



**ADB Working Paper Series**

**THREE GENERATIONS OF CHANGING  
GENDER PATTERNS OF SCHOOLING  
IN THE PEOPLE'S REPUBLIC OF CHINA**

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**Abstract**

The phenomenon of son preference in the People's Republic of China and throughout much of Asia has been well documented. However, changing economic conditions, such as increases in educational attainment and employment opportunities for women and the rise in the prevalence of one-child families, have likely changed the incentives for parents to invest in daughters. In this paper we take advantage of data spanning three generations of Chinese families to examine the evolution of educational attainment for boys and girls and importantly the relative levels of schooling of each gender. We also use variation in the timing of compulsory schooling laws and the implementation of the one-child policy to assess the effect of these policy measures on the relative educational levels. We find a substantial narrowing of the gap between the schooling of boys and girls, so much so that girls now have more schooling on average than boys. In addition, public policy initiatives had a larger effect in rural than urban areas.

**Keywords:** compulsory schooling, one-child policy, gender differences in education, People's Republic of China

**JEL Classification:** I2, I280, J13, J16

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## 1. INTRODUCTION

The People's Republic of China (PRC) has distinguished itself over the past several decades by its extremely rapid economic growth and the accompanying sharp rise in literacy and in living standards. However, it is also notable for the strong son preference that has led to one of the most imbalanced sex ratios in the world. The most recent data put the ratio at 1.15 boys to girls at birth and 1.17 boys to girls between the ages of 0 and 14 years (World Fact Book 2018). Son preference has been a pronounced phenomenon for generations and is evident in several other countries as well (see Hesketh and Xing [2006] for a discussion detailing sex ratios in Asia).

Son preference has been attributed to numerous underlying cultural norms (Das Gupta et al. 2010) but is likely also due, at least in part, to economic factors. Parents who may anticipate a need for old-age support may prefer sons who not only have had a greater earning potential than daughters, but who, given cultural norms, have typically been more likely to live near parents than daughters who traditionally have lived nearer their husband's family.

The strong son preference in the PRC is manifested prior to birth in selective abortion and other means of skewing the sex ratio at birth, and subsequently through higher mortality rates for newborn daughters relative to sons. It can also manifest itself as children grow, with fewer resources devoted to daughters than to sons. Studies have shown worse health outcomes for girls than for boys (Pande 2003; Li, Zhu, and Feldman 2004; Mishra, Roy, and Retherford 2004), less financial support (Lei et al. 2017), and less investment in schooling (Gandhi Kingdon 2002; Wang 2005; Song, Appleton, and Knight 2006).

In this paper we examine this latter outcome, differential investments in schooling. These differences bear clearly on well-being throughout the child's adult life. Similarly schooling investments have been key to the pronounced economic growth in the PRC, so they are an important part of meeting future economic goals. Finally, not only do family preferences and resources affect schooling, but several public policy interventions have likely had an impact as well, meaning that understanding the mechanisms for changing patterns of schooling attainment has important implications for choices regarding future government policies.

In addition to differences by gender, we focus our attention on differences in schooling investments between rural and urban areas. Not only are economic conditions different across regions, implying differing returns to education, but we might also expect the strength of son preference and other attitudes towards sons and daughters to vary differentially between the two areas as well.

In this paper we use data from the China Health and Retirement Longitudinal Study (CHARLS) to analyze schooling attainment for three generations of Chinese men and women, giving us an unusually long view of changes in investments. While CHARLS is a panel study of individuals aged 45 or older and their spouses, the survey also collects information on the parents and children of these respondents. These generation data provide us with the opportunity to examine the time path of schooling investments for individual families and to control for differences *within* families. We can look at intergenerational correlations in schooling attainment for a full three-generation dynasty.

In our work we not only look at time trends in completed schooling but attempt to identify the importance of two key policies central to Chinese economic growth: compulsory schooling laws and the enactment of the PRC's one-child policy. The effects of these policies are identified through the variation in timing for the rollouts and the degree of enforcement across geographic regions.

We find large differences in schooling by both region (urban or rural) and gender, but these differences have decreased substantially over time—particularly those differences between the schooling attainment of males and females in urban areas. The gains in schooling for females are large enough that among the youngest in our sample, women have more years of schooling, on average, than do young men. With respect to public policy levers, we find that compulsory schooling laws contributed significantly to the rise in schooling, and did so to a greater extent in rural areas, and particularly for females in these areas. Furthermore, the one-child policy has had a significant effect on schooling for both boys and girls, likely as parents increase the investment in children rather than attempt to divide that investment across siblings. The lower total cost associated with raising one child rather than several also allows greater resources to be directed toward education. However, contrary to expectations, we do not find differing effects of the one-child policy for educational outcomes for males and females.

In the following section we provide some background on son preference and on schooling attainment. In Section 3 we introduce our data set along with some descriptive statistics. Section 4 provides our formal regression analysis and the final section offers our conclusions.

## **2. BACKGROUND**

### **2.1 Overview**

The PRC's economic growth has indeed been rapid, averaging close to 10% per year from 1989 to the present. Going back even further, the peak annual growth rate hit 19.3% in 1970 (numbers based on public data from the World Bank). This modernizing and growing economy has meant more resources to finance education and more job opportunities for educated individuals, particularly for women. A more educated populace, in turn, itself contributes to economic growth. Another artifact of modernization, improved health, and the increasing life expectancy accompanying economic growth provide for a longer working life and a longer length of time over which to reap returns to an investment in education. And finally, modernization can bring with it changes in attitudes or preferences, particularly the tradition of son preference, leading potentially to smaller biases in the distribution of educational investments.

In addition to the effect of rising economic fortunes in the PRC, and increased employment opportunities for women vis-à-vis schooling investments, education attainment in schooling levels in the PRC was also likely affected by public policy. Compulsory schooling laws introduced by the government beginning in 1986 mandated attendance through grade nine. These mandates would be expected to have had a larger effect on schooling for girls than boys, since girls started at lower levels of education. In providing a larger positive impact on female educational levels, these laws ought to have reduced the difference in the schooling attainment of boys and girls. Similarly, one might expect the effects of compulsory schooling to be larger in rural areas where schooling levels were initially low.

Finally, the one-child policy may also have led not just to greater schooling investment overall, but to a decline in the gap between the education of boys and girls. There are several reasons to posit such an effect. First, as highlighted by Almond, Li, and Meng (2014), with a limit on the number of children a family can have, parents with the strongest son preferences may choose selective abortion or other means to ensure the birth of a son. Thus, those families who did have a daughter would have been less averse to investing in a girl and thus more likely to provide her with greater levels of schooling. Second, with a single child, parents have an incentive to invest heavily in that child regardless of gender, and even if the “returns” to investing in a daughter are smaller than those of investing in a son, the investment in schooling will likely yield positive returns. And finally, with fewer children to support, parents can invest more in the schooling of all children. But daughters, starting at a lower average level of schooling, have more potential for gain once financial constraints are eased.

