 phases in total) to proxy neighbourhood quality

- Balloting based on home distance and citizen status, should the applicants exceed the available places in any phase

Taxation System

1 Progressive personal income tax rate: 2% for income below
SGD 30,000 (USD 22,308); up to 22% for above SGD 320,000
(USD 237,948.3)

2 No capital gains tax or inheritance tax

3 Top 13.2% of taxpayers contributes to about 90.6% of assessed
tax; lowest 30% and those in the middle percentile range about
0.7% and 8.7%

Major Findings

- Significant impact of public housing and public education programs in promoting upward mobility in intergenerational housing consumption, esp. for grass-roots families

- Downward mobility in housing consumption for children of middle-class parents; call for policy attention for the sandwiched middle class

- Stagnancy in intergenerational housing consumption for top families; little tax interventions

Contributions

1. Active literature extending intergenerational studies to financial behaviors (Charles et al. 2014; Black et al., 2017, 2020)
   - First to document intergenerational correlation in housing consumption using real transactions (literature uses imputed housing value or homeownership)

2. Mechanism: a new environmental pathway of affordable public housing; contributing to nature vs. nurture literature (Black et al., 2017, 2019; Fagereng et al., 2018; Chetty and Hendren, 2018)

3. Policy implication: Singapore as a lab; use public housing policies to promote intergenerational mobility, especially for grass-root families

Data

Residential Data

Demographic information of 2,171,383 Singaporean residents at least 20 years old, from 1996 to 2018.

Housing Transaction Data

Private housing transaction prices from the Real Estate Information System (REALIS) from 1995 to 2018; public resale housing transaction prices from the HDB website between 1997 and 2012.

Credit/Debit Card Consumption Data

Individual consumption between 2016:01 and 2017:12 for 25,000 customers of a leading bank in Singapore.

Residential Data

- Step 1 $\Rightarrow$ 99.2% of all residential buildings
    - 1965-1984 birth cohorts; children at least 30 years old
- Step 2 $\Rightarrow$ 149,745 non-co-residing parent-child pairs
    - Parent-child relationships: share same home address for at least 2 waves; age gap 18-45 years;
    - Non-co-residing parent-child pairs: residential status in first wave as a proxy for parents' housing status and latest wave for children
- Step 3 $\Rightarrow$ data of neighborhood quality
    - Take-up rate at phases 1-3 for 172 primary schools in 2006; cumulative take-up rate by phase 2B
    - Constructed 156 sub-zones with diagonal of 4km
    - Match with residential data to measure neighborhood quality when children grow up

Housing Transaction Data: Match the Nearest Price Record before Data Wave

- Private housing records: 1995-2018 with detailed residential address, transaction prices, floor areas, sale dates, etc.

- Public housing records: 1997-2012; same buildings & same floor divisions & same room types; drop multiple records (1.3%)

- Adjusted to 2014 prices

Credit/Debit Card Consumption Data

- Transaction amount from all credit/debit cards and cash withdrawal, transaction date; sum up by month from all categories

- Pair consumption (other than housing) of parents with children; restrict children to be at least 30 years old

- Rich demographic & socioeconomic information: age, gender, property type, property address, etc.

- Trim top and bottom 1% of the consumption/income ratio; average across months to get rid of transitory shocks

Summary Statistics

149,745 non-co-residing parent-child pairs with children at least 30 in 1965-1984 cohorts

Variable	Mean (Standard deviation)
Housing price of children in the latest wave	498386.5 (462469.3)
Housing price of parents in the first wave	385121.5 (362318.5)
Children's age in the last wave	38.93 (4.24)
Parents' age in the first wave	58.25 (7.46)
Children's gender (male=1)	0.52 (0.50)
Children's type of residence (HDB=1, other=0)	0.83 (0.38)
Parents' type of residence (HDB=1, other=0)	0.95 (0.22)
Children's ethnicity (Chinese=1, Indian=2, Malay=3, Other=4)	1.41 (0.80)
Parents' ethnicity (Chinese=1, Indian=2, Malay=3, Other=4)	1.40 (0.79)
Number of children per family	2.65 (1.20)
Observation	149,745

Estimation Bias & Overcoming Strategy

Lifecycle bias: Different age-consumption trajectories may bias the estimate of lifetime consumption

- Children at least 30 years old; control age polynomials
- Housing transaction prices for parents from the first observed waves and for children from the last observed waves

Attenuation bias: Consumption in specific year(s) may be subject to transitory shocks; not proper measure of lifetime consumption

