Involution, Intergenerational Mobility, and Family Fertility Decisions: Theory and Empirical Evidence

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Overview

Motivation and Research Questions

Research Background

- Intergenerational mobility in China has shown a downward trend in recent years.
- The phenomenon of "involution" has intensified
- Fertility rates in East Asian countries have continued to decline

Research Questions

- How do competitive pressures and social comparison affect individual fertility decisions within households?
- What are the implications of these individual decisions at the macro societal level?
- What kind of social equilibrium will emerge in such a competitive society?

Main Findings

- Household per capita educational investment increases with the intensity of social competition, as shown in the empirical analysis. Meanwhile, the number of children declines as competition intensifies.
- **The Fertility Paradox**: More altruistic parents tend to have more children. However, under intense social competition, parental altruism exacerbates the negative effect of competition on fertility—greater altruism may actually lead to lower fertility.
- In a two-class society (rich vs. poor), when the initial level of social competition is low, competition eventually stabilizes at a moderate level, and social mobility improves. In contrast, when initial competition is high, it tends to intensify over time, leading to a widening gap in human capital investment between rich and poor families and more severe class stratification.

Literature Review

- **Household Fertility Decisions**
  - Quantity-quality tradeoff models of fertility decisions (Becker and Tomes, 1976; Becker and Tomes, 1986; de la Croix and Doepke, 2003; Yuan, 2021)
  - Empirical evidence: peer effects (Fang, 2021); fertility intention (Yi and Yi, 2008; Jiang, 2020; Liu et al., 2023)
- **Competition and Investment**
  - Tournament models (Clark and Riis, 1998; Zábojník and Bernhardt, 2001; Dietl et al., 2012)
- **Intergenerational Mobility and Fertility**
  - Impact of fertility decisions on intergenerational mobility (Lam, 1986; Moav, 2005)
  - Impact of intergenerational mobility on fertility decisions (Zang et al., 2023; Gan and Wang, 2023; Xie et al., 2023; Cai and Xie, 2024)

Theoretical Framework

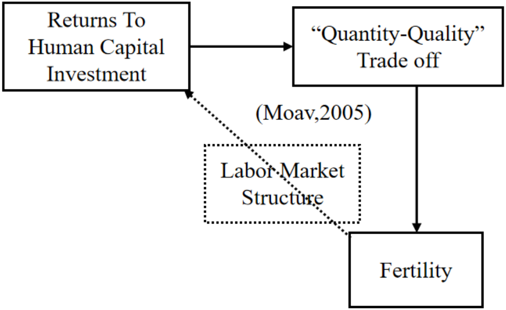

Figure: Theoretical Framework(Moav,2005)

Theoretical Framework

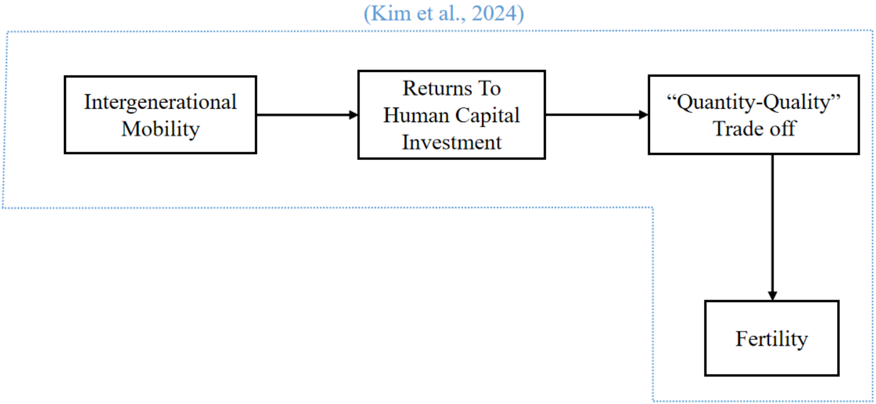

Figure: Theoretical Framework(Kim et al., 2024)