## 2.2 Son Preference

The tradition of son preference has long been strong in several Southeast Asian countries, and is evident through the skewed sex ratios existing therein. However, recent evidence suggests that this pattern is beginning to change. Lin (2009) notes the decline in son preference in Taipei, China. Survey results regarding women in Taipei, China indicate large declines in the fraction of women who report that absent a son, they would continue to have children regardless of the size of their family, until they had a son. Similarly, there are large declines in the fraction of women preferring more boys to girls (family size held constant), large increases in the fraction stating that sex does not matter, and even an increase in the fraction of those preferring more girls than boys.

In examining the correlates of son preference, it appears to be negatively related to the education of the mother, suggesting that increasing the level of education among women could result in an upward spiral of increasingly high schooling attainment for girls. Related work examining preferences in the Republic of Korea (Chung and Das Gupta 2007) reports similarly large declines in the importance of having a son among women of childbearing age.

This same pattern, a decline in the stated preference for sons, is evident in the PRC as well. Hesketh and Xing (2006) cite the results of a survey of young women in the PRC regarding preferences for both their desired family size and gender composition. The vast majority of women surveyed reported that their ideal family would consist of one son and one daughter. The next most frequently cited response was no gender preference. Among those stating a preference for one child, slightly more (5.9%) preferred one girl than preferred one boy (5.6%). We note that these data are based solely on hypothetical responses from women but the pattern does indicate that preferences are less uniformly skewed towards boys than in the past.

## 2.3 Schooling in the PRC

In 1986, the PRC instituted compulsory schooling requirements, mandating nine years of schooling for all children. Despite the laws, enrollment beyond primary grades remained far from universal for some time. The China Education and Research Network provides statistics indicating that in 1990, approximately 75% of those finishing primary school “graduated” to middle school.<sup>1</sup> While enrollments increased

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<sup>1</sup> [http://www.edu.cn/gai\\_kuang\\_495/20100121/t20100121\\_441886.shtml](http://www.edu.cn/gai_kuang_495/20100121/t20100121_441886.shtml)

rapidly in the following years, the children in our sample were born before 1991 and thus attended primary schools well before middle school attendance was ubiquitous.

Unsurprisingly, schooling in rural areas has been far below that in urban areas (Connelly and Zheng 2003) and several factors likely come in to play in explaining that difference. In rural areas the opportunity cost of sending a child to school is likely larger because the child could provide labor for the family. Conversely, the returns to schooling are lower in rural areas so the cost of foregoing a middle school education is lower. The “cost” of getting to school in terms of distance traveled/difficulty is also larger in rural areas, thereby reducing attendance (Li and Liu 2014). And the burden of paying associated school fees and the cost of books may be felt more strongly in rural areas where incomes are lower.<sup>2</sup>

### 3. DATA

#### 3.1 Description of CHARLS

Our data come from the Chinese Health and Retirement Longitudinal Study, or CHARLS. CHARLS is a longitudinal survey that is nationally representative of the noninstitutionalized Chinese population aged 45 years or older and their spouses. The first wave of the survey was fielded in 2011 with follow-up waves in 2013 and 2015 and continuing on a biennial basis.<sup>3</sup> CHARLS is part of a set of “sister surveys” established across a large number of countries, with the respondent populations in all cases focused on those approaching retirement. These related studies include the Health and Retirement Study in the United States (HRS), the Japanese Survey of Aging and Retirement (JSTAR), the Korean Longitudinal Study of Aging (KLOSA), the English Longitudinal Study of Ageing (ELSA), and the Survey of Health, Aging, and Retirement in Europe (SHARE), among others.<sup>4</sup> The surveys interview both respondents and their spouses, obtaining information on income, wealth, health, and family relationships.

The initial interview round of CHARLS, undertaken in 2001, surveyed 17,587 individuals in 10,257 households. There were 8,436 males and 9,151 females in this initial wave, with the larger number of women being due to differential mortality at older ages.<sup>5</sup> We draw our data primarily from the second wave of the survey in which a total of 18,605 respondents were interviewed.

Our study is focused on trends in schooling and the role of public policies instituted in the latter part of the last century in affecting that change. The key policies we analyze are the one-child policy and compulsory schooling laws, both of which were implemented approximately 30 to 40 years ago. To this end, we construct our analytic sample to focus primarily on the children of our respondents. With parents averaging 60 years old when the survey began, their children were born in precisely the time period most affected by the changes. In fact, the average birth year of the children in our sample is 1977, just prior to the establishment of the one-child policy. In addition to

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<sup>2</sup> Reforms enacted in 2001 through 2006 puts limits on the amount of tuition and fees that could be charged and allowed for financial assistance. See Chyi and Zhou (2014) for a discussion on the impact of these reforms.

<sup>3</sup> The 2015 data are not yet publicly available.

<sup>4</sup> Other related surveys are The Irish Longitudinal Study on Ageing (TILDA), the Mexican Health and Aging Study (MHAS), the Longitudinal Aging Study in India (LASI), and the Study on Global AGEing and Adult Health (SAGE).

<sup>5</sup> Despite the skewed sex ratio at birth currently, the sex ratio at birth in 1953 was estimated to be 105 boys for every 100 girls—approximately what is expected naturally (World Bank 2018).



these children, we also include the respondents themselves as well as the parents of the respondents (the grandparents of those on whom we focus). While many of these grandparents have already died, the survey collected schooling information and birth year for deceased grandparents so we can thus include them in our analysis of schooling attainments over time.

The use of these data, for three generations of the same family, is a key way in which our study differs from others examining schooling in the PRC. Not only do we have schooling for three generations in the same family, but at the child level, we have schooling for (typically) all children in the family.<sup>6</sup> We can thus look at differences in schooling attainment holding constant family fixed effects. In doing so, when focusing on the child generation, we are implicitly examining differences between brothers and sisters within the same family. We can thus assess the importance of gender, holding constant factors such as familial resources and attitudes towards schooling, measures that may be correlated with educational attainment and with the gender composition of the family, leading to biased results.

Both the parents and grandparents in our sample (i.e. the respondents and spouses in CHARLS and their own parents) are well beyond the age at which individuals are likely to be enrolled in school, so the initial reports of educational attainment are an accurate measure of completed schooling. However, at the start of the survey, a substantial fraction of children of the respondents are young enough that they are still accumulating years of schooling. We therefore impose an age cutoff for children, and choose the age of 22. Furthermore, to ensure that we have as large a sample as possible of those in this generation who are 22 years old or older, we use observations on schooling as measured in the second wave of the survey—the most recent data available. In doing so, we are providing these children with the potential for two additional years to age and to finish their education relative to schooling as reported in wave 1. Our age cutoff of 22 is thus based on age in wave 2, corresponding to the year 2013. These “children” were thus born in 1991 or earlier. Because our top education category is “some college or more,” even those children who are still attending college at the age of 22 will be denoted as having achieved some college, so their “final” level of schooling in our classification scheme will not change in subsequent waves. It is unlikely that many of those aged 22 years or older who have not previously attended college will return to school later in the survey (nor will those aged 22 or older return to complete primary school, middle school, or high school). With these restrictions we are left with a sample of 9,751 families with 27,306 children. Excluding families with zero household weight leaves 26,798 children in 9,558 families.