- Housing is not a commodity with high trading frequency
- Nature of housing consumption contributes to mitigate attenuation bias

Coresidence bias: Household surveys target household members staying at home during surveys; selective

- Residential data track all home moves
- Focus on non-coresiding parents and children

Relative Mobility

Calculate percentile ranks of housing consumption (0 - 100)

$$y_i^k = \alpha_0 + \alpha_1 x_i^p + Z_i' \alpha_Z + \epsilon_i \tag{1}$$

- y_i^k: housing rank of a child from family i in latest observed wave
- x_i^p: housing rank of parents in first observed wave
- Z_i': parents' and children's age and age squared
- Standard errors clustered at building level

By socioeconomic categories: parents in bottom vs. top 50 percentile ranks; bottom 50, mid 30, and top 20 percentile ranks

Mechanism Exploration—Social Engineering Programs

$$y_i^k = \beta_0 + \beta_1 x_i^p + \beta_2 x_i^p \times I_i + Z_i' \beta_Z + \delta_i \tag{2}$$

- Parents' housing type: I_i equals 1 if parents are observed in the private residence in the first wave

- HDB expansion period: I_i is an indicator vector which specifies low or high HDB expansion period

- Neighborhood quality: I_i equal to 1 if children grow up in good neighborhood

Absolute Mobility

Expected housing rank of a child whose parents have a housing percentile rank of 50 (Chetty et al., 2014)

Focus on child with median parents in the distribution of housing consumption in public and private housing markets, respectively

$$\bar{y}_{50,h} = \gamma_0 + \gamma_1 \times 50 \tag{3}$$

- $\bar{y}_{50,h}$ (h = public or private housing market): expected housing rank of a child born to hypothetical parents with median housing rank
- γ_0 and γ_1 from Eq. (1)

Calculate the threshold point for child's upward mobility at which children's housing rank equals parents' housing rank:

$$y_t = \frac{\gamma_0}{1 - \gamma_1} \tag{4}$$

- y_t stands for the threshold point at which parents' housing rank equals children's housing rank

Supplementary Estimation

Intergenerational correlation in consumption other than housing using credit/debit card data based on Eq. (1)

- y_i^k: rank of consumption/income ratio of a child from family i

- x_i^p rank of consumption/income ratio of a parent from family i

- Fixed-effect estimation to swipe constant preference in consumption across generations

Intergenerational Correlation in Housing Consumption

High mobility in housing consumption across generations with a robust estimate around 0.18

Outcome Variable: Housing Rank of Children	(1)	(2)
Panel A. Full Sample		
Parents' housing rank	**0.175*****	**0.176*****
	(0.004)	(0.003)
Constant	41.26***	-
	(0.204)	-
Age controls	N	Y
Observation	149,745	149,745
R-squared	0.031	0.036
Threshold for children's upward mobility	50.012	-

Robustness checks

Outcome Variable: Housing Rank of Child		
	(1)	(2)
Panel A. Robustness Check 1. Additional Control Variables		
Parents' housing rank	**0.176*****	**0.164*****
	(0.004)	(0.004)
Age controls	Y	Y
Ethnicity of parents and children and children's gender	N	Y
Observation	149,745	149,745
R-squared	0.036	0.061
Panel B. Robustness Check 2. Standard Errors Clustered at Family Level		
Parents' housing rank	**0.175*****	**0.176*****
	(0.003)	(0.003)
Age controls	N	Y
Observation	149,745	149,745
R-squared	0.031	0.036
Panel C. Robustness Check 3. Children at Least 35 Years Old		
Parents' housing rank	**0.177*****	**0.178*****
	(0.004)	(0.004)
Age controls	N	Y
Observation	125,513	125,513
R-squared	0.031	0.036

By Parents' Housing Rank

- Children of grass-root parents (bottom 50 percentile ranks): the estimate 0.06 implies high upward mobility
- Children of rich parents (upper 50 percentile ranks): estimate reaches 0.36; significantly higher

Panel B. Parents' Rank in [0, 50] and [50, 100] Categories		
Parents' housing rank	**0.058*****	**0.057*****
	(0.009)	(0.009)
Parents' housing rank	**0.301*****	**0.303*****
$\times$ I (parents in ranks 50-100)	(0.013)	(0.013)
Age controls	N	Y
Observation	149,745	149,745
R-squared	0.037	0.042

