Health Gradients and Intergenerational Transmission by SES

Evidence from Imperial China

Karen Eggleston,
Stanford University and NBER
Wolfgang Keller and Carol Shiue,
HKUST, U. Colorado, CEPR and NBER

karene@stanford.edu

American Economics Association
Philadelphia

January 3, 2025

Overview

Introduction

Contributing to the economics of the health gradient

- Most evidence on the health-status gradient (aka Preston Curve) and intergenerational transmission focuses on 20th-century West.
- Previous studies of China tend to focus on the elite and special settings (e.g. Lee et al. 1994, Maystadt and Migali 2021, Chen and Preston 2022).
- Using matched lifespan-status data on multiple generations, we study the evolution and reproduction of the health-status gradient in a 1298-1775 sample from Central China (Anhui province, Tongcheng).
- Our sample with majority commoners captures a fuller span of the status distribution.
- Chinese civil service exam: distinctive setting where male educational attainment directly conveys social status – not hereditary, open to a wide swath of the population.

Background

Chinese Genealogies as a Source of Information

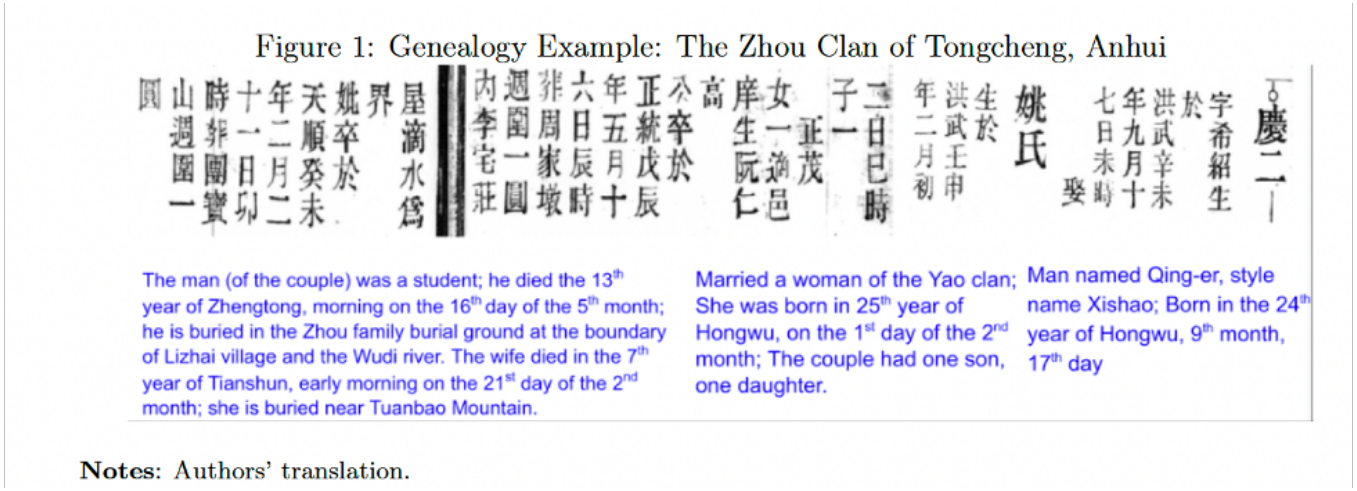


Figure 1: Genealogy Example: The Zhou Clan of Tongcheng, Anhui

The man (of the couple) was a student; he died the 13th year of Zhengtong, morning on the 16th day of the 5th month; he is buried in the Zhou family burial ground at the boundary of Lizhai village and the Wudi river. The wife died in the 7th year of Tianshun, early morning on the 21st day of the 2nd month; she is buried near Tuanbao Mountain.

Married a woman of the Yao clan; She was born in 25th year of Hongwu, on the 1st day of the 2nd month; The couple had one son, one daughter.

Man named Qing-er, style name Xishao; Born in the 24th year of Hongwu, 9th month, 17th day

Notes: Authors' translation.

Figure 1: Genealogy Example (Shiue and Keller 2024)

- To achieve a reasonably representative sample, we select the genealogies of 7 clans (N 40,000 men, women, and children, patrilineally linked).
- Compile sample to target the fact that most of the population had no social status ("commoner") while top-status holders may have been around 2 percent.
- For analysis of selection and bias, see our appendix, Shiue (2025).

