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Three Essays on Chinese Population

By

Yi Zhou

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Committee in charge:

Professor Ronald Demos Lee, Chair
Professor Alan Auerbach
Professor Jennifer Johnson-Hanks
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Abstract

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How can we interpret the demographic behaviors in Chinese society, whose culture is quite different from the West? To what extent can these behaviors be explained with existing theoretical frameworks? Or do we need to modify these frameworks or even create new ones? To shed lights on these questions, I conducted three quantitative studies using Chinese data samples. Each study investigates a specific question. Using the Great Famine as a natural experiment, the first essay examines the causal link between education at young ages and cognitive abilities in elder life. I find that the unexpected occurrence of famine deprived millions of educational opportunities at that time, which in turn resulted in long-term consequences for mental health and cognition. The second essay also focuses on the cognitive functions of elder adults in China through a discussion about the role of political connections, measured with a dummy variable indicating whether at least one of each respondent's children is politically employed. The empirical results confirm the beneficial effect of having a cadre child, which partially works through the channel of encouraging social interaction. In the last essay, I examine how a girl's educational attainment is associated with her given name. The given name may reveal the expectations of parents and also affect girls' self-aspirations. By constructing three quantitative indices for each given name based on its relative frequency in different groups, I show that girls with a more educated, urban, male-sounding name are more likely to attend junior high school.

To my parents, Hua Zhou and Fengzhen Chen, and my wife, Xiao Xiao,
for their constant support and unconditional love.
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1. Introduction

As high-quality data on Chinese households becomes increasingly available, we today have more resources to unveil the factors shaping behaviors among various Chinese demographics. For example, the China Health and Retirement Longitudinal Study (CHARLS), similar to the Health and Retirement Study (HRS) in United States, collects nationally representative data samples that have been used to inform scientific research on the elderly in China since 2011. Empirical studies on Chinese population not only help scholars and policymakers understand this most-populous country better, but also make contributions by exploring some universal (cross-cultural) scientific questions. For example, the Great Famine happened in the period of 1959-1961 has been widely used as a natural experiment for identifying the causalities of different research questions.

My dissertation is composed of three empirical-based essays, all of which use data samples from the Chinese population. The first two essays investigate social determinants of differences in cognitive aging in the context of Chinese societies. The third essay uses quantitative measures to explore the role of parental attitudes in the accumulation of daughters' human capital based on the names they choose for their daughters.

The first essay (Chapter 2) explores whether educational attainment has a cognitive reserve capacity in elder life. Whether the education of youth protects people from the loss of cognitive abilities in later years is a classic research question in social epidemiology. The largest challenge for causal identification is the potential endogeneity that highly-educated people may be different from less-educated people in dimensions that can't be observed with survey data. Using pilot data from the China Health and Retirement Longitudinal Study (CHARLS), I revisit the impact of education on cognitive abilities in old age. OLS results showed that respondents who completed primary school obtained 18.2 percent higher scores on cognitive tests than those who did not. I then constructed an instrumental variable (IV) by leveraging data from China's Great Famine of 1959-1961 as a natural experiment to estimate the causal effect of education on cognition. Two-stage least squares (2SLS) results provided sound evidence that completing primary school significantly increases cognition scores, especially in episodic memory, by almost 20 percent on average. Moreover, Regression Discontinuity (RD) analysis provides further evidence for the causal interpretation, and shows that the effects are different for the different measures of cognition explored here. The results also show that the Great Famine resulted in long-term health consequences through the pathway of lost educational opportunities rather than through the pathway of nutrition deprivation.

The second essay (Chapter 3) investigates whether children's political success contributes to social stratification and health inequality among older adults. In most developing countries, including China, local cadres possess considerable power affecting many aspects of a normal citizen's life. People have more incentives to interact with the parents of cadre children than with other parents. And a number of previous studies have

confirmed that the frequency of social interactions is positively associated with cognitive function at older ages. Using China Health and Retirement Longitudinal Study (CHARLS) data, I investigate whether having a cadre (i.e. politically employed) child substantially increases overall cognitive functioning among older adults. The findings show that the beneficial effect on cognitive functioning of having a cadre child is equivalent to a 1.5-year increase in education, even after controlling for other variables related to general intelligence. This positive effect is more salient among parents of higher-ranking cadre children, and in less-marketized regions. The results of a Sobel test suggest that about one fifth of the effect can be explained by increased social interaction.

In the last essay (Chapter 4), I investigate the link between a girl's given name and her educational attainment. The striking increase in female schooling is a revolutionary change that has affected many parts of the world. Most of the previous studies on this topic focus on the forces of markets and institutions, such as industrial change and compulsory education laws. The roles of parental attitudes and girls' career aspirations were undervalued and sometimes dismissed as "unobservable selectivity". However, parents' and girls' "taste" for a particular lifestyle may play an important role, and given names may reveal the expectations of parents and affect girls' self-aspirations. Using data from 2005 Chinese Population Census, I construct three quantitative indices for each name based on its relative frequency in different groups (high/low education, rural/urban, male/female). Names related to flowers or beauty are scored lower than those related to intelligence in these indices. The regression results show a consistent trend that girls with more educated, urban, male-sounding names are more likely to attend junior high school. About sixty percent of the effects remain after the variables of parents' socio-economic characteristics are controlled. On the other side, I find negative correlations between name indices and the number of younger siblings. According to the quantity-quality tradeoff theory, it suggests that the increase in female school participation is partially caused by parental choices, and the given name can reveal parental attitudes. The predictive power of the given name still exists in the subsample of households with two or more daughters after adding household-level fixed-effects, which implies the effects of the given name may also play a role by changing girls' career aspirations.

All the essays investigate demographic behaviors empirically based on data samples of the Chinese population, yet each essay can seem independent of the others. But in fact, these essays are linked in some senses. The first two essays share the same key dependent variable, which puts them both in the same branch of literature. On the other side, the second and third essays attach great importance to the role of family in determining individuals' social status. As Hammel (1990) stated: "Culture may explain why the population of a geographic region or linguistic area continues to behave demographically in much the same way over time, even though economic conditions change" (page 495). Overall, in the context of Chinese culture, these essays collectively portray how individuals react to social changes and explore the consequences of their behaviors.

2. Effects of Education on Cognition at Older Ages: Evidence from China's Famine

2.1 Introduction

Aging populations present an unprecedented challenge all over the world. Demographic changes have brought renewed focus to the health of elderly people, both physically and mentally. *Cognition*, an important measure of mental health, refers to mental processes that involve several dimensions, including thinking part of cognition and includes memory, abstract reasoning and executive function, and the knowing part, which is the accumulation of influence from education and experience. (McArdle et al., 2002). A growing literature in economics shows that cognition is closely linked to an older person's wealth and quality of life. For example, cognition has great impact on financial outcomes and retirement saving trajectories in later life, through a fundamental role in decision making and rational thinking (Glymour et al., 2008; Smith et al., 2010; Banks et al., 2011). The ability to make decisions and think in a rational way is increasingly important today as state provision declines (Banks & Mazzonna, 2012).

The relationship between education and the cognitive capacities of elderly people is interesting not only for policymakers but also for further academic research. The positive correlation between education and cognitive capacity at advanced ages has already been well established in the literature (Zhang, 1990; Stern et al., 1994; McArdle & Woodcock, 1998; Arvanitakis et al., 2003). However, most of these studies have limited contribution to policymaking because the causal relationships involved are ambiguous, and the earlier literature mainly focuses on data from developed countries, which leaves a number of open questions: Does the education-cognition association hold in developing countries such as China? Which dimension of cognition benefits most from educational attainment? Additionally, is there any causal effect of education on cognitive abilities at older ages?

Due to endogeneity problems arising from reverse causation, as well as unobservable factors that may be correlated with cognition and education (e.g., inherent ability), few studies have investigated the causal link, with the exception of Glymour et al. (2008) and Banks and Mazzonna (2012). Both studies used compulsory school laws (CSLs) as exogenous shocks to education to identify the causal effects of schooling on cognitive abilities at older ages, although they adopted different approaches. Despite looking at two different regions and using two separate methodologies, the results of the two studies are quite consistent: Education has a positive and significant causal effect on the cognitive abilities of older people, especially on memory.

This paper investigates the relationship between education and cognition at older ages in China by using data from the pilot survey of the China Health and Retirement Longitudinal Study (CHARLS). To begin with, we examine the association between cognition and education in an OLS framework, and find that primary school completion is strongly correlated with higher cognitive abilities. We then leverage the sudden and unexpected drop of total school enrollment in China caused by the Great Famine of 1959-1961, which forced millions of children to drop out of primary school, to investigate the causality. Since children usually entered school at seven or eight years old and primary

schooling lasted five years during that time, we thus constructed an instrument for primary school completion—an indicator variable which equals to one if the respondents were born between 1948 and 1953 (treatment group), and zero otherwise (control group). We then conducted the 2SLS estimation, and the results indicated that education has a remarkable and significant causal effect on cognition. Specifically, primary school completion leads to about a 20 percent increase in cognitive test scores among our respondents.

One concern is that famine potentially has differential effects on the health of children at different ages, so its overall effect will have been different on the treatment group and the control group, depending on the stage of development when they suffered serious malnutrition. Moreover, Grantham-McGregor et al. (2007) found that famine had a much greater effect in terms of malnutrition on young children aged below five than on children older than five. If famine has different effects on health in the treatment group and control group, then the IV estimation would be biased because the IV is also linked to the dependent variable (cognitive abilities) through the pathway of childhood health. We conducted a RD design to address the potential problem by setting the threshold at the year of birth being 1948 (that is, people who were aged twelve in 1960) and selected proper bandwidths to avoid including those aged below five when the famine took place. Consistent with 2SLS, estimates from RD design provide evidence for the causality from education to cognition.

This study overcomes important limitations in the previous studies investigating causality in the education-cognition nexus (Glymour et al., 2008; Banks & Mazzonna, 2012). In particular, the respondents in the two studies cited were so old that differential mortality patterns by various cohorts may have driven their results. In comparison to their samples, the individuals in CHARLS were much younger since the oldest individual in our treatment group was only 61 years old when the survey took place.

Moreover, our study contributes to a growing literature on the long-term consequences of China's Great Famine. The use of famine as a "natural experiment" for epidemiologic research purpose can date back to the classic study on the 1944-1945 Dutch Hunger Winter (Stein et al., 1975) and more recent studies on the Dutch Famine (Susser & St. Clair, 2013). In recent years, studies of China's 1959-1961 famine and its long-term consequences on mental illness emerged (St. Clair et al., 2005; Song et al., 2009; Huang et al., 2013). However, in contrast to previous studies that mainly focused on the direct effects of malnutrition during pregnancy or early childhood on outcomes in later life, this study investigates the indirect consequences of famine from interrupted everyday life and schooling. Our results suggest that the respondents, who were in their primary school years during the famine, suffered substantially from impaired cognitive functioning due to limited access to educational resources in their youth.

2.2 Background

Following decades of independent research in neuroscience and social science, Beckman (2007) summarized the ways the architecture of the brain and the process of skill formation are influenced by an interaction between genetics and individual experience. In this process, schooling plays a key role. Scrams et al. (2006) find that "[m]ore education trains people to have more efficient circuits of synaptic connectivity or

more efficient of alternative brain network." In both neuroscience and social science, established strands of the literature have established the relationship between education and cognitive abilities.

A large number of studies in the neuro-scientific literature has been done to investigate the role of education and the risk of symptoms of some "organic and progressive" diseases such as Alzheimer's disease (AD) and dementia, focusing either on the way education affects the risk of contracting a disease or the way it affects the severity of the symptoms once people are diagnosed and examined. Most literature on the first topic concludes that less educated people face a higher risk of developing Alzheimer disease or dementia (Stern et al., 1994; Zhang, 1990). Recently, Caamaño-Isorna et al. (2006) reexamined the relationship between education level and the risk of dementia using a meta-analytic methodology. Based on 19 observational studies published before October 2005, they confirm a negative relationship. Other researchers look at the relationship between education level and rates of cognitive decline in patients with Alzheimer's disease. Amid a heated debate, firm results came in Arvanitakis et al. (2003), which provided direct evidence of the link between education and cognition rates in AD patients. Unlike in previous studies, researchers in this study were able to observe brain slides from 130 elderly Catholic clergymen who made tissue donations to the study directly. They found that education actually modifies the relationship between AD pathology and the level of cognitive function: Patients with more years of education require a stronger pathology to reach any level of cognitive impairment (Arvanitakis et al., 2003). However, such neurological studies have significant limitations. The sample sizes are usually small. Most individuals in the sample are patients, and hence the results may not be able to explain normal cognitive declines in the absence of pathology. Importantly, most studies do not address the causal link between education and cognition.

In contrast to neuroscientists, social scientists typically take a more statistical approach to the issue, applying regression analysis to survey data with large sample sizes to measure cognitive performance. Most of the studies that are conducted by social scientists support the view that early education is positively associated with cognitive function late in life (c.f., Zhang, 1990; Stern et al., 1994; McArdle & Woodcock, 1998; Arvanitakis et al., 2003). This conclusion has been replicated in a number of countries. In the United States, people raised in higher socioeconomic communities display better cognitive functioning when in old age (Bennett et al., 2006). Using data from the UK, Singh-Manoux et al. (2005) find that childhood SEP (a measure of socioeconomic status) has few positive effects on cognitive aging directly, but it has a substantially positive "indirect effect" mediated by education and adult socioeconomic status. Studies about the causal link between education and cognition have only recently begun to appear. Two of them, as mentioned above, are Glymour et al. (2008) and Banks and Mazzonna (2012). They exploited the exogenous CSL changes in the U.S. and UK, respectively, to identify treatment effects on the treated. Both of these causality studies dealt with developed countries.

We argue that the education-cognition nexus is more critical in poor nations, where educational resources are limited and compulsory education laws either do not exist or cannot be enforced effectively. Under such circumstances, the opportunity to receive an education depends upon a family's allocation of resources as well as regional and societal

resource allocation—especially across genders, ethnicities, regions and social classes. Regardless of the way educational resources are distributed, inequality in access to education breeds new inequalities. This process has long-term consequences, including differences in cognitive functioning.

2.3 Data

The data we employed originates from the 2008 wave of the China Health and Retirement Longitudinal Study (CHARLS) pilot survey, which was conducted in Zhejiang and Gansu provinces in China. CHARLS is a survey of the elderly in China, based on a sample of households with members aged 45 years or above. It attempts to set up a high-quality public micro-database, which can provide a wide range of information from socioeconomic status to health conditions, to serve the needs of scientific research on the elderly (Zhao et al., 2009). The pilot survey collected data from 95 communities/villages in 32 counties/districts, covering 2,685 individuals living in 1,570 households. The CHARLS pilot sample is representative of people aged 45 and over living in households in Gansu and Zhejiang provinces. The CHARLS pilot sample was randomly drawn in four stages (county, neighborhood, household and respondent levels). If one member of a household aged 45 or over is sampled, then his or her spouse is also included without regard to his or her age. Up to now, this dataset has been used in a number of academic studies on health of the elderly in China (Lei et al., 2012; Smith et al., 2012; Huang et al., 2013). In this study, we limited our empirical analysis to the respondents at least 45 years of age who completed the cognitive tests. We also excluded from the study those who were born during and after Great Famine (1959-1961), because these groups are greatly affected by the Great Famine (Meng & Qian, 2009; Chen & Zhou, 2007).

2.3.1 Measures of Cognition

Cognition refers to mental processes that involve several dimensions (McArdle et al. 2002; Cunha & Beckman, 2008). There is a four-page questionnaire in CHARLS to test respondents' cognitive functioning. Following previous literature (Lei et al., 2012; McArdle et al., 2007), we rely on four measures of cognition functioning in this paper: Telephone Interview of Cognitive Status (*TICS*), words recall, draw a figure successfully and one overall measure (cognition):

• **TICS:** There are ten questions in this part, from awareness of the date (using either the solar or lunar calendar), the day of the week and season of the year, to successively subtracting 7 from 100. The TICS score is based on the number of correct answers. This is a measure of the mental capacity of the respondent, ranging from zero to ten.