Theoretical Framework

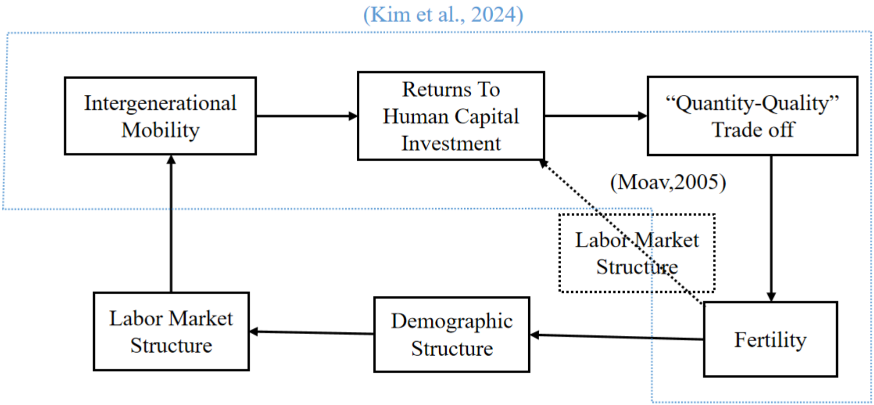

Figure: Theoretical Framework

Model Setup: Life Cycle Structure

Assume the economy consists of a set of agents. Each agent lives for two periods: childhood and adulthood. At any point in time, two overlapping generations coexist.

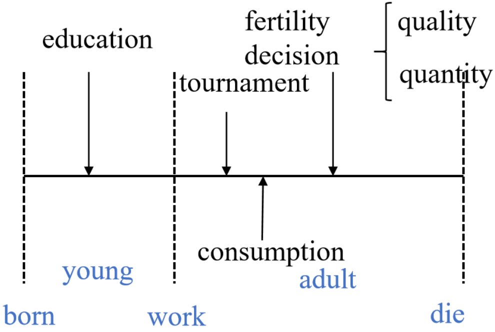

Figure: Household Lifecycle Decisions

Model Setup: Households and Preferences

- There are N households indexed by i, differentiated by their initial wealth w_i, with $w_1 \geq w_2 \geq \cdots \geq w_N$.
- Assume all children in a household are homogeneous. The utility function of household i is:

$$u(c_i, n_i, h_i) = \frac{c_i^{1-\rho} - 1}{1-\rho} + \alpha\phi(n_i)w(h_i)$$

where:

  - c_i: consumption in adulthood;
  - $\rho \in (0,1)$: coefficient of relative risk aversion;
  - $\alpha \in (0,1)$: parental altruism — higher α indicates greater weight on children's future;
  - n_i, h_i: number of children and human capital per child;
  - $w(h_i)$: income of a child with human capital h_i.

Model Setup: Budget Constraint and Human Capital

- Human capital of a child in household i is determined by:

$$h_i = \theta_1 e_i$$

  where e_i is educational investment per child, and $\theta_1 > 0$ is the return to education.
- Budget constraint:

$$c_i + n_i e_i \leq w_i$$

Wage Determination: Tullock Contest Model

- Two job types: **advanced** (managerial) and **basic**, with wages w_a and w_b respectively.
- Managerial wage: $w_a(h_i) = Ah_i$; basic wage: $w_b = Ah_b$, where $h_b < h_i$. We will justify the linearity later.
- Agents with $h_i < h_b$ are ineligible for employment (earn 0).
- The eldest child of each household enters the contest. If successful, all siblings in the household gain access to advanced jobs via relational networks.
- Probability of winning:

$$P_i(h_i, h_{-i}) = \frac{h_i^\gamma}{\sum_{j=1}^{N} h_j^\gamma}$$

where γ captures the discrimination power in the tournament.