### 3.2 Descriptive Characteristics of Sample

Descriptive statistics for our sample are presented in Table 1. Here we use one observation per family and values of time-varying variables as measured in 2013. Because of the large differences between urban and rural areas in important measures such as schooling, income, and the enforcement of the one-child policy, we also report the means separately by the urban/rural status of the respondent household. The two rightmost columns of the table report these means. For this table, wherein we measure variables on the household level, we define rural or urban based on the location of the primary respondent at the time of the interview. We note that given the PRC’s rapid industrialization, this location may be different from the location of children or grandparents. It may also differ from the location of the respondent at the time he or

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<sup>6</sup> We limit our sample to children aged 22 years or older so in some families we will omit younger siblings.

she was born or the time the children were born. Later in the paper, when analyzing schooling on an individual level, we use the hukou of the individual's birth for each generation.

**Table 1: Weighted Summary Statistics of Family Characteristics**

	All		Urban		Rural	
	<i>N=9,558*</i>		<i>N=3,680</i>		<i>N=5,600</i>	
	Mean	SE	Mean	SE	Mean	SE
Married couple	0.72	(0.005)	0.72	(0.007)	0.73	(0.006)
Birth year of father	1952	(0.109)	1952	(0.179)	1952	(0.138)
Birth year of mother	1953	(0.109)	1953	(0.173)	1953	(0.142)
Number of children	2.94	(0.016)	2.62	(0.025)	3.23	(0.021)
Only child	0.16	(0.004)	0.24	(0.007)	0.08	(0.004)
Number of sons	1.53	(0.011)	1.33	(0.017)	1.71	(0.015)
Number of daughters	1.41	(0.012)	1.29	(0.020)	1.52	(0.017)
Birth year of oldest child	1976	(0.108)	1976	(0.174)	1975	(0.141)
Birth year of youngest child	1981	(0.080)	1981	(0.131)	1981	(0.101)
Family income	35,694	(1,011)	49,576	(1,210)	24,411	(1,467)
Years of schooling						
Grandfather (father's side)	2.02	(0.040)	2.65	(0.074)	1.47	(0.042)
Grandmother (father's side)	0.765	(0.026)	1.17	(0.052)	0.39	(0.022)
Grandfather (mother's side)	1.93	(0.038)	2.49	(0.071)	1.45	(0.040)
Grandmother (mother's side)	0.66	(0.024)	1.03	(0.050)	0.34	(0.020)
Father	6.80	(0.053)	8.09	(0.089)	5.70	(0.062)
Mother	4.11	(0.052)	5.82	(0.091)	2.68	(0.053)
Sons (within family mean)	9.80	(0.044)	11.23	(0.070)	8.61	(0.052)
Daughters (within family mean)	9.00	(0.054)	10.93	(0.079)	7.35	(0.064)

Among our total sample, 72% are married; the mean birth year for the male respondents in the family (the fathers in our generational approach) is 1952, and for the females (mothers) it is 1953. The mothers in our sample were thus, on average, 26 years old in 1979 when the one-child policy was established. Unsurprisingly given the sampling frame, the birth years of respondents are identical across urban and rural regions.

The average number of children for the families in our sample is 2.94, a surprise to many given the recent attention to the PRC's one-child policy. In line with the well-documented unequal gender ratios, there are more sons than daughters—1.53 compared to 1.41. Families with only one child are surprisingly rare, comprising just 0.16% of the families in our sample. (This fraction rises to 0.18 when including families with children under 22, demonstrating the expected rise over time in the prevalence of one-child families.)

It is when looking at these variables—variables pertaining to family size and composition—that we see large differences across rural and urban areas, providing our first indication that son preference and investments in children might vary across regions. The average family size in urban areas is 2.62 children compared to 3.23 in rural areas, which is consistent with the greater costs of raising children in urban areas and the negative correlation typically found between income and family size across

countries. Similarly, only children are far more common in urban areas—0.24 versus 0.08—where not only are children more costly, but the one-child policy was more strictly enforced.

When looking at the gender of children, the son bias appears to be far larger in rural than in urban areas. In urban areas there are 1.33 sons and 1.29 daughters, on average, for a sex ratio of males to females of 1.031—actually a bit below what is considered normal—compared to 1.71 sons and 1.52 daughters in rural areas, with an implied sex ratio of 1.125 in rural areas.

We also see the expected differences in income across regions, with household income in urban areas being approximately twice that of rural areas.<sup>7</sup>

There has undoubtedly been a sharp rise in educational levels in the PRC. To examine the changes in schooling over time we stacked the data for all three generations of family members to provide a person-level (rather than family-level) data set. Each respondent couple contributes two observations for themselves, four observations for their parents/parents-in-law, and one observation for each child. An unmarried respondent contributes an observation for herself, one for each of her parents, and one for each of her children. While the respondent-based sample is population-representative for individuals of the targeted cohort, we note that this expanded person-level sample is not population-representative for the older and younger cohorts. Nonetheless, we believe these data provide important information regarding the correlates of schooling attainment and that our generational approach, using three generations for a particular family, provides insights not otherwise attainable.

Using these data we examine years of schooling by birth year, gender, and rural/urban status.<sup>8</sup> We construct a single years-of-schooling measure based on 12 educational categories reported in the survey (including “did not finish primary school but capable of reading and writing,” “graduate from primary school,” and “graduate from middle school”). Appendix Table A1 reports our cross-walk between categories and years of schooling.

