Heterogeneity in the Multidimensional Child Quality-Quantity Trade-off and Its Consequences for Intergenerational Mobility

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Motivation

More than 160 countries have implemented family planning policies (de Silva and Tenreyro, 2017)

The child quality-quantity (Q-Q) trade-off (Becker and Lewis, 1973)
→ Family planning increases the *price* of child quantity
→ Parents have fewer children but the average quality of the children improves

Mixed empirical evidece

- Quantity ↓ → Quality ↑ (Rosenzweig and Wolpin, 1980; Li et al., 2008; Rosenzweig and Zhang, 2009)
- No trade-off (Black et al., 2005; Angrist et al., 2010; Åslund and Grönqvist, 2010; Liu, 2014)
- Quantity ↓ → Quality ↓ (Qian, 2009)

Heterogeneity in the child quality-quantity trade-off
→ Would policies promoting small families amplify or reduce inequalities across generations?

This paper

Research questions

- How different dimensions of child quality respond a change in the price of child quantity and whether the responses differ across parents?
  - Multidimensional child quality and heterogeneity across parental occupations
  - E.g. education is a less expensive investment to teachers; health is a more valuable investment to farmers
  - A test of the Becker-Lewis's (1973) Q-Q model
- What are the consequences for labor market outcomes and intergenerational income mobility?

Identification

- Variation in the enforcement of the One-Child Policy (OCP) in rural China since 1979
  - Second-child penalty: the "price" of an unauthorized second child (García, 2020)
  - Varying across ethnic groups and family types, provinces, and time → a triple-difference strategy

Related literature

Reconcile with existing evidence using OCP to test the Q-Q model

- Q-Q trade-off exists only for health and not for education in rural China (Liu, 2014)
- Family planning policies less effective to raise the education of farmers' children (Qian, 2009; Li and Zhang, 2017)
- Reducing family size might affect child quality negatively when a larger family is desired (Guo et al., 2021)

Related literature

Factors explaining socioeconomic inequalities in human capital investments in the children

- Credit constraints (e.g. Caucutt and Lochner, 2020)
- Parental beliefs about returns to different investments (e.g. Kaufmann, 2014; Boneva and Rauh, 2018)
- Land rights and cultural norms (La Ferrara and Milazzo, 2017; Jensen and Miller, 2017; Congdon Fors et al., 2019; Bau, 2021)
- **Parental occupations affect the expected costs and returns on investment in children's education**

Intergenerational tranmission of human capital, physical capital, and income

- In China (Alesina et al., 2020; Fan et al., 2021; Jia et al., 2021; Yu et al., 2021) and in other societies (e.g. Björklund et al., 2006; Pekkarinen et al., 2009; Black and Devereux, 2011; Lefgren et al., 2012; Chetty et al., 2014; Grönqvist et al., 2017; Adermon et al., 2018)
- Family size reduction associated with upward mobility only for middle class or elite families in pre-transition Europe (Van Bavel et al., 2011)
- **Family planning policies contributing to the recent increase of intergenerational income persistence in China** (Fan et al., 2021)

Outline

Data

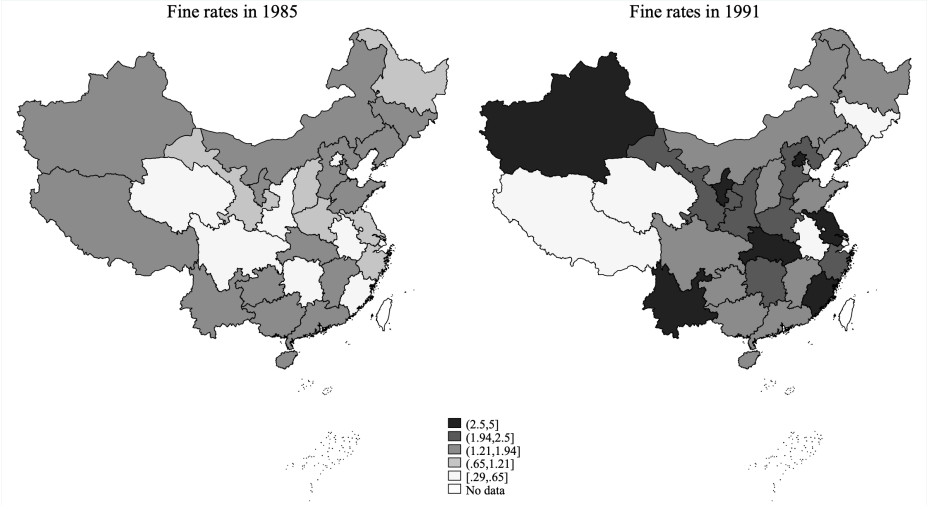
China Family Panel Studies (CFPS)

- **Sample**: 2894 firstborn children born between 1966 and 1990 in rural China
- **Outcomes:**
  - Family size, health, education, farmland and other assets, occupational outcomes measured in 2010
  - Lifetime income constructed from the income data in the 2010, 2012, 2014 waves (Fan et al., 2021)
- **Father's occupation at age 12 of the firstborn**:
  - Farmers (67%)
  - Low-skill workers: physical laborer, salespersons (26%)
  - High-skill workers: doctors, teachers, accountants (7%)