Fertility Decision Problem

Household i solves the following optimization problem:

$$\max_{\{c_i, n_i, h_i\}} \quad \frac{c_i^{1-\rho} - 1}{1-\rho} + \alpha\phi(n_i)\left[p(h_i, h_{-i})w_a(h_i) + (1 - p(h_i, h_{-i}))w_b\right]$$

$$\text{s.t.} \quad c_i + n_i e_i \leq w_i$$

$$h_i = \theta_1 e_i \geq h_b$$

$$\text{with } w_a = Ah_i, \quad w_b = Ah_b, \quad p(h_i) = \frac{h_i^{\gamma}}{\sum_{j=1}^{N} h_j^{\gamma}}$$

Corner and Interior Solutions

Corner solution $(h_i = h_b)$: First-order condition becomes

$$\frac{n_i^{1-\varepsilon}}{(w_i - \frac{n_i h_b}{\theta_1})^{\rho}} = A\alpha\theta_1\varepsilon$$

Interior solution $(h_i > h_b)$: First-order conditions:

$$\left(w_i - n_i \frac{h_i}{\theta_1}\right)^{-\rho} \cdot \frac{h_i}{\theta_1} = \alpha\phi'(n_i)\left[A h_b + p(h_i)A(h_i - h_b)\right]$$

$$h_i \left[\frac{\partial p(h_i)}{\partial h_i}(h_i - h_b) + p(h_i)\right] = \varepsilon(n_i)\left[h_b + p(h_i)(h_i - h_b)\right]$$

with

$$\varepsilon(n_i) = \frac{n_i \phi'(n_i)}{\phi(n_i)} > 0, \quad \frac{\partial p}{\partial h_i} = \frac{\gamma h_i^{\gamma-1} \sum_{j \neq i} h_j^{\gamma}}{\left(\sum h_j^{\gamma}\right)^2}$$

Equilibrium Characterization

Assuming symmetric initial wealth w_i, the equilibrium winning probability becomes:

$$p = \frac{1}{N}, \quad \frac{\partial p}{\partial h_i} = \frac{1}{N}\left(1 - \frac{1}{N}\right)\frac{\gamma}{h_i}$$

Then, the equilibrium human capital and fertility satisfy:

$$h_i = \begin{cases} \frac{\varepsilon + \frac{\gamma}{N}}{\frac{\gamma}{N} + \frac{1-\varepsilon}{N-1}} h_b, & \text{if} \quad N > \frac{1}{\varepsilon} \\ h_b, & \text{otherwise} \end{cases}$$

$$\frac{n_i^{1-\varepsilon}}{\left(w_i - \frac{n_i h_i}{\theta_1}\right)^{\rho}} = \begin{cases} \frac{A\alpha\theta_1\varepsilon(1+\gamma)}{N\varepsilon+\gamma}, & \text{if} \quad N > \frac{1}{\varepsilon} \\ A\alpha\theta_1\varepsilon, & \text{otherwise} \end{cases}$$

As the left-hand side is strictly increasing in n_i, the solution n_i^* exists and is unique.

From now on, we focus on the interior solution case: $0 < \varepsilon < 1$, $N > \frac{1}{\varepsilon}$.

Comparative Statics: Effect of N (Competition Level)

Effect of N on human capital:

$$\frac{\partial h_i}{\partial N} = \frac{\frac{N}{N-1}(1-\varepsilon)\varepsilon + \gamma\varepsilon + (N\varepsilon + \gamma)\frac{1}{(N-1)^2}(1-\varepsilon)}{\left(\frac{N}{N-1}(1-\varepsilon) + \gamma\right)^2} h_b > 0$$

Effect of N on fertility:

$$\left(\frac{(1-\varepsilon)n_i^{-\varepsilon}}{(w_i - \frac{n_i h_i}{\theta_1})^{\rho}} + \rho \frac{n_i^{1-\varepsilon} \cdot \frac{h_i}{\theta_1}}{(w_i - \frac{n_i h_i}{\theta_1})^{\rho+1}} \right) \frac{\partial n_i}{\partial N} = -A\alpha\theta_1\varepsilon^2 \cdot \frac{1+\gamma}{(N\varepsilon+\gamma)^2} < 0 \tag{3.3}$$

Proposition 1: Effect of Competition N on Fertility

Under interior solution:

- Per-child educational investment increases with the level of competition N.
- Fertility decreases as competition intensifies.