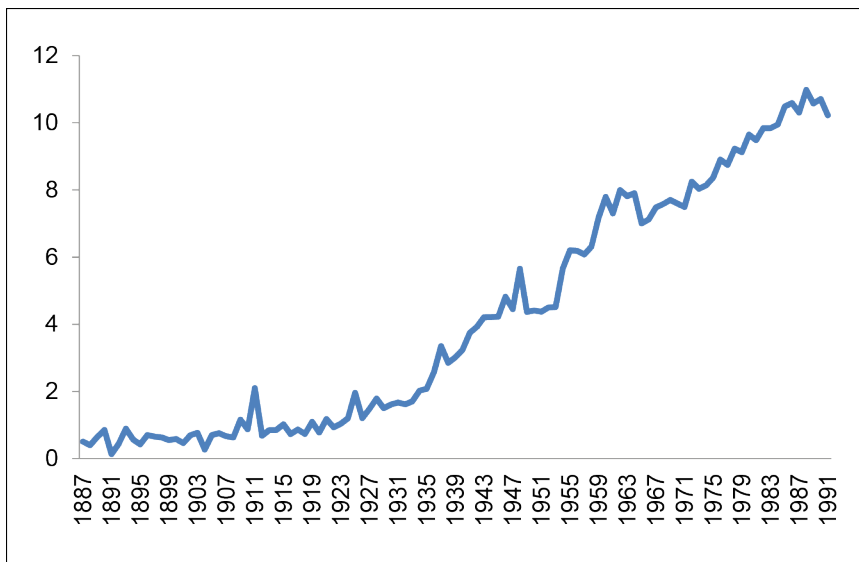
Figure 1a shows a dramatic and continued rise in schooling levels over time for the full sample. The horizontal axis measures the birth year of the individual and the vertical axis measures schooling attainment in 2013 when the youngest in our sample are 22 years old. Figure 1b shows this rise in schooling by gender and clearly demonstrates the convergence in the educational attainment of males and females. Although difficult to discern in the figure, the schooling level for women has not only caught up with that of men, but has begun to surpass it. Despite changes like compulsory schooling laws and the PRC’s one-child policy, we do not see dramatic breaks in trend for the 1979 or 1986 birth year cohorts in either figure. However, we do see some indication of a decline in schooling for those born in the early 1950s, who would have been approaching middle school age during the Cultural Revolution in 1966.

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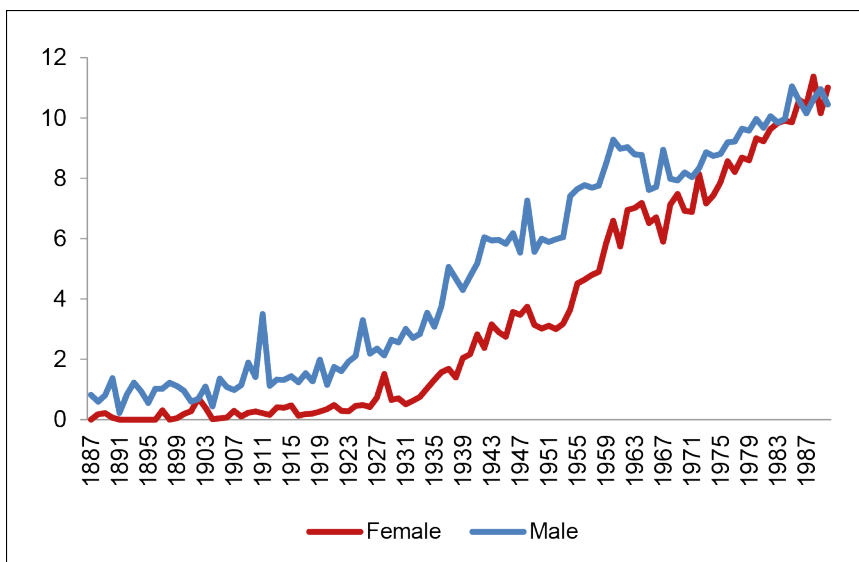
<sup>7</sup> While nearly all our data come from the publicly available data on the CHARLS website, our income measure is that developed by the HRS Harmonization project and available from <https://g2aging.org/>

<sup>8</sup> The measure of rural/urban differs marginally across generations. For children of the respondents and the respondents themselves, we use their initial hukou. The hukou for grandparents is available only if the grandparent is still alive. If we do not have this information because the grandparent has died or because it is missing, we use, in order, whether the grandparent grew up in a rural area or currently lives in a rural area. In the absence of either of these two measures, we impute urban/rural status based on the region of their child’s hukou (the parent’s hukou in our terminology).

**Figure 1a: Schooling by Birth Year**



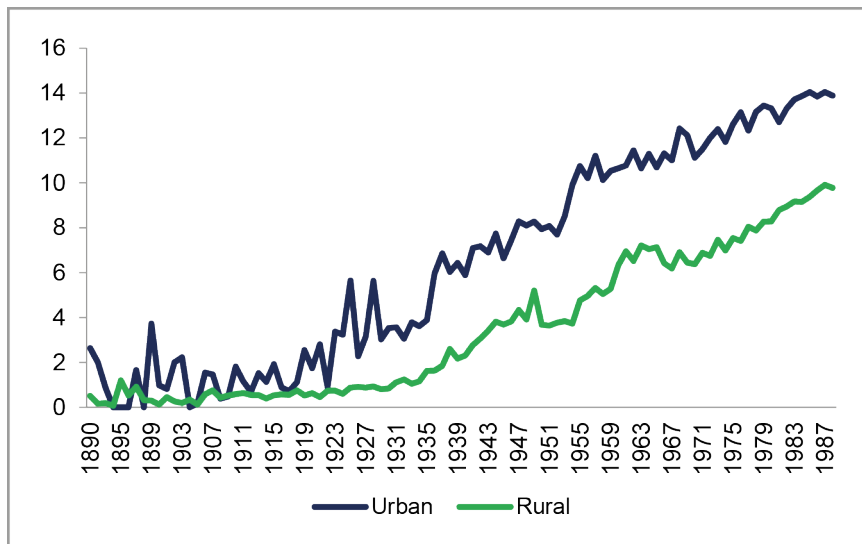
**Figure 1b: Schooling by Birth Year and Gender**



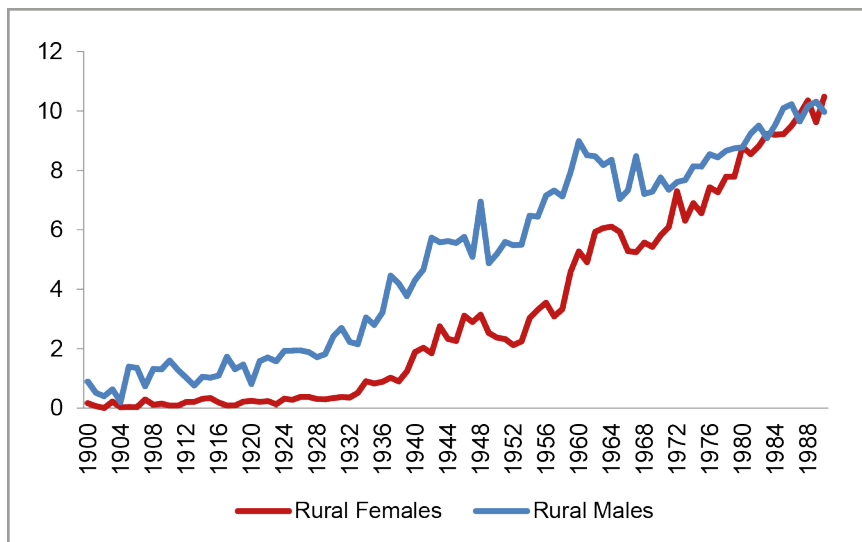
Figures 2a, 2b, and 2c repeat the analysis for rural and urban individuals. As shown in Figure 2a, the rise in schooling levels was initially more rapid in urban areas (and given our smaller number of observations, noisier) but the two regions have risen roughly in parallel for the past 30 or more years.

