Intergenerational Mobility Effects of Region-Based Education and Migration Policy in China

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Motivation

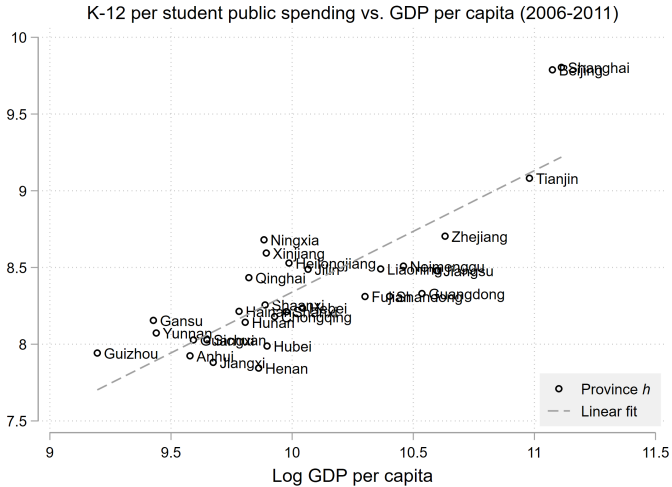
- Understanding the mechanisms underlying intergenerational income mobility and inequality has been a longstanding issue.
  - Childhood location is found to be a key factor.

- Substantial regional inequality in China along its economic growth,
  $\Rightarrow$ potentially persists across generations.

- China's educational policies, K-12 to college, are largely region-based
  $\Rightarrow$ have potentially contributed to unequal access to opportunities:
  - Decentralized public K-12 funding implies that richer provinces have higher quality public schools
  - More colleges located in developed regions and allocate disproportionally more seats to richer provinces.
  - *Hukou* restricts access to local public education and college access in better-resourced cities.

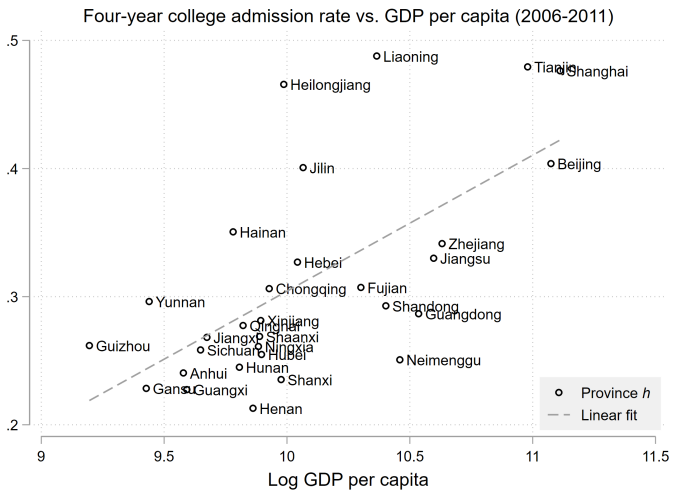
Institution #1: Decentralized K-12 Public Education Spending

- Public schools in rich areas are better funded than those in poor areas.



Institution #2: Province-based College Admission

- Substantially more college seats are allocated to richer provinces in per capita sense.
- Students are allocated to schools based on college entrance exam (*Gaokao*) **within** their province.



This paper

Question:

- How do existing region-based edu policies in China affect income, intergenerational mobility, inequality, and welfare?
  - In particular, how do they affect outcomes for the poorest in the population?
- How can policy be used to improve access to opportunity and mobility?

Strategy:

- Build a spatial OLG model that encapsulates:
  - salient features of the institutional setting,
  - tournament competition for college admission, and
  - dynamic human capital development with both public and private investment.
- Calibrate the model to match important moments (earnings, migration, regional college enrollment, etc.) in current China.
- Examine short- and long-run effects of counterfactual policy changes.

Preview of (preliminary) results

- Lift Hukou-restricted access to local edu or equalize regional public edu spending

  ⇒ large aggregate effects on spatial distributions and mobility

  - Positive effects concentrated on children of low-income parents,
  - who lack high-quality private investment.