Effect of Altruism α on Fertility Decisions

- Human capital investment is independent of altruism:

$$\frac{\partial h_i}{\partial \alpha} = 0$$

- Fertility increases with altruism:

$$\frac{\partial \left(\frac{n_i^{1-\varepsilon}}{(w_i - \frac{n_i h_i}{\theta_1})^{\rho}} \right)}{\partial \alpha} = \left(\frac{(1-\varepsilon) n_i^{-\varepsilon}}{(w_i - \frac{n_i h_i}{\theta_1})^{\rho}} + \rho \cdot \frac{n_i^{1-\varepsilon} \cdot \frac{h_i}{\theta_1}}{(w_i - \frac{n_i h_i}{\theta_1})^{\rho+1}} \right) \cdot \frac{\partial n_i}{\partial \alpha}$$
$$= \frac{A\theta_1 \varepsilon (1+\gamma)}{N\varepsilon + \gamma} > 0$$

Cross-partial effect:

$$M \cdot \frac{\partial^2 n_i}{\partial N \partial \alpha} = -A\theta_1 \cdot \frac{\varepsilon^2 (1+\gamma)}{(N\varepsilon + \gamma)^2} - \frac{\partial M}{\partial n_i} \cdot \frac{\partial n_i}{\partial \alpha} \cdot \frac{\partial n_i}{\partial N}$$

where M is the term in parentheses in Eq. (3.3) and $M > 0$.

Threshold for the Interaction of N and α

A sufficient (but not necessary) condition for $\frac{\partial^2 n_i}{\partial N \partial \alpha} < 0$ is:

$$\frac{\partial M}{\partial n_i} \geq 0 \Rightarrow n_i h_i > \widetilde{n_i h_i}$$

Proposition 2: Effect of Altruism α on Fertility

Under interior solution:

- Higher parental altruism leads to greater fertility.
- However, when the total cost of childrearing is sufficiently high, greater altruism may reinforce the negative effect of competition on fertility.

Model Extension: Two Types of Households

- There are two types of households in the society: $\{a, b\}$, with initial population sizes N_0^a and N_0^b respectively.
- The initial wealth levels differ: $w^a > w^b$.
- All children must attain at least the minimum human capital level h^b to be eligible for employment.
- Children from type-a households compete for advanced positions. If successful, they earn wage w^a; if not, they take basic jobs with wage w^b.
- Children from type-b households can access basic jobs directly as long as $h_i^b \geq h^b$.
- Wages are defined as:

$$w^a(h_i) = Ah_i^a, \qquad w^b(h_i) = Ah_i^b$$

Fertility Decisions by Household Type

1. Type-a Households

The fertility decision problem for type-a households follows the same structure as in the symmetric case:

$$h^a = h_i^a = \begin{cases} \frac{\varepsilon + \frac{\gamma}{N}}{\frac{\gamma}{N} + \frac{1-\varepsilon}{N-1}} h^b, & \text{if } N > \frac{1}{\varepsilon} \\ h^b, & \text{otherwise} \end{cases}$$

$$\frac{(n_i^a)^{1-\varepsilon}}{\left(w^a - \frac{n_i^a h_i^a}{\theta_1}\right)^{\rho}} = \begin{cases} \frac{A\alpha\theta_1\varepsilon(1+\gamma)}{N\varepsilon+\gamma}, & \text{if } N > \frac{1}{\varepsilon} \\ A\alpha\theta_1\varepsilon, & \text{otherwise} \end{cases}$$

2. Type-b Households

The optimal solution in the symmetric setting:

$$h_i = h_i^b$$

$$\frac{(n_i^b)^{1-\varepsilon}}{\left(w^b - \frac{n_i^b h_i^b}{\theta_1}\right)^{\rho}} = A\alpha\theta_1\varepsilon$$

Firm's Optimization Problem

The firm chooses the number of job positions: L^a managerial positions and L^b basic positions.