Enforcement of the OCP at the province level between 1979 and 2000

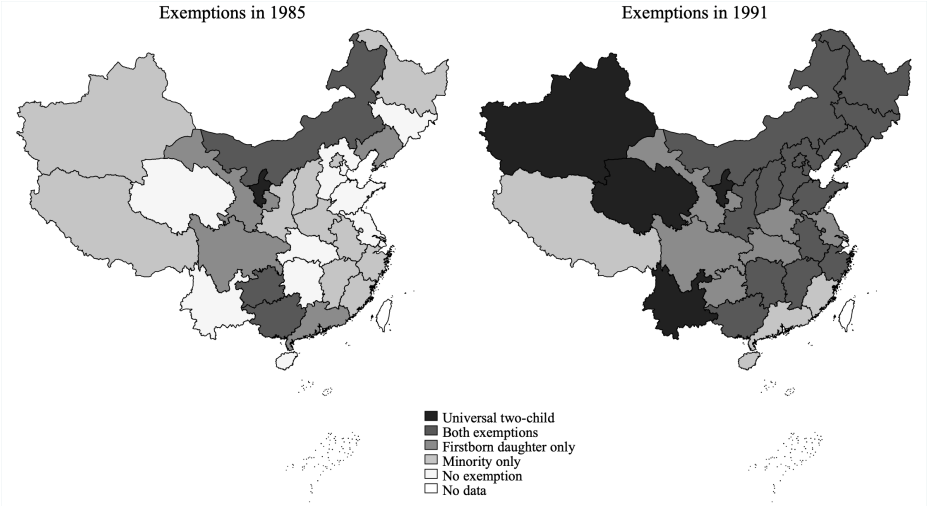
- Fine rates in a multiple of household annual income for unauthorized births (Ebenstein, 2010)
- "Free" second-child granted to certain groups (Scharping, 2013)

Fines for unauthorized births under OCP



Source: Ebenstein (2010).

Exemptions granted to rural couples' second child



Source: Scharping (2013).

Second-child penalty

Consider a couple with the first child born in year t and province p, what's the penalty of a second child in year $t + s$ in province p?

- $Fine_{t+s,p}$: generic fine rates in year $t + s$ in province p
- $Permit_{t+s,g,p}$: eligbility to a "free" second child applied to group g in year $t + s$ in province p
  - Group g defined by gender of the firstborn and ethnicity
- The penalty for having a second child when the firstborn is aged s
  - Zero if $Permit_{t+s,g,p} = 1$
  - $Fine_{t+s,p}$ if $Permit_{t+s,g,p} = 0$

The **average penalty of a second child** in the 10 years following the birth of the first child

$$Penalty_{tgp}^{(1-10)} = \frac{1}{10} \sum_{s=1}^{10} Fine_{t+s,p}(1 - Permit_{t+s,g,p})$$

Summary statistics | Variation | Example: gender | Example: ethnicity

Outline

A triple-difference strategy

The second-child penalty $Penalty_{tgp}^{(1-10)}$ varies across groups g (gender and minority status), provinces p, and cohorts t

$$y_{itgp} = \gamma Penalty_{tgp}^{(1-10)} + X_{it}\beta + Z_{itp} + \lambda a_{itgp} + V_{pt} + W_{gp} + \kappa_{gt} + \epsilon_{itgp}$$

- y_{itgp} = outcome of a firstborn child i born in year t and province p who belongs to group g
- V_{pt} = province-cohort fixed effects,
- κ_{gt} = group-cohort fixed effects
- W_{gp} = group-province fixed effects
- X_{it} = individual controls:
- Z_{itgp} = group fixed effects interacted with pre-birth OCP intensity
- γ: reduced-form effect of the second-child penalty on the firstborn of the family
- **Common trends assumption:** inter-group differences trend similarly across provinces if there were no changes in the second-child penalty specific to one group

Identification validity

Common trends assumption

- The second-child penalty uncorrelated with pre-determined charateristics Balancing table
- Similar trends among untreated firstborn children in older cohorts Event study
- Exposure to second-child penalty determines not only quantity but also timing of siblings Timing

No gender selection among the firstborn Summary statistics

Restrictions on internal cross-province migration: limited selection through migration

Outline

Total effect of the second-child penalty on the firstborn

Family size, health, education, and wealth

	(1) Any sibling (0/1)	(2) Height (sd)	(3) Secondary education (0/1)	(4) Land[a]	(5) Non-land[ab]
Second-child Penalty	-0.145***	0.199*	0.008	0.936	8.516
	(0.044)	(0.112)	(0.051)	(0.871)	(6.444)
	[0.006]	[0.137]	[0.534]	[0.270]	[0.231]
R^2	0.589	0.383	0.437	0.377	0.590
Mean dep var	0.771	0.015	0.245	4.663	48.767
Observations	2894	2807	2894	2851	2763

[a] Household wealth per capita in 1,000 *yuan*

[b] Housing properties, savings, stock market shares, and valuables

Sharpened FDR q-values in brackets (Anderson, 2008).

Effect of the second-child penalty by father's occupation

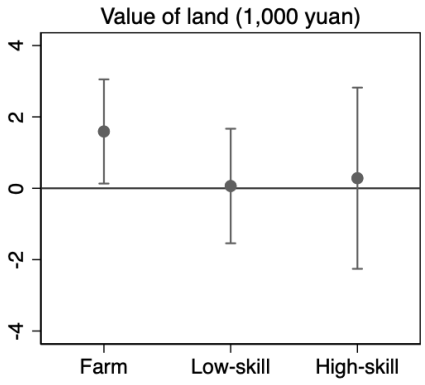
Family size and human capital

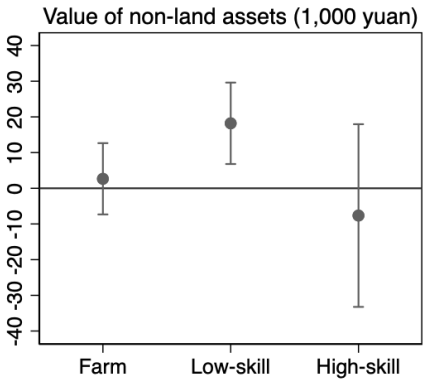
Notes: Coefficients on Second-child Penalty and 90% confidence interval by father's occupation

Sibling composition | Health | Education | Expenditure | Quantile regression education