- Children born to grass-root parents: high upward mobility in housing consumption (children: 46.5, parents: 27.2)
- Upper half distribution have downward mobility (children: 54.1, parents: 72.8)
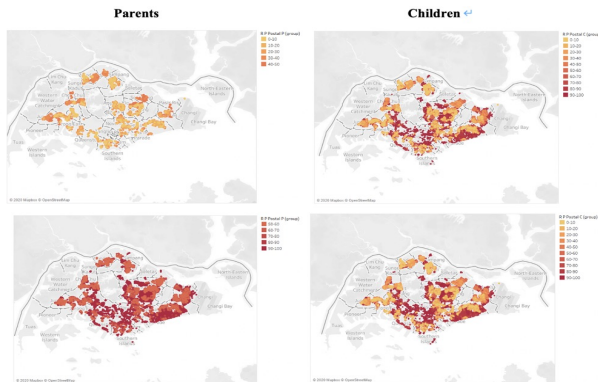

Figure 1: Heat Maps of Housing Ranks of Parents and Children Conditional on Parents in the Bottom 50% (Upper Panels) and Top 50% (Lower Panels)

By Parents' Housing Rank

- Middle-class parents (50-80 percentile housing ranks): 0.17
- Top parents (top 20 percentile ranks): 0.96, indicating high intergenerational persistence in housing consumption

Panel C. Parents' Rank in [0, 50], [50, 80], and [80, 100] Categories		
Parents' housing rank	**0.058*****	**0.057*****
	(0.009)	(0.009)
Parents' housing rank	**0.110*****	**0.114*****
$\times$ I (parents in ranks 50-80)	(0.021)	(0.021)
Parent's housing rank	**0.904*****	**0.906*****
$\times$ I (parents in ranks 80-100)	(0.036)	(0.036)
Age controls	N	Y
Observation	149,745	149,745
R-squared	0.041	0.046

- Children of grass-root parents: strong upward mobility in housing wealth
- Children in the middle-class families: worse off than their parents
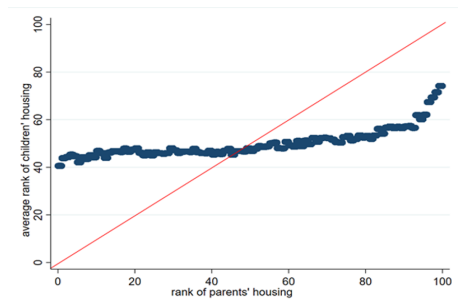- Children of rich parents: the strongest persistence in housing mobility

Figure 2: Child's Housing Rank versus Parents' Housing Rank

Social Engineering Programs: Public Housing

Hypothesis: affordable public housing frees up poor households'
budget constraints; parents can invest more in child's human capital,
increasing equality of opportunity

Evidence: Higher mobility rate among children growing up in public
rather than private housing

Outcome Variable: Housing Rank of Children	(1)	(2)
Parents' housing rank	**0.136*****	**0.137*****
	(0.004)	(0.004)
Parents' housing rank	**0.774*****	**0.784*****
$\times$ I (parents in private residence)	(0.148)	(0.146)
Age controls	N	Y
Observation	149,745	149,745
R-squared	0.040	0.045

Evidence: Higher intergenerational mobility in housing consumption in high expansion period (by approx. 6 percentage points) compared to low expansion period

	Outcome Variable: Housing Rank of Children			
	(1)	(2)	(3)	(4)
	Parents in HDB residence		Parents in private Residence (falsification test)	
Parents' housing rank	0.169***	0.171***	0.753**	0.801***
	(0.014)	(0.014)	(0.301)	(0.301)
Parents' housing rank	-0.051***	-0.053***	0.246	0.217
× I (high HDB expansion period)	(0.015)	(0.015)	(0.370)	(0.370)
Parents' housing rank	0.014	0.009	0.208	0.179
× I (low HDB expansion period)	(0.016)	(0.016)	(0.420)	(0.420)
Age controls	N	Y	N	Y
Observation	142,432	142,432	7,313	7,313
R-squared	0.019	0.024	0.009	0.012
Difference in rank-rank estimate between high and low HDB expansion periods	-0.065***	-0.061***	0.038	0.038
	(0.009)	(0.009)	(0.376)	(0.377)

Social Engineering Programs: Public Education

Hypothesis: Neighborhood effect (Chetty and Hendren, 2018); quality public
education enhances upward mobility of those children born to poor families

Evidence: decreasing (increasing) intergenerational persistence (mobility)
for grass-root families in better neighborhood (with better primary schools)