• **Words recall:** Interviewers read a list of ten nouns, and respondents were asked immediately to recall as many of the words as they could in any order. About ten minutes later, after the respondents had finished measurements of self-reported depression, numeracy and drawing, they were asked again to recall as many of the original words as possible. This test measures episodic memory. We averaged the number of correct answers as our dependent variable, which ranges from zero to ten. However, 188 out of 1,635 respondents skipped the words recall section because they did not understand what the interviewers were testing, due to dialect or cognitive reasons. We treated those who skipped this session as missing in following analysis, but the results and conclusions still

hold when we assume that the scores of words recall for these people are zero.

• **Draw a figure successfully:** In the survey, a picture of two overlapped pentagons is shown, and the respondents were asked to replicate the figure as similarly as possible. Interviewers would then score the answer as 1 if the respondent successfully performed this task, and 0 if they failed to do so.

• **Overall Cognition:** This is an overall measure of respondents' cognitive function. We used the sum of all three above measures to represent the respondent's cognitive status as a whole, ranging from zero to twenty-one.

2.3.2 Education

In the CHARLS questionnaire, respondents are asked, "What is the highest level of school you have completed?" The original answers are classified into 11 categories: "Illiterate," "Did not finish primary school but capable of reading and/or writing," "Home school," "Elementary school," "Middle school," "High school," "Vocational school," and four higher levels. Due to the low education level of our respondents, we define "more educated" as those who have completed elementary school (Yes = 1). Years of education may be a better measure, but the pilot CHARLS does not provide this information.

Due to the relatively low education level in China, previous literature using CHARLS usually categorized education into four groups: illiterate, some primary school/can read or write, finish primary school, and junior high or above (Lei et al., 2012; Huang et al., 2013; Strauss et al., 2012). There are a number of reasons why we chose to use primary school completion only. The first reason is because we aim to establish the causality between education and cognition and our strategy only allows us to construct a single variable for education. The second reason is because primary school is the earliest stage of education and as children usually went to school at age 7, we can more accurately figure out who is in the eligible age range for primary school during the Great Famine (More details can be found in Section 2.4.3). The third reason is because during that period, most of the children were able to go to primary school but many of them dropped out or stopped during or after primary school since there was no compulsory schooling law and parents/children could make decisions to continue education or not. This provided rich variation for our analysis below.

Table 2-1 presents the summary statistics. Column 1 shows results for the full sample, while columns 2 and 3 report those of male and female subsamples, respectively. Panel A shows the statistics for cognition, which presents a fairly substantial variation across the cognition measures in our sample. Panel B reports those for basic demographic variables and socioeconomic variables. Statistics present a very low education level attained by our respondents, with only with 55 percent of men and 25 percent of women having completed primary school. The average age of the full sample is 61.4, and most of them are married (82%).

Since the relation between education and cognition is of central interest in this study, Table 2-2 sheds some light on it by comparing cognition measures in the more educated group with those in the less educated group by gender. The statistics show that those who completed primary school did much better in cognition tests than those who did not, and the magnitude is even greater in female sample.

2.4 Empirical Results

2.4.1 Baseline Estimation and Endogeneity Problem

To analyze the impact of education (primary school completion) on cognition at older ages, we first estimated the following equation:

$$(1)\ Cog_{ij} = \beta_0 + \beta_1 Primary_{ij} + \beta_2 X_{ij} + \gamma_1 Age + \gamma_2 Age^2 + \rho_j Pref_j + \varepsilon_{ij}$$

in which i and j index for individual and prefecture, respectively. We denoted with Cog_{ij} the individual i's cognitive ability, which may be TICS, words recall, draw a figure successfully or cognition. $Primary_{ij}$ is the indicator of whether the individual i completed primary school. The coefficient of $Primary_{ij}$, β_1, is of central interest because it directly represents how much the cognition of respondents with higher education is higher than that of those in the lower education group. We denoted by X_{ij} the covariates that may influence both education and cognition together and those that may increase estimation power, which included gender (male = 1), marriage status (married = 1), height in centimeters, urban residency (yes = 1), and whether the individual was born during the Great Famine (yes = 1). Height is controlled because it is highly correlated with children's health and nutrition status (Fogel, 1994), which is also strongly correlated with education status (Case, 2008). Age and Age^2 are age and age squared, respectively. We added prefecture dummies $Pref_j$ in all regressions to capture prefecture-level fixed effects since there is severe regional segregation in China (Strauss et al., 2012; Huang et al., 2013),

Panel A of Table 2-3 presents OLS estimation for β_1. All of the coefficients of primary school completion are substantial and significant at 1% in all cognition measures. Specifically, the change from not completing to completing primary school is associated with an increase of more than 20 percent in overall cognitive ability. Furthermore, positive association between primary school completion and cognitive abilities are found in subsamples by gender or type of living residency, though the results are not provided here. However, though many covariates are controlled for, these coefficients cannot be interpreted as causal effects because there exist potentially other unobservable confounding factors. For example, individuals with higher inherent ability when they were children (or younger) might be more likely to achieve higher educational attainment and to have better cognitive function when they are older. OLS estimation would overestimate the effects of education on cognition if this is the case. To address this problem, we used both two-stage least squares (2SLS) and regression discontinuity (RD) design to estimate the causal effects of completing primary school on cognitive abilities of the older people. Both methods exploit the exogenous shock to education from China's Great Famine of 1959 -1961.

2.4.2 Exogenous Shock: China's Great Famine

In 1958, the vast "Great Leap Forward" movement was launched, and all rural residents were organized into People's Communes that typically contained thousands of households. This forced collectivization backfired badly. Over the following three years, grain production dropped sharply and a great famine took hold in nearly every region of

China. Several studies were conducted to determine the factors responsible for the famine. Among the most commonly cited are "bad weather, excessive procurement by the state, delayed response to the food shortage, weakened production incentives due to the sweeping collectivization program in 1958, and resource diversion as a result of massive industrialization" (Chen & Zhou, 2007).

This nationwide famine caused an unprecedented number of deaths, with the worst of the famine hitting in 1960. Lin and Yang (2000) show that the gross mortality rate rose sharply in 1959 and reached its peak (approximately 25 per thousand) in 1960. In addition, the Great Famine not only brought an unprecedented number of deaths but also caused malnutrition and social disorder. The long-term consequences of malnutrition on the survivors have been studied in several recent articles (you may wish to cite some recent article references here). Moreover, there are a number of studies discussing the long-term effects (especially on health outcomes) of the Great Famine on the survivors, and these studies find that the effects of malnutrition are extremely acute for people who were infants during the famine (Chen & Zhou, 2007; Almond et al., 2007; Meng & Qian, 2009). A similar conclusion also comes out of studies of the Greek famine from 1941 to 1942 (Neelsen & Stratmann, 2011).

However, very few studies address the long-term consequences of social disorder resulting from famine. One aspect of social disorder was the impact on education supply: Schools closed, teacher attendance declined, and students spent more time farming. As a result, children left their schools and lost opportunities to invest in their own human capital. Hannum (1999) found that school enrollment during the famine declined sharply, and he concluded that it "stemmed from both school closings and hardships." From Figure 2-1, we can observe that enrollment numbers dropped sharply during the famine, especially in 1960, when the Great Famine was at its peak. This result supports the hypothesis that the famine significantly affected educational attainment.

2.4.3 Instrumental Variable (IV) and 2SLS

An estimation strategy similar to ours is that by Lequien (2011), which used World War II as an exogenous shock on French educational attainment. While similar in some senses, famine can be distinguished from war as an instrumental variable. First, the Great Famine was almost completely unexpected. As Lin (1990) shows, China's agricultural output kept growing at 3-4% per year from 1952-1958, and the growth rate in 1958 was 2.8%. That growth reverted to a 14% contraction in 1959 and a further 13% decline in 1960. Second, China's *hukou* (household registration) system placed strong constraints on population mobility across counties in the whole country, rendering it difficult for people to escape the Great Famine by moving. Third, the Compulsory Education Law was not established in China until 1986, and before that, households had the choice of whether or not to continue sending their children to school.

In this paper, respondents who were of primary school age during the famine were categorized as the treatment group. During that period, children usually entered school at seven or eight years old and the primary schooling lasted five years, and thus the treatment group included respondents who were born between 1948 and 1953. Therefore, we coded the instrument as 1 if a respondent is in the treatment group, and 0 otherwise. A valid instrument must satisfy two criteria. The first is to be correlated with the

endogenous variable. In other words, the Great Famine must exert some influence on some of the respondents' educational attainments. Figure 2-2 illustrates this effect by plotting the adjusted primary school completion rate according to year of birth. The dashed lines are from a linear fit, and solid lines are estimated through *lowess* smoothing with bandwidth 0.9. Educational attainment is clearly lower for those born between 1948 and 1953 in comparison to both preceding and succeeding cohorts, although there is no significant difference between the post-1953 and pre-1953 birth cohorts.

The second criterion is that the instrument should not be linked to cognition through channels other than education. The main concern in this regard is that the Great Famine may physically affect cognitive functioning through malnutrition. To establish the validity of our instrumental variable, we plot height against year of birth for men and women in Figures 2-3a and 2-3b, respectively. Since height is a good measure of childhood health, we should expect that the famine-stricken cohorts are shorter than the control group, if the respondents in our treatment group suffered physical damage due to famine. However, we found height to be fairly continuous for the full periods, and especially at the cutoff points (1948 and 1953) and between them, for both male and female samples. Additionally, height is controlled for in all of the regressions to capture health effects in childhood. However, one may argue that the Great Famine may bias the IV results by influencing respondents' childhood health in the treatment group and the control group in ways that may not be reflected in height because mean height may be influenced by the scar effects and selection effects of famine (Meng & Qian, 2009). This means that the height of those suffering from famine may be higher (selection) or shorter (scar) than those who are not influenced by famine. To address this problem, we employed the RD method in Section 2.4.4.

Figure 2-4 can be viewed as the intuitive reduced from the results for our IV estimation. It plots the overall measure of cognitive ability over year of birth, adjusted by age and gender. Beyond confirming the validity of our instrument, it provides additional evidence for the effect of education on cognition in later life, with cognition levels falling sharply in the post-1948 cohorts. The average cognition level of the "treatment group" is also below that of post-1953 cohorts. Similar to Figure 2-2, there is no significant difference in cognition when comparing the individuals born before 1953 and those after that.

Based on the validity of the instrument constructed above, we estimated the effect of education by two-stage least squares (2SLS):

(2-1) $$Primary_{ij} = \pi_0 + \pi_1 Birth^{1948-1953} + \pi_2 X_{ij} + \theta_1 Age + \theta_2 Age^2 + \delta_j Pref_j + \eta_{ij}$$

(2-2) $$Cog_{ij} = \alpha_0 + \alpha_1 \widehat{Primary}_{ij} + \alpha_2 X_{ij} + \mu_1 Age + \mu_2 Age^2 + \tau_j Pref_j + e_{ij}$$

in which equation (2-1) is the first stage, and we denoted by $Birth^{1948-1953}$ the instrument variable constructed as above, with η_{ij} being the new error term. $\widehat{Primary}_{ij}$ represents the predicted values from estimating Equation (2-1), and the other variables are as described above.

The first two columns in Table 2-4 report first-stage results in two slightly different samples: One includes those who skipped the word recall test, and the other excludes them. The results are quite similar. On average, respondents born between 1948 and 1953

are about 14 percent less likely to finish primary school, with all the other covariates controlled for. Both of the exclusive F-test statistics for the instrument in the two samples are over 26, with both p-values being below 0.001. The second stage results are reported in Panel B of Table 2-3. The coefficients of primary school completion are all positive in every dimension of cognition, and they are significant at the 10 percent significance level except when the dependent variable is TICS, supporting positive causality from education to cognition. Specifically, completing primary school brings about a substantial increase in cognition of 2.23, with a magnitude of 20 percent of the mean value. The coefficients of education in 2SLS are slightly larger in scale compared to the OLS estimation in Panel A, partly because it is the Local Average Treatment Effect (LATE) that we estimated: Those whose schooling choice was influenced by famine were more likely to be poorer respondents with lower socioeconomic status, and thus the marginal effect of education could be potentially greater.

It may be a problem that very old individuals (i.e., those over 75) are included in control group, which may bias our IV estimation by unobservable cohort effect or mortality selection. To avoid this and to test our model's robustness, we omitted those born prior to 1935 and performed the 2SLS estimation once more. Columns (3) and (4) in Table 2-4 present the first-stage results, and Panel C in Table 2-3 shows the second-stage estimation. All of the results are consistent with those from the full sample, and the estimated effects of education on cognition are even greater and more significant.

2.4.4 One Step Further: Regression Discontinuity (RD) Design

However, 2SLS may still suffer from other problems. Notably, the instrument may be correlated with cognitive abilities directly because, as Grantham-McGregor et al. (2007) note, the effects of malnutrition are most severe in individuals who are under five years of age. Though there is no direct evidence for such an effect in the data we presented in Figures 2-3a and 2-3b, we still cannot rule out this possibility due to the scar effect and selection effect of the famine (Meng & Qian, 2009). Furthermore, the 2SLS may be biased due to the inclusion of those youngsters in the control group.

To address the problem, we leveraged the RD design implicit in the enormous social disorder brought by Great Famine to measure its impact on education and cognitive ability at older ages. The RD design was developed more than five decades ago and has been used successfully to test the causal nature of relationships in economics literature (Lee & Lemieux, 2010). Above all, by estimating the effect of education at the neighborhood of thresholds, RD addresses the problem that famine may have different effects in the control group and the treatment group since the effect of famine can be viewed as homogenous in a relatively small neighborhood. Second, we may address the mortality selection issue and famine's heterogeneous effect problem at the same time by choosing an appropriate threshold and neighborhood without very old respondents in the survey or without young children during the Famine. Third, RD results also provide additional evidence for the causal interpretation between education and cognition when compared to those in 2SLS.

As already explained, birth years including and between 1948 and 1953 are two potential thresholds for our RD estimation. Those born just before 1948 are more likely to complete primary school than those born just after, as those born just after were more

likely to drop out of school due to the Great Famine. Similarly, those born just after 1953 should have higher a probability of completing primary school than those born just before 1953. Figure 2-2 also sheds some light on this effect, but the difference between respondents born before 1953 and those born just after 1953 is not significant. The reason may be twofold. First, children born just before 1953 were still very young when the Great Famine ended in 1962. Some of them were likely to go back to primary school afterwards and complete it. Second, children born between 1954 and 1959 were less than six years old when the Famine took place, so they potentially suffered directly from the famine more than those born before 1953. Due to these potential problems, we use only birth year 1948 as the threshold in this section. Actually, Figures 2-2 and 2-4 provide separate tests as to whether the Great Famine caused a discontinuous change in primary school completion and cognition. In addition, the RD methodology requires that the respondents cannot choose to be in the treatment group or the control group exactly around the threshold (Imbens & Lemieux, 2008; Lee & Lemieux, 2010). This condition holds in our case, since children clearly did not choose their birth year and, at the time of conception, parents could not have foreseen that a famine would affect their children years later.

In practice, we estimated the following equations for the RD design:

$$(3-1)\ \ Primary_{ij} = \pi_0 + \pi_1 Birth^{1948+} + \pi_2 X_{ij} + F(Age) + \theta_j Pref_j + v_{ij}$$

$$(3-2)\ \ Cog_{ij} = \alpha_0 + \alpha_1 \widehat{Primary}_{ij} + \alpha_2 X_{ij} + F(Age) + \vartheta_j Pref_j + u_{ij}$$

in which $Birth^{1948+}$ is an indicator variable equal to one for respondents born after 1948. $F(Age)$ is a polynomial in the age of 2008, which includes age, age square, and age cubic. Actually, the results are robust to the degree of the polynomial: All of the results are consistent when we only use linear and square terms of age for $F(Age)$. The definitions of other variables are same as in Equations (2-1) and (2-2). We used 2SLS to estimate the Equations (3-1) and (3-2) and Table 2-6 presents RD estimates for α_1. Different panels show the results with different bandwidths. Above all, despite the small sample size, we find some evidence for the causal effect of education on cognitive abilities in our RD results, especially in the "words recall" column, given that two out of three coefficients are significant at the 10 percent level. Second, the estimates from RD are consistent with those in Table 2-3 only with slight differences. The reason may be that the RD results are based on a smaller sample and are even more "local" because they only apply to respondents born around 1948. Finally, all of the coefficients are positive except for Column (1). This is also consistent with previous results since there is no evidence for the effect of education on TICS in Table 2-5, either. Third, across the rows the estimates are similar, suggesting that our RD model is robust to changes in bandwidth.