Effect of the second-child penalty by father's occupation

Household wealth per capita

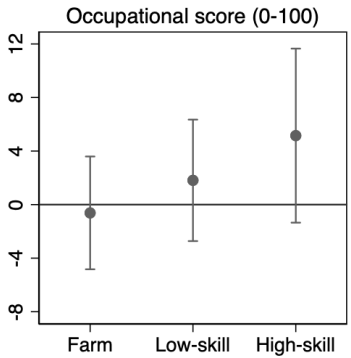


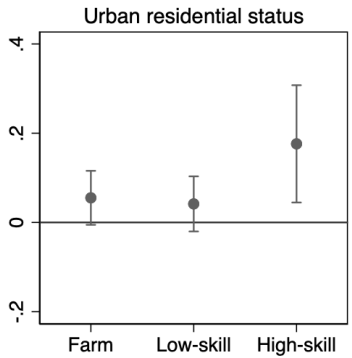


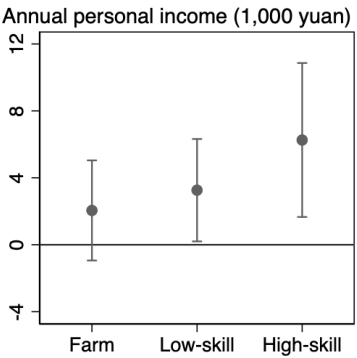
Estimates

Effect of the second-child penalty by father's occupation

Labor market outcomes







Occupational score: Treiman's Standard International Occupational Prestige Scale (1977) ranging from 1 to 100, a higher score means more power and privilege

Estimates | Intergenerational income mobility | Income distribution

Robustness checks

- Estimates with CFPS sampling weights Weighted estimates
- Only provinces without strong son preference Son preference
- Controlling for group-specific effects of provincial socioeconomic development Socioeconomic development
- Heterogeneity by paternal education Paternal education
- Alternative measures of Second-child Penalty Alternative measures
  - Ineligibility to second-child permits only: fine rates may reflect local fertility demand (Zhang, 2017)
  - A minimum 3-year birth-spacing requirement
  - Exploiting variation in high Second-child Penalty only: less prone to negative weights than a continuous measure in two-way fixed effects model (de Chaisemartin and D'Haultfoeuille, 2020)

Outline

What explains the gradient in the effect on education?

- The returns to education are higher when the father is a high-skill worker
  - Parental networks and skills complement child education
  - Parental perceptions
- The opportunity cost of education is higher for the only child in farming families
  - Land with insecure tenure allocated based on household labor supply and the ability/desire to engage in agricultural production (Brandt et al., 2002)
  - Two-child farming family: the older child goes to school and the younger child stays on the farm
  - One-child farming family: the only child stays on the farm

Returns to education

	(1)	(2)
	Mincerian returns	
Measures of human capital:	Years of schooling	Height (sd)
Dependent variable:	Log(income)	
Panel A.		
Human capital (Education or health)	0.059***	0.035***
	(0.003)	(0.013)
R^2	0.223	0.152
Panel B. Heterogeneity by father's occupation		
Human capital	0.056***	0.038
	(0.007)	(0.026)
Low-skill × Human capital	0.001	-0.004
	(0.008)	(0.030)
High-skill × Human capital	0.025**	0.004
	(0.011)	(0.054)
R^2	0.224	0.152
Observations	3353	3322

Sample: all children born in rural China between 1966 and 1975

Heterogeneous returns by father's education

Opportunity cost of education

"Use-it-or-lose-it" land rights in rural China

- Land with insecure tenure allocated based on household labor supply and the ability/desire to engage in agricultural production (Brandt et al., 2002)
- Education promotes nonfarm employment and permanent migration to cities (Zhao, 1999, 1997)

Pre-OCP:

- Youngest son stays home and inherit the land from the parents (Unger, 2006)
- Higher opportunity cost of secondary education for the younger child who stays
- Older children more likely to attend secondary school Education by birth order

Post-OCP:

- Higher opportunity cost of secondary education for the first and only child who stays
- The firstborn in farming families less likely to finish secondary education when family size reduces Quantile regression education

Conclusion

How OCP penalty affects the quantity and quality of children and intergenerational mobility

- The second-child penalty due to the OCP successfully reduced family size
- Depending on parental occupation, different components of child quality respond differently to the second-child penalty
- Stricter enforcement of OCP accounted for one-third of the increase in intergenerational income elasticity

Implications:

- Why the effect on education varies by parental occupation
  - Different expected costs and returns to education rather than different ability to finance children's education
- What to expect under the two-child or three-child policy
  - Farmers and low-skill workers more responsive than high-skill workers
  - Relaxation of the one-child restriction not enough to increase mobility

Thank you!
If you have more questions and comments,
reach me at y.xiao@uva.nl.

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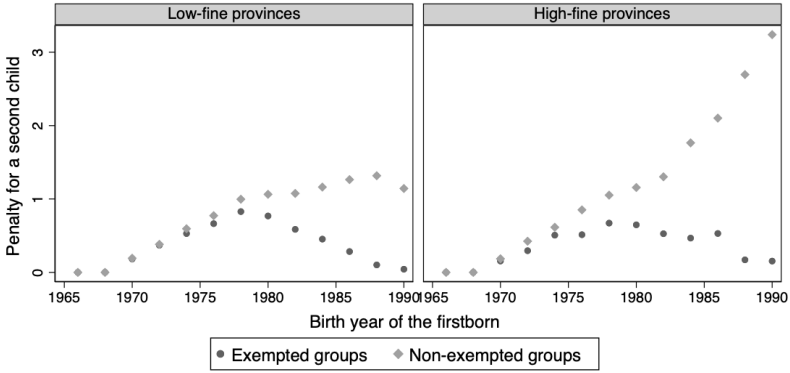
Summary statistics of the firstborn