Outcome Variable: Housing Rank of Children		
	(1)	(2)
Parents' housing rank	0.169***	0.345***
	(0.005)	(0.048)
Parents' housing rank × I (good neighborhood)	0.005	**-0.259*****
	(0.007)	(0.074)
Parents' housing rank × I (good neighborhood) × I (2nd quintile)	-	**0.221****
	-	(0.102)
Parents' housing rank × I (good neighborhood) × I (3rd quintile)	-	**0.303*****
	-	(0.102)
Parents' housing rank × I (good neighborhood) × I (4th quintile)	-	**0.305*****
	-	(0.102)
Parents' housing rank × I (good neighborhood) × I (5th quintile)	-	**0.432*****
	-	(0.103)
Age controls	Y	Y
Observation	141,308	141,308
R-squared	0.034	0.045

- **lowest quintile:** better neighborhood promotes intergenerational mobility in housing consumption by 0.259

- **2nd-4th quintiles:** insignificant impact in promoting intergenerational mobility (neither eligible for public housing nor financially capable to sort into better neighborhood)

- **top quintile:** enhanced intergenerational housing persistence by 0.173 (little tax intervention; financially free to sort into better neighborhood)
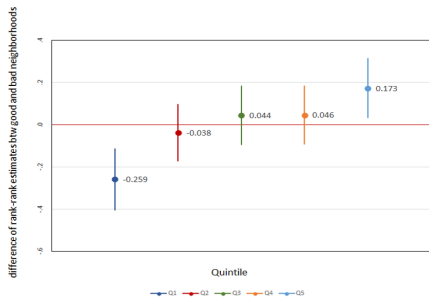

Figure 3 Difference in Rank-rank Correlation Coefficients btw Better and Worse Neighborhoods conditional on Parents' Housing Quintile

Trade-off between Housing and Other Consumption?

Potential concern: parents perform trade-off btw housing consumption and other individual/household consumption, instead of investment in children's human capital

However, Evidence: Intergenerational correlation in other consumption is low; no significant difference btw children growing up in public and private residences

| Outcome Variable: Rank of Children' s Consumption/Income Ratio		
	Children at Least 30 Years Old	Children at Least 20 Years Old
Panel A. Full Sample		
Rank of parents' consumption/income ratio	0.066*	0.085***
	(0.035)	(0.023)
Age controls	Y	Y
Observation	876	1,859
Panel B. by Parents' Residential Type		
Rank of parents' consumption/income ratio	0.116**	0.108***
	(0.055)	(0.038)
Rank of parents' consumption/income ratio × I (HDB residence)	-0.099	-0.041
	(0.072)	(0.048)
Age controls	Y	Y
Observation	876	1,859
Pair	0.013	0.058
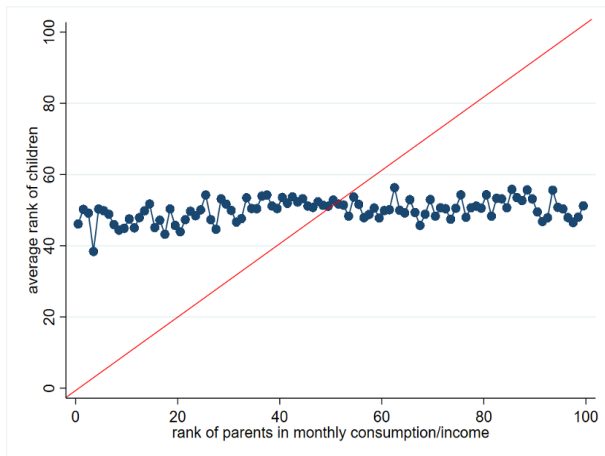
Figure 4: Children' s Consumption/Income Rank versus Parents' Consumption/Income Rank (other than Housing Consumption)

Conclusion

Use large-scale social engineering programs and rich housing data in Singapore as a laboratory,

1. Upward mobility in intergenerational housing consumption by grass-roots families; public housing & education programs

2. Downward mobility for children of sandwiched middle-class parents; neither eligible for public housing nor capable to sort into better neighborhood

3. Strong intergenerational correlation for children from rich families; little tax interventions & financially free to sort into top neighborhood

Policy Implication

- Social engineering programs are a bundle of schemes that can be used to generate optimal welfare outcomes

- Use public housing policies to promote intergenerational mobility, esp. for grass-root families

- Policy attention to declining status of the middle-class children

- Policy attention to stagnant intergenerational mobility at the top

Thank You!

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