Data

- Records lifespan, lifetime highest achievement on civil service exam.
- Our 4 status categories measure SES by educational titles, position, indicators of wealth.
- Enables tracking intergenerational mobility in both status and health as measured by lifespan.

Table 1: Summary Statistics

	N	Mean	Standard Deviation	Min	Max
Lifespan	4,656	52.39	15.50	16	91
Status (Percentile)	4,753	0.50	0.23	0.35	0.97
Total Number of Sons	4,753	2.12	1.61	0	10
Birth Year	4,754	1703.52	67.69	1298	1775
Year of Death	4,656	1755.66	69.82	1348	1856

Average lifespan by status: Married men (1298-1775)

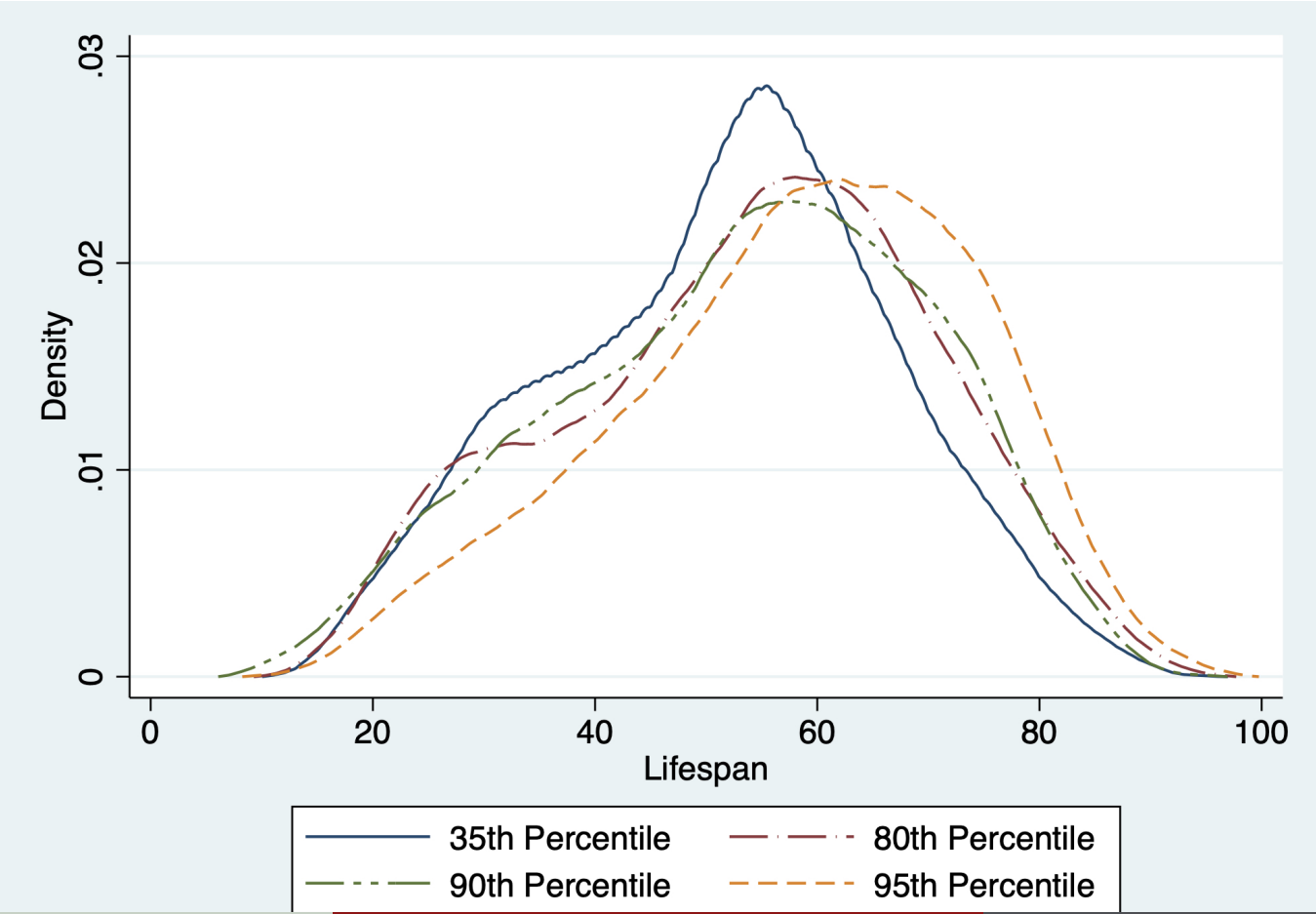
Table 2: Status Groups and Lifespan

Status	Description	Percentile	N	Fraction of Sample	Lifespan (Mean)
1	No Status	0.354	3,368	0.709	51.41
2	Village head, multiple consecutive marriages, relative of minor official	0.782	693	0.146	53.79
3	Wealthy farmer, landowner, or merchant; scholar; official student	0.893	363	0.076	53.39
4	Graduates of the civil service examination at local, provincial (*juren*), and national (*jinshi*) level, high government officials	0.965	329	0.069	58.22
Total			4,753	1.000	52.39

Notes: Authors' calculation. Percentile of status is mid-point of status group; e.g. with 70.9% of men in the lowest status class, the mid-point is $(0 + 0.709)/2 = 0.354$. Social status coding informed by Chang (1955, 1962), Ho (1962) and Telford (1986, 1992). Number of observations (N) is for social status.