Therefore, it is reasonable to conclude that education has a substantial positive effect on cognition. The effects on different measures of cognition, however, are varied. Accounting for the fact that cognition is multidimensional, the composition and structure for each dimension may be different (McArdle et al., 2002). For example, our results suggest that the enhancement of TICS may depend more on inborn endowments than on education, while for episodic memory it may be possible to rely relatively more on education and less on initial ability. However, we cannot provide direct evidence for

these relationships, and further study is needed on this point.

2.5 Concluding Remarks

Previous studies have shown that a positive correlation exists between education and the elderly's cognitive capacities (Zhang, 1990; Stern et al., 1994; McArdle & Woodcock, 1998; Arvanitakis et al., 2003). However, there are few satisfactory answers to the question of whether education has causal effects on cognition at older ages, since most of the studies focused on correlation rather than causality. Two exceptions, Glymour et al. (2008) and Mazzonna and Banks (2012), treated compulsory school laws as exogenous shocks to education and found that schooling does have a causal effect on cognitive abilities, especially memory, at older ages. However, the studies are undermined by the fact that their respondents were very old and their applicability is limited by their focus on developed countries only (the U.S. and the U.K.). In countries such as China, rapid aging has occurred at much lower levels of national income and worse health conditions than was the case in industrial countries and, unfortunately, no previous research has shed light on the question.

This paper investigated the relationship between education and cognition at older ages in China by using CHARLS pilot data, seeking to measure both correlation and causality. To begin with, we examined the association between cognition and education in an OLS framework, and found that respondents who completed primary school obtained 18.2 percent higher scores in cognitive tests than those who did not. We then constructed an instrumental variable (IV) by exploiting China's Great Famine during 1959-1961 to estimate the causal effect of education on cognition. Individuals of primary school age during the famine were less likely to finish primary school compared with individuals in other cohorts. From the results of CHARLS data, we found that the Famine had a fairly substantial negative effect on the chance of schooling: Cohorts born from 1948 to 1953, who were exactly at the ages of initial primary school enrollment during the Famine, were 14 percent less likely to complete primary school with a full set of covariates controlled for.

This event provided us with an opportunity to perform 2SLS and RD estimation to identify the causal impacts of education on the cognition of elderly people. 2SLS results provided sound evidence that completing primary school significantly increases cognition scores in later life by 20 percent on average. Moreover, 2SLS results are robust when we omitted those born before 1935 to address mortality selection issues. Furthermore, to address the potential problem that famine may have a more significant effect on younger children included in the control group, we conducted RD analysis and provided further evidence for the causal interpretation. The results are robust when we choose a different bandwidth, and are consistent with those in 2SLS.

Both IV and RD estimates showed that the effects of education are different for the different measures of cognition we explored. Education shows protective effects on the cognition reserve of all dimensions investigated, and the protective effect of education is especially significant for the performance of word recall, a test of working memory. This result is also supported by neurological studies. Nakamura et al. (1999) observed that rats which were bred in an enriched environment had more synaptic vesicles, and such brain anatomical modifications helped these rats perform better in a memory test than rats bred

in a standard environment (Winocur, 1998).

Our study faces a series of potential pitfalls. First, the CHARLS 2008 dataset we used is not longitudinal and only contains data from two provinces. The small sample prompts us to use more specific settings in 2SLS and RD to obtain precise estimations. For example, exploiting the geographic variance may provide helpful additional information, since the timing and intensity of the famine varied from region to region. Second, it would be plausible to control cohort effects more specifically or narrow the bandwidth in RD to obtain more accurate estimates in a larger sample because one may argue that the estimates in RD may still suffer from the heterogeneous health impacts of famine on different cohorts given that the narrowest width is four years. Moreover, due to what we estimated in this paper is the LATE and our data only included two provinces in China, the generalizability to the broader population is subject to question. Finally, this study mainly focuses on statistical identification of the casual link from education to cognition reserve with survey data, and thus it may fail to provide more understanding on pathological pathways.

Figure 2-1 Growth Rate of Total Enrollment Over Year

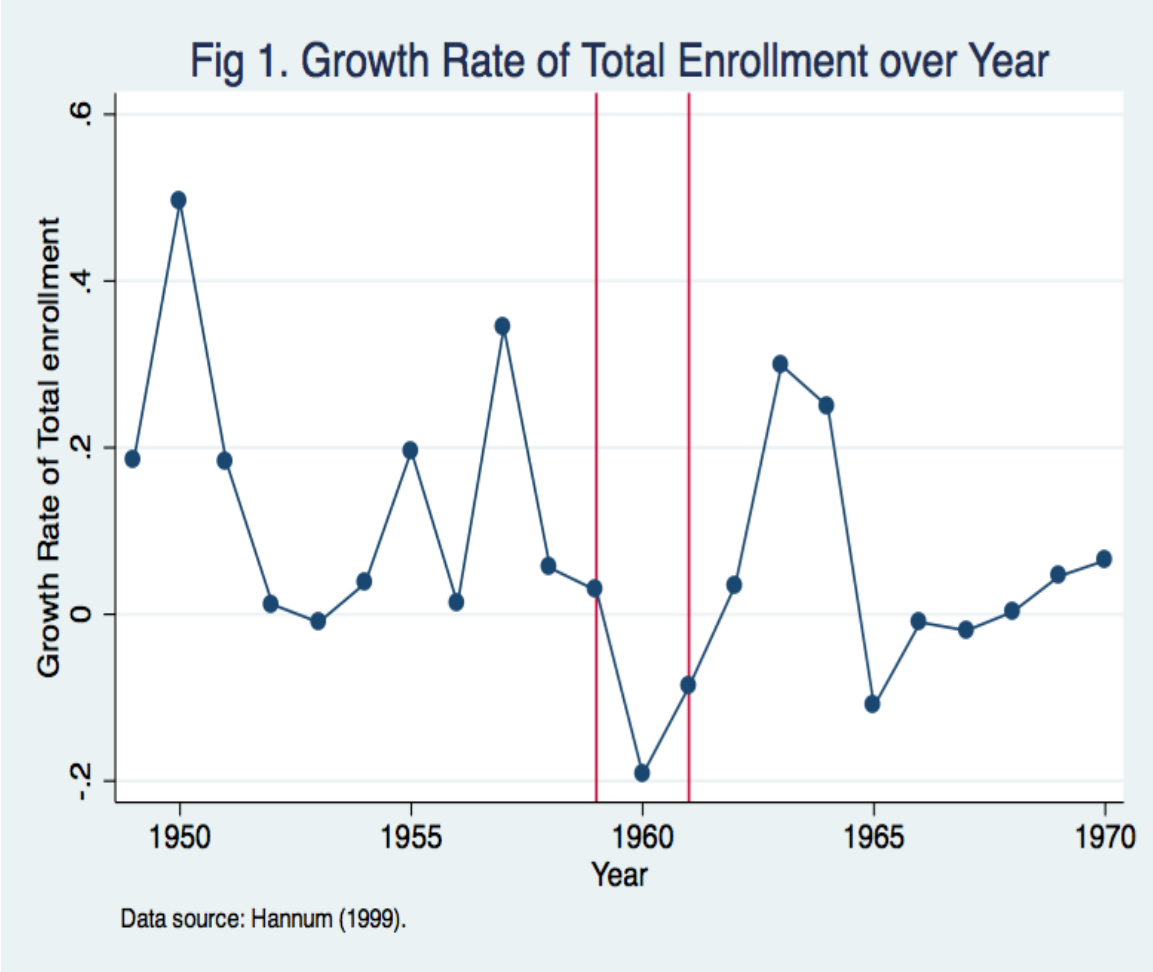


Figure 2-2 Primary School Completion Rate Over Year of Birth

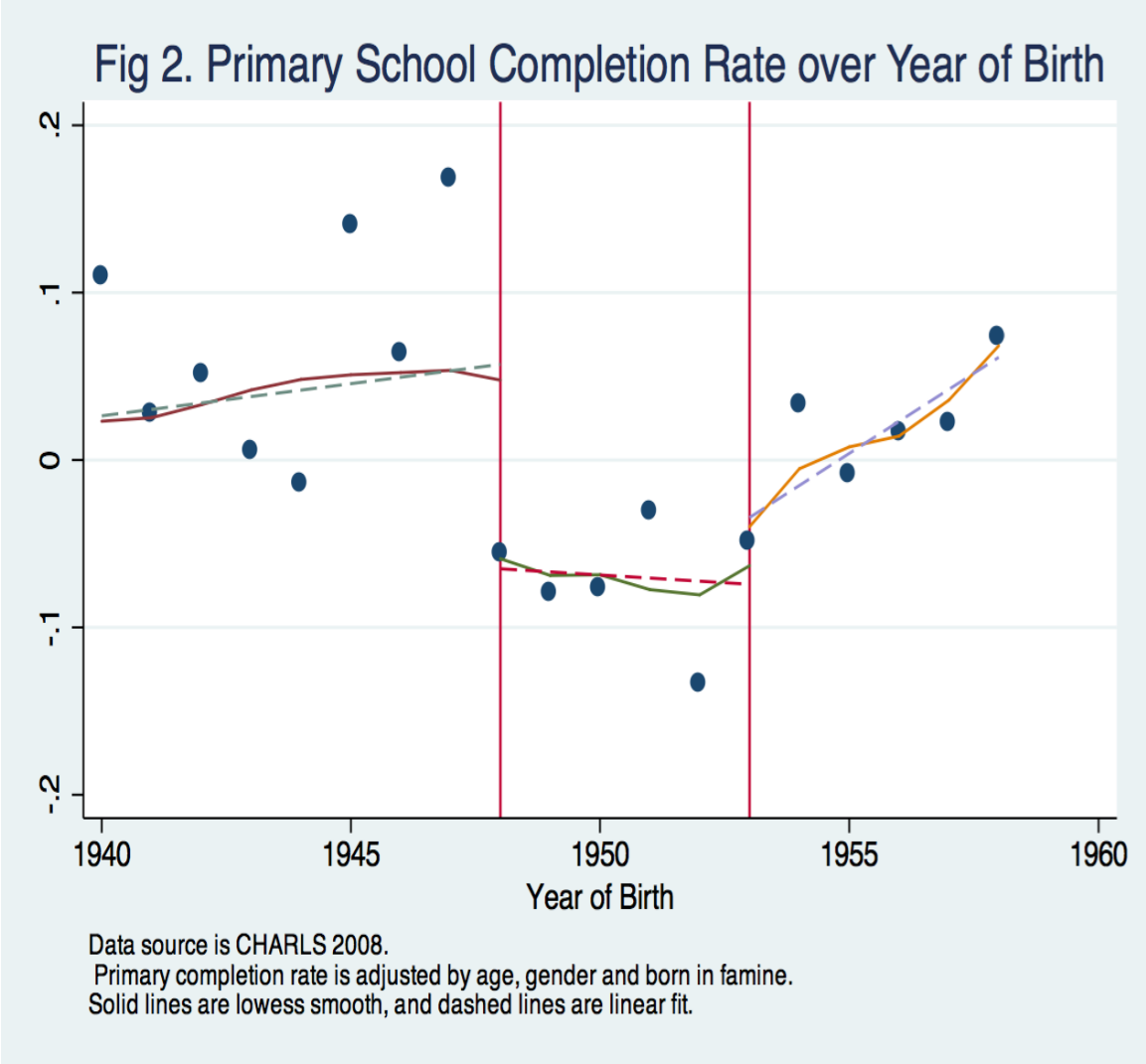
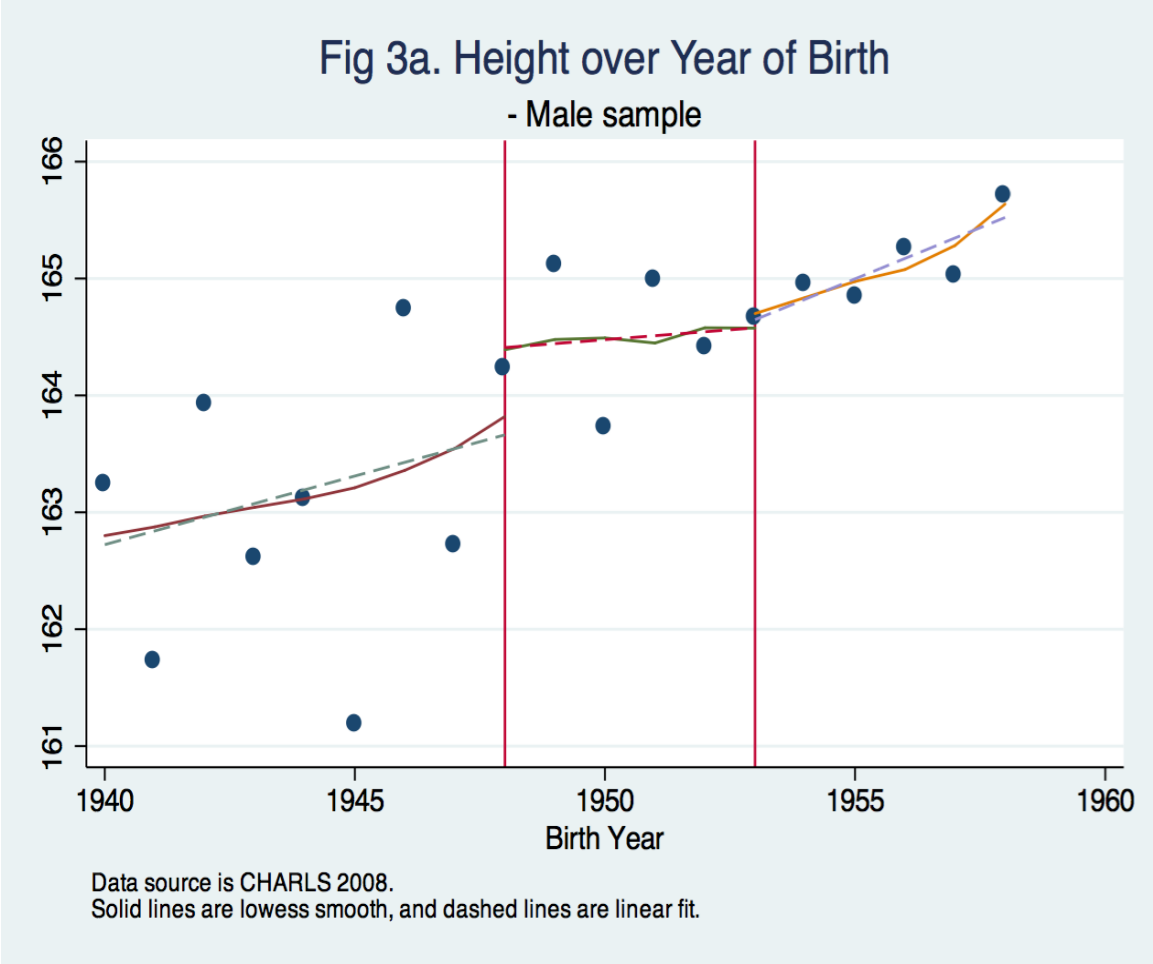