- Equalize college admission allocations (thus a later-stage intervention)

  ⇒ modest effects on aggregate outcomes, even with behavioral responses to college access

  - Mostly negatively affecting children of high-income parents.
  - Purely merit-based college quota allocation does the opposite but still modest effect.

Related literature

- OLG models studying intergenerational outcomes and the income distribution
  Becker and Tomes (1979, 1981); Loury (1981); Durlauf (1996)
  - Sub-literature focusing on regions, educational policies, and child investments
    Fernandez-Rogerson (1996, 1998); Benabou (2002); Lee-Seshadri (2019); Eckert-Kleineberg (2019).
  - Determinants of intergenerational mobility in developing countries with fast-changing economy
    Solon (1999); Asher et al. (2018); Alesina et al. (2020).
    * *The implication of regional inequality in education on intergenerational inequality*

- Economic effects of the Hukou system
  Whalley and Zhang (2007); Bosker et al. (2012); Zhao (2017); Sieg, Yoon and Zhang (2023)
  * *Interaction with educational system*

- Effects of college admissions / AA policies on mobility and welfare;
  Abbott et al. (2019); Herskovic-Ramos (2019); Capelle (2020); Arcidiacono and Lovenheim (2016)
  * *Early vs. late intervention in access to opportunity*

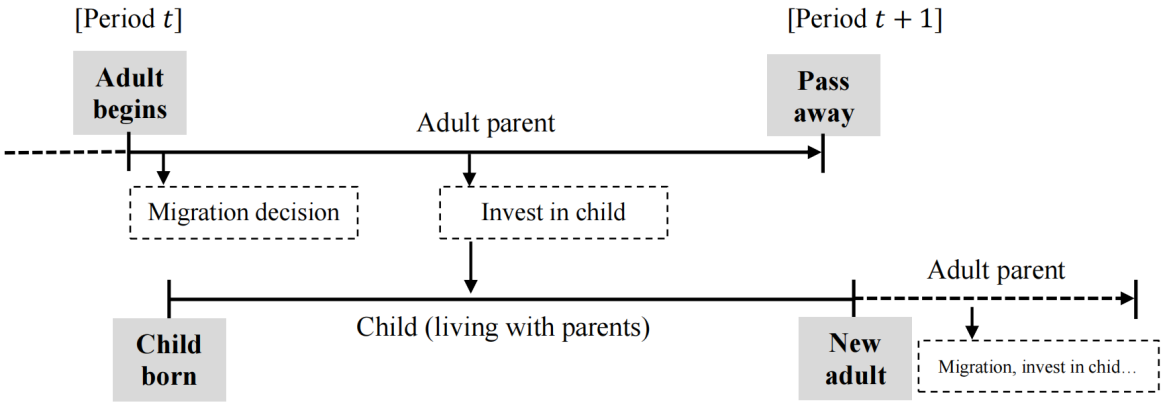
Outline of the talk

- Introduction
- **Model**
- Calibration
- Policy evaluation
- Conclusion

Model Setup

- Overlapping generations model of human capital accumulation, built on Becker and Tomes (1979).
- Measure of dynastic households, each comprised of 2 two-period-lived individuals (one adult and one child).
- A set of locations $\ell \in \mathcal{L}$, which differ in
  - wages / return to human capital,
  - public education spending,
  - college quota allocations,
  - housing costs.

Model: Timeline



Model: Adult begins period t - migration, consumption, investment

- Initial state variable: education e, final human capital H_2, initial hukou $hk_0 \in \mathcal{L}$;
- Adults choose to migrate to $\ell \in \mathcal{L}$, acquire local Hukou hk according to hk_0 and e;
- In location ℓ, earns income

$$y = \bar{w}_\ell \cdot H_2 \cdot \varepsilon_y,$$

  - $\bar{w}_\ell$ is location-specific wage per unit of human capital, ε_y is an idiosyncratic shock.

- Pay proportional income-tax rate τ_r for local public education spending.
- Inelastically purchase one unit of housing at housing price

$$P_\ell = A_\ell \cdot N_\ell^\phi.$$

  - A_ℓ is a location constant, N_ℓ is population size, ϕ is the inverse price elasticity of housing supply.
  - Housing price P_ℓ broadly captures the congestion effect.