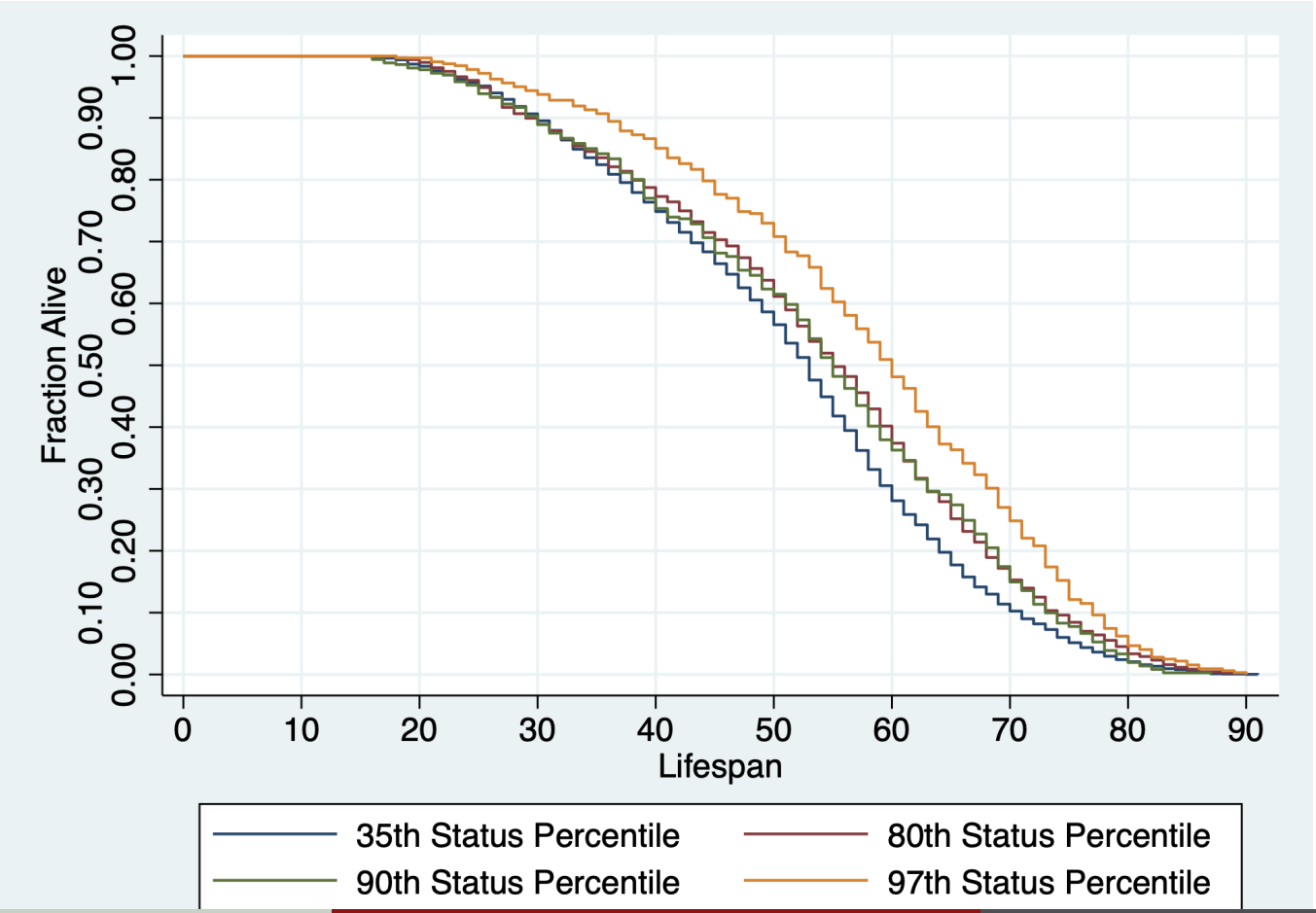
The Health-Status Gradient

- High-status men have a 22 percent higher probability of living past 50 than low-status men.
- The predicted change in lifespan for a man