Perhaps most interestingly, echoing the results in Figure 1b, the schooling attainment of women has caught up with (and somewhat surpassed) that of men, even in rural areas where son preference would be thought to be most entrenched.<sup>9</sup> There was, however, a delayed convergence in rural areas. While women in urban areas were achieving educational levels similar to those of men for cohorts born as early as the mid-1950s, in rural areas this convergence occurred approximately 20 years later.

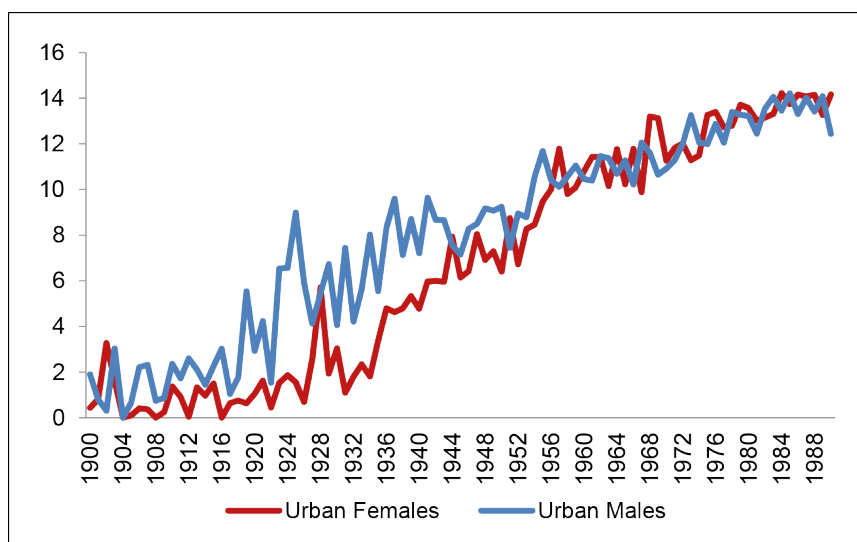
**Figure 2a: Schooling by Birth Year and Residence**



**Figure 2b: Schooling by Birth Year and Gender: Rural**



<sup>9</sup> Remember the hypothesis of Almond, Li, and Meng (2014) that given the sex selection possible before birth and the one-child policy, families with daughters may have a less strong son preference, and thus greater investments in those daughters.

**Figure 2c: Schooling by Birth Year and Gender: Urban**

To assess these increases in schooling in more detail, we examine the distribution of completed schooling. Table 2 shows the level of schooling attained—none (illiterate), primary school or less, middle school, high school, or college or above—for each cohort, and separately by urban and rural status. We construct these categories from survey responses that include much more detail (e.g. home schooling, literate but did not finish primary school, and type of graduate degree). Appendix Table A1 lists the originally reported schooling level.

As was apparent in the figures, the rise in educational attainment across three generations is dramatic. Average schooling for urban individuals rose from 2.83 in the oldest cohort to 12.36 in the most recent. The comparable numbers for rural status are from less than one year of schooling to eight years.

When looking at the individual categories of schooling, it is particularly astonishing to see the high rate of illiteracy prevalent among the oldest generation. The average year of birth for grandparents is around 1923–1924 and yet nearly 60% of urban individuals and as many as 80% of rural individuals were illiterate.<sup>10</sup> By comparison, in the United States in the 1920s, approximately 95% of adults were literate.<sup>11</sup> (Note that the United States' statistic is for the *population* at that time, not the *cohort* born at that time who would be expected to have even greater educational attainment.) Even at these extremely high rates of illiteracy women are disadvantaged. The illiteracy rate for rural women is 90% (!) compared to “just” 62% for men. And even among urban women illiteracy is 70%, so urban women are less literate than even rural men. The educational achievement in the PRC is dramatically seen at this lowest level of education in that for the child generation, illiteracy falls to well below 1% for urban children and to 6.35% for rural children. Also noteworthy is the increase at the highest level of schooling with over one-third of the children in the urban sample now having at least some college education.<sup>12</sup>

<sup>10</sup> Note that this sample is representative of parents of a representative sample of the Chinese population, they are not themselves representative.

<sup>11</sup> <https://ourworldindata.org/literacy/> (referenced October 20, 2017).

<sup>12</sup> To again draw a comparison with the United States, among those aged 25–44, 64% have some college (United States Census Bureau 2016). <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p20-578.pdf>

**Table 2: Patterns of Education across Cohorts**

	Urban Hukou			Rural Hukou		
	Male	Female	All	Male	Female	All
<b>Child cohort</b>						
<i>Number of observations</i>	1,836	1,635	3,471	11,419	10,374	21,793
Average birth year	1974	1974	1974	1976	1976	1976
Years of schooling	12.28	12.45	12.36	8.58	7.46	8.04
Level/degree obtained						
Illiterate (0/1)	0.44	0.87	0.65	2.89	10.09	6.35
Primary and below (0/1)	7.82	6.19	7.02	33.66	38.55	36.01
Middle school (0/1)	23.71	22.36	23.05	39.46	30.91	35.36
High school (0/1)	31.11	35.88	33.44	13.76	11.63	12.74
College and above (0/1)	36.91	34.71	35.84	10.23	8.81	9.55
<b>Parent cohort</b>						
<i>Number of observations</i>	758	777	1535	5670	6521	12,191
Average birth year	1951	1953	1952	1952	1953	1953
Years of schooling	9.40	8.32	8.85	6.32	3.39	4.84
Level/degree obtained						
Illiterate (0/1)	4.07	10.23	7.29	12.05	41.32	27.66
Primary and below (0/1)	23.84	23.28	23.55	46.78	37.80	41.99
Middle school (0/1)	29.72	28.38	29.02	26.09	15.18	20.27
High school (0/1)	32.66	29.41	30.96	12.77	5.10	8.68
College and above (0/1)	9.71	8.70	9.18	2.31	0.60	1.40
<b>Grandparent cohort</b>						
<i>Number of observations</i>	1,020	1,821	2,841	7,947	13,597	21,544
Average birth year	1923	1924	1924	1922	1924	1923
Years of schooling	4.34	1.98	2.83	1.79	0.45	0.94
Level/degree obtained						
Illiterate (0/1)	36.80	69.83	57.96	62.48	89.81	79.84
Primary and below (0/1)	39.20	19.34	26.48	30.66	8.81	16.78
Middle school (0/1)	7.99	4.89	6.00	4.20	0.95	2.14
High school (0/1)	10.55	4.70	6.80	2.14	0.42	1.05
College and above (0/1)	5.46	1.24	2.76	0.52	0.00	0.19

The narrowing of the gender gap observed in the figures is even more visible in this table. Among the grandparent generation, urban men had more than twice as many years of schooling on average as did women: 4.34 versus 1.98. In the parental generation, women had almost caught up, with an average of 8.32 years of schooling compared to 9.4 for men. For the most recent cohort, women had *more* schooling on average than men, with 12.28 years for men and 12.45 years for women—a phenomenon apparent throughout the developed world.