Model: Adult begins period t - migration, consumption, investment

- Parent allocates the remaining income into:
  - consumption c,
  - investment x in child's pre-college human capital.

- Parent thus solves the individual problem:

$$\max_{\ell,c,x} u(c, H_2, \ell) + \varepsilon_\ell + \theta \mathbf{E}[\ln(H_2'(x, \ell))]$$

  - θ is parental altruism, in warm glow,
  - H_2' is child's final human capital (all terms with ' denotes child generation),
  - ε_ℓ is an idiosyncratic location preference.

Model: Child human capital and education

- Child accumulates pre-college human capital H_1' from
  - private investment x, and
  - public education spending $\bar{x}_\ell$:

$$H_1' = (H_2)^{\nu} \cdot [\omega x^{\rho} + (1-\omega)\bar{x}_\ell^{\rho}]^{\frac{\delta}{\rho}} \cdot \varepsilon_H'$$

- Child admitted into college, depending on whether pre-college H_1' exceeds region-specific admission threshold in *Hukou location* for each college level e':

$$e' = \begin{cases} \text{tier-1/elite,} & \text{if } H_1' \geq \bar{H}_{\ell,2} \\ \text{4y col,} & \text{if } H_1' \in [\bar{H}_{\ell,1}, \bar{H}_{\ell,2}) \\ \text{below col,} & \text{if } H_1' < \bar{H}_{\ell,1} \end{cases}$$

- Child's human capital continues to develop during college:

$$H_2' = H^{col}(H_1', e')$$

Model: Regional educ and migration policy matters

- Migrant: parents choosing location ℓ receive local Hukou with probability $q_\ell(e)$
  - which increases with education level e
- Without local Hukou faces extra costs/penalties in earnings, housing, and child investment efficiency.
- In particular, without local Hukou in developed locations, their children
  - Cannot attend local (higher-quality) public school
  - Have to compete in the home location for (fewer) college admission quotas.

Model: Equilibrium

- Given the warm glow specification, We define a static equilibrium and avoid the steady-state concept.

- A static equilibrium consists of a spatial allocation of households, such that
  - Households maximize utility,
  - Local education budgets are balanced,
  - College admission thresholds are determined in all locations,
  - Housing markets clear.
  - *Labor markets clear (to be added with a representative firm in each location).*

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Data Sources

- China Family Panel Studies (CFPS) (2010-2020):
  - microdata on location choice, wages, family education expenditures, Hukou status, etc.
  - nationally comparable ability tests
- National Bureau of Statistics (NBS):
  - Public education expenditures, average income, housing expenditures
  - Census 2000 & 2010 on population sizes
- Administrative data on college quota and admission outcomes

Calibration Process

We match the model's initial condition to key features in Chinese data using the following steps:

- Aggregate data into two representative provinces, one rich and one poor.

Province	Pop (%)	Income	K-12 spending	4y college (%)	Tier-1 college (%)
Poor	63.94	28,588	4,693	16.2	3.9
Rich	36.06	56,318	7,439	24.8	6.7

- Externally calibrate parameters from data and previous literature.
- Internally calibrate parameters to match observed moments in current China.

Internal Calibration: Matched Moments

Moment (Source)	Data	Model
Population distribution, poor province (%) (NBS)	63.9	64.1
Migration volume from rich to poor (%) (CFPS)	4.9	6.4
Average yearly earnings in poor province (NBS)	28,588	27,543
Average yearly earnings in in rich province (NBS)	56,318	57,809
Std. dev. of log earnings, poor province (CFPS)	1.16	1.12
Std. dev. of log earnings, rich province (CFPS)	1.07	1.06
% province ℓ attending 4-year college (admin data)	16.2	16.2
% province ℓ attending elite college (admin data)	3.9	3.9
% province h attending 4-year college (admin data)	24.8	24.7
% province h attending elite college (admin data)	6.7	6.7
% from lowest income Q attending college (CFPS)	6.1	7.0
Intergenerational elasticity [Fan et al. (2019)]	.410	.400

Validation Exercise: Quartile Transition Matrix

- We construct un-targeted income-quartile transition matrix (across generations):