	All	Mean Boy	Girl	Gender difference p-value
Panel A. Individual charateristics				
Boy (0/1)	0.503	1.000	0.000	
Minority (0/1)	0.089	0.087	0.090	
Age (years)	31.663	31.749	31.576	0.601
Father's age (years)	57.256	57.368	57.141	0.565
Mother's age (years)	55.031	55.147	54.912	0.528
Mother's age at birth (years)	23.482	23.539	23.425	0.548
Father middle school (0/1)	0.374	0.367	0.381	0.497
Father high school (0/1)	0.119	0.124	0.114	0.964
Mother middle school (0/1)	0.192	0.191	0.192	0.328
Mother high school (0/1)	0.042	0.037	0.046	0.528
Father farmers (0/1)	0.660	0.666	0.654	0.609
Father low-skill occupation (0/1)	0.277	0.276	0.278	0.917
Father high-skill occupation (0/1)	0.063	0.058	0.068	0.412
Panel B. Treatment variable				
Penalty	0.735	0.982	0.485	
Observations	2895	1310	1585	

Second-child Penalty | Identification validity

Variation in the second-child penalty

Exempted groups: groups ever subject to exemptions between 1979 and 2000



Second-child Penalty

Balancing test

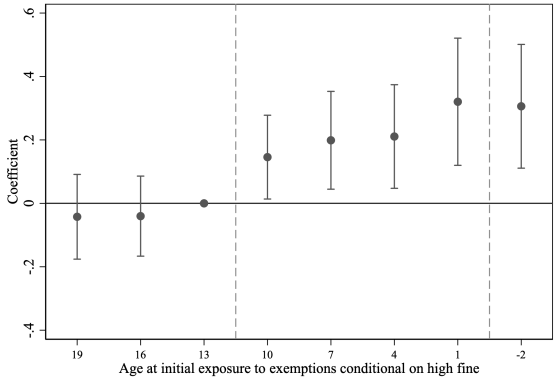
Table 1: Balancing test

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						Father's occupation at age 12		
	Father's age	Mother's age	Father's education	Mother's education	Mother's age at birth	Farm	Low-skill	High-skill
Penalty	0.415	0.230	-0.034	0.012	0.117	-0.043	0.068	-0.025
	(0.495)	(0.453)	(0.041)	(0.032)	(0.384)	(0.042)	(0.046)	(0.029)
R^2	0.753	0.785	0.250	0.252	0.267	0.328	0.335	0.214
Mean dep var	58.306	55.950	0.117	0.038	23.385	0.677	0.257	0.066
Observations	2856	2823	2862	2834	2794	2894	2894	2894

Identification validity

Support for common trends assumption

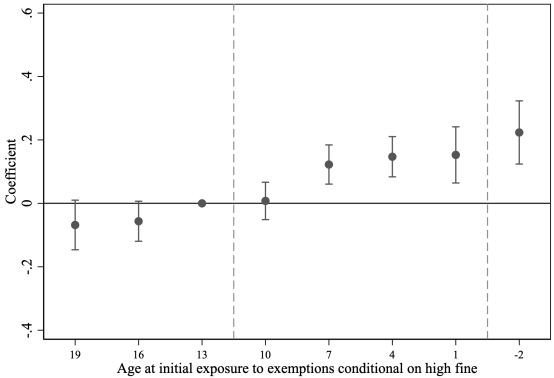
How much **more likely the parents would have a second child** when they face a sudden decrease in the second-child penalty at age a instead of age 13 of the first child?



Identification validity

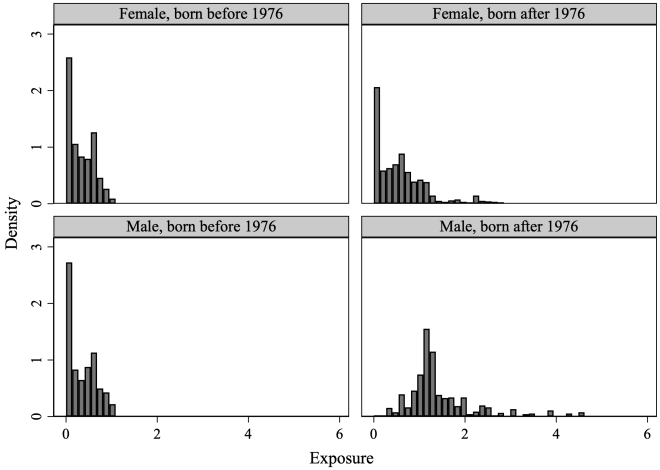
Double difference Event study

- First difference: group × province
- Second difference: cohort



Identification validity

Histogram of Second-child Penalty



Example: gender of the firstborn

Table 2: Examples of constructing the second-child penalty

Panel A.						
Province	Liaoning	Hubei	Liaoning	Hubei	Liaoning	Hubei
Year firstborn girl eligible	1985	1991	1985	1991	1985	1991
Birth year	1971	1971	1979	1979	1990	1990
Fine age 1	0	0	1.21	1.21	1.21	2.83
Fine age 2	0	0	1.21	1.21	5	2.83
Fine age 3	0	0	1.21	1.21	5	2.83
Fine age 4	0	0	1.21	1.21	5	2.83
Fine age 5	0	0	1.21	1.21	5	2.83
Fine age 6	0	0	1.21	1.21	5	2.83
Fine age 7	0	0	1.21	1.21	5	2.83
Fine age 8	1.21	1.21	1.21	0.94	5	2.83
Fine age 9	1.21	1.21	1.21	0.94	5	2.83
Fine age 10	1.21	1.21	1.21	0.94	5	2.83
Panel B. Second-child Penalty by gender of the firstborn						
Girl	0.36	0.36	0.61	1.13	0.00	0.00
Boy	0.36	0.36	1.21	1.13	4.62	2.83

Second-child Penalty

Example: ethnicity

Table 3: Examples of constructing the second-child penalty: ethnicity

Panel A.						
Province	Liaoning	Hubei	Liaoning	Hubei	Liaoning	Hubei
Year minority eligible	1988	2001	1988	2001	1988	2001
Birth year	1971	1971	1979	1979	1990	1990
Fine age 1	0	0	1.21	1.21	1.21	2.83
Fine age 2	0	0	1.21	1.21	5	2.83
Fine age 3	0	0	1.21	1.21	5	2.83
Fine age 4	0	0	1.21	1.21	5	2.83
Fine age 5	0	0	1.21	1.21	5	2.83
Fine age 6	0	0	1.21	1.21	5	2.83
Fine age 7	0	0	1.21	1.21	5	2.83
Fine age 8	1.21	1.21	1.21	0.94	5	2.83
Fine age 9	1.21	1.21	1.21	0.94	5	2.83
Fine age 10	1.21	1.21	1.21	0.94	5	2.83
Panel B. Second-child Penalty by ethnicity of the firstborn boy						
Minority boy	0.36	0.36	0.97	1.13	0.00	2.83
Majority boy	0.36	0.36	1.21	1.13	4.62	2.83

