The Beckerian and the Darwinian Trade-off of Children in Chinese Families: Transmission of Fertility across Generations in China, 1400-1900 (Extended Abstract).

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1. Introduction

The paper studies the survival of Chinese families and the strategies applied to achieve the continuity of bloodlines in the long run. Two different kinds of trade-off are examined in the paper, the Darwinian trade-off, i.e. the trade-off between parental/grand-parental fertility and next-generation fertility, and also the Beckerian trade-off, i.e. the quantity-quality trade-off of offspring.

High fertility does not always translate directly to high survival. David Lack (1954) first demonstrates the existence of regulations in a “natural population” in the evolution of both birds and mammals. Later being developed into the life-history theory, the trade-off between fertility and different biological traits, aiming at increasing survival rates, has long been studied by biologists and zoologists in animal and human societies (Stearns, 1989; 1992; Strassmann and Gillespie, 2002). Economists and demographers have also managed to examine this kind of Darwinian trade-off between survival and fertility. With the genealogical data of half a million residents from four generations in Quebec, Galor and Klemp (2014) insist that a moderate fecundity, but not a high fecundity, coupled with a higher level of education was more conducive for the continuity of lineages, and the representation of these individuals has also increased in the total population in a gradual way. Similarly, Song, Campbell, and Lee (2015) also point out that the “family reproductive strategies” of the higher status people in Qing China was not to maximize the numbers of male descendants in each generation, but to minimize the possibility of extinction of the family. They also find from the imperial lineage and the farming population in rural Liaoning that the male family founders with higher social characteristics would raise chances of the continuity of these specific patrilines, and these families also experienced higher growth rates in family size.

In terms of the Beckerian trade-off, it is one of the key features described in the modern economic world. Becker (1960) first inserts fertility decision into the economic analysis and argues that parents would sacrifice the number of children they could have for higher quality of their children. Since that, there is an extensive amount of empirical literature attempting to show evidence to this argument. In the Chinese setting, Qian (2009) and Li, Zhang and Zhu (2008) both study quantity-quality trade-off of children in contemporary China. Shiue (2016) tests the hypothesis for the pre-modern Chinese context and finds that the trade-off existed before 1800 and disappeared afterwards.

To contribute to the previous literature, the paper exploits a new genealogical dataset that contains more than 35,000 males in six Chinese lineages from 1400 to 1900 and mainly addresses the following research questions: Did the two types of trade-off exist in Chinese families? What were the shared characteristics of the survived descent lines? Did Chinese parents sacrifice the number of children they produced to invest more into the quality of the children?

2. Data

In Ming (1368-1644) and Qing (1644-1911) China, lineages were the most widespread and long-lasting social organizations. In a society that attached great importance to the maintenance and expansion of the patrilines, keeping genealogical records became common practice for most of the lineages to remind the offspring of their family history. The primary data used in this paper comes from genealogical books of six lineages in Southeast China. Of the six lineages, three of them are ordinary families and three of them are elite ones. Theoretically speaking, each male family member had his own mini-biography in the genealogical book, which enables us to identify his name (s), birth order in his male siblings and in the generation, birth and death dates, social status records, number of wives and their surnames, birth and death dates, and most importantly, the number of sons he had. Due to the strong son preference in imperial China, information about daughters are highly under-recorded in the genealogies. Table 1 shows the basic information of the genealogical books used in the paper.

Table 1 Basic Information of Genealogies by Lineage

Lineage	Huang	Que	Zhou	Gu	Zha	Zhuang	Total
Number of volumes	4	16	4	32	24	16	96
First compilation year	1487	1664	1598	1286	c.1500	1572	/
Last compilation year	1846	1928	1947	1876	1909	1875	/
Compilation times	6	5	12	12	9	10	/
Average length between compilations (years)	59.8	52.8	29.1	49.2	45.4	30.3	/
Period covered	c.1300-1846	c.1300-1920	c.1200-1946	c.1100-1876	1325-1905	c.1350-1875	/
Number of generations	17	25	28	22	20	20	/
Male entries	1,411	8,957	1,059	16,536	5,078	4,581	37,622
Males with birth years	777	6,998	702	6,454	4,552	4,074	23,557
Individuals with birth and death years	685	4,236	679	5,087	3,260	2,340	16,287

The structure of the lineage organization also enables us to distinguish different branches with different paternal heads in the same lineage. It is a common practice of lineages to be divided into different branches (*pai*) starting from a certain generation. Different branches with paternal heads of different social status could largely affect the survival of the branch in the long run, despite that they were from the same lineage. I can identify the shared characteristics among the survived branches, and also among the extinct ones.