The firm's production function is assumed to take a CES form:

$$y = \left(\kappa \left(\sum_{j=1}^{L^a} h_j^a \right)^{\sigma} + (1-\kappa) \left(\sum_{j=1}^{L^b} \min\{h_j^a, h_j^b\} \right)^{\sigma} \right)^{1/\sigma}$$

- σ: elasticity of substitution between job types
- $\kappa \in (0,1)$: relative importance of managerial jobs
- h_j^a, h_j^b: human capital of type-a worker and type-b worker respectively

Firm's profit function:

$$\pi = y - \sum_{j=1}^{L^a} w^a(h_j^a) - \sum_{j=1}^{L^b} w^b(h_j^b)$$

Firm's First-Order Condition

At equilibrium, assume all workers from each type are identical.
From the first-order condition of profit maximization:

$$\frac{w^a(h^a)}{w^b(h^b)} = \frac{\kappa}{1-\kappa} \cdot \left(\frac{L^a h^a}{L^b h^b}\right)^{\sigma-1} \cdot \frac{h^a}{h^b} = \frac{h^a}{h^b}$$

Solving yields:

$$\frac{L^a h^a}{L^b h^b} = \left(\frac{\kappa}{1-\kappa}\right)^{\frac{1}{1-\sigma}} \tag{4.1}$$

- The ratio of managerial to basic job positions is inversely related to the relative human capital levels.
- When h^a/h^b is large, managerial positions become relatively scarce.

General Equilibrium Analysis

Let: $\frac{1}{N} := p =$ probability a household secures a managerial job $= \frac{L^a}{N_0^a n^a}$

Market clearing conditions:

$$L^a = N_0^a n^a \cdot \frac{1}{N}$$
$$L^b = N_0^a n^a \left(1 - \frac{1}{N}\right) + N_0^b n^b$$

Therefore, equilibrium competition level N is:

$$N = \frac{\frac{h^a}{h^b}\left(\frac{1-\kappa}{\kappa}\right)^{\frac{1}{1-\sigma}} + 1}{1 + \frac{N_0^b n^b}{N_0^a n^a}} \tag{4.2}$$

Intergenerational Dynamics

At generation t, the number of type-a and type-b households evolves as:

$$N_0^a(t) = N_0^a(t-1) \cdot n^a(t-1) \cdot \frac{1}{N(t-1)}$$

$$N_0^b(t) = N_0^b(t-1) \cdot n^b(t-1) + N_0^a(t-1) \cdot n^a(t-1) \cdot \left(1 - \frac{1}{N(t-1)}\right)$$

This implies the ratio evolves as:

$$\frac{N_0^b(t)}{N_0^a(t)} = \frac{N_0^b(t-1)n^b(t-1)}{N_0^a(t-1)n^a(t-1)} \cdot N(t-1) + N(t-1) - 1 \qquad (4.3)$$

We obtain the dynamic equation:

$$\frac{N_0^b(t)}{N_0^a(t)} = \left[\frac{\frac{h^a(t)}{h^b(t)} \left(\frac{1-\kappa}{\kappa}\right)^{\frac{1}{1-\delta}} + 1}{N(t)} - 1 \right] \cdot \frac{n^a(t)}{n^b(t)} = \frac{h^a(t-1)}{h^b(t-1)} \left(\frac{1-\kappa}{\kappa}\right)^{\frac{1}{1-\delta}} \tag{4.5}$$

We now analyze how competition level $N(t)$ evolves across generations.

Existence of Equilibrium and Steady State

- The right-hand side of the dynamic equation increases with N_{t-1} and is greater than K. The left-hand side decreases with N_t; its derivative is bounded above by $\frac{1}{N_t^2} < \varepsilon^2$.
- When no equilibrium exists, the left-hand side of (4.5) remains strictly below the right-hand side.

Lemma 1 (Existence of Equilibrium and Steady State)

- If $K = \left(\frac{\kappa}{1-\kappa}\right)^{\frac{1}{1-\sigma}} > \frac{2}{\varepsilon} - 2$ and $N_{t-1} < N_{t-1}^*$, a unique equilibrium exists.
- Given the existence of equilibrium, if $w^a > w^* > w^b$, then a unique steady state exists.