moving from lowest to highest status (0 to 100th percentile) is about seven years.

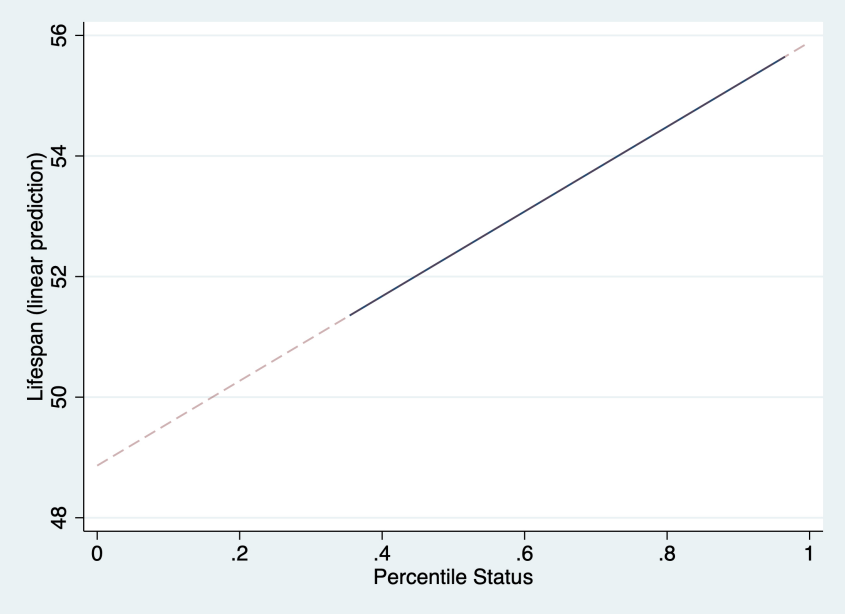


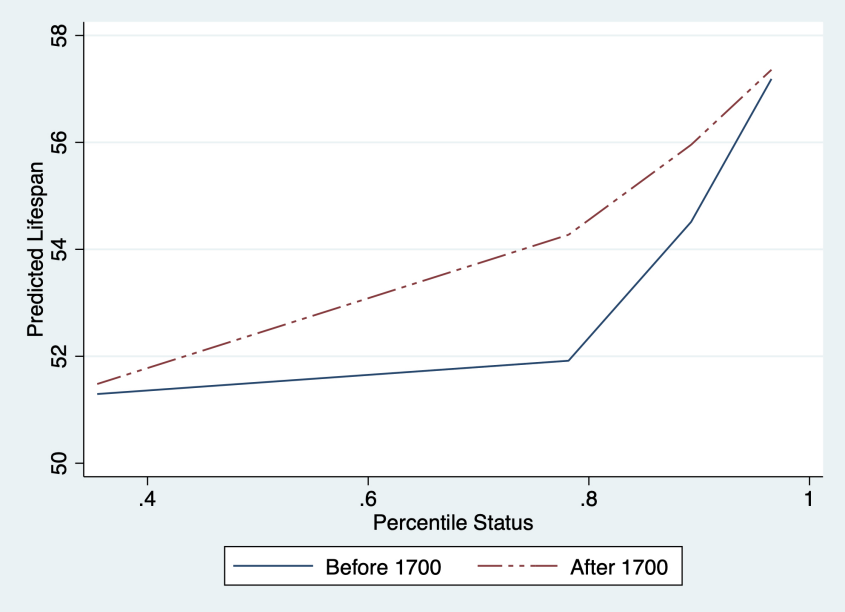
Kaplan-Meier survival estimates by status