Second-child Penalty

Total effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Siblings	Any sibling	Good health	Height (sd)	Height top quintile	Schooling	HS completion
Farm × Penalty	-0.206*	-0.133***	0.099*	0.220**	0.144***	0.156	-0.026
	(0.109)	(0.046)	(0.056)	(0.109)	(0.052)	(0.367)	(0.049)
Low-skill × Penalty	-0.248**	-0.162***	0.081	0.172	0.139**	0.257	0.048
	(0.113)	(0.047)	(0.059)	(0.120)	(0.055)	(0.415)	(0.057)
High-skill × Penalty	-0.137	-0.109	0.145	0.206	0.181**	0.962	0.128*
	(0.162)	(0.067)	(0.089)	(0.190)	(0.090)	(0.585)	(0.076)
R^2	0.540	0.590	0.270	0.383	0.303	0.549	0.440
Mean dep var	1.471	0.771	0.589	0.015	0.216	8.351	0.245
Observations	2894	2894	2893	2807	2807	2894	2894
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Cognition	Land	Non-land	Employed	Occu score	High-skill	Urban *hukou*
Farm × Penalty	0.059	1.592*	2.657	0.112*	-0.619	-0.093	0.055
	(0.091)	(0.886)	(6.060)	(0.062)	(2.556)	(0.095)	(0.037)
Low-skill × Penalty	0.106	0.063	18.203***	0.070	1.813	-0.044	0.042
	(0.100)	(0.974)	(6.925)	(0.065)	(2.753)	(0.102)	(0.037)
High-skill × Penalty	0.219	0.282	-7.643	0.096	5.153	0.049	0.176**
	(0.148)	(1.541)	(15.534)	(0.090)	(3.945)	(0.133)	(0.080)
R^2	0.542	0.379	0.593	0.346	0.433	0.432	0.422
Mean dep var	0.000	4.663	48.767	0.618	39.941	0.113	0.174
Observations	2893	2851	2763	2845	1785	1757	2894

Timing of siblings

	(1)	(2)
	First sibling	
	before age 5	after age 5
Penalty ages 1–5	-0.109*	0.031
	(0.063)	(0.044)
Penalty ages 6–10	0.021	-0.089***
	(0.035)	(0.025)
Penalty birth year	0.099	-0.037
	(0.073)	(0.081)
Penalty 1–2 years before birth	-0.153	0.174
	(0.129)	(0.111)
Penalty 3–4 years before birth	0.060	-0.100
	(0.223)	(0.138)
R^2	0.470	0.279
Mean dep var	0.644	0.115
Observations	2894	2894

Identification validity

Effects on family size

	(1)	(2)	(3)	(4)	(5)	(6)
	Number of siblings		Any sibling		Any male sib	Any female sib
Penalty	-0.222**	-0.206*	-0.145***	-0.133***	-0.071*	-0.080
	(0.108)	(0.109)	(0.044)	(0.046)	(0.042)	(0.053)
		[0.234]		[0.036]		
Low-skill × Penalty		-0.042		-0.029		
		(0.061)		(0.030)		
		[0.859]		[0.836]		
High-skill × Penalty		0.069		0.024		
		(0.127)		(0.054)		
		[0.859]		[0.859]		
R^2	0.540	0.540	0.589	0.590	0.473	0.378
Mean dep var	1.471	1.471	0.771	0.771	0.553	0.478
Observations	2894	2894	2894	2894	2894	2894

Note: Sharpened FDR q-values in brackets.

Plots Total effects by parental occupation

Effects on children's health

	(1)	(2)	(3)	(4)	(5)	(6)
	Good health		Height (sd)		Height top quintile	
Penalty	0.093*	0.099*	0.199*	0.220**	0.143***	0.144***
	(0.054)	(0.056)	(0.112)	(0.109)	(0.050)	(0.052)
		[0.250]		[0.204]		[0.036]
Low-skill × Penalty		-0.018		-0.047		-0.005
		(0.035)		(0.060)		(0.039)
		[0.859]		[0.838]		[1.000]
High-skill × Penalty		0.046		-0.014		0.037
		(0.074)		(0.133)		(0.072)
		[0.859]		[1.000]		[0.859]
R^2	0.270	0.270	0.383	0.383	0.302	0.303
Mean dep var	0.589	0.589	0.015	0.015	0.216	0.216
Observations	2893	2893	2807	2807	2807	2807

Note: Sharpened FDR q-values in brackets.

Plots | Total effects by parental occupation

Effects on children's schooling

	(1)	(2)	(3)	(4)	(5)	(6)
	Years of schooling		Complete high school		Cognitive score (sd)	
Penalty	0.215	0.156	0.008	-0.026	0.082	0.059
	(0.376)	(0.367)	(0.051)	(0.049)	(0.092)	(0.091)
		[0.859]		[0.859]		[0.859]
Low-skill × Penalty		0.102		0.074**		0.047
		(0.223)		(0.036)		(0.058)
		[0.859]		[0.204]		[0.838]
High-skill × Penalty		0.806*		0.154***		0.160
		(0.432)		(0.052)		(0.115)
		[0.234]		[0.036]		[0.436]
R^2	0.549	0.549	0.437	0.440	0.542	0.542
Mean dep var	8.351	8.351	0.245	0.245	0.000	0.000
Observations	2894	2894	2894	2894	2893	2893

Note: Sharpened FDR q-values in brackets.