Figure 2-3 Height Over Year of Birth



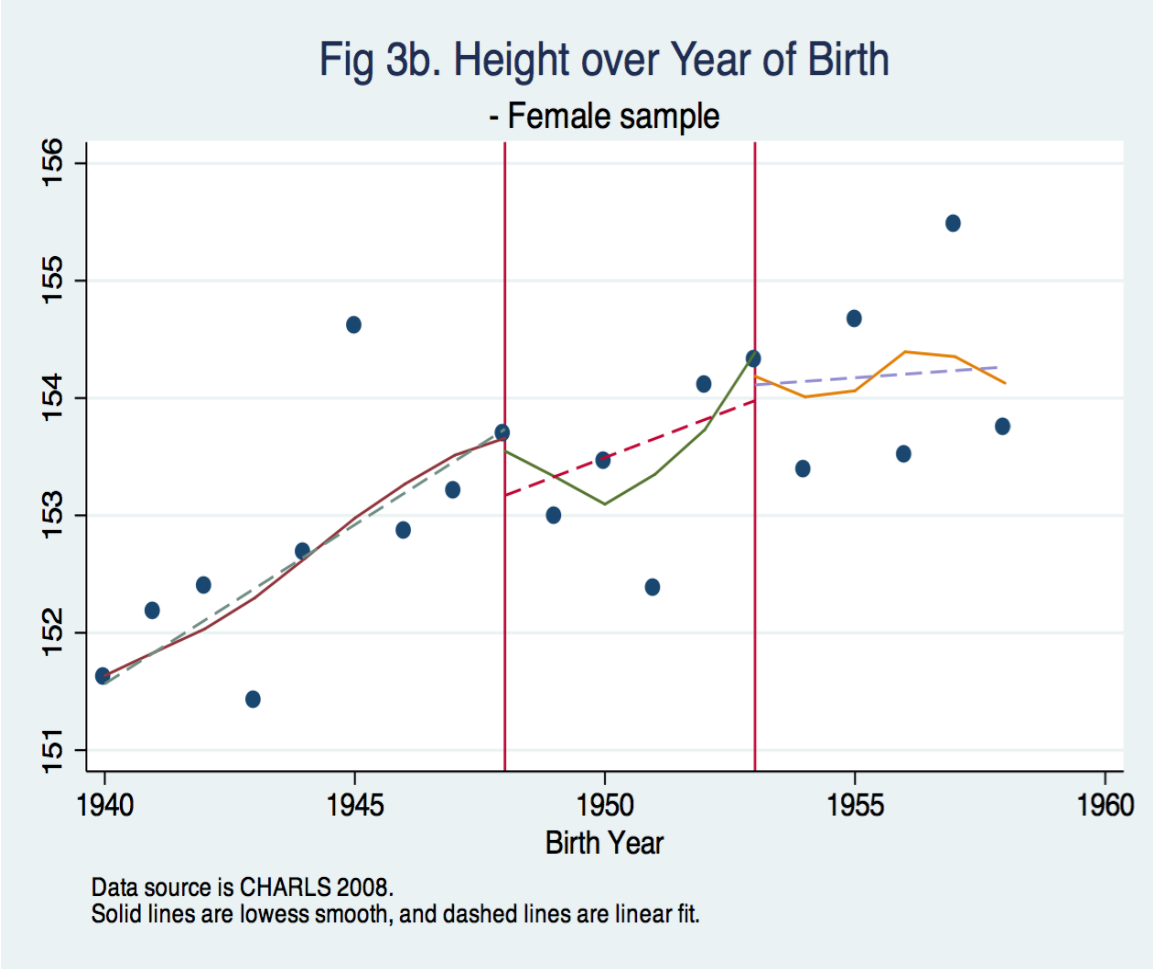


Fig 3b. Height over Year of Birth
- Female sample
156
155
154
153
152
151
1940
1945
1950
1955
1960
Birth Year
Data source is CHARLS 2008.
Solid lines are lowess smooth, and dashed lines are linear fit.

Figure 2-4 Cognitive Ability Over Year of Birth

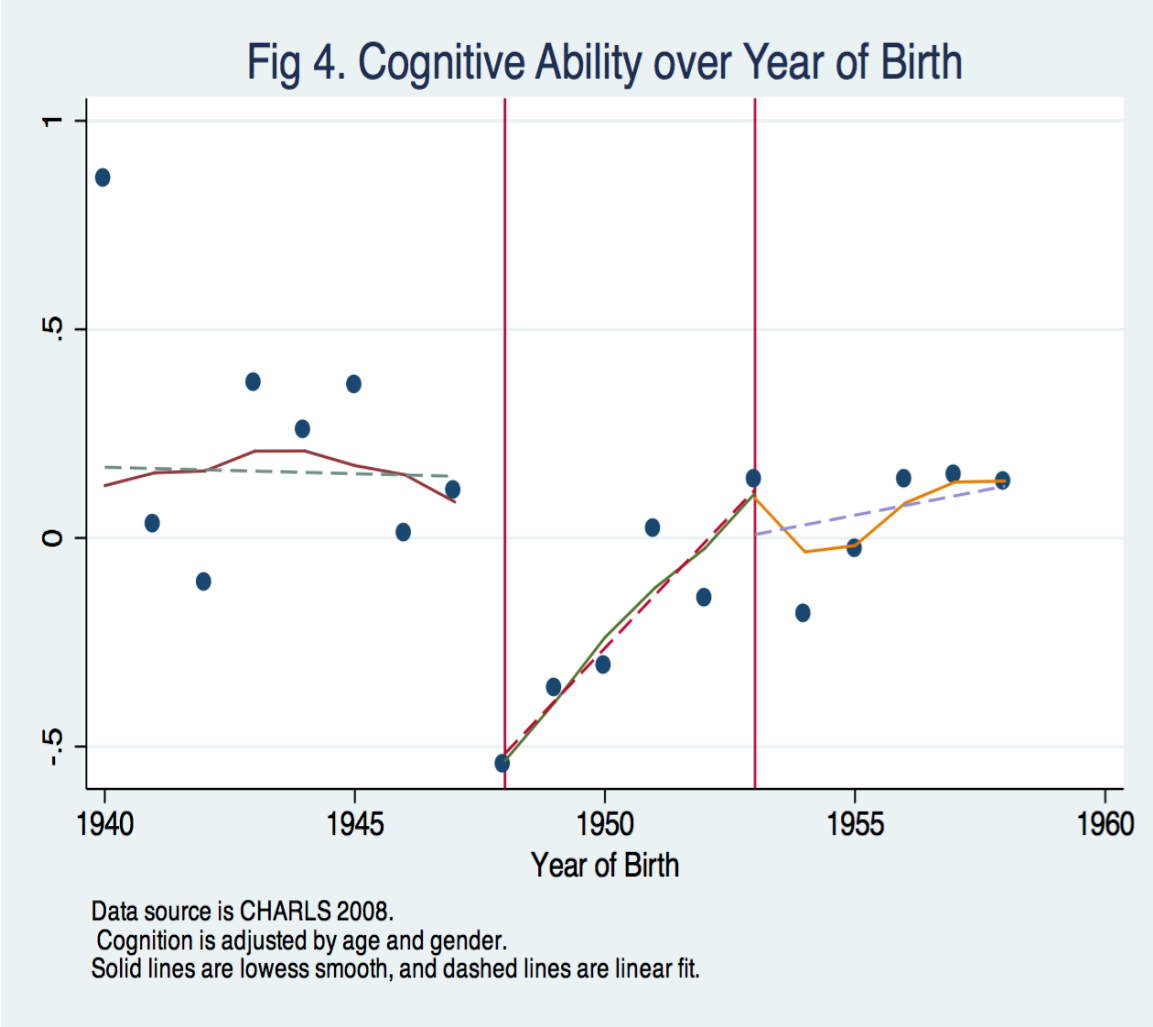


Table 2-1 Summary Statistics

	(1) Full sample	(2) Male sample	(3) Female sample
Panel A: Cognition			
TICS (0-10)	8.03	8.35	7.67
	(1.94)	(1.79)	(2.04)
Draw a figure (0/1）	0.56	0.65	0.46
	(0.50)	(0.48)	(0.50)
Words recall (0-10)	3.09	3.23	2.91
	(1.90)	(1.88)	(1.92)
Cognition(0-21)	11.76	12.31	11.12
	(3.50)	(3.32)	(3.59)
Panel B: SES and demographics			
Primary school completion (Yes = 1)	0.37	0.50	0.23
	(0.48)	(0.50)	(0.42)
Male (Yes = 1)	0.53		
	(0.50)		
Married (Yes = 1)	0.82	0.85	0.78
	(0.39)	(0.35)	(0.42)
Urban (Yes = 1)	0.47	0.43	0.51
	(0.50)	(0.50)	(0.50)
Height (cm)	158.88	163.96	153.07
	(7.82)	(5.78)	(5.44)
Age	61.37	61.76	60.92
	(8.51)	(8.55)	(8.44)
Obeservations	1635	873	762

NOTE: Standard deviations in parentheses. Data source is CHARLS 2008.
Telephone Interview of Cognitive Status (TICS):There are ten questions in this part, from awareness of the date (using either solar or lunar calendar), the day of the week and season of the year, to successively subtracting 7 from 100. This index is formed of the number of correct answers.
Draw a figure: Respondents are shown a picture of two overlapping pentagons and asked to draw it. We score the answer as 1 if the respondent successfully performs this task.

Words recall: There are a set of questions asks a respondent to recall a series of 10 simple nouns and to recall again after approximately 10 minutes. We average the number of correct answers as this index. This is a measure of episodic memory, and is a component
of fluid intelligence.

Cognition is the variable that is the sum of all the measures above.

Table 2-2 Cognitive Abilities Comparison

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Male sample			Female sample		
	Completed primary school	Not completed primary school	Difference (1) - (2)	Completed primary school	Not completed primary school	Difference (4) - (5)
TICS (0-10)	8.82	7.88	0.947***	8.85	7.32	1.527***
	(1.51)	(1.92)	(0.117)	(1.60)	(2.03)	(0.168)
Draw a figure (0-1）	0.77	0.53	0.238***	0.75	0.37	0.381***
	(0.42)	(0.50)	(0.0313)	(0.43)	(0.48)	(0.0409)
Words recall (0-10)	3.72	2.70	1.022***	3.99	2.57	1.424***
	(1.83)	(1.78)	(0.130)	(1.82)	(1.82)	(0.165)
Cognition (0-21)	13.32	11.19	2.128***	13.59	10.33	3.263***
	(3.00)	(3.31)	(0.226)	(3.03)	(3.39)	(0.298)
Observations	439	434		172	590	

NOTE: In columns (1), (2) and (4), (5), standard deviations are in brackets. In columns (3) and (6), standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Data source is CHARLS 2008.

Table 2-3 Primary School and Cognitive Abilities

VARIABLES	(1) TICS (0-10)	(2) Draw a figure (0-1)	(3) Words recall (0-10)	(4) Cognition (0 -21)
Panel A: OLS estimation				
Primary school completion (Yes = 1)	0.959***	0.250***	0.918***	2.135***
	(0.0972)	(0.0249)	(0.101)	(0.175)
Observations	1,635	1,635	1,447	1,447
R-squared	0.241	0.239	0.217	0.308
Panel B: 2SLS estimation (Full sample)				
Primary school completion (Yes = 1)	0.458	0.338*	1.284*	2.233*
	(0.765)	(0.195)	(0.751)	(1.291)
Observations	1,635	1,635	1,447	1,447
R-squared	0.229	0.233	0.210	0.308
Panel C: 2SLS estimation (Drop those born before 1935)				
Primary school completion (Yes = 1)	0.684	0.474***	1.649**	2.964**
	(0.675)	(0.180)	(0.701)	(1.187)
Observations	1,460	1,460	1,310	1,310
R-squared	0.237	0.181	0.160	0.278

NOTE: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Data source is CHARLS Pilot data 2008. Covariates include age, age square, height, and dummies for gender, married, urban residence and prefectures.

Table 2-4 First Stage for 2SLS Estimation

	(1)	(2)	(3)	(4)
	Full Sample		Drop those born before 1935	
	Full	Drop those skipping words recall	Full	Drop those skipping words recall
VARIABLES	Dependent variable: Primary school completion (Yes = 1)			
Born between 1948 and 1953	-0.135***	-0.144***	-0.169***	-0.176***
	(0.0262)	(0.0282)	(0.0298)	(0.0319)
male	0.227***	0.237***	0.239***	0.246***
	(0.0313)	(0.0342)	(0.0331)	(0.0359)
married	0.0760**	0.0785**	0.0766**	0.0790**
	(0.0303)	(0.0330)	(0.0337)	(0.0365)
urban	0.168***	0.145***	0.168***	0.143***
	(0.0255)	(0.0272)	(0.0273)	(0.0290)
height	0.00584***	0.00540**	0.00614***	0.00586**
	(0.00203)	(0.00220)	(0.00216)	(0.00233)
age	0.0244	0.0383*	0.115***	0.124***
	(0.0178)	(0.0200)	(0.0397)	(0.0428)
age2	-0.0267*	-0.0377**	-0.102***	-0.110***
	(0.0139)	(0.0157)	(0.0329)	(0.0355)
Constant	-1.214*	-1.562**	-3.922***	-4.160***
	(0.651)	(0.717)	(1.231)	(1.318)
Observations	1,635	1,447	1,460	1,310
R-squared	0.208	0.202	0.208	0.199
F-statistic for IV	26.55	26.08	32.16	30.44
Prefecture dummies	Yes	Yes	Yes	Yes

Note: Data source is CHARLS 2008. Standard errors in parentheses

Table 2-5 The Results of Regression Discontinuity (RD)

VARIABLES	(1) TICS (0-10)	(2) Draw a figure (0-1)	(3) Words recall (0-10)	(4) Cognition (0-21)
Panel A: Band = ± 4 years				
Primary school completion	0.0950	0.117	2.228*	2.706
	(1.114)	(0.285)	(1.351)	(2.175)
Panel B: Band = ± 5 years				
Primary school completion	-0.379	0.0900	1.878	2.120
	(1.183)	(0.295)	(1.238)	(2.013)
Panel C: Band = ± 6 years				
Primary school completion	-0.129	0.154	1.917*	2.535
	(1.053)	(0.264)	(1.124)	(1.815)

NOTE: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Data source is CHARLS 2008. Covariates include age, age square, age cubic, height, and dummies for gender, married, urban residence and prefectures.

3. Cadre Children and Cognitive Function of Parents in China

3.1 Introduction

Cognitive functioning is widely recognized for its critical importance in promoting effective decision-making among older adults. For example, decisions regarding which type of insurance plans to choose, when to retire, and how to invest and spend retirement savings, all heavily rely on cognitive skills (Smith et al. 2010; Banks et al. 2011). Individual characteristics, such as income, social class, education, gender and living arrangement, are found to be correlated with mental health (Wildman 2003; Ahern and Galea 2006; Mutaner et al. 2003; Huang and Zhou 2013; Weir et al. 2014; Huang et al. 2015; Ren and Treiman, 2015). In recent years, there have been calls to study social determinants of cognitive functioning (Kuiper et al. 2016), particularly among older adults who may experience cognitive decline with serious psychosocial, health, and economic consequences.

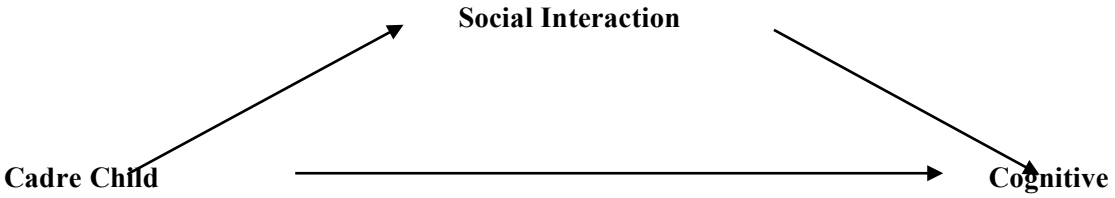
Traditional studies of cognitive functioning have been criticized for failing to recognize the potential effects of social determinants on individual's health outcomes from the perspective of social networks. Song and Lin (2009) first take into account the impact of returns on social capital investment on health outcomes. Such models focus on resources that may be accessible through an individual's direct and indirect social ties (Lin 1999). According to the social capital theory, social status can be gained by taking certain positions in a social structure or building relationships with authorities or others with powerful social roles.

Political connections are an important form of social capital, especially in developing countries. Though the interaction between social capital and cognitive functioning has been discussed in some existing literature, to our knowledge the present study is the first empirical analysis investigating the impact of political connection on cognitive functioning. There are several channels through which political connection may promote cognitive ability. First, political connections create economic returns, and economic resources have been confirmed as a key determinant of cognitive functioning (Wildman 2003; Ahern and Galea 2006). Second, political connections enhance the holder's social status by encouraging social interaction. Other individuals, especially those who strongly demand indirect political ties, have incentives to develop and maintain ties with people who have political connections. And social ties are found to promote mental health and buffer psychological stress (Kawachi and Berkman 2001).