- Chance of surviving to age 50: 0.72 for highest-status men, whereas only 0.58 for low-status men.
- Spans the 0.67 chance of survival to age 50 (conditional on surviving to age 15) for men born in England and Wales in 1841-1844 (HMD).



Linear and non-linear gradient over time





Fractional polynomial fit

The Health-Status Gradient among Married Women

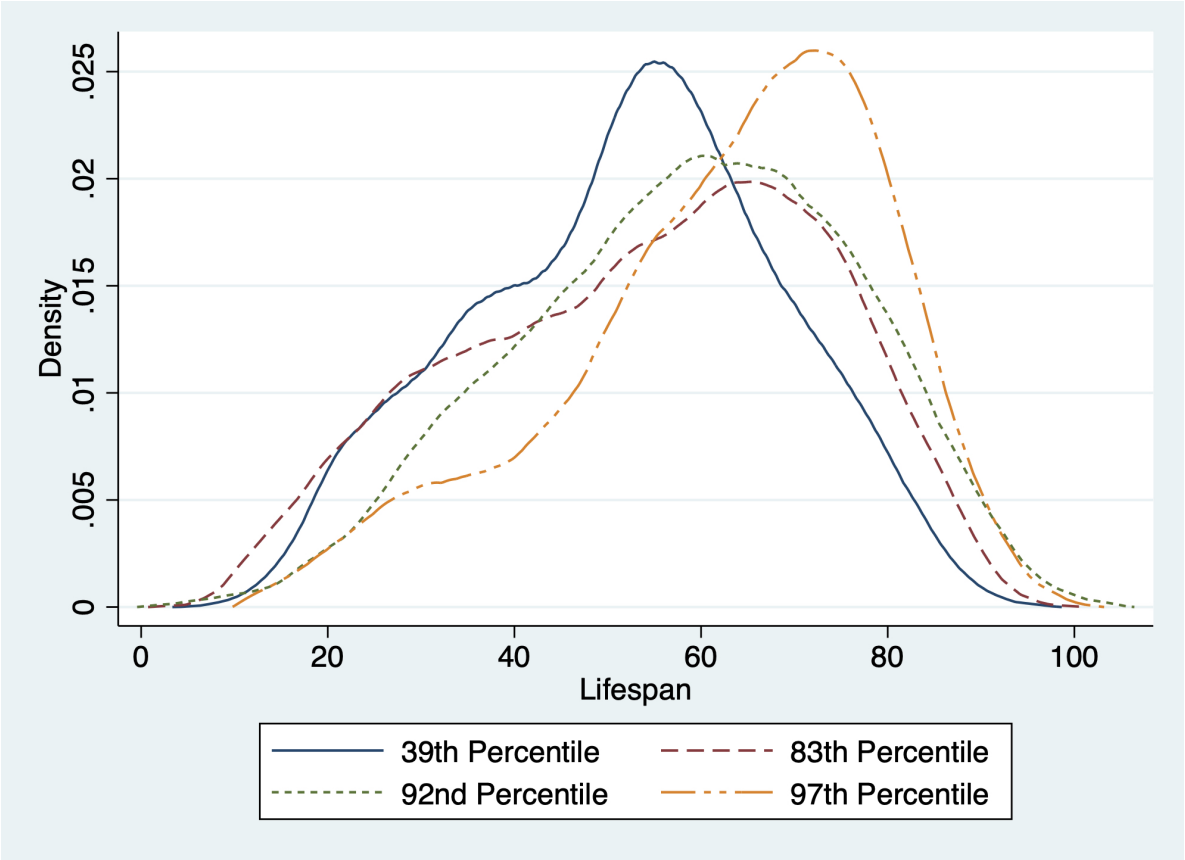


Figure 4: Wife Lifespan and Husband Status

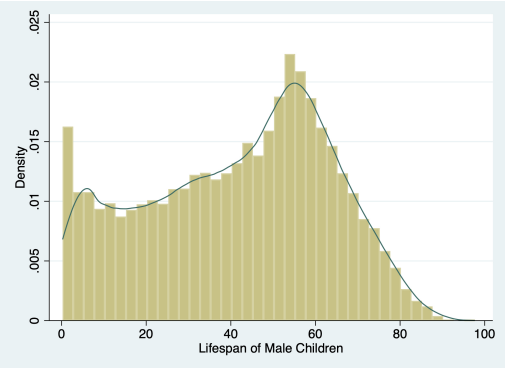
- With a premium of almost 11 years for the highest compared to the lowest status group, the health-status gradient for women is steeper than for men (7 years difference).

Gradient in child mortality

Table 4: Mortality Rates of Sons

	N	One Year or less (12 months)	Five Years or less	Ten Years or less	Fifteen Years or less
34th Percentile Status	6,460	0.84	6.72	12.40	17.76
76th Percentile Status	1,447	1.11	7.32	12.65	16.10
88th Percentile Status	749	0.53	6.01	9.88	12.55
96th Percentile Status	745	0.13	2.95	4.56	6.58
All	9,401	0.80	6.46	11.62	16.20

Notes: Mortality rates given in percent. number of sons for which father status is available: n = 9,401.



In England and Wales, male S(10/1) declined from 17.8 percent in 1841-44 to 8.8 in 1900-1904, comparable to the difference in under-ten mortality between a commoner (12) and a high-status son (5).

Intergenerational correlation in lifespan

- Suggestive that health may have played an important role intergenerationally, especially for higher-status households endeavoring to protect or improve their status.
