Intergenerational Transmission of Education in China: New Evidence from the Chinese Cultural Revolution[1]

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Abstract: This paper estimates the effect of parental education on children education by using instruments generated by the Chinese Cultural Revolution, and further explores the mechanisms of this causal relationship. Several important findings stand out from our empirical analyses. We find larger intergenerational persistence in education for higher level in urban areas but for lower level of education in rural areas. The main results from instrumental variable estimation show that the nurture effect is larger and more significant for fathers than for mothers. A deeper investigation of the mechanism behind this nurture effect informs us that father's education pass on to children's education partly through the income channel. Another notable finding is that even after controlling for father's income, parental education still has a significantly positive effect on children education through the nurture effect. This indicates that beyond the income channel, there may exist other channels such as better home environment, which deserve future research to explore.

Keywords: intergenerational education mobility; inequality; nurture effect; China

1. Introduction

Intergenerational mobility in income has received much attention in economics literature in the past few decades (Solon, 1999; Black and Devereux, 2011). This issue is particularly important in a developing country such as China where income inequality increased dramatically in the past several decades with the transition from a planned economy to a market-oriented economy (Meng et al., 2005; Benjamin et al., 2011; Song, 2013). Several studies have identified an important role of parental education in the transmission of economic status from one generation to the next (Gong et al., 2012; Yuan and Lin, 2013; Magnani and Zhu, 2015; Fan, 2016).

Two commonly recognized mechanisms behind this intergenerational transmission are nature and nurture effects. The nature effect refers to the intergenerational education transmission related to inherent abilities that parents pass to their children through genes, while the nurture effect refers to a causal effect of parental education on children's schooling through educational investment, better home environment, and so on. In econometrics terms, the nurture effect is interpreted as the causal relationship while the nature effect results in the potential endogeneity problem.

A major contribution of this paper is to estimate the nurture effect using instruments generated by the Chinese Cultural Revolution and to test the mechanisms through which the nurture effect works. We will also examine several heterogeneities in different dimensions of these transmission effects. For the purpose of this research, the newly-released CHIP 2013 (China Household Income Project) dataset will be used.

Several important findings appear from our empirical analyses. First, the intergenerational education mobility is lower in urban than rural China. Second, more intergenerational persistence in education tends to occur for higher level of education in urban areas but for lower level of education in rural areas. The high persistence found in rural areas for the lowest education group might be some evidence for educational poverty traps in that parents can pass their low education to their children

which may create persistent poverty in income over generations. Third, the results show that fathers' education has a significant impact on children education through the nurture effect, but mothers' nurture effect is relatively smaller. A deeper investigation of the mechanism behind this nurture effect informs us that father's education can pass on to children's education partly through the income channel. Another notable finding is that even after controlling for father's income, parental education still has a significantly positive effect on children education through the nurture effect. This indicates that beyond the income channel, there may exist other channels such as better home environment, which deserve future research to explore.

The remainder of this paper is organized as follows. Section 2 reviews previous literature and specifies our contributions, and Section 3 describes the dataset and presents some descriptive statistics. Section 4 demonstrates the OLS and IV regression results to disentangle the nurture effect from the nature effect and explores the mechanisms behind these effects. Section 5 concludes.

2. Literature review and our contributions

This section will review the existing research in the area of exploring the intergenerational education transmission and specify our contributions.

2.1 Nature vs. nurture effect

Existing studies on this topic mainly focus on disentangling the nurture effect from the nature effect through three identification strategies. The first is to use twin parents. Behrman and Rosenzweig (2002) is one of the first studies that identify the nurture effect using the children of monozygotic twin mothers and fathers, which can difference out genetic factors that influence children's education. A more recent paper using this method is Bingley et al. (2009). They use unique Danish administrative data for identical and fraternal twin parents and their children to estimate both short-run and long-run intergenerational education effects. They find that fathers'

education has a positive nurture effect on children's outcomes but mothers' education has no nurture effect. However, this method often suffers from the weak external validity since twins may be systematically different from the general population, and the results above may not be generalized to a broader sample.

The second is to use data from adopted children. Under the assumption that adopted children are randomly assigned to families as infants and treated exactly the same as biological children, comparing adopted children and natural children can identify the effect of environmental factors on the intergenerational transmission of education. Sacerdote (2002) and Plug (2004) use this method and find father's education has significantly positive influence on children's education. The potential identification problem within this methodology is the non-random adoption problem, which may bias the results.

The third is to employ the IV approach, which isolates the effect of parents' education on children outcomes using instrumental variables, such as some important education reforms. For example, Black et al. (2005) utilizes the Norwegian schooling reforms during 1959–1973 and finds weak causal effects of parental education on children's education attainment. More recent papers such as Oreopoulos et al. (2006), Holmlund et al. (2011) and Stella (2013) use compulsory school law changes to study the intergenerational correlation of education, and they all find significantly positive nurture effects.

However, compulsory school reform is rarely used as the instrumental variable in China.[1] The reason is that the compulsory school reform was implemented in 1986. Accordingly, most of people who experienced that education reform don't have children or their children are too young to finish schooling. In addition, we should be aware of an important limitation to use the compulsory schooling law as the

[1] One exception is Song (2012) which identifies the causal effect of popularizing compulsory schooling on poverty reduction in China.

instrument to estimate the nurture effect. The laws only affected the bottom of educational attainment distribution, and hence most of the literature using this IV to identify the nurture effect focuses on the effect for the low-educated groups, which may not be applicable for other groups.