Maintaining the tie with an individual who has close relationships with political leaders is potentially beneficial, especially in East Asian societies. For example, personal connections with authorities can help individuals obtain employment. Bian (1997) shows that many job seekers were indirectly connected with their ultimate helpers through intermediaries to whom both are strongly tied. Zhang and Li (2003) show that, in rural areas of China, having family members as cadres significantly increased the odds of nonfarm employment. After more than 30 years of market reform, the economic value of

political connections in China may have declined, but it is still significant today. A recent study finds that having a cadre parent is associated with a 15% premium in the first job offer salary among recent college graduates (Li et al. 2012). In Singapore the context of the labor market is quite different from China, but there are many overlapping cultural roots (78% of Singapore's population have a Chinese origin), and here jobs are also channeled through strong ties more frequently than through weak ties, just as in China. In particular, higher-status helpers usually lead to better jobs for job movers in both China and Singapore (Bian and Ang 1997).

Building social connections with cadres directly can sometimes be costly. Kinship with a government cadre, however, provides an alternative way to be socially connected to cadres indirectly, through interaction with cadres' family members, their parents in particular. Following this line of reasoning, this study investigates a reverse intergenerational transfer of cognition – whether parents who have a cadre child demonstrate better cognitive abilities than parents who don't. Here cadre child is defined as an offspring who has obtained an administrative level in government or other public agencies. Having a cadre child means the parent has certain type of "political connection", which attracts neighbors to build social ties with him or her (in exchange for certain benefits), and greater involvement in social interactions leads to an increase in cognitive functioning. In other words, political connection indirectly affects cognitive functioning through the mediator of social interaction. Following the mediation analysis approach (Baron and Kenny, 1986), we illustrate the logical chain of our hypothesis with the figure as follows:



Using CHARLS 2011, we empirically find that cadres' parents have better cognitive function than their peers, after controlling for variables of personal characteristics (e.g., education, occupation and wealth), community characteristics and financial aid from children. More specifically, the effect of having a cadre child on overall cognition is as large as an increase of about 1.5 years in education. This finding supports our hypothesis that political connection, in term of kinship with cadres, is associated with better cognitive functioning. The magnitude of such effect depends on the cadre child's official rank. In old adults, having a cadre child is more protective of cognitive decline if the cadre child holds a higher administrative rank. The effect also varies with the degree of local marketization. In more-marketized provinces, the impact of political connection becomes weaker and less significant. We construct a dummy variable indicating a respondent's career success to address the potential endogeneity bias. An old adult is classified as a "local elite" if they were: government employee, village head, manager in firm, or self-employed entrepreneur with an annual income above the average level of the self-employed group. The results of robustness examinations also support our core hypothesis that political connection matters for cognitive health.

Because social interaction has been confirmed as an influential factor affecting cognitive functioning, this paper then proceeds to examine whether political connection protects cognitive health through this channel. We find that parents of cadre children have more social interactions than their peers. At the same time, the coefficient of having a cadre child drops by twenty percent, if the frequency of social interactions is included in our regressions. These findings suggest that the beneficial effect of political connection on cognitive functioning is partially mediated through the channel of enhancing social interaction. The mediation role of social interaction is further confirmed by the results of a Sobel test.

A recent clinic-pathological study may shed some light on the mechanism of explaining the relationship between social interaction and cognitive functioning. This study shows that social network size modifies the association between Alzheimer's disease pathology and cognitive functioning (Bennett et al. 2006). That is, conditional on pathological impairment, social interaction can improve the clinical manifestation of Alzheimer's disease. Despite this evidence, the neurobiological mechanism behind the association between social interaction and cognitive functioning is still not fully understood. Another potential explanation is that social interaction enhances self-efficacy beliefs, which results in better maintenance of cognitive performance (Seeman *et al*., 1996).

This paper contributes to the emerging literature on social networks and mental health in several ways. First, it extends the value of political connections from economic returns to health consequences. To our best knowledge, this paper is the first to empirically test the relationship between political connection and cognitive functioning. Second, it reexamines the association between social capital and mental health in a specific context – kinship ties to cadres in China. Finally, this paper also contributes to understanding the social inequality of mental health in developing countries where political elites still have a strong influence over resource distribution.

3.2 Background

The social context of daily life in China provides us with an opportunity to examine whether there is a link between political connection and cognitive functioning among older adults. In China, having a cadre child is relatively rare for elder adults. For example, our sample consists of about 10,000 households, among which only 492 households report having at least one cadre child (less than 5%).

The recruitment of cadres is extremely competitive in China. The Civil Servant Law of the People's Republic of China came into force in 2006, requiring cadres to be selected and appointed on the basis of "open examination, strict inspection, equal competition and enrollment". In 2013, for example, 1.52 million people registered to take the national civil-servant exam, vying for about 20,000 government vacancies. On average, about 77 people compete for each single position. The most desirable vacancy, however, is reported to have a competitive ratio of 7,192 to 1[1]. Only a few of those who do very well on the written exam are invited to be interviewed in person. Applicants need to pass this tough interview before they can obtain a cadre position. After the enactment

[1] According to the news report on *China Daily*. http://www.chinadaily.com.cn/business/2014-03/27/content_17385340.htm

of the Civil Servant Law in 2006, the chance of being a cadre becomes less likely to be affected by parental socioeconomic status than before. Rather, one's intelligence plays a more significant role in selecting and appointing cadres.

Local cadres in China possess considerable power and affect many aspects of a normal citizen's life, such as family planning, low-income living allowances, and civil disputes. A personal connection (or "guanxi") with some government cadres can be a practical means for advancing one's specific interests (Yan 1996). Both direct and indirect ties with authorities provide substantial advantages in labor market (Bian, 1997; Bian and Ang, 1997). Therefore, it is reasonable to assume that households generally have incentives to build up "guanxi" with cadre families. In exchange for specific interests, people interact more frequently with family members of a cadre, which increases the frequency of social interaction for cadre families. Having a cadre child not only increases the supply of social interaction for parents but also creates in them a stronger demand for social interaction because they feel more proud and more comfortable in the interactions.

3.3 Hypotheses

Studies on the link between mental health and social interaction can be traced back to the sociologist Emile Durkheim (1951). Many following studies confirm that older adults with frequent engagement in social activities experience less cognitive decline than others (Bassuk et al. 1999; *Zunzunegui* et al. 2003; James et al. 2011; Hu et al. 2012). Furthermore, Ertel et al. (2008) find evidence showing that earlier social interaction protects against memory loss in later life and earlier cognitive loss can only explain very little of later changes in social interaction. **As discussed earlier in this paper, older adults who have a cadre child tend to have more social activities. Therefore, on average, their cognitive performance should be better than other older adults in the same community (Hypothesis 1)**.

Political connection realizes its value through the exchange of benefits. Cadres with higher administrative rank in the government are generally more influential in deciding how resources should be allocated. On the other side, in most cases, high-rank cadres have been working in the government longer than low-rank cadres, and thus their parents have had longer exposure to the beneficial effect of political connection. **The protective effect of political connection on cognitive health should be greater for the parents of high-rank cadres than for the parents of low-rank cadres (Hypothesis 2).**

The beneficial effect of political capital also depends on the local institutional environment. In regions where market institutions dominate political power in allocating resource, the value of political connections would be marginal. **Therefore, the protective effect of political connection on cognitive health should be smaller in more-marketized regions than in less-marketized regions (Hypothesis 3).**

Based on ample existing studies and theoretical frameworks that examine the link between social capital and mental health, we propose that the buffer effect of political connection, at least partially, channeled through the enhancement of the social interactions of the old adults. **We expect that the parents of cadres on average have more social activities than their peers (Hypothesis 4).**

3.4 The Challenges of Endogeneity

Like many other studies assessing the function of social capital, a few salient sources of endogeneity limit the causal inference of this paper (Chen, 2011). First, simultaneity bias could arise when having a cadre child and actively engaging in social activities are simultaneously determined by some characteristics (e.g. ability, intelligence, personality) of the parents themselves. For example, parents who are more successful in their own career may be more likely to have a cadre child. Meanwhile, they are also more likely to actively participate in social activities. Second, we also face the challenge from reverse causality. The reverse causality concern is twofold: cognitive ability, in turn, could also affect both the offspring's occupation and their own social interactions. To address simultaneity issues as well as reverse causality concerns, one best-case scenario is using the opportunity of some "natural experiment" to estimate the coefficient of interest. However, given the lack of a suitable instrument in this setting, we consider two alternative identification strategies to make our results more convincing.

First, we rerun our models based on a subsample of parents having at least one child aged 35 or younger. The reverse causality should be less of a concern with this subsample because the attainment of cadre status became much less dependent on parents' social standings after the enactment of the Civil Servant Law in 2006. According to the application eligibility terms in the Civil Servant Law, applicants for civil servants must be younger than 35 years old, although this requirement can be relaxed to younger than 40 years old only for those with master or doctoral degrees. Thus, cadre children aged 35 or younger in our sample were younger than 30 at the time of 2006 and most of them got into governments through the strict civil-servant exam and interview.

Second, we construct a "local elite" variable to control for parents' career success. Moreover, we divide our full sample into two subsamples based on whether the respondent is a local elite or not and compare the coefficients of these two subsamples. We can reasonably assume that the group of "non-local-elite" parents on average have lower initial cognition and less social resources. If the effects in this subsample are close to those in the whole sample, then the impact of reverse causality is not strong enough to invalidate our conclusions.

3.5 Research Design

To estimate the impact of having a cadre child on cognitive ability, we use the OLS (Ordinary Least Squares) model below:

$$Y_{ij} = \beta_0 + \beta_1 cadre\ child_{ij} + \gamma_1 Age_{ij} + \gamma_2 Age_{ij}^2 + \gamma_2 X_{ij} + \gamma_3 Prov_j + \varepsilon_{ij} \quad (1)$$

Here Y_{ij} is a cognitive score or the measure of social interaction. $cadre\ child_{ij}$ is the indicator of whether the individual i living in province j has a cadre child or not (yes = 1). X_{ij} is a set of control variables, $Prov_j$ is a set of province dummies, and ε_{ij} is the error term. All standard errors are clustered at the community level.

3.5.1 Data

China Health and Retirement Longitudinal Study (CHARLS), an HRS sister study, aims to collect a nationally representative sample of Chinese residents aged 45 and older, which will serve the needs of scientific research about the Chinese elderly (Zhao et al.,

2013). If one member of the household 45 or older is sampled, then his or her spouse would be automatically included without regard to age. The national waves of CHARLS were fielded in 2011 and 2013, and they included 17,500 individuals within 10,000 households in 27 provinces, 150 counties/districts, and 450 villages/resident committees. CHARLS has already become a primary data source for scientific research about the health of the elderly in China (Huang et al., 2013; Zhao et al., 2014). As described below, CHARLS assesses cognitive functioning using several validated instruments (Lei et al., 2012; Huang and Zhou, 2013; Weir et al., 2014). However, because there are very few major changes in the cadre status of children in a time frame of two years, longitudinal analysis is less appropriate in the present study. We therefore conduct cross-sectional analysis using the CHARLS 2011 data. Results are almost identical using the CHARLS 2013 data, which is not reported here. We choose to present the results using the 2011 data because the baseline sample has a better national representativeness. The 2013 sample has the issue of longitudinal attrition, which has made it less representative. Table 3-1 presents the definition and statistical description of each variable.

3.5.2 Variables

Cognitive Function

Following Huang and Zhou (2013), we use three measures of cognitive ability in our study: Telephone interview about cognitive status (TICS), Memory (based on a word-recall assessment), and a composite measure based on the aforementioned two measures. Details are provided below.

- Telephone Interview about Cognitive Status (TICS)

TICS is a ten-question interview that is administered over the telephone by a trained interviewer. Questions include time orientation (such as day, date, month, year and season etc.), and a serial-7 number subtraction question. A respondent receives one point for each correct answer. The overall TICS score ranges from zero to ten, measuring mental intactness of the respondent.

- Memory

Episodic memory is measured with the score of a word-recall assessment. After hearing ten nouns read aloud via telephone interview, respondents were asked to immediately recall as many as they can remember. A delayed recall is assessed about ten minutes later, following completion of several other cognitive tasks. Immediate and delayed recall scores are averaged to measure episodic memory performance.

- Composite Cognition Score

To create a standardized measure of overall cognitive performance, we transformed the raw scores of TICS and memory into standardized scores, by calculating the difference between the raw score and the mean score and dividing the difference by the standard deviation. The Composite Cognition Score is the sum of standardized scores of TICS and memory. Therefore, the mean of this overall measure is close to 0[2].

[2] We also use the sum of original scores as alternative of overall measure and get almost the same findings.

Cadre Child

The CHARLS survey asks about the position/occupational title of respondents' children. We identify cadre families as those having at least one adult child who has obtained an administrative level in government or other public agencies. Following Zhou (1995), we further classify cadre families into two subgroups: low-rank ("Ke" level and below in China's bureaucratic system) cadre families and high-rank ("Chu" level and above) cadre families. "Ke" and "Chu" officials represent the majority of the Chinese bureaucracy. If a respondent has two or more cadre children, we categorize them according to the highest-ranking child.

Social Interactions

There are seven questions in the CHARLES questionnaire that measure social interactions. These questions assess the type and frequency of engagement in community-based social activity. Assessed domains include:

(1) Interacting with friends.
(2) Playing Ma-jong, chess, or cards, or going to a community club.
(3) Providing help to family, friends, or neighbors, who do not live with the respondent and don't pay for that help.
(4) Going to a social or sports club or any other kind of club.
(5) Joining a community-related organization.
(6) Doing voluntary or charity work.
(7) Caring for a sick or disabled adult who does not live with the respondent and doesn't pay for the help.

Respondents were queried about the frequency with which they engaged in each activity and score ranges included 3 (daily basis), 2 (weekly), 1 (monthly), or 0 (no/little participation). We sum the scores of all seven activities to generate a composite measure of social interactions. Social activities were also divided into two categories according to their purposes: "entertaining activities" (1, 2, 4, and 5) and "voluntary activities" (3, 6, and 7).

Other Control Variables

We use respondents' demographics as controls, including gender, age, education, marital status, and the number of children (all children alive, including adopted children). We further control for total financial assets, as well as monetary transfer from children. The dummy variable of whether the respondent was a cadre himself or herself is also included in our regression model. Moreover, since both child cadre status and parental cognitive functioning may both be a byproduct of heritable intelligence, we also control for the respondent's career success, using a variable indicating whether the respondent is a "local elite". Moreover, two community characteristics, population and income per capita in logarithmic form, are also included.

3.6 Results

3.6.1 Effects of having cadre offspring on cognitive abilities

Table 3-2 presents the results of OLS regression on the entire sample. We find that having a cadre child is associated with better cognitive functioning, no matter whether measured with TICS or memory. According to the results of reduced-form regression, having a cadre child improved older adult's composite cognition score by 0.22 points on average. The coefficient slightly reduces to 0.19 when a number of control variables are added. More specifically, the magnitude of the effect on overall cognition is equivalent to an increase of 1.5 years of education. The effects on TICS and memory are also on the same order of magnitude.

Consistent with previous studies (Lei et al., 2012; Huang and Zhou, 2013), educated residents living in urban areas demonstrate better cognitive performance conditional on age. Women tend to have higher scores in TICS but lower scores in memory. The status of "local elite" is positively associated with an elder's cognition and its effect is of the same scale as that of having a cadre child. We also have conducted the regressions above with the male sample and the female sample separately. The coefficients are quite close and thus we choose not to report.

3.6.2 The role of cadre child's administrative rank

In China, high-rank cadres are also higher up in the bureaucratic hierarchy of power and privileges. High-rank cadres can mobilize more resources, and thus the returns of social ties with their families are expected to be greater. Also, higher administrative rank usually means a longer period of serving in the government. Therefore, parents of high-rank cadres tend to have a longer duration of exposure to the beneficial effect of political connection. The coefficients of children's cadre status should be larger in magnitude for parents of higher-rank cadres.

In order to test this hypothesis, we divide the cadre families into two groups: families with cadre children whose administrative ranks are above the entry level ("Chu" level and above) and families with entry-level cadre children ("Ke" level and below). In our sample, the number of high-rank cadre families is similar to the number of low-rank cadre families. We conduct regression analyses on high-rank cadre families and low-rank cadre families separately. The results are reported in Table 3-3. As shown in Panel A of Table 3-3, having a low-rank cadre offspring doesn't significantly affect cognitive function. In contrast, the buffer effects of having high-rank cadre offspring are substantially larger and statistically significant (see the Panel B of Table 3-3). We therefore expect that the overall effects we find in the full sample are mainly driven by high-rank cadre families. This is not surprisingly to us as low-rank cadres are likely to have obtained their cadre status in the recent past and it takes time to reveal the beneficial effect on cognition.