- Controlling fertility to invest more in each son – the quantity-quality trade-off – is less risky if child mortality can be kept low (and the mother would be more likely to survive the childbearing years to invest in the son's early education, enhancing cultural transmission).
- Shiue (2017) shows a negative correlation between fertility and education when the return to education was high; Shiue and Keller (2024) explore Q-Q trade-off in elite families' recovery from devastation of Ming-Qing transition.
- We confirm status persistence is much higher than lifespan persistence (0.6 versus 0.15).
- Mother-son lifespan correlation stronger than father-son.
- Lifespan persistence for top status families is higher than for commoners.

Intergenerational transmission

	(1)	(2)	(3)	(4)	(5)
Father Lifespan	0.062**	0.063**	0.060**		
Mother Lifespan				0.095***	
Parent Lifespan					**0.176*** **
Son Birth Year FE		Y	Y	Y	Y
Father Birth Year FE		Y	Y		Y
Mother Birth Year FE				Y	Y
Clan FE			Y		
N	1,896	1,889	1,889	1,737	1,662

Figure 5: Intergenerational Lifespan Mobility Regressions, 1675 - 1775

- Dep var is son lifespan in years; parent lifespan defined as average of mother and father lifespan; sample is all sons in birth cohorts where mother, father, and son reach at least 15 years.
- Magnitude closely matches that found by Black et al. (2024) in the US 1880-1920 cohorts.

Intergenerational transmission over time

- Intergenerational health persistence declined over time.
- IG status persistence much higher (0.67) and also declined over time.