Dynamics of Competition Level

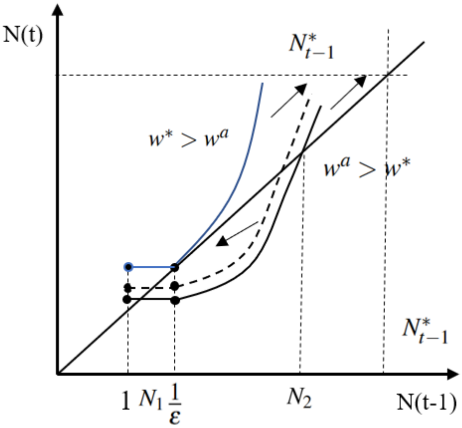

Figure: Evolution of Competition Level Over Time

Dynamics of Competition

Proposition 3

The evolution of social competition across generations follows:

1. When initial competition lies in the moderate range $1 < N_0 < \frac{1}{\varepsilon}$, competition stabilizes at a level $N_1 \in (1, \frac{1}{\varepsilon})$, regardless of the specific value.
2. When initial competition is high, $N_0 > \frac{1}{\varepsilon}$:
   - a) If the wealth gap between the two types of households is large, there exists an unstable fixed point N_2.
     If $\frac{1}{\varepsilon} < N < N_2$, competition gradually declines to N_1;
     If $N_2 < N < N^*_{t-1}$, competition increases over time until equilibrium breaks down.
   - b) If the wealth gap is small, the dynamics follow the same pattern as in case 2(a) with $N_2 < N < N^*_{t-1}$.

Dynamics of Fertility Decisions

Proposition 4

The evolution of household fertility decisions:

1. Type-b (relatively poorer) households maintain constant fertility decisions across generations.
2. For type-a (richer) households:
   1. When $1 < N_0 < \frac{1}{\varepsilon}$: they also invest minimally in human capital; in the first generation, they have more children than type-b households, but eventually the two types converge.
   2. When $N_0 > \frac{1}{\varepsilon}$:
      a) If the wealth gap is large and $\frac{1}{\varepsilon} < N < N_2$: educational investment decreases, fertility increases, and eventually type-a behavior aligns with type-b.
      If $N_2 < N < N^*_{t-1}$: educational investment increases, fertility decreases, until the system reaches a breakdown.
      b) If the wealth gap is small, dynamics mirror case 2(a) with $N_2 < N < N^*_{t-1}$.

Intergenerational Overlap and Firm Behavior

Proposition 5

Firm hiring decisions, population structure, and wealth distribution evolve as follows:

1. When $1 < N_0 < \frac{1}{\varepsilon}$: no distinction between household types; both invest the same in human capital.
2. When $N_0 > \frac{1}{\varepsilon}$:
   a) If the wealth gap is large and $\frac{1}{\varepsilon} < N < N_2$: the number of managerial positions rises, the proportion of rich households increases, and the wealth gap narrows, eventually leading to a population of only type-b households.
   If $N_2 < N < N^*_{t-1}$: the number of managerial positions declines, the proportion of rich households decreases, and the wealth gap widens.
   b) If the wealth gap is small, the outcome follows the same pattern as in case 2(a) with $N_2 < N < N^*_{t-1}$.

Empirical Evidence: Data Sources

- **Micro-level data:** 2018 China Household Income Project (CHIP)
  - Nearly 20,000 household samples across 234 counties in 15 provinces.
- **Macro indicators:** Provincial-level data such as GDP per capita and student-faculty ratios, sourced from the National Bureau of Statistics.
- **College entrance statistics:** Provincial admission rates for Project 985 and 211 universities, obtained from official releases by the Ministry of Education and provincial education departments.