Plots | Total effects by parental occupation

Effects on children's household wealth per capita

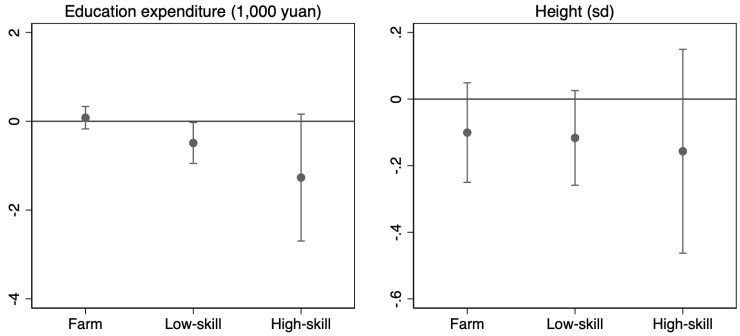
	(1)	(2)	(3)	(4)	(5)	(6)
			Nonland assets			
	Land value		Total		Housing	Financial
Penalty	0.936	1.592*	8.516	2.657	1.947	0.709
	(0.871)	(0.886)	(6.444)	(6.060)	(6.051)	(2.326)
		[0.249]		[0.869]	[0.995]	[0.836]
Low-skill × Penalty		-1.529***		15.547***	12.640***	2.906
		(0.555)		(4.072)	(3.745)	(1.776)
		[0.036]		[0.001]	[0.018]	[0.436]
High-skill × Penalty		-1.310		-10.300	-11.618	1.318
		(1.080)		(13.177)	(13.036)	(2.410)
		[0.567]		[0.838]	[0.838]	[1.000]
R^2	0.377	0.379	0.590	0.593	0.585	0.349
Mean dep var	4.663	4.663	48.767	48.767	42.776	5.991
Observations	2851	2851	2763	2763	2763	2763

Outcomes measured in 1,000 yuan (≈ 150 USD). Sharpened FDR q-values in brackets.

Plots | Total effects by parental occupation

Education and health investments

$$y_{itp} = \delta Anysibling_i + X_i\beta + V_t + W_p + \epsilon_{itp}$$



Notes: Coefficients on $Anysibling_i$ and 90% confidence interval by father's occupation
Sample: firstborn children aged between 10 and 15 in 2010 with a rural *hukou* at age 3 and at most one sibling

Education and health

Estimates adjusted by CFPS sample weights

	(1) Siblings	(2) Any sibling	(3) Excellent health	(4) Height (sd)	(5) Height top quintile
Penalty	-0.260*	-0.123**	0.147**	0.131	0.148**
	(0.137)	(0.057)	(0.069)	(0.121)	(0.060)
Low-skill × Penalty	0.016	-0.015	-0.008	-0.048	-0.041
	(0.086)	(0.049)	(0.045)	(0.075)	(0.041)
High-skill × Penalty	0.078	0.055	0.032	0.191	0.105
	(0.166)	(0.061)	(0.099)	(0.184)	(0.087)
	(6) Schooling	(7) HS completion	(8) Cognition	(9) Land	(10) Nonland
Penalty	-0.000	-0.035	0.066	1.391*	1.408
	(0.443)	(0.062)	(0.120)	(0.837)	(6.216)
Low-skill × Penalty	-0.020	0.065	0.074	-0.848	11.043***
	(0.269)	(0.044)	(0.077)	(0.647)	(4.258)
High-skill × Penalty	1.020*	0.138**	0.246*	-0.899	4.657
	(0.569)	(0.069)	(0.149)	(1.043)	(12.807)
	(11) Employed	(12) Occu score	(13) High-skill	(14) Urban *hukou*	(15) Income
Penalty	0.116	-2.527	-0.189*	0.016	3.066
	(0.075)	(3.195)	(0.106)	(0.049)	(2.274)
Low-skill × Penalty	-0.051	1.996	0.034	-0.021	1.282
	(0.045)	(1.706)	(0.046)	(0.030)	(1.245)
High-skill × Penalty	-0.018	6.925**	0.171*	0.147*	5.008*
	(0.081)	(3.056)	(0.099)	(0.086)	(2.796)

Robustness

Robustness checks

	(1) Siblings	(2) Any sibling	(3) Height (sd)	(4) HS completion	(5) Land	(6) Assets	(7) Employed	(8) High-skill	(9) Income
Panel A. Group-specific effects of socioeconomic development									
Penalty	-0.216*	-0.111**	0.244**	-0.030	2.104**	3.816	0.125*	-0.077	1.844
	(0.114)	(0.047)	(0.116)	(0.051)	(1.005)	(5.527)	(0.065)	(0.093)	(1.912)
Low-skill × Penalty	-0.039	-0.027	-0.042	0.076**	-1.561***	15.155***	-0.043	0.048	1.187
	(0.061)	(0.030)	(0.061)	(0.036)	(0.563)	(4.038)	(0.042)	(0.038)	(1.070)
High-skill × Penalty	0.067	0.023	-0.011	0.153***	-1.326	-10.240	-0.016	0.142*	4.214*
	(0.128)	(0.055)	(0.133)	(0.052)	(1.073)	(13.380)	(0.079)	(0.084)	(2.490)
R^2	0.542	0.592	0.386	0.442	0.381	0.595	0.348	0.433	0.501
Panel B. Interactions of the penalty with paternal education									
Penalty	-0.214*	-0.137***	0.215*	-0.038	1.689*	0.361	0.118*	-0.096	2.350
	(0.114)	(0.049)	(0.118)	(0.053)	(0.984)	(6.973)	(0.065)	(0.098)	(1.833)
Low-skill × Penalty	-0.037	-0.028	-0.051	0.074**	-1.499***	15.568***	-0.041	0.059	1.296
	(0.060)	(0.029)	(0.059)	(0.036)	(0.563)	(4.126)	(0.042)	(0.039)	(1.103)
High-skill × Penalty	0.097	0.026	-0.041	0.150***	-1.108	-11.515	-0.003	0.160**	4.819*
	(0.133)	(0.055)	(0.145)	(0.056)	(1.179)	(12.844)	(0.081)	(0.079)	(2.593)
Middle school × Penalty	0.017	0.008	0.008	0.029	-0.257	4.914	-0.012	0.033	-0.792
	(0.055)	(0.023)	(0.057)	(0.036)	(0.606)	(6.219)	(0.049)	(0.038)	(1.172)
High school × Penalty	-0.078	-0.009	0.057	0.006	-0.511	0.977	-0.031	-0.092	-1.542
	(0.135)	(0.049)	(0.117)	(0.053)	(0.825)	(8.160)	(0.059)	(0.069)	(1.749)
R^2	0.540	0.590	0.384	0.441	0.380	0.594	0.347	0.435	0.501
Mean dep var	1.471	0.771	0.015	0.245	4.663	48.767	0.618	0.113	15.675
Observations	2894	2894	2807	2894	2851	2763	2845	1757	2724