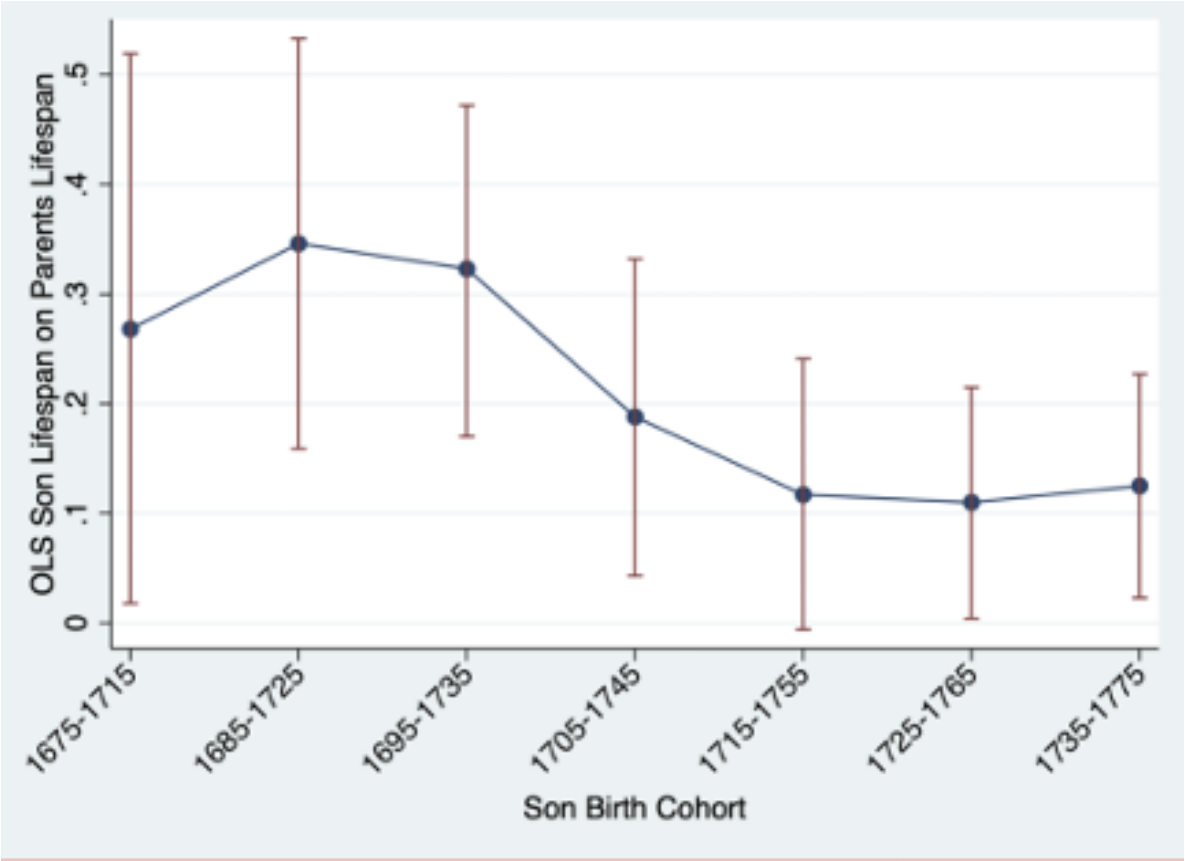


Figure 6: Relative Lifespan Mobility: Regressions for Rolling 40-Year Windows

Conclusion

- Evidence from pre-demographic-transition Asia is sparse.
- Maystadt and Migali (2021) study intergenerational health transmission of elite military in China over a later period (the long 19th century). However, they do not document status gradients, intergenerational status mobility, nor the relationship between health and status persistence, as we do.
- We document an evident gradient in adult lifespan in the 1600s and 1700s
- Status was also somewhat protective of survival for children, implying that the overall health-status gradient in life expectancy was larger than for adult lifespan.
- We estimate intergenerational health transmission of 0.18, remarkably similar to that found for the late 19th and early 20th century US (Black et al. 2024) and contemporary Taiwan (Chang et al. 2024).

Conclusion (cont.)

- We are not aware of any previous studies analyzing intergenerational status and health persistence over multiple generations and their relationship to the health-status gradient for a given generation.
- Our estimates confirm that mothers are especially salient for intergenerational health transmission and that lifespan information from both parents is important for obtaining unbiased intergenerational mobility estimates.
- Findings support 2-way causality gradient, perhaps especially that poor health limited earning potential and exam performance (e.g., health shocks reinforcing cycles of illness-induced poverty).
- "Well-being" mobility – e.g. proxied with 'full income' of years lived at a given per capita income – appears to have long been higher than status persistence.
- Ongoing research: role of clan, brothers, lifespan resilience to downward mobility, shocks like Ming-Qing transition