		Child Quartile			
	CFPS Data	1	2	3	4
Parent Quartile	1	35.7%	28.5%	19.9%	16.0%
	2	28.4%	27.2%	25.3%	19.1%
	3	19.3%	27.2%	28.7%	24.8%
	4	16.7%	17.6%	25.5%	40.1%
	Model	1	2	3	4
Parent Quartile	1	40.6%	27.2%	19.7%	12.5%
	2	29.0%	29.5%	24.8%	16.8%
	3	20.5%	26.8%	29.5%	23.2%
	4	9.9%	16.5%	26.1%	47.5%

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Counterfactual Policy Experiments

- Lifting barriers to opportunity
  - **[Hukou]**: removes Hukou restriction on local educ access

- Reallocating quality of opportunity (early vs. late)
  - **[Edu Spend]**: equates per-student public spending levels across regions (through funding redistribution)
  - **[College-Equity]**: equal proportion of applicants from each region attends each level of college
  - **[College-Merit]**: highest human capital individuals attend highest level of college, regardless of location

Counterfactual Policy Experiments

We are interested in:

- Long-run effects: comparisons across baseline and counterfactual steady states (iterating the model forward until stable spatial distribution of population)
  - Cannot estimate effects on specific groups, as population compositions will differ
- Short-run effects: the next child generation
  - Starting from baseline allows the study of effects on specific groups, e.g. children born to low-income parents

[Hukou] vs. [Edu Spend]: Long-run Results

	Baseline	[Hukou]	[Edu Spend]
Population distribution, rich province	36.1%	41%	32.7%
Intergenerational Elasticity (IGE)	0.401	0.384 (4% ↓)	0.374 (6.5% ↓)
Gini	0.564	0.543 (3.7% ↓)	0.563 (0.2% ↓)
Δ Welfare (% consumption equiv.)	-	8.0	3.7

- Both generate sizable aggregate effects
- **[Hukou]**: Lifting hukou benefits both children (pre-college and college) and parents (migration)
- **[Edu Spend]**: Equalizing pre-college spending mostly breaks income-edu linkages

Short-run Results - Who (gen $t+1$) benefits?

Welfare %

Parent Income quartile & baseline location	Poor province [Hukou]	Poor province [Edu Spend]	Rich province [Hukou]	Rich province [Edu Spend]
Q1 (bottom)	16.3	17.4	10.0	-9.3
Q2	14.4	15.9	0.5	-14.5
Q3	13.3	13.4	-3.0	-14.3
Q4 (top)	10.5	8.0	-5.3	-11.5

- **[Hukou]** benefits most people by increasing the option value and access to better schools - except for higher housing costs and congestion
- **[Edu Spend]** benefits poor and hurt rich province
- Largest gains for children born to bottom-Q parents esp. in poor province
  - Gain the most from better public investment because they don't have as much private investment
  - Richer parents compensate by increasing private investment

[College-Merit] vs. [Equity]: Long-run results

	Baseline	[College-Merit]	[College-Equity]
Population dist., rich province	36.1%	37.2%	35.7%
IGE	0.400	0.411	0.390
Welfare %	-	0.4	-0.3

- Modest effects on spatial distribution and IGE (also smaller-scale policy changes and costs)
- Small effects on mobility and welfare
  - Given the low college enrollment rates, bottom-Q families are not affected anyway
- In [Merit], largest gains for children born to high income parents in rich province.
  - Strengthen income-edu linkage
- In [Equity], the opposite
  - Rich parents increase private investment into child's human capital

Concluding remarks

- We build a spatial OLG model highlighting migration, child development, and education opportunities
- Sizable effects from promoting access to opportunities (lifting Hukou)
  - Rich province grows, and inequality and IGE decrease
  - Bottom three Qs of children born in the poor province experience substantial gains in income, college-going, and welfare
  - Frees parents as well
- Equating edu spending has similar results on inequality and intergenerational elasticity, but smaller welfare gains
  - Both have relatively larger effects on children of low-income parents
- Changing college seat allocations has modest aggregate effects
  - Short-run effects on college attendance concentrated to children of high-income parents
  - Probably too late for mobility policy targets