Change in rural areas has been slower. In the grandparent generation, the average years of schooling for men was four times that of women, narrowing to just under two times for the parental generation and to just 15% greater (8.58 versus 7.46) for the youngest cohort.

Our data are unique in that we have information on the schooling for three generations *within* a family. We can therefore examine the extent to which there are within-family correlations across generations. Because of our interest in gender differences, we look separately at correlations for sons/daughters, mothers/fathers, and grandfathers/grandmothers. Table 3 presents the results. We note that there are relatively large correlations across generations that, as expected, decline with the distance between the generations. The correlation between sons (daughters) and their mothers is 0.41 (0.51) and 0.44 (0.48) with fathers. It is worth noting that the correlations with both parents are slightly higher for daughters than sons. If we consider parental education to be a proxy for family income then it may suggest that income is more important in determining a daughter's educational attainment than a son's. Alternatively, greater schooling by parents may reflect a greater emphasis placed on education, an emphasis that is more important for daughters, who have traditionally been short-changed in this regard.

**Table 3: Correlations in Schooling across Generations**

	Son	Daughter	Mother	Father	Father's Mother	Father's Father	Mother's Mother	Mother's Father
Son	1.00	0.59	0.41	0.44	0.14	0.20	0.15	0.19
Daughter		1.00	0.51	0.48	0.19	0.25	0.20	0.23
Mother			1.00	0.43	0.25	0.29	0.27	0.29
Father				1.00	0.18	0.24	0.18	0.22
Father's mother					1.00	0.47	0.33	0.24
Father's father						1.00	0.27	0.33
Mother's mother							1.00	0.47
Mother's father								1.00

The correlations between the educational levels of children and their parents are uniformly greater than those between parents and grandparents, with the correlation between a father (mother) and his (her) own mother being 0.18 (0.27), and 0.24 (0.29) with his (her) own father. Again, the correlations are higher between women and their parents than for men and their parents. Interestingly, we also see that correlations with the educational levels of one's in-laws are nearly identical to those of one's own parents, perhaps attesting to assortative mating or to the similarity of educational levels within a particular locale.

Finally, with regard to within-generation correlations, the correlation between married couples in the parent generation (i.e. between mothers and fathers in our nomenclature), at 0.43, is quite similar to that between married couples one generation older, which is 0.47 for both that between the husband's parents and the wife's parents. With respect to the children, we note that the correlation between brothers and sisters, at 0.59, is similar to that found in the United States and other countries for siblings more generally (not brothers and sisters) (see des Etangs-Levallois and Lefranc (2017) for a summary of the literature across European countries and the United States).

### 3.3 Measurement of Key Variables

In order to assess the importance of compulsory schooling laws and the one-child policy we need good measures of the extent to which the policies were relevant for a particular child. We thus construct two new variables, one for each policy, that summarize the impact. We describe our efforts here. Because of the timing of these



policy interventions they are relevant only for the schooling attainment of the most recent cohorts—those who were attending or could have been attending school in the 1970s and 1980s or whose siblings may have done so.

In 1986, the PRC enacted a law mandating nine years of compulsory education for all children. Given the existing schooling levels, this law primarily affected rural areas wherein the previous requirement was just four to six years of schooling. The law was rolled out gradually across provinces beginning in the most economically advanced areas. Children were subject to the law if they had not reached grade nine (the new required level of schooling) at the time the law came into effect. We thus code our measure of compulsory schooling to be specific to the child's birth year and province.<sup>13</sup> Within each province the law was introduced gradually from more to less urban areas. We do not have information at this level of detail and simply use the date on which the law first went into effect in each child's home province. In our regression analyses to follow, we interact this measure with an indicator of urban or rural status to allow for differing effects in enforcement and implementation.

The second key policy change is the advent of the PRC's one-child policy, enacted in 1979 and implemented in 1980. As with the compulsory schooling laws, enforcement varied across regions.<sup>14</sup> Later the government relaxed the requirement and allowed rural families to have a second child if the first child was a girl or if both parents were only children.<sup>15</sup>

The impact of the one-child policy depends primarily on the age of the mother and on how her fertility was affected because of the law. She may have made a conscious decision not to have a daughter through selective abortion, or may have altered the timing of the pregnancy given that she would likely incur only one pregnancy. To capture the impact on the mother and thus on the child, we use a measure of exposure to family planning regimes similar to that constructed in Wang (no date) based on the fraction of a woman's fertile years spent under the one-child policy.<sup>16</sup> In examining the schooling of children in our sample, we use the measure constructed based on the mother's age. We also interact this measure with a dummy variable for the gender of the child.

## 4. DATA ANALYSIS

The dramatic rise in schooling shown in our figures and in Table 2 likely has many causes. There has been widespread economic growth that has both made schooling more affordable and has raised the returns to schooling. Also, in a transition from an agricultural economy to a more urban economy, children are less needed to work the land and the opportunity cost of schooling is thus lower.<sup>17</sup> However, as discussed

<sup>13</sup> The information was collected from the Regulations on the Implementation of Compulsory Schooling Laws of each province.

<sup>14</sup> The policy also affected only the Han majority. The Han population constitutes approximately 93% of our sample, which is nearly identical to the approximately 92% in the PRC as a whole. We have repeated all the analyses below with controls for ethnicity, but given the overwhelming fraction of Han, our conclusions are the same regardless of whether it is included. For parsimony we report results ignoring this measure of ethnicity.

<sup>15</sup> Families could also have more than one child if they paid the fine associated with the additional child or if children were born outside the country.

<sup>16</sup> Wang used the fraction of years under each of three different family planning regimes. We use only the most recent as it is most relevant to our sample.

<sup>17</sup> Compulsory schooling laws outlawed the hiring of children younger than 15, although in rural areas such employment likely continued to at least some extent.

above, there have also been changes in government policies that likely influenced schooling levels, most directly the installation of compulsory schooling laws, and more indirectly the one-child policy, which, among other effects, would have reduced competition for parental resources, and for girls, the probability that a brother would be favored.

## 4.1 Full Sample

We begin our multivariate analysis with a standard regression equation for completed schooling using our stacked data for all three generations:

$$Schooling_{ij} = \alpha_0 + \alpha_1 X_{1ij} + \varepsilon_{ij}$$

Column (1) of Table 4 reports the results for our most basic specification controlling for gender, time, and whether the person has rural hukou. We measure time in terms of birth year, centered at the birth year of the oldest individual in our sample (1852).<sup>18</sup> The variable thus increases by one for each year of birth beyond 1852, and for a child born in 1980 would have a value of 118. Other variables are defined straightforwardly.