3.6.3 Social interaction: a possible mechanism

The empirical results above have shown the favorable role that having cadre offspring plays in protecting cognitive health among the elderly in China. A possible explanation is that having cadre offspring enhances the social capital of a family and creates substantial incentives for other community members to keep interpersonal relationships with the

cadre family. On the other side, the parents of a cadre child are more willing to interact with others because they are more proud and more confident in the interaction.

This improvement will then translate to a higher level of social interaction for the elderly. Previous studies show that social interaction has positive impacts on general health (Kawachi et al., 1999; Kawachi, 1999; Rose, 2000; Veenstra, 2000; Poortinga, 2006), as well as on cognitive ability of the elderly (Seeman et al., 2001; Ayotte et al., 2013). Our analysis lends strong supports to this explanation, as our results suggest that having a cadre child is positively related to the frequency of social interaction of elder adults. We also find the effect on social interaction is more salient for high-rank cadre families.

As a robustness check, we replace the dependent variable with the two more-narrow definitions of social interaction: entertaining activities and voluntary activities. We find that the effects on social interaction are mainly from the social activities related to entertainment. However, having a cadre child has much weaker impact on the frequency of voluntary activities. These results are consistent with our previous discussion of social exchange. In some cases, people do voluntary work partially for invisible benefits, such as respects, friendship and social status. When parents have a cadre child, their incentives for voluntary activities are weaker even though they may control more resources. This is because they can obtain these benefits through sharing their political connection.

The results in Table 3-4 confirm the significant positive relationship between having a cadre child and the social interactions of parents. Then we investigate whether social interaction is one pathway through which the political connections affect cognition. We rerun the regressions using overall cognition as the outcome of interest but add social interaction as an additional covariate.

In Table 3-5, we report the results and compare the coefficients with and without social interaction included. Results in Panel A and Panel B show that including social interaction in our model reduces the effect of having a cadre child on overall cognition.

In psychological studies, Sobel test is widely used to investigate whether a factor is among the mediating mechanisms that translate a stimulus into a response (MacKinnon et al., 2007; Sobel, 1986). The results of the Sobel test confirm the mediator role of social interaction ($z=3.315$, $p=0.001$). This finding supports our hypotheses by showing that social interaction partially mediates the relationship between having a cadre child and cognitive functioning. More specifically, social interaction accounts for about one fifth of the total effects.

3.6.4 Marketization and the value of political connection

The value of political connection varies with institutional contexts. Then, will a reform towards marketization preserve or reduce the return of political capital? There isn't a simple answer to this question. According to market transition theory (Nee, 1996), in regions with higher market freedom, the distribution of resources is more based on market institutions than upon positional power and political capital. However, Nee and Cao (2002) further argue that the existing institutions are likely to persist at the early stages of market transition and the influence of political capital may not decline until the scale and the strength of market economy reach a "tipping point". On the other side,

some economists also contend that some kinds of marketization reforms (e.g. dual-track price system) even temporarily increase the return on political power (Lau et al. 1997).

In this section, we investigate how local marketization modifies the impact of political connection on cognitive functioning. The degree of marketization is measured with the province-level NERI index of marketization (Fan et al. 2011). We further divide our sample into two subsamples based on the value of NERI index of local marketization. Then we conduct regressions separately with these two subsamples and report results in Table 3-6.

Based on the results in Panel B, we find that the effects of having a cadre child on memory and social interaction are weaker and also less significant in more-marketized province. This finding is somewhat consistent with the market transition theory: when resource allocation is mainly controlled by market institutions rather than by political power, the value of political connection becomes marginal and so does the benefits associated with political connection.

3.7 Robustness Check

The results presented so far are suggestive, but by no means conclusive given several endogeneity concerns in our identification strategy. One potential endogeneity problem in our study is that the parents of cadre children may have some advantages in social resources, which can't be fully controlled with their educations, incomes and other social-economic variables that we have. These unobserved advantages can enhance cognitive reserve and the likelihood of the offspring child's cadre status. The enactment of the Civil Servant Law in 2006 has, however, greatly weakened the linkage from parents' social resources to the child's attainment of cadre position because this law stipulates that the recruitment of civil servants should be on the basis of open examinations and fair competition. Therefore, this endogeneity problem will have much less impact if we can exclude from our sample the respondents whose children got into governments before 2006 from our sample.

However, our dataset doesn't contain information about when a cadre child entered government. As an alternative, we only keep the parents who have at least one child aged 35 or younger. About one third of the observations are dropped from our sample. These cadre children were younger than 30 in 2006 and thus most of them obtained their cadre positions through passing the civil-servant exam. We rerun our regressions with this subsample and report the results in Table 3-7.

The empirical results in Panel A of Table 3-7 are quite close to those in Table 3-2. It implies that, in an institutional environment where the selection of cadre is more based on personal merits than upon parents' social capital, having a cadre child still has positive impacts on parents' cognitive functioning and social interaction. In other words, the impact of simultaneity is not strong enough to explain the positive association between child's cadre status and parent's cognitive functioning.

As discussed earlier, we construct a dummy variable of "local elite" to measure the career success of a parent. A respondent will be classified as "local elite" if he or she satisfies at least one of the following four criteria: (1) used to be a cadre; (2) used to be a village head; (3) used to be a manager in firm; (4) used to a self-employed entrepreneur

with an annual income above the average of all self-employed entrepreneurs. In Table 3-2, we can see the "local-elite" parents on average have better cognitive abilities than "non-local-elite" parents.

In general, local-elite parents have more social resources than non-local-elite parents. Then consider the following situation: non-local-elite parents don't have any advantages in social resources or cognitive abilities, and their children obtain cadre positions mainly by good luck or hard work. In this case, the attainment of child's cadre status is randomly decided. In other words, the correlation between parent's social capital and likelihood child's cadre status is close to zero. If the problem of reverse causality was extremely severe and the effects in our regressions were spurious, we should expect that the effects of having a cadre child are weaker or even not exist in the group of non-local-elite parents. Therefore, we investigate the severity of reverse causality by conducting regressions with "local-elite" subsample and "non-local-elite" subsample separately.

As shown in Panel B of Table 3-7, we find that the effects for "non-local-elite" parents are substantial and statistically significant. It suggests that the problem of reverse causality may not be an important issue in our empirical identification. Moreover, the coefficient of having a cadre child in the regression on social interaction is statistically significant for "non-local-elite" parents but not for the "local-elite" parents. It may be because "local-elite" parents have sufficient social interaction already and the enhancement from having a cadre child is somewhat marginal.

3.8 Concluding Remarks

Mental disorders contribute significantly to the burden of disease worldwide. The Global Burden of Disease Study 2010 identified mental and substance use disorders as the fifth leading cause of death and disability, accounting for 183.9 million disability-adjusted life years worldwide in 2010 (Whiteford et al. 2013). However, currently psychiatry lacks effective universal prevention and treatment of mental illness (Jacka et al. 2013). Risk factor identification is thus imperative for providing valuable clues about targets for intervention and prevention (Jacka et al. 2013).

Using a nationally representative CHARLS sample, we examine the impact of having a cadre child on cognitive functioning at older ages. We find that having a cadre child is associated with improved cognitive abilities and this relationship is strengthened among those with higher administrative rank. We find that the effects of having a cadre child on social activities follow the same pattern and when we further control for social activities in our model of cognition abilities, the effect size becomes significantly smaller. The evidence from a Sobel test further confirms that the relationship between having a cadre child and cognitive functioning is partially mediated through the channel of social interaction.

The present findings join the growing body of literature linking cognitive wellbeing to social interaction. People with less social interaction are more likely to experience greater decline in the cognitive ability, especially in their later ages. This speaks to the importance of the promoting and supporting social interactions and social ties among the elderly, especially among the socially isolated elderly who are at greatest risk of poor mental wellbeing.

However, our study also contains a number of limitations. First, it's not a longitudinal study but only cross-sectional. Caution is needed in interpreting our results since our results do not imply a particular causality claim. Second, though we attempt to include the behaviors of social interaction into our analyses, we can only observe the frequency but may miss other important aspects of social interaction, such as quality and hierarchy. For example, Belle (1983) found that participation in social networks could be harmful for women with low resources because they often struggle to respond to needs of other members. This may also be true in our case, but we are less concerned because the treated group in our study tends to have higher social standing in their communities. Though it's difficult to fully rule out confounders, this paper still sheds some light on the possible nature of the relationship between social ties and cognitive health.

Table 3-1 Variable Definition and Statistical Description

Variables	Definition	Mean	Std.
TICS	Cognitive ability related to telephone interview of cognitive status (TICS).	5.916	3.335
Memory	Cognitive ability related to words recall.	2.523	2.164
Cognition	A composite measure based on the TICS and words recall.	0.008	1.716
Cadre Child	=1 if individual has at least one child serving as cadre in the government, =0 otherwise.	0.049	
Low-Rank	=1 if the cadre child holds an administrative rank which is "Ke" level and below in China's bureaucratic system , =0 if otherwise.	0.026	
High-Rank	=1 if the cadre child holds an administrative rank which is "Chu" level and above in China's bureaucratic system, =0 if otherwise.	0.025	
Social Interaction	Social interaction. A weighted sum of the total points that a respondent gets for his/her engagement in 7 types of social activities.	1.307	1.829
Voluntary Activities	Social activities related to offering help to others	0.107	0.471
Entertaining Activities	Social activities related to community entertainments	1.199	1.707
Age	Age in years	59.046	10.127
Female	=1 if individual is female; =0 if individual is male.	0.521	
Married	=1 if a respondent has a partner, =0 if otherwise.	0.872	
Illiterate	=1 if a respondent did not complete the elementary school or did not get any formal education,=0 if otherwise	0.446	
Primary	=1 if a respondent only completed the elementary school or home school,=0 if otherwise	0.220	
Middle School	=1 if a respondent only completed the middle school,=0 if otherwise	0.206	
High School	=1 if a respondent only completed the high school or vocational school,=0 if otherwise	0.102	
College	=1 if a respondent attended the college education or more, =0 if otherwise	0.025	
Chronic	The number of chronic diseases a respondent bears	1.362	1.393
Log of asset	The log level of family financial asset.	4.003	5.666
Local Elite	=1 if the individual were: former government employee, former village head, former manager in firm, or self-employed entrepreneur with annual income above the average level of the self-employed group; =0 if otherwise	0.05	
Children Number	The number of living children	2.643	1.449
Children Aid	The monetary aids from all children. (in thousand RMB)	0.096	0.377
Population	Population of the community (in thousand)	3.308	3.695
Income Per Capita	The log level of income per capita in a community	7.997	1.210
Marketized Index	A index to measure the degree of marketization of a province in 2007	7.795	1.677

Note: Marketized Index is from Fan et al. (2011)

Table 3-2 Estimates of OLS Regression for Cadre Child on Cognition

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TICS (0-10)	TICS (0-10)	Memory (1-16)	Memory (1-16)	Overall Cognition	Overall Cognition
Cadre Child	0.651***	0.465***	0.121	0.157*	0.222***	0.190***
	(0.119)	(0.120)	(0.084)	(0.083)	(0.064)	(0.062)
Chronic		0.003		0.007		0.008
		(0.019)		(0.014)		(0.010)
Local Elite		0.184		0.317***		0.173***
		(0.126)		(0.091)		(0.066)
Female		0.616***		0.309**		0.398***
		(0.167)		(0.132)		(0.086)
Age		0.408***		-0.245***		-0.053*
		(0.059)		(0.038)		(0.031)
Age^2		0.263***		0.072***		0.109***
		(0.025)		(0.017)		(0.013)
Married		-0.002***		-0.001***		-0.001***
		(0.000)		(0.000)		(0.000)
Primary		0.204**		-0.033		0.039
		(0.082)		(0.055)		(0.042)
Middle School		1.664***		0.541***		0.725***
		(0.075)		(0.050)		(0.039)
High School		1.985***		0.882***		0.932***
		(0.088)		(0.057)		(0.044)
College		2.163***		1.117***		1.066***
		(0.109)		(0.073)		(0.057)
Log of asset		2.073***		1.292***		1.089***
		(0.202)		(0.159)		(0.114)
Children Number		0.053***		0.039***		0.032***
		(0.006)		(0.004)		(0.003)
Aid from Children		-0.023		-0.016		-0.016
		(0.022)		(0.016)		(0.012)

Population		0.086		0.048		0.041
		(0.053)		(0.050)		(0.032)
Income per capita		0.019		-0.002		0.009
		(0.015)		(0.010)		(0.007)
Rural		0.152***		-0.016		0.032*
		(0.032)		(0.031)		(0.018)
Province Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.007***	-3.909***	2.224***	1.282**	-0.365***	-3.255***
	(0.159)	(0.842)	(0.178)	(0.603)	(0.126)	(0.442)
Observations	17,352	15,270	17,352	15,270	17,352	15,270
R-squared	0.044	0.221	0.023	0.144	0.041	0.215

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 3-3 Estimates of OLS Regression for Cadre Child on Cognition: by rank

	(1)	(2)	(3)
Variables	TICS	Memory	Cognition
		Low-rank cadre families	
Cadre Child	0.207	-0.046	0.121
	(0.167)	(0.108)	(0.240)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	14,928	14,928	14,928
R-squared	0.217	0.143	0.243
		High-rank cadre families	
Cadre Child	0.802***	0.388***	0.422***
	(0.156)	(0.118)	(0.082)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	14,873	14,873	14,873
R-squared	0.221	0.143	0.215

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Other controls are the same as the controls in Table 3-2.

Table 3-4 Estimates of OLS Regression for Cadre Child on Social Interaction

	(1)	(2)	(3)
	Full sample	Low-rank	High-rank
Panel A: Dependent Variable – Social Interaction			
Cadre Child	0.237**	0.083	0.413***
	(0.095)	(0.119)	(0.159)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	15,270	14,928	14,873
R-squared	0.072	0.069	0.072
Panel B: Dependent Variable – Entertaining Activities			
Cadre Child	0.208**	0.084	0.345**
	(0.091)	(0.115)	(0.148)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	15,270	14,928	14,873
R-squared	0.077	0.074	0.077
Panel C: Dependent Variable – Voluntary Activities			
Cadre Child	0.029	-0.001	0.068
	(0.024)	(0.027)	(0.045)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	15,270	14,928	14,873
R-squared	0.058	0.059	0.060

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Other controls are the same as the controls in Table 3-2.

Table 3-5 Estimates of OLS Regression with/without Social Interaction

	(1)	(2)	(3)
Dependent Variable:			
Overall Cognition	Full sample	Low-rank	High-rank
Panel A: without social interaction			
Cadre Child	0.190***	0.121	0.422***
	(0.062)	(0.240)	(0.082)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	15,270	14,928	14,873
R-squared	0.215	0.243	0.215
Panel B: with social interaction			
Cadre Child	0.151**	0.080	0.354***
	(0.060)	(0.230)	(0.085)
Social Interaction	0.164***	0.166***	0.165***
	(0.008)	(0.008)	(0.008)
Other controls	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes
Observations	15,270	14,928	14,873
R-squared	0.244	0.242	0.244

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Other controls are the same as the controls in Table 3-2.