Descriptive Statistics

Variable	Definition and Coding	Obs.	Mean	SD
num_schoolkids	Number of school-aged children	1,940	1.671	0.701
rural	1 = Rural residence, 0 = Urban	1,940	0.518	0.500
hukou	1 = Urban household registration, 0 = Rural	1,890	0.258	0.437
edu_parents	Highest parental education level (ordinal)	1,940	4.06	1.84
comp211	Admission competition ratio (211 universities)	1,940	22.94	5.629
comp985	Admission competition ratio (985 universities)	1,940	69.30	15.90
tutor_expense	Extracurricular tutoring expense (RMB)	1,940	2,092	5,993
sum_edu	Total child education expenditure (RMB)	1,940	105,861	91,731
nation	1 = Ethnic minority, 0 = Han majority	1,940	0.079	0.270
gender	1 = Male, 0 = Female	1,940	0.539	0.499
privateschool	1 = Private high school, 0 = Public	1,940	0.126	0.332
ln_perconsump	Log of per capita consumption	1,940	10.110	0.708

Model Specification and Identification Strategy

We test whether increased competition intensifies household educational investment. The benchmark specification is:

$$standardized\_edu_i = \alpha_0 + \alpha_1\, comp_i + \beta\, X_i + \varepsilon_i$$

- $standardized\_edu_i$: Standardized pre-college educational spending per child i.
- $comp_i$: Competitive pressure faced by child i, proxied by the inverse of the provincial 985 or 211 admission rate.
- X_i: Control variables including household income, parental education, urban/rural status, etc.
- ε_i: Error term capturing unobserved shocks.

Results

Table 2: Effect of Social Competition on Household Educational Investment

	(1)	(2)	(3)	(4)	(5)	(6)
	Comp211 as key regressor			**Comp985 as key regressor**		
comp211/comp985	0	0.012***	0.014***	0	0.005***	0.001
	(0.004)	(0.003)	(0.005)	(0.001)	(0.001)	(0.002)
ln_perconsump		0.503***	0.554***		0.510***	0.555***
		(0.033)	(0.034)		(0.034)	(0.034)
gender		-0.042	-0.031		-0.044	-0.029
		(0.034)	(0.033)		(0.034)	(0.033)
privateschool		0.492***	0.479***		0.471***	0.475***
		(0.058)	(0.058)		(0.059)	(0.058)
nation		0.018	0.028		0.007	0.032
		(0.060)	(0.063)		(0.059)	(0.064)
edu_parents		0.093***	0.102***		0.093***	0.100***
		(0.013)	(0.012)		(0.013)	(0.012)
hukou		0.313***	0.284***		0.315***	0.285***
		(0.060)	(0.059)		(0.061)	(0.059)
num_schoolkids		-0.119***	-0.129***		-0.111***	-0.119***
		(0.024)	(0.024)		(0.024)	(0.024)
rural		-0.159***	-0.177***		-0.159***	-0.179***
		(0.040)	(0.039)		(0.040)	(0.040)
Socioeconomic controls	N	N	Y	N	N	Y
Observations	1,940	1,890	1,890	1,940	1,890	1,890
R-squared	0	0.443	0.471	0	0.444	0.469

Note: Robust standard errors in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Instrumental Variable Strategy

Endogeneity concern: Households may endogenously select education investment based on unobserved preferences or constraints.

Instrument: Per-student government education expenditure at the provincial level.

Two-stage least squares (2SLS):

1. **First stage:**

$$\widehat{comp_i} = \delta_0 + \delta_1 Z_i + \gamma X_i + u_i$$

   where Z_i is the instrumental variable (education spending).

2. **Second stage:**

$$standardized\_edu_i = \alpha_0 + \alpha_1 \widehat{comp_i} + \beta X_i + \varepsilon_i$$

Instrumental Variable

Instrument: Per-student government education expenditure

Table 3: Effect of Social Competition on Household Educational Investment (IV)

	(1) Comp211	(2) Comp985
comp211/comp985	0.053***	0.014***
	(0.018)	(0.005)
ln_perconsump	0.548***	0.546***
	(0.034)	(0.034)
gender	-0.038	-0.037
	(0.034)	(0.034)
privateschool	0.487***	0.462***
	(0.058)	(0.058)
nation	0.007	-0.023
	(0.063)	(0.065)
edu_parents	0.108***	0.105***
	(0.013)	(0.013)
hukou	0.283***	0.286***
	(0.059)	(0.059)
num_schoolkids	-0.157***	-0.136***
	(0.027)	(0.025)
rural	-0.169***	-0.172***
	(0.040)	(0.040)
Socioeconomic controls	Yes	Yes
Observations	1,890	1,890
R-squared	0.457	0.455

Note: Robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Robustness Checks

The positive effect of social competition on educational investment is robust.