**Table 4: Regression Analysis for All Three Generations**

	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)
Time (birth year – 1852)	0.124 (0.001)	0.131 (.001)	0.119 (0.001)	0.127 (0.001)	0.137 (0.003)	0.149 (0.002)
Grew up in rural area	–3.340 (0.045)	–1.343 (0.083)	–3.139 (0.066)	–1.350 (0.083)	–1.045 (0.290)	1.489 (0.287)
Female	–1.690 (0.030)	–1.773 (0.027)	–2.365 (0.146)	–2.506 (0.110)	–6.137 (0.356)	–5.809 (0.327)
Female*time			0.010 (0.001)	0.007 (0.001)	0.049 (0.003)	0.046 (0.003)
Female*rural					3.907 (0.379)	3.747 (0.347)
Rural*time					–0.020 (0.003)	–0.024 (0.003)
Female*rural*time					–0.045 (0.004)	–0.043 (0.004)
Constant	–3.428 (0.076)		–3.037 (0.109)		–4.893 (0.272)	
Observations	58,362		58,362		58,362	
Mean of dep. variable	5.13		5.13		5.13	
R-squared	0.50	0.67	0.50	0.68	0.51	0.68

<sup>18</sup> The birth years of the grandparent generation are reported by the respondents. While a grandparent born so long ago appears to be unlikely, we have not edited the data.

Unsurprisingly each of these factors has a significant effect on schooling, and even with this most parsimonious specification, the R<sup>2</sup> is 0.50. Each additional year corresponds to a gain of 0.12 years of schooling, or 1.2 years per decade. We also see a large negative effect for a rural hukou, associated with a reduction of 3.3 years in expected education. Females too are worse off, with 1.7 fewer years on average.

Because we have multiple observations per family we can control for unobserved family fixed effects. These could represent family values regarding education, resources to finance an education, or potentially measures of the difficulty of accessing schooling in the particular family's locale. Specifically, we allow the error term in the regression specification to have a family fixed effect in addition to the individual component, so that the error term is  $\varepsilon_{ij} + u_j$ . The results of this fixed effects specification, reported in column (2), are similar to those in column (1). An additional year of time is associated with 0.13 more years of schooling, and women have 1.8 years fewer years of schooling than men. The effect of living in a rural area is mitigated when we control for family effects. This variable is identified using families in which there is a generational shift in region.

Expanding on our list of control variables, in columns (3) and (4) we include an interaction of female with time to assess the extent to which the disadvantage women have in terms of schooling has been declining over time. With the inclusion of this interaction term, the linear effect of time is similar to that in the original specification at 1.2 years of schooling per decade, as is the coefficient on rural status. There is a slightly larger negative effect of being female as measured at time zero, but the interaction term means that this negative effect declines over time at the rate of 0.1 years per decade—an extremely modest gain for women.

The final two columns add interactions between female and rural; rural and time; and female, rural, and time. These regressors allow for varying gains for women in rural relative to urban areas, different time trends for the two regions, and differing time trends for rural and urban areas more generally.

As in the previous specifications, all coefficients are significantly different from zero. Time continues to have a similar effect to that in column (1), with the coefficient increasing only slightly to 1.4 years of additional schooling per decade. With the addition of the interaction terms, the linear effect of a rural hukou is much larger in absolute value than it was previously, and its negative impact increases slowly over time at a rate of 0.2 years per decade. For women with a rural hukou, the negative effect of a rural hukou at time zero disappears, likely simply because the years of schooling that long ago were near zero in rural areas for all, so that there is little difference for men and women. However, the three-way interaction (female x rural x time) points to a decline in the relative position of women in rural areas relative to men and relative to women in urban areas.

## 4.2 Policy Factors

To focus on our policy variables, we limit our sample to observations for the youngest cohort because they are of an age where they would have potentially been impacted by the changing policies. In Table 5 we first replicate the results of Table 4 for the single cohort to assess whether the standard set of regressors impact years of schooling differently for this cohort. In columns (5) through (8) we then add regressors to examine the effect of the two policy interventions on years of schooling.

**Table 5: Regression Analysis for Child Generation**

	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)	OLS (7)	FE (8)
Time (birth year – 1852)	0.140 (0.003)	0.081 (.005)	0.101 (0.004)	0.049 (0.005)	0.029 (0.005)	0.039 (0.006)	0.036 (0.006)	0.042 (0.007)
Grew up in rural area	-4.263 (0.076)	-1.386 (0.005)	-4.257 (0.076)	-1.346 (0.190)	-2.613 (0.079)	-1.385 (0.193)	-2.365 (0.124)	-0.977 (0.226)
Female	-0.910 (0.052)	-1.226 (0.046)	-9.369 (0.678)	-9.598 (0.595)	-9.963 (0.638)	-9.695 (0.602)	-7.191 (1.069)	-8.453 (1.003)
Female*time			0.068 (0.005)	0.068 (0.005)	0.073 (0.005)	0.069 (0.005)	0.055 (0.009)	0.063 (0.009)
Only child					1.097 (0.121)	–	1.273 (0.148)	–
One-child policy†					0.645 (0.106)	–	0.427 (0.141)	–
Compulsory schooling					0.352 (0.085)	0.305 (0.096)	-0.159 (0.214)	0.332 (0.308)
Father's yrs of school					0.253 (0.007)	–	0.229 (0.010)	–
Mother's yrs of school					0.222 (0.008)	–	0.181 (0.011)	–
Female*comp. school							-0.939 (0.320)	-0.841 (0.356)
Female*one-child policy							0.502 (0.207)	–
Rural*comp. school							0.577 (0.281)	-0.090 (0.366)
Rural*one-child policy							0.079 (0.207)	0.148 (0.216)
Female*rural							-1.427 (0.183)	-1.203 (0.175)
Female*rural*comp. sch.							0.919 (0.418)	1.209 (0.444)
Female*rural*one-child pol.							0.040 (0.304)	
Female*rural*only child							0.387 (0.413)	
Female*only child							0.101 (0.326)	–
Female*father's school							0.043 (0.015)	0.036 (0.014)
Female*mother's school							0.082 (0.016)	0.101 (0.015)
Constant	-4.709 (0.344)		-0.726 (0.468)		6.845 (0.617)	–	4.199 (0.733)	
Observations	23,473		23,473		23,473		23,473	
Mean of dep. variable	8.54		8.54		8.54		8.54	
R-squared	0.20	0.73	0.21	0.74	0.30	0.74	0.31	0.74

In the simplest specification, column (1), the estimated effects are surprisingly similar to those shown in the first column of Table 4. An additional year for this cohort is associated with a 0.14 gain in schooling, slightly larger than, but comparable to, the 0.124 value in Table 4. The effect of a rural hukou, while similar to that previously reported, is now larger in absolute value. This stems from the rising levels of education overall: As schooling levels rise at similar rates overall, the difference between rural and urban measured in levels becomes larger. There is, however, a much larger change for the female dummy variable relative to Table 4: For this youngest cohort, women can expect only 0.9 fewer years of schooling relative to men compared to the 1.7 years when estimated over all cohorts.