Table 3-6 Estimates of OLS for Cadre Child on Cognition: by Marketization

	(1)	(2)	(3)	(4)
Dependent Variable	TICS	Memory	Overall Cognition	Social Interaction
Panel A: Less-Marketized Sample				
Cadre Child	0.452***	0.385***	0.281***	0.344**
	(0.172)	(0.120)	(0.087)	(0.142)
Other controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Observations	7,364	7,364	7,364	7,364
R-squared	0.228	0.157	0.223	0.090
Panel B: More-Marketized Sample				
Cadre Child	0.488***	-0.029	0.122	0.137
	(0.169)	(0.113)	(0.087)	(0.126)
Other controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Observations	7,906	7,906	7,906	7,906
R-squared	0.213	0.134	0.207	0.055

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 3-7 Estimates of Regressions for Robustness Check

	(1)	(2)	(4)	(5)
Dependent Variable	TICS	Memory	Overall Cognition	Social Interaction
Panel A: Parents of Children Aged 35 or Younger				
Cadre Child	0.468**	0.258*	0.193*	0.270*
	(0.193)	(0.135)	(0.099)	(0.138)
Other controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Observations	9,858	9,858	9,858	9,858
R-squared	0.177	0.105	0.158	0.071
Panel B: "Non-Local-Elite" Parents				
Cadre Child	0.446***	0.149*	0.183***	0.235***
	(0.124)	(0.085)	(0.064)	(0.070)
Other controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Observations	14,545	14,545	14,545	14,545
R-squared	0.216	0.136	0.208	0.070
Panel C: "Local-Elite" Parents				
Cadre Child	0.944*	0.397	0.421*	0.392
	(0.500)	(0.362)	(0.254)	(0.408)
Other controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Observations	724	724	724	724
R-squared	0.147	0.140	0.159	0.104

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4. To be Beautiful or Smart: Daughter Naming and Female Schooling

4.1 Introduction

In the past century, a striking growth in female schooling has taken place across the globe. Equipped with education, women have increased their involvement in the economy and changed their roles in the family. Claudia Goldin (2006) called such a significant change a "quiet revolution" transforming women's lives and also the world. What were the forces pushing this revolution? Most previous studies give credit to the changes in markets and institutions, such as the expansion of industries demanding less muscle and more thought, and the adoption of compulsory education laws. However, parents under the same economic conditions invest differently in their daughters' human capital and some parents don't send their daughters to school even though compulsory education laws require them to do so. Goldstein and Stecklov (2015) suggest child naming provides a window to look into parents' minds. Using the U.S. censuses of 1880 to 1930, they find that the given names of children of European immigrants signal their parents' attitudes to cultural assimilation, and that ethnic naming can affect occupational achievement. In this paper, I investigate the sources of such heterogeneity by 'looking into the minds' of Chinese parents by studying the effect of given names with the data 2005 China Population Census.

The differences in parents' attitudes and girls' career aspirations are often overlooked or treated as "unobservable selectivity" in the traditional cost-benefit-analysis framework, and thus the importance of the role of gradual transformation of social traditions in such a "quiet revolution" may be underestimated. According to the cost-benefit-analysis framework, a change of parental investment in their daughter's education must be caused by at least one of the factors in the system: educational costs, expected returns and household budget constraints. The parameters of parents' utility function are often assumed to be homogeneous and invariant across time. These untested and possibly incorrect assumptions could cause some misinterpretations in empirical studies. For example, the heterogeneity of parents' preference is sometimes considered as unobservable selectivity that disturbs causal identification (Chetty et al., 2016) and the impact of the transformation of social tradition is wrongly credited to market forces. In developing countries, economic development loosens household budget constraints while at the same time increasing the value of child labor. That may explain why empirical studies cannot reach an agreement about whether economic development strengthens or weakens gender stratification in education (Hannum, 2005). Under such a condition, the cost-benefit analysis framework also lacks predictive power when a change in market conditions induces income effect and substitution effect simultaneously. It is partially because the attitudes of parents (or in the words of economists, preference heterogeneity) were unknown or ignored in these studies.

Knowledge about parents' attitudes toward their daughters' education is of great importance for policy makers. A lot of effort has been spent on identifying the effects of policies that aim to increase female schooling (King and Hill, 1997). The channels through which policies affect individuals' behaviors are complicated. Policies such as

compulsory education laws and child labor laws directly affect the costs and returns on investments in daughters' education. However, the effects of some policies are also mediated by changing attitudes and aspirations. For example, in India, the gender gap in career aspirations closed by 20% in parents and 32% in adolescents if a village was randomly assigned a female leader (Beaman et al., 2012). Huang et al. (2015) also find that the enforcement of One-Child Policy in China can explain about 30 percent of the increase of education for women born between 1945 and 1980; the change of parents' subjective attitudes is among the potential mechanisms behind such an effect. Therefore, the estimates of the impacts of a specific policy could be biased if researchers assume the preferences of individuals are fixed and do not take into account the possibility of changes in attitudes.

People think differently about the life paths of their children, especially for daughters. Most parents have pre-formed expectations about whether their daughter will be family-oriented or career-oriented at the time of her birth, though they are not always consciously aware of these expectations. But baby naming may reveal their true attitudes. In China, a given name typically consists of one or two Chinese characters with each character carrying a specific meaning.[3] For example, a name containing an intelligence-related character may reveal parents' expectations about their daughter's academic performance while one containing a flower-related character may deliver the message that parents want their daughter to be beautiful and soft. In some sense, the expectations embedded in the former name are more career-oriented and less family-oriented than in the latter. It is also well recognized that role models are an important influence on educational choices (Dryler, 1998), and parents may have ideas about who is worthy of imitation for their children. In this case, they may decide on a given name that is the same as or similar to the name of the chosen role model. For example, if rural parents expect their daughters to work and live in cities, they will look at the names of their friends living in cities and imitate them.

This paper investigates the link between a girl's given name and her educational attainment. The premise is that the name may contain information about her parents' expectations and also affect the girl's own career aspirations. A girl whose name contains a character related to beauty is found to be less likely to enroll in secondary school than a girl whose name contains a character related to intelligence. Using a strategy similar to Goldstein and Stecklov (2015), I further construct three quantitative measures of parents' expectations: education-name index (ENI), urban-name index (UNI) and male-name index (MNI). For girls, a name sounding more educated, urban, and male is found to be associated with higher educational attainment and a lower number of younger siblings. This finding is consistent with the theory of quantity-quality tradeoff and suggests that daughter naming may reflect parents' preferences. The effects of name indices still exist even when I control the household-level fixed effects with a subsample of families with more than one daughter, which implies that name affects education through channels other than just parental attitudes. The effects on education are stronger in rural areas than in urban areas but the effects on sibling numbers are weaker.

[3] Not like in the West, a Chinese kid is rarely given a name once used by his (her) elder relatives because of the tradition of "name taboo (*避讳*)",.

The main goal of this paper is to explore the role of parental attitudes in the accumulation of women's human capital. First, the paper contributes to understanding the rapid rise in female schooling in China during the 1980s. Previous studies explain such a revolutionary change with regulation policies such as the One-Child Policy and compulsory education laws or with the expansion of industries requiring less muscle power and more brain power. Our results suggest that the shift in social ideas about women's roles is also a driving force. Second, it is also related to the branch of literature about the effects of the number of siblings on educational outcomes (Blake 1981; Guo and VanWey, 1999; Zajonc and Markus, 1975). Our results show that parents make joint decisions about children quantity and children quality as early as around the birth of the eldest child. Third, by comparing the results of the rural sample with those of the urban sample, I show that the magnitudes of effects may depend on environmental factors.

4.2 Data

The dataset used in this paper is a 25-percent sample of the 2005 China One-Percent Population Census with names, which includes approximately 3 million individuals. This dataset contains information about name, gender, educational level, year and month of birth, region of residence, type of hukou (rural/urban)[4], occupation (in seven categories), monthly income, and relationship to the household head. The measure of education here is a dummy variable, whether a girl has gone to secondary school or not. In fact, the compulsory education law of China was implemented in 1986, but even so more than 10 percent of parents living in rural areas didn't enroll their daughters in secondary school. Therefore, this study mainly focuses on the marginal effect on individuals on the left tail of educational distribution. In other words, this study investigates who will drop out of secondary school and violate the compulsory education law? The answer to this question can help policy makers to improve the efficacy of compulsory education law.

I limit our analysis to eldest girls born in the period of 1986-1991. That is, they were 14-19 years old when the survey was conducted in 2005. Because the legal age for enrolling in secondary school in China is 12 years old, girls who were not enrolled in or hadn't finished secondary school after their fourteenth birthdays can be reasonably considered as dropouts. On the other side, the legal marriageable age for females is 20 in rural China and two years older in the cities. If a daughter gets married and leaves the house, her information may not appear in our data. To avoid the endogeneity caused by sample selection, I exclude daughters older than 20 from our sample.

Three name indices are computed on the basis of the subsample of women born in the period of 1976-1985, who are one to fifteen years older than the girls analyzed in this paper. I excluded names used by fewer than ten people during our computation to ensure the precision of indices, with the result that more than 3,000 names were kept. The indices of these names are matched to the 31,688 girls in our test set. Such a methodology is consistent with our hypothesis that parents tend to give a name similar to the role models whom they want their daughter to imitate.

[4] Hukou is the government system of household registration record in China. This system identifies every person as a resident of an area. The residency status can be either "urban" or "rural", which was originally determined the status of parents but could be under some conditions. The movement of people between rural and urban areas was strictly controlled in the years before 1980s.

4.3 Measures

A typical Chinese given name is composed of one or two Chinese characters, each with a specific meaning. The number of commonly-used characters in daily life is estimated to be around 3500. That is, the potential combinations of two-character names could be as many as one million. However, the top 10 family names in China cover 52.8% of the whole population and the top 100 family names cover 96.6%. Therefore, compared with that in Western countries, the distribution of family names in China is highly concentrated, but the set of potential given names is much larger. In most cases, I can read parents' attitudes from the meanings of the characters of a given name. For example, one of my teachers in high school was named "Mingshu (*明书*)", which means "understand the books". Such a name clearly delivers the message that her parents expected her to be literary.

I compute the degree of the orientation of parents' expectations based on the relative frequency of each name in a specific group. For example, the education-name index (ENI) is the proportion of high-school graduates among the holders of a specific given name. ENI is defined as:

$$ENI_i = \frac{N(name_i | high\ school\ graduation = 1)}{N(name_i)},$$

where the denominator is the number of individuals holding given name i and the numerator is the number of high-school graduates holding the given name i in the cohorts born during 1976-1985. For example, there are 12 people holding the given name "Ziyi (*子怡*)" and 10 of them had completed high school. Then, the ENI value of "Ziyi (*子怡*)" is 0.83. Similarly, I can compute the urban-name index (UNI) and male-name index (MNI) as follows:

$$UNI_i = \frac{N(name_i | urban\ resident = 1)}{N(name_i)}$$

$$MNI_i = \frac{N(name_i | male = 1)}{N(name_i)}$$

The values of these three indices range from 0 to 1. For example, a UNI value of zero means that no urban resident has adopted this name and a MNI value of 1 means that this name is exclusively used by men. As in other developing countries, the income gap between rural and urban in China is sizable and urban life is much more attractive. According to household registration policies, a rural hukou holder will be granted an urban hukou automatically once he or she is registered in a college. Every year since 2000, millions of people changed their hukou from rural to urban by passing the college entrance exam. At the same time, job opportunities in the cities have higher educational requirements. Therefore, parents who want their daughter to live in a city will invest more in their daughter's education. The male-name index is more related to the degree of son preference. A male-style name for a daughter can be a signal that the parents will raise her like a son. In less-developed regions, boys tend to obtain more educational resources from the family. The kernel distributions of all indices by residence are presented in Figure 4-1.

Urban residents on average were given names of higher ENI and UNI values. But there are large overlapping areas between the distributions of rural samples and those of urban samples. It means that parents living in similar social contexts can have heterogeneous attitudes toward their daughters. A girl is rarely given a name more typically given to a boy and it's especially rare in rural areas. Therefore, girls with man-style names could be quite special. One example is Chien-Shiung Wu (*吴健雄*), who was a professor of physics at UC Berkeley and also the first female president of American Physical Society. Her given name "Chien-Shiung (*健雄*)" means "strong and manly", which is typically used by men.

During the transformation of women's social roles, parents may disagree about what kind of career is most beneficial for their daughter or the family. In traditional society, sons took on the responsibilities of taking care of elderly parents and daughters realized their value through the marriage market. As China becomes more modernized, women increasingly participate in the labor market and obtain similar returns as men on human capital. Therefore, some old-fashioned parents may attach great importance to marriage while some more modern parents might pay more attention to their daughter's educational attainment and career success. With all this in mind, are our indices good measures for parents' attitudes?

As mentioned earlier, the Chinese characters of a given name carry specific meanings which may reflect parental attitudes. For example, a flower-related or beauty-related name shows the expectation that the parents want their daughter to be beautiful and competitive on the traditional marriage market. And an intelligence-related name reveals that the parents have high expectations for their daughter's educational attainment. To examine whether our name indices capture parents' expectations, I found the five most common characters in each of the following categories: flower-related, beauty-related, and intelligence-related.

For each character, I calculate the means of ENI and UNI of all names containing this character. I adjust the means for each character by deducting the means of the whole population, and then plot the adjusted values in Figure 4-2. I can see that names containing an intelligence-related character are scored significantly higher than those containing a flower-related or beauty-related character in both ENI and UNI. And almost all the average values of names containing a flower-related or beauty-related character are lower than the average of the whole population. The pattern shown in Figure 4-2 supports that our indices do effectively capture parents' expectations embedded in their daughter's name.

4.4 Results

To examine how female schooling is associated with a daughter's given name, I conduct the following OLS regressions:

$$Y_{ijb} = \beta_0 + \beta_1 nameindex_i + \beta_2 X_i + \beta_3 cohort_b + \beta_3 province_j + \varepsilon_i$$

Here Y_{ijb} is the dependent variable of our interests. It can be a dummy variable indicating whether the individual went to secondary school, and it also can be the number of younger siblings. X_i are a group of variables of parents' characteristics including

marriage age, education and occupation. $cohort_b$ are a group of dummy variables indicating birth year and $province_j$ are province-level dummies.

I first investigate the effects of the given name on girls' education empirically. The regressions of education on ENI, UNI and MNI are conducted separately. The results are reported in Table 4-2. All the coefficients of name indices are significantly positive and the coefficient of UNI is the largest among them. The magnitudes of the coefficients drop by around 40 percent if I control the variables of parents' characteristics such as income, education, occupation, and marriage year. Girls living in rural areas were less-educated than girls living in the cities. The father's income is positively associated with his daughter's education but the coefficient of the mother's income is statistically insignificant. However, while both the father's and the mother's education have encouraging effects on the daughter's education, the magnitude of the mother's education is stronger.

The results suggest that the predictive power of the given name is statistically significant. More specifically, according to the regressions controlling the parents' characteristics, an increase of 0.1 in ENI, UNI and MNI will boost the likelihood of secondary school enrollment by 9.8%, 12.3% and 2.1%. In other words, the effect of an increase of 0.1 in ENI will be roughly equivalent to an increase of 2500 Chinese Yuan in father's income.

I then investigated the mechanism behind the positive relationships between education and name indices. As discussed before, given names reveal parents' expectation and thus can predict their home encouragement. However, in the survey of the 2005 Population Census, respondents were not asked about their expectations for their children's education or their attitudes toward child-raising. As far as I know, Hannum et al. (2009) is the only attempt to investigate the role of parents' attitudes with questionnaire surveys. Their questionnaire has some questions about parental perceptions of abilities and appropriate roles for boys and girls. The potential problem of the survey approach is that parents may not reveal their true attitudes for emotional and/or moral reasons.

According to Becker (1991)'s classic theory, parents have to make a trade-off between child quantity and quality. Parents may have heterogeneous preferences about quantity and quality. Those who aim to raise more highly-educated children have to have fewer children because of time and resource constraints. Therefore, if the correlations observed in Table 4-2 are because name is a good proxy for parents' attitudes, then I also expect that high-scored names are associated with smaller family size. I regress the number of younger siblings on the name indices and present the results in Table 4-3.

I find that the number of younger siblings is negatively associated with the name indices. Similar to the results in Table 4-2, the coefficients of name indices drop by around 40% after the variables of parents' characteristics are controlled. Take column (4) as an example. The number of younger siblings will decrease by 0.04 as the ENI value increases by 0.1. It suggests that the effect on education is actually caused by parents' choice and that name choice can be a good proxy of parents' attitudes towards the quantity-quality tradeoff. The signs of the coefficients of control variables are also consistent with Becker and Barro (1988). Rural couples tend to have more children. The

father's income has an encouraging effect on child quantity which supports the hypothesis of income effect, but the mother's income has a discouraging effect which suggests that substitution effect dominates income effect here because the mother's salary is a large part of the "shadow price" of raising a child. Both the father's and mother's education are negatively associated with the number of younger siblings, but the coefficient of the mother's education is larger.