Robustness

Alternative exposure measures

	(1) Siblings	(2) Any sibling	(3) Height (sd)	(4) HS completion	(5) Land	(6) Assets	(7) Employed	(8) High-skill	(9) Income
Panel A. Measuring Second-child Penalty using only second-child permit eligibility									
Ineligibility	-0.298	-0.230**	0.440*	0.000	3.144	16.530	0.164	-0.110	1.670
	(0.319)	(0.108)	(0.246)	(0.110)	(1.933)	(19.089)	(0.166)	(0.145)	(3.708)
Low-skill × Ineligibility	-0.124	-0.044	-0.088	0.091	-1.932*	31.504***	-0.110*	0.029	3.930*
	(0.135)	(0.054)	(0.118)	(0.069)	(1.075)	(9.296)	(0.065)	(0.075)	(2.055)
High-skill × Ineligibility	0.135	0.050	-0.171	0.196*	-0.914	10.579	-0.051	0.175	7.875**
	(0.234)	(0.099)	(0.222)	(0.100)	(1.540)	(22.418)	(0.123)	(0.154)	(3.868)
R^2	0.540	0.589	0.383	0.440	0.378	0.594	0.346	0.431	0.501
Panel B. Considering the requirement of a minimum 3-year spacing									
Penalty^s	-0.206	-0.144***	0.240*	-0.030	1.786*	4.300	0.130*	-0.090	1.695
	(0.133)	(0.052)	(0.123)	(0.058)	(0.999)	(6.892)	(0.070)	(0.101)	(2.085)
Low-skill × Penalty^s	-0.055	-0.042	-0.031	0.083**	-1.542**	16.690***	-0.040	0.056	1.379
	(0.066)	(0.031)	(0.063)	(0.037)	(0.606)	(4.501)	(0.044)	(0.038)	(1.135)
High-skill × Penalty^s	0.028	-0.004	-0.029	0.162***	-1.331	-10.882	-0.021	0.148*	4.174*
	(0.130)	(0.053)	(0.137)	(0.053)	(1.161)	(13.990)	(0.082)	(0.086)	(2.518)
R^2	0.540	0.590	0.383	0.442	0.380	0.594	0.346	0.433	0.501
Panel C. Variation in high penalty only									
Penalty × $\mathbb{I}$(Penalty ≥ 1)	-0.198**	-0.088**	0.178*	-0.021	0.867	4.666	0.092*	-0.020	1.148
	(0.099)	(0.040)	(0.095)	(0.041)	(0.740)	(5.492)	(0.052)	(0.066)	(1.598)
Low-skill ×	-0.060	-0.042	-0.027	0.093***	-1.234**	14.191***	-0.049	0.054*	1.018
Penalty × $\mathbb{I}$(Penalty ≥ 1)	(0.054)	(0.027)	(0.054)	(0.032)	(0.503)	(4.067)	(0.037)	(0.033)	(0.969)
High-skill ×	0.050	0.019	-0.016	0.145***	-1.116	-19.174	-0.027	0.182**	3.360
Penalty × $\mathbb{I}$(Penalty ≥ 1)	(0.123)	(0.053)	(0.107)	(0.047)	(0.945)	(13.188)	(0.074)	(0.079)	(2.298)
R^2	0.540	0.590	0.383	0.443	0.379	0.595	0.347	0.435	0.500
Mean dep var	1.471	0.771	0.015	0.245	4.663	48.767	0.618	0.113	15.675
Observations	2894	2894	2807	2894	2851	2763	2845	1757	2724

Robustness

Effect on labor market outcomes

	(1) Occupational status	(2) Urban residential status	(3) Income
Penalty	-0.619	0.055	2.051
	(2.556)	(0.037)	(1.815)
Low-skill × Penalty	2.432*	-0.014	1.210
	(1.379)	(0.023)	(1.072)
High-skill × Penalty	5.772**	0.121*	4.208*
	(2.927)	(0.069)	(2.485)
R^2	0.433	0.422	0.500
Mean dep var	39.941	0.174	15.675
Observations	1785	2894	2724

[a] Treiman's Standard International Occupational Prestige Scale (1977) ranging from 1 to 100, a higher score means more power and privilege
[b] Income measured in 1,000 yuan (≈ 150 USD)