Column (3) adds the interaction of female with time. The estimated effect is much larger (nearly seven times greater) than in the parallel specification in Table 4, pointing to the recent relative gains in female educational levels in the PRC. As with Table 4, the fixed effects specifications do not reveal any substantial differences.

The remaining columns in Table 5 include measures of our policy changes, add parental schooling measures, and show further interactions.<sup>19</sup> To examine the effect of the one-child policy, we add an indicator for the child being an only child (we do not have this information for the older cohorts) as well as measures for the degree to which the child's mother was impacted by the one-child policy during her childbearing years (denoted here with the label "one-child policy"). In column (7) and column (8), we add variables delineating whether the child was subject to compulsory schooling laws, the educational levels of the child's father and mother, and numerous interactions with gender and rural hukou.

Beginning in column (5) we note first that the specification is well identified: All coefficients are significantly different from zero. With the addition of policy variables and parental education, the time trend decreases substantially to just 0.29 years per decade. This value pertains to males as the effect for females is the sum of this coefficient and the interaction female\*time ( $0.029 + 0.073 = 0.102$ ). Other variables have similar effects to those in the previous specifications. Among the newly added variables, being an only child is associated with over one year of additional education, a substantial increase. With a mean education level of 8.54 years, this represents a 13% increase and is roughly equivalent to the gain experienced by women over a decade of time.

The one-child policy adds to this only child effect with an additional 0.65 years of schooling, as does the compulsory schooling law, which is associated with 0.35 years of schooling. Both father's schooling and mother's schooling levels have positive and significant effects on the child's schooling attainment and are similar in magnitude. An additional year of education for the child's father is associated with 0.25 additional years for the child, while an additional year of mother's education is associated with 0.22 years. Compared to a child whose father has a middle school education, a child whose father graduated from high school would be expected to have  $0.25 \times 3$  or 0.75 additional years of schooling. This effect could come directly from the value more educated parents place on schooling or the accessibility of schooling in the locale, or could serve as a proxy for financial resources of the family.<sup>20</sup>

<sup>19</sup> We cannot include parental schooling in Table 4 because we have no such measures for the oldest cohort.

<sup>20</sup> While we have good measures of family income, they pertain to 2011 or 2013 when the interviews were conducted, not to the time at which children were enrolled or considering enrolling in school.

When turning to a fixed effects specification (column (6)) we are unable to identify those regressors that do not vary within family. Because “family” in this one-generation specification is just siblings, several variables are constant within family, namely only child, the one-child policy measure that is based on the mother’s age and location, and the years of schooling attained by the father and mother. The compulsory schooling variable is identified because children were born in different years and thus faced different regimes, although we recognize that there could be “spillover effects” if parents endeavor to ensure the same schooling for all siblings. The estimated effect of compulsory schooling is statistically indistinguishable from that in the OLS specification, as are other variables with the exception of rural hukou, which again changes significantly in the fixed effects version.

In the final pair of columns we add interaction terms allowing compulsory schooling laws, the one-child policy, and parental education to vary across urban and rural areas and by the gender of the child. With the large number of interactions, the net effects are often difficult to discern at a passing glance. Here we focus on relative rather than absolute comparisons.

Focusing on these linear and interaction terms, being an only child continues to have a large, positive, and significant effect on schooling, as does the one-child policy. However, the linear term for compulsory schooling is not significantly different from zero, and in fact, the standard error is larger than the coefficient. As regards interactions with “female,” being the only child has a significantly larger effect for daughters, suggesting that competition and tighter financial constraints matter more for the schooling of girls. Perhaps surprisingly, the one-child policy does not appear to favor girls over boys: The linear effect is positive and significant but the interaction with female is not significantly different from zero (the point estimate is 0.50 with a standard error of 0.2). Schooling of parents continues to be more important, but, echoing the results in Table 3, the relationship is significantly stronger for daughters than sons. An additional year of education for one’s father is associated with 0.23 years of additional schooling for a son and  $0.23 + 0.043 = 0.273$  for a daughter. If schooling is a proxy for the family’s financial means, this would indicate that the income elasticity of schooling is greater for daughters than sons. Interestingly, an additional year of schooling for a mother implies 0.18 years of additional schooling for a son, but  $0.18 + 0.082 = 0.262$  for a daughter. Thus, while the effect of either parent’s education is stronger for daughters than sons, the additional effect of a mother’s education for daughters is greater than the additional effect of a father’s, perhaps pointing to the greater bargaining position of more educated wives.

As expected, children in rural areas are worse off, and the penalty is larger for girls. While the linear term for compulsory schooling is itself not significantly different from zero, compulsory schooling does have a large effect in rural areas of just over a half of a year of schooling (significantly different from zero at the 5% level). And this positive effect is substantially larger still for girls in rural areas, associated with an additional year of education.

When looking at the fixed effects specification, the results are all similar to the OLS specification with the exception of the effect of the mother’s schooling for daughters, which increases while that for father’s schooling decreases.

As these results demonstrate, public policy can have important effects on schooling attainment as well as on male/female and rural/urban differences in this measure. We note that the gains in education observed here come not just from policies that directly target education, such as compulsory schooling laws, but also from policies such as the one-child policy that have indirect effects. Depending on the specification, the one-child policy and compulsory schooling have effects that are far larger than simply economic growth as proxied by a time trend.

## 5. CONCLUSION

The rise in economic growth and educational attainment experienced in the PRC over the last several decades has been stunning and has been shared across demographic groups, improving outcomes for both men and women and those in rural and urban areas. Further, the gains experienced, particularly by women, resulted in a reduction in the large disparity initially existing between schooling levels of men and women. In fact, we find that women now have more average years of schooling than do men. Gains in rural areas, while substantial, still leave individuals in these areas far behind their urban counterparts.

In this paper we examine the effect on schooling of two important policy changes—the institution of nine years' compulsory schooling and the one-child policy. Our study differs from past work in that we can examine differences within families and across generations of the same family. We find that the effects of compulsory schooling were large and significant only in rural areas and were largest for rural women. This is not surprising as schooling in urban areas was already typically higher than that mandated by the policy. In contrast, the one-child policy, which was instituted nationwide but which was more strictly enforced in urban areas, had nearly equal positive effects on schooling for men and women and for rural and urban areas. These results point more generally to the importance of policy as well as general economic growth in driving schooling attainment.

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## APPENDIX

**Table A1: Assigned Years of Schooling based on Education Level**

<b>Education Level</b>	<b>Assigned Years of Schooling</b>
No formal education (illiterate)	0
Did not finish primary school but capable of reading or writing	2
Sishu/home school	2
Graduate from elementary school	6
Graduate from middle school	9
Graduate from high school	12
Graduate from vocational school	14.5
Graduate from two/three-year college/associate degree	14.5
Graduate from four-year college/bachelor's degree	16
Graduate from postgraduate, master's degree	18
Graduate from postgraduate, doctoral degree/Ph.D.	21