Table 2 Segmentation in the Zhou, Huang, Que, and Zha Lineages

Lineage	Branch division time	No. of branches
Zhou	Generation 6	5
Huang	Generation 4	10
Que	Generation 5	4
Gu	Generation 16	16
Zha	Generation 6	18
Zhuang	Generation 9	8

Note: 1. There were in total 10 people in the 6th generation of Que lineage, only 7 of them left offspring. 2. The 6th generation of Zha lineage had 31 people in total, but 13 of them left no offspring, so only 18 branches were formed afterward.

3. Methodology

In order to test the Darwinian trade-off, I will first show the number of descendants of each paternal head in each branch and the number of generations that the branch survived. I will then follow the methods in Kaplan et al. (1995) to test the relationship between the number of children and the number of grandchildren. I will run regressions based on the following equation:

$$N\_Grandsons_i = \alpha + \beta_1 N\_Sons_i + \beta_2 N\_Sons_i^2 + \delta P + \varepsilon, \ (1)$$

where *N_Grandsons* is the total number of grandsons a male had, *i* denotes male individuals. α is the constant. *N_Sons* is the number of sons a male had, and *N_Sons2* is the squared term of *N_Sons*. *P* is a set of control variables that also affected the number of grandsons, including whether the male was educated or not, and the birth cohort and lineage fixed effects. ε is the error term. If the trade-off did exist, a negative β_2 would be expected, as it means that the relationship between the number of sons and the number of grandsons is not linear. After achieving a certain number of sons, having more sons would decrease the number of descendants in the next generation.

To examine the Beckerian child quantity-quality trade-off, I will run a Probit regression based on the following equation:

$$EDU_C = \alpha + \beta_1 Size + \beta_2 EDU_F + \delta W + \varepsilon, \ (2)$$

where EDU_C is a dummy variable denotes the educational attainment of the male individual; it equals one when the male was educated. α is the constant, and *Size* is the number of brothers a male had (including himself) in the family. EDU_F is a dummy variable indicates the father's educational attainment. *W* denotes all the control variable, including the birth order of the male, whether the male survived to adulthood or not, whether he was out-migrated or not, the birth cohort fixed effect and the lineage fixed effect. ε is the error term. Similar to the previous model, if the trade-off existed, a negative β_1 would be existed, as it represents that the parents choose between the quantity and the quality of their sons. The summary statistics of all the variables used in the two models are presented in Table 3.

Table 3 Summary Statistics

Statistics	N	Mean	Std.	Min	Max
Number of sons	35,677	1.131	1.302	0	12
Number of grandsons	35,344	1.071	2.153	0	50
Education	35,682	0.031	0.173	0	1
Father education	35,682	0.085	0.279	0	1
Number of brothers	34,829	2.574	1.491	1	12
Birth order	35,617	1.760	1.090	1	12
Out-migration	35,691	0.005	0.068	0	1
Survival to adulthood	35,691	0.911	0.285	0	1
Birth cohort	34,140	5.187	0.982	1	7
Lineage	35,691	3.830	1.351	1	6

Source: The lineage sample.

4. Preliminary results

Preliminary results suggest that branches with a high social class paternal founder could have more descendants and survive for more generations compared to the ones with a low social class founder. I also cannot find clear evidence to support the existence of Beckerian trade-off in the six Chinese lineages from 1400 to 1900.

Figure 1 compares the number of male descendants over generations of high-social-class paternal heads and that of low-social-class paternal heads in one of the elite lineages I investigate in the paper, the Zha lineage. As expected, branches with high-social-class founder could survive longer and have more male descendants in total.