- **Alternative Standardization Methods:**
  - We apply three approaches to standardize household educational investment: division by provincial mean, division by provincial median, and deviation from provincial mean.
- **Alternative Dependent Variable:**
  - We replace the dependent variable with standardized household expenditures on out-of-school tutoring, using the Z-score method.
- **Alternative Data Source (CFPS):**
  - We use pooled data from four waves of the China Family Panel Studies (2014–2020), with a total sample size of 4,649.

Heterogeneity Analysis

Table 7: Effect of Social Competition on Household Educational Investment: Heterogeneity by Place of Residence

	(1) Urban (211)	(2) Rural (211)	(3) Urban (985)	(4) Rural (985)
comp211/comp985	0.021**	0.012***	0.014	0.012**
	(0.008)	(0.004)	(0.012)	(0.005)
Individual and household controls	Y	Y	Y	Y
Socioeconomic controls	Y	Y	Y	Y
Observations	901	989	901	989
R-squared	0.456	0.213	0.446	0.140

Note: Robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 8: Effect of Social Competition on Household Educational Investment: Heterogeneity by Hukou Type

	(1) Urban Hukou (211)	(2) Rural Hukou (211)	(3) Urban Hukou (985)	(4) Rural Hukou (985)
comp211/comp985	0.015	0.016***	0.003	0.024***
	(0.013)	(0.004)	(0.018)	(0.006)
Individual and household controls	Y	Y	Y	Y
Socioeconomic controls	Y	Y	Y	Y
Observations	487	1,403	487	1,403
R-squared	0.473	0.318	0.470	0.219

Note: Robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Heterogeneity

Table 9: Effect of Social Competition on Household Educational Investment: Heterogeneity by Parental Education

	Comp211			Comp985		
	Low Edu.	Medium Edu.	High Edu.	Low Edu.	Medium Edu.	High Edu.
comp211/comp985	0.015***	0.039***	-0.040**	0.030***	-0.002	-0.011
	(0.005)	(0.013)	(0.017)	(0.006)	(0.016)	(0.022)
Individual and household controls	Y	Y	Y	Y	Y	Y
Socioeconomic controls	Y	Y	Y	Y	Y	Y
Observations	1,176	421	293	1,176	421	293
R-squared	0.302	0.350	0.547	0.107	0.336	0.546

Note: Robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 10: Effect of Social Competition on Household Educational Investment: Heterogeneity by Income Level

	Comp211			Comp985		
	Low Income	Middle Income	High Income	Low Income	Middle Income	High Income
comp211/comp985	0.009	0.015**	0.018	0.010	0.024***	0.031*
	(0.008)	(0.007)	(0.012)	(0.008)	(0.009)	(0.016)
Individual and household controls	Y	Y	Y	Y	Y	Y
Socioeconomic controls	Y	Y	Y	Y	Y	Y
Observations	503	862	525	503	862	525
R-squared	0.233	0.342	0.504	0.208	0.272	0.452

Note: Robust standard errors in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Conclusion

1. **Key Theoretical Insights:** Greater social competition leads to higher per-child educational investment and lower fertility; parental altruism affects decisions differently across contexts.
2. **Macroeconomic Equilibrium Implications:**
   - Under low competition: convergence in human capital, rising proportion of wealthy families;
   - Under high competition: increasing stratification, high investment but declining fertility among the rich.
3. The competition effect is more pronounced in rural areas, families with low parental education, and high household income.
4. **Policy Implications:** Alleviate excessive educational competition, optimize resource allocation, and strengthen family support systems to stabilize fertility.
5. **Limitations and Future Directions:** The model omits child number discreteness and upward-downward mobility; empirical analysis may suffer from measurement error and regional heterogeneity—future work should improve data quality and model structure.

Thank you!