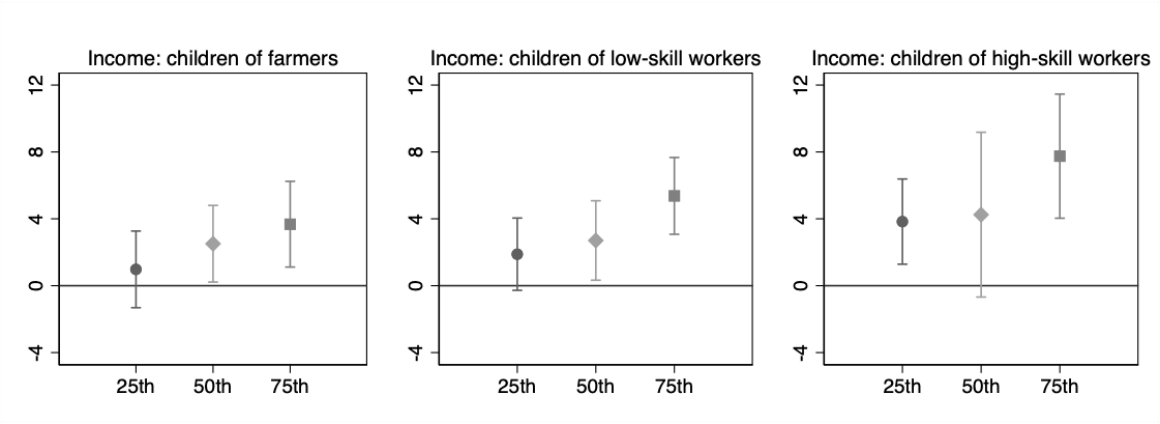
Plots

Intergenerational income correlation

	(1) Income of the children
Penalty	0.809
	(2.122)
Computed income of father × Penalty	0.116*
	(0.069)
R^2	0.500
Observations	2724

Labor market outcomes

Distributional effects on labor income



Labor market outcomes

Distributional effects on labor income

	(1)	(2)	(3)
	Conditional percentiles of lifetime income		
	25th	50th	75th
Farm × Penalty	0.977	2.509*	3.677**
	(1.392)	(1.393)	(1.558)
Low-skill × Penalty	1.885	2.705*	5.370***
	(1.314)	(1.444)	(1.396)
High-skill × Penalty	3.833**	4.249	7.746***
	(1.549)	(2.995)	(2.255)
Diff (Low-skill - Farm)	0.908	0.196	1.694**
	(0.980)	(0.816)	(0.761)
Diff (High-skill - Farm)	2.857***	1.740	4.069
	(1.071)	(3.143)	(2.610)
R^2	0.037	0.038	0.039
Observations	2724	2724	2724

Differences in family types and birth order

	(1)	(2)	(3)	(4)	(5)
	Educational attainment				
	Years	Primary	Lower secondary	Upper secondary	Height (sd)
Farmer × First child	0.766	0.055	0.130**	0.079	-0.059
	(0.512)	(0.050)	(0.067)	(0.053)	(0.116)
Non-farmer × First child	-0.299	-0.021	-0.010	-0.014	-0.042
	(0.630)	(0.054)	(0.076)	(0.076)	(0.155)
R^2	0.284	0.192	0.254	0.172	0.066
Mean dep var farm	7.141	0.770	0.509	0.155	0.046
Mean dep var non-farm	9.337	0.903	0.760	0.314	0.208
Observations	523	523	523	523	513

Sample: all children born in rural China between 1966 and 1975 in two-child families

Back

Only provinces without strong son preference

	(1)	(2)	(3)	(4)	(5)	(6)
	Siblings	Any sibling	Any male sib	Any female sib	Height (sd)	HS completion
Penalty	-0.237	-0.175***	-0.101*	-0.086	0.339**	-0.047
	(0.149)	(0.067)	(0.057)	(0.070)	(0.139)	(0.060)
Low-skill × Penalty	0.005	-0.005	-0.048	0.022	-0.018	0.093**
	(0.068)	(0.033)	(0.030)	(0.032)	(0.072)	(0.038)
High-skill × Penalty	0.087	0.035	0.010	-0.000	0.010	0.149***
	(0.135)	(0.057)	(0.063)	(0.066)	(0.152)	(0.057)
R^2	0.599	0.640	0.496	0.421	0.433	0.467
Mean dep var	1.451	0.739	0.523	0.460	-0.027	0.262
Observations	1869	1869	1869	1869	1816	1869
	Land	Assets	Employed	Occu. score	High-skill	Income
Penalty	1.712	10.038	0.115	-1.240	-0.122	3.233*
	(1.132)	(8.046)	(0.085)	(2.898)	(0.104)	(1.855)
Low-skill × Penalty	-1.764**	16.047***	-0.035	2.356	0.044	1.005
	(0.687)	(5.242)	(0.053)	(1.610)	(0.041)	(1.214)
High-skill × Penalty	-0.975	-11.624	0.001	5.146	0.083	4.667
	(1.304)	(16.620)	(0.093)	(3.894)	(0.102)	(3.023)
R^2	0.422	0.625	0.367	0.440	0.449	0.499
Mean dep var	4.889	52.196	0.623	39.807	0.115	16.210
Observations	1843	1782	1830	1160	1140	1759

Robustness

Distributional effects of OCP on years of schooling

	(1)	(2)
	Dep var: Log(income)	
Measures of human capital:	Years of schooling	Height (sd)
Human capital	0.057***	0.036
	(0.007)	(0.029)
Low-skill × Human capital	0.001	-0.003
	(0.008)	(0.031)
High-skill × Human capital	0.022*	0.006
	(0.012)	(0.055)
Middle school × Human capital	-0.009	0.001
	(0.009)	(0.040)
High school × Human capital	0.022	-0.020
	(0.014)	(0.061)
R^2	0.225	0.152
Observations	3353	3322

Back

Distributional effects on on years of schooling

Quantity and quality | Opportunity cost

Distributional effects of OCP on years of schooling

	(1)	(2)	(3)
	Years of schooling		
	Conditional percentile		
	25th	50th	75th
Farm × Penalty	0.102	-0.277	-0.679*
	(0.264)	(0.378)	(0.413)
Low-skill × Penalty	0.571	0.131	-0.224
	(0.367)	(0.414)	(0.420)
High-skill × Penalty	1.568**	0.755	0.115
	(0.618)	(0.506)	(0.436)
Diff (Low-skill - farm)	0.468**	0.408	0.455
	(0.232)	(0.312)	(0.325)
Diff (High-skill - farm)	1.466**	1.032***	0.794***
	(0.635)	(0.318)	(0.279)
R^2	0.135	0.137	0.139
Observations	2894	2894	2894

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