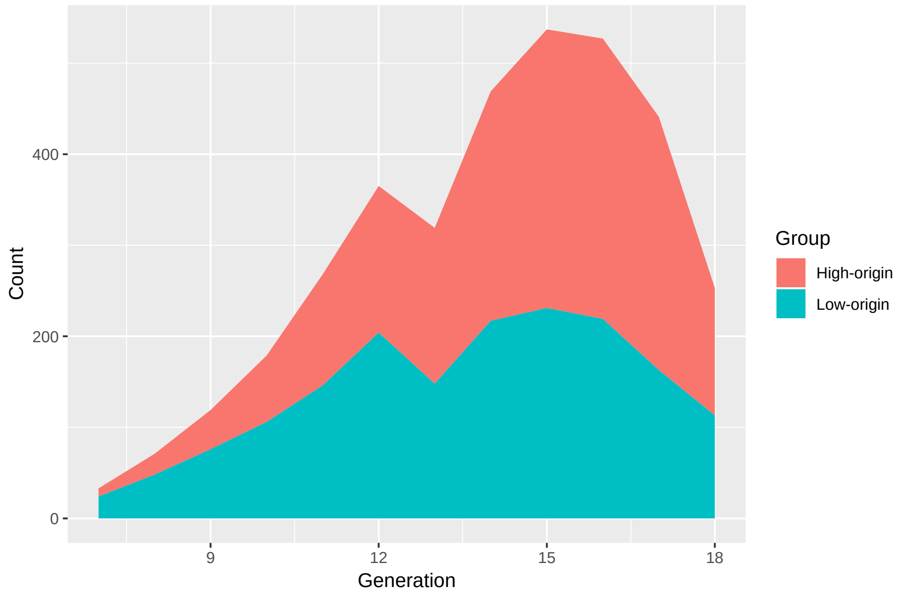

Figure 1 Number of descendants over generations, high and low social class paternal heads.
Note: It is a stacked area plot.

Preliminary results from the regression based on Equation (1) show that there is no trade-off between number of sons and number of grandsons (see Table 4a). The coefficients on the number of sons and the squared term of number of sons are positive and statistically siginificant, both before and after conditioning on the control variables. The results indicate that having more sons would result in more grandsons in the six lineages. Results of the Probit regression based on Equation (2) also suggest no clear evidence on Beckerian quality-quantity trade-off of children (see Table 4b). Father's education plays the key role in determining whether the male individual is educated or not, and the coefficients on number of brothers are always positive and significant in all columns.

Table 4a OLS Regression on the Number of Grandsons

	Dependent Variable:		
	Number of Grandsons		
	(1)	(2)	(3)
Number of Sons	0.817***	0.625***	0.611***
	(0.056)	(0.059)	(0.059)
(Number of Sons)^2	0.048***	0.072***	0.071***
	(0.016)	(0.016)	(0.016)
Education			0.842***
			(0.092)
Controls			
Birth cohort FE	N	Y	Y
Lineage FE	N	Y	Y
Constant	0.014	0.905***	0.821***
	(0.018)	(0.182)	(0.183)
N	35,344	33,821	33,821
R^2	0.377	0.409	0.413

Note: 1. Robust standard errors are in parentheses. 2. *p<0.1; **p<0.05; ***p<0.01.

Table 4b The quantity-quality relationship, Probit Regression

	Dependent Variable:			
	Education			
	(1)	(2)	(3)	(4)
Number of brothers	0.085***	0.026***	0.026**	0.047***
	(0.008)	(0.009)	(0.010)	(0.011)
Father's education		1.507***	1.188***	1.201***
		(0.030)	(0.039)	(0.039)
Controls				
Birth order	N	N	N	Y
Out-migration	N	N	N	Y
Survival	N	N	N	Y
Birth cohort FE	N	N	Y	Y
Lineage FE	N	N	Y	Y
Constant	-2.117***	-2.244***	-2.133***	0.019***
	(0.028)	(0.030)	(0.210)	(0.005)
N	34,829	34,829	32,406	32,406
Pseudo R^2	0.011	0.201	0.260	0.268

Note: 1. Robust standard errors are in parentheses. 2. *p<0.1; **p<0.05; ***p<0.01.