Because socio-economic conditions and institutions in rural China are quite different from those in urban China, parents with similar attitudes may behave differently when raising children. I further divided our sample into two groups according to respondent's residency, and re-conducted our analyses above with rural and urban groups separately. The results are shown in Table 4-4, in which columns 1 to 3 are for rural samples and columns 4 to 6 are for urban samples. The coefficients are consistent with our previous findings: the name indices are positively associated with education and negatively associated with the number of younger siblings in both rural and urban areas. For the rural sample, the magnitudes of the effects on education are smaller than that for the urban sample but the magnitudes of the effects on the number of younger siblings are greater. One possible explanation is the difference in freedom of choice. For example, urban residents face stricter implementation of compulsory education laws but have easier access to contraception. Therefore, compared with rural parents holding similar expectations, urban parents have less power to decide whether send their daughters to secondary school but have better control over the total number of children.

Besides predicting parents' educational inputs, name also changes its holder's career aspirations and affects others' perceptions of her. For example, a couple may unintentionally give an intelligence name to their daughter but nonetheless the name inspires the girl to study hard when she understands its meaning. At the same time, people draw information from a person's name and make inferences. In Bertrand and Mullainathan's (2004) field experiment, fictitious resumes were sent to help-wanted ads in Boston and Chicago. Those with white-sounding names received 50 percent more callbacks for interviews. Similarly, girls with intelligence-related names are more likely to be perceived as being from families with a high socio-economic status, which gives them some advantages in seizing some opportunities. To examine whether the effects of name come from sources other than parents, I added household-level fixed effects into our regressions and repeated our analyses with the subsample of households with two or more daughters. I also control a dummy variable indicating whether she is the eldest daughter but do not find a significant effect. In Table 4-5, I can see that the coefficients are still statistically significant. Even in the same family, the daughter with a higher scored name tends to have higher educational attainment. In other words, the effects of name on education work through channels other than the parents' inputs. However, because only a fraction of our sample (13771 out of 31688) are living in households with at least two daughters, I can't estimate the relative contribution of these channels by comparing the coefficients in Table 4-5 with those in Table 4-1.

One concern about the findings presented above is that the effects of name on education could be caused by some variables missing in our regressions. That is, even though I have done all that I can do to control parents' characteristics, there still could be some unobservable factors which affect daughter naming and educational inputs

simultaneously. By adding household-level fixed effects, the regressions in Table 4-5 provide evidence supporting the causal link between given name and education.

4.5 Concluding Remarks

With the name data from the 2005 China One-Percent National Census, I attempt to measure parents' expectations of their daughters based on name giving. More specifically, I construct three indices for each name: the proportion of high-educated users (ENI), the proportion of urban-resident users (UNI), and the proportion of male users (MNI). I find that daughters with high-scored names tend to be better educated and have fewer younger siblings. The effects of parental expectations on female schooling hold robustly even after I control for parental characteristics. In other words, the heterogeneity of parental expectations contributes significantly to educational gender inequality in China. But the effects depend on the choice set in the context. For example, urban residents have less freedom in deciding whether to send their daughters to secondary school because of the strict implementation of compulsory education law, but they can control fertility better because contractive methods are more available. The association between education and name indices remains significant even after I have the variables of parent characteristics controlled. This suggests that the given name affects girls' education through channels other than parents' inputs.

China has experienced a great transformation in the past half century, which makes gender inequality in China a momentous but complicated topic. On one side, the tradition of son preference still plays an important role in daily life. For example, there are many studies showing the existence of gender discrimination and selective abortion. On the other side, China is also on a fast track to modernity. If I look at indicators such as female labor participation and the share of female college graduates, women in China seem to perform quite well in education and careers. Obviously, the duality of China's "quiet revolution" reflects the dynamic process of the conceptual shift of women's social role. It's meaningful to investigate how people change their attitudes during this transformation and whether the shift in subjective attitudes has a real impact on women's development. Our study sheds some light on understanding the changes in female schooling, and in fertility behavior in China.

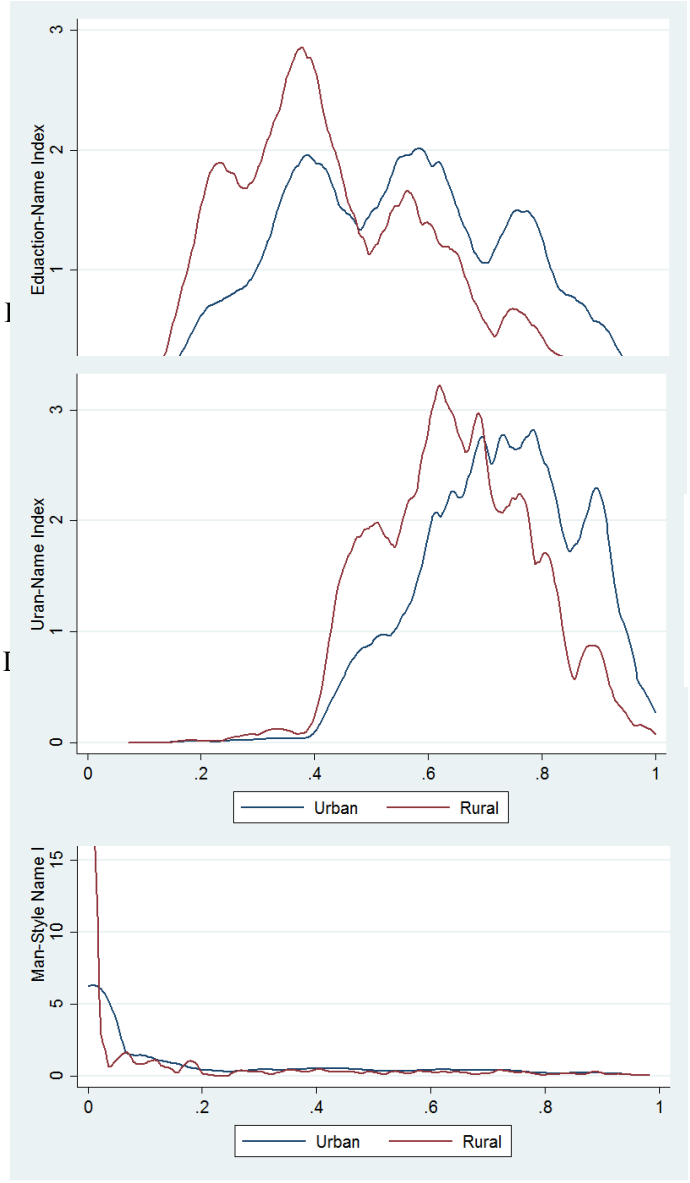
One potential extension of this work is to link our findings with policies in China. According to the classic model of utility maximization, one policy can alter individuals' behaviors by changing prices immediately. However, policies also induce long-term consequences by changing preferences. For example, the one-child policy in China reduces fertility and raises girls' education by increasing the costs of births beyond the "birth quota". But social values shift as more and more women become educated and enter the workplace on the same level as men. The role of breadwinner has become increasingly acceptable for women. After the policy has been in place for a few decades, it becomes highly unlikely that fertility rates or women's roles would go back to their original points even if the policy was abandoned. Both social values and parents' attitudes have changed.

However, I acknowledge that this study still has some limitations. The most problematic is that the questionnaire of the census survey doesn't provide much information about how parents think and behave. For example, if the questionnaire

contained questions about parents' expectations of their daughters' education or their actual expenditures on her education, I may find more convincing evidence for our story. One potential extension of this work is to re-examine our findings with household-level surveys conducted by academic institutions.

Figure 4-1 The Kernel Distribution of Name Indices (by Rural/Urban)

(a) The Kernel Distribution of Education-Name Index (ENI)



(b) The Kernel I

(c) The Kernel I

Figure 4-2 The ENI and UNI of Names with a Specific Character

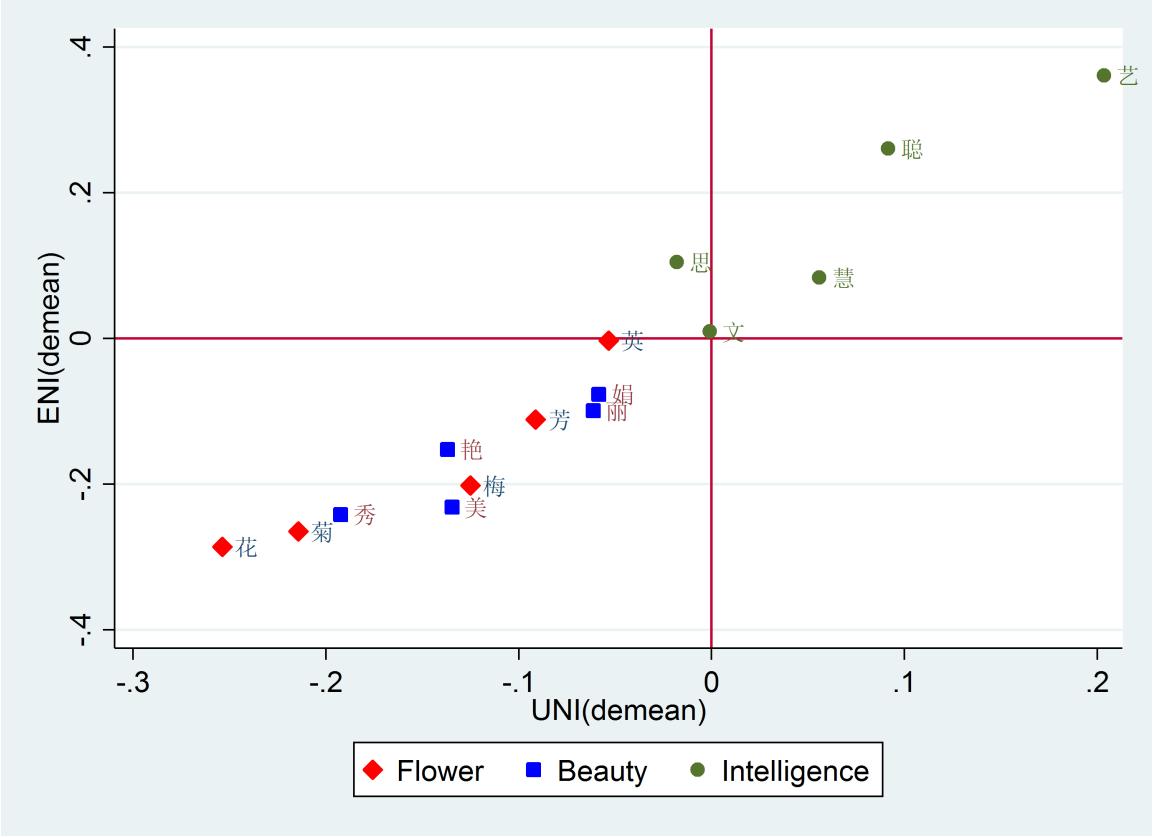


Table 4-1 Three Groups of Chinese Characters from Common Names

	花	梅	菊	英	芳
Flower-related	(flower)	(plum Blossom)	(chrysanthemum)	(petal)	(fragrant)
	美	丽	艳	秀	娟
Beauty-related	(beautiful)	(pretty)	(gorgeous)	(elegant)	(graceful)
	文	慧	聪	思	艺
Intelligence-related	(literary)	(intelligent)	(smart)	(thinking)	(arts)

Table 4-2 The Estimates of Regressions for Name Index on Education

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: whether attend to junior high school (Yes=1/No=0)						
ENI	1.657***			0.989***		
	(0.0596)			(0.0598)		
UNI		2.084***			1.231***	
		(0.0798)			(0.0797)	
MNI			0.395***			0.209***
			(0.0443)			(0.0428)
Mother's Income				-3.11e-05	-3.42e-05	-3.71e-05
				(3.40e-05)	(3.41e-05)	(3.42e-05)
Father's Income				4.94e-05***	5.11e-05***	5.36e-05***
				(1.80e-05)	(1.80e-05)	(1.81e-05)
Mother's Education				0.366***	0.371***	0.393***
				(0.0170)	(0.0170)	(0.0170)
Father's Education				0.262***	0.267***	0.286***
				(0.0168)	(0.0168)	(0.0168)
Rural	-1.076***	-0.948***	-1.076***	-0.500***	-0.505***	-0.545***
	（0.0247）	（0.025）	(0.0247)	(0.0266)	(0.0266)	(0.0266)
Constant	11.60***	10.99***	12.51***	11.26***	10.90***	11.76***
	(0.0951)	(0.108)	(0.0895)	(0.0964)	(0.108)	(0.0914)
Mother's Occupation Dummies	No	No	No	Yes	Yes	Yes
Father's Occupation Dummies	No	No	No	Yes	Yes	Yes
Mother's Marriage-year Dummies	No	No	No	Yes	Yes	Yes
Father's Marriage-year Dummies	No	No	No	Yes	Yes	Yes
Birth-Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,682	31,688	31,688	31,682	31,688	31,688
R-squared	0.248	0.246	0.231	0.299	0.298	0.293

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4-3 The Estimates of Regressions for Name Index on the Number of Younger Siblings

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: the number of younger siblings					
ENI	-0.703***			-0.400***		
	(0.0252)			(0.0250)		
UNI		-0.946***			-0.558***	
		(0.0338)			(0.0332)	
MNI			-0.159***			-0.0842***
			(0.0188)			(0.0179)
Mother's Income				-2.48e-05*	-2.36e-05*	-2.24e-05
				(1.42e-05)	(1.42e-05)	(1.43e-05)
Father's Income				2.66e-05***	2.60e-05***	2.48e-05***
				(7.53e-06)	(7.53e-06)	(7.56e-06)
Mother's Education				-0.117***	-0.118***	-0.129***
				(0.00710)	(0.00709)	(0.00709)
Father's Education				-0.055***	-0.055***	-0.0640***
				(0.00701)	(0.00700)	(0.00701)
Rural	0.543***	0.544***	0.603***	0.359***	0.359***	0.377***
	(0.0106)	(0.0106)	(0.0105)	(0.0111)	(0.0111)	(0.0111)
Mother's Occupation Dummies	No	No	No	Yes	Yes	Yes
Father's Occupation Dummies	No	No	No	Yes	Yes	Yes
Mother's Marriage-year Dummies	No	No	No	Yes	Yes	Yes
Father's Marriage-year Dummies	No	No	No	Yes	Yes	Yes
Birth-Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.728***	1.035***	0.340***	0.697***	0.887***	0.495***
	(0.0403)	(0.0455)	(0.0380)	(0.0402)	(0.0450)	(0.0382)
Observations	31,682	31,688	31,688	31,682	31,688	31,688
R-squared	0.258	0.259	0.242	0.329	0.330	0.324

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4-4 The Estimates of Regressions for Name Index (Rural/Urban)

	(1)	(2)	(3)	(4)	(5)	(6)
	Rural			**Urban**		
Panel A. Dependent Variable: whether attend to junior high school (Yes=1/No=0)						
ENI	0.960***			0.790***		
	(0.0711)			(0.107)		
UNI		1.191***			0.922***	
		(0.0929)			(0.150)	
MNI			0.196***			0.163**
			(0.0514)			(0.0742)
Constant	10.72***	10.35***	11.15***	12.11***	11.87***	12.53***
	(0.156)	(0.165)	(0.153)	(0.132)	(0.162)	(0.118)
Observations	23,300	23,305	23,305	8,382	8,383	8,383
R-squared	0.208	0.207	0.202	0.387	0.386	0.384
Panel B. Dependent Variable: the number of younger siblings						
ENI	-0.298***			-0.504***		
	(0.0310)			(0.0390)		
UNI		-0.421***			-0.752***	
		(0.0404)			(0.0546)	
MNI			-0.0655***			-0.107***
			(0.0223)			(0.0273)
Constant	0.894***	1.176***	0.894***	0.670***	0.942***	0.401***
	(0.0665)	(0.0720)	(0.0665)	(0.0483)	(0.0592)	(0.0435)
Observations	23,305	23,305	23,305	8,382	8,383	8,383
R-squared	0.229	0.232	0.229	0.361	0.362	0.349

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4-5 The Estimates of Regressions for Name Index on Education
(with Household-Level Fixed Effects)

	(1)	(2)	(3)
Dependent Variable: attended junior high school or not (Yes=1/No=0)			
ENI	1.078***		
	(0.118)		
UNI		1.251***	
		(0.141)	
MNI			0.323**
			(0.141)
First Birth	0.0521	0.0495	-0.0164
	(0.0404)	(0.0402)	(0.0581)
Constant	0.709***	0.363***	1.937***
	(0.0756)	(0.107)	(0.14)
Observations	7,695	7,704	7,705
Number of Households	6,066	6,066	6,066

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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