In response to the issues mentioned in the paragraph above, several attempts have tried to use the Chinese Cultural Revolution (CR) as the instrument, such as Meng and Gregory (2002) and Meng and Zhao (2013). However, these studies only focused on urban China and used the datasets in early time periods when the children whose parents were affected by CR had not yet finished schooling.

Beyond the existing studies, our paper will employ the Chinese Cultural Revolution (CR) as the instrument to disentangle the nurture effect from the nature effect using more recent nation-wide dataset (CHIP 2013). Moreover, since the Cultural Revolution affects in urban and rural China differently, our paper will employ separate sets of instruments for urban and rural areas - a revised version from Chen (2010) who studied the effect of parental education on children health. Finally, we do include the rural-to-urban migrants in our analysis, unlike the previous studies in which only urban hukou holders were studied (Meng and Zhao, 2013; Magnani and Zhu, 2015).

2.2 Heterogeneity analysis

Although heterogeneity in educational transmission has been recognized as an important dimension of educational inequality, very few studies have explicitly addressed this aspect of intergenerational education transmission (Bauer and Riphahn, 2007). We summarize the existing heterogeneity studies by several dimensions as shown below.

The most discussed heterogeneity is the differential effect between fathers and

mothers. For example, Behrman and Rosenzweig (2002) find a positive and large effect of the father's schooling but no effect for the mother's schooling. In contrast, Stella (2013) shows that maternal education is more important than paternal education for the next generation.

The second comparison is also the gender difference -- the differing effect of parents' education on sons' and daughters' education. Bruck and Esenaliev (2013) find that daughters tend to experience lower intergenerational mobility than sons in Kyrgyzstan using data from three household surveys collected in 1993, 1998 and 2011. Magnani and Zhu (2015) use the Census data in China and finds that the effects of paternal education transmission on sons' education attainments are larger than those of maternal transmission, while the paternal and maternal transmission has similar impacts on daughters' education.

The third is to investigate changes in intergenerational education correlation over time for different age cohorts. Bruck and Esenaliev (2013) discover that the younger cohorts in Kyrgyzstan, who were exposed to the transition during their school years, experienced a rapid decline in educational mobility. Magejo et al. (2014) identifies a decrease in intergenerational transmission of education for 1954-1993 birth cohorts.

The final comparison is between urban and rural population. Golley and Kong (2013) investigate the difference in intergenerational education correlation between urban and rural China. They point out that the higher mobility observed in rural and migrant populations stems from the fact that the majority of these children complete only junior high school, with some children in the youngest cohorts moving down the education ladder relative to their parents. In contrast, urban children seem to at least maintain their parents' education level.

In order to obtain a deeper insight about these heterogeneities mentioned above, our paper will conduct a comprehensive heterogeneity analysis to investigate the

heterogeneity in different dimensions, including father versus mother, son versus daughter, urban versus rural, high-educated parents versus low-educated parents, etc. More importantly, we will combine these heterogeneity results with the distinction between nature and nurture effect. Although previous studies reviewed above have examined various heterogeneities, they mainly use the OLS regressions and rarely consider the heterogeneous nurture effect. Our paper will fill in this gap by running IV estimations in different dimensions.

2.3 Mechanism analysis

A lot of literature has estimated the nurture effect in different countries and for different cohorts, but the specific mechanism is largely unknown to us. Black and Devereux (2011) proposed three possible mechanism of intergenerational transmission of education. The first is the income channel. That is the higher educated parents tend to have higher income and higher income leads to higher education attainment of their children. The second is that parental education may affect parental time allocation and the productivity of the parent in child-enhancing activities. The third is about the bargaining power, which would be influenced by parents' education. However, empirical tests of each of three channels are still in infancy. A recent paper by Piopiunik (2014) provides evidence that additional schooling raises parents' valuation of their children's education, which is an important channel in the intergenerational transmission of education.

To contribute to the literature on identifying the mechanisms of the nurture effect, our paper will utilize father's income as an intermediate variable to test to what extent the income channel can explain the intergenerational education mobility in both nature and nurture effect.

3. Data description

We use the CHIP 2013 (China Household Income Project) survey data to investigate the impact of parental education on children education. CHIP is a study designed by a team of Chinese and Western economists and is among the best available national survey data on household income, expenditures, education, and program participation. CHIP particularly suits the analytical needs of this study because it includes the completed years of schooling for children and their parents as well as various demographic and socioeconomic characteristics. This differs from several other well-known datasets in China such as CGSS (China General Social Survey) and CFPS (China Family Panel Studies) which only provide the level of education (e.g., primary school, middle school, high school, and college) and do not tell us whether the person quitted in the middle of each level of schooling. As a result, we are not able to know the exact years of schooling using other datasets. Another advantage of the CHIP dataset is that it includes father's income which is very useful in the mechanism analysis. Finally, we do include the rural-to-urban migrants sample in our analysis, unlike the previous studies in which only urban hukou holders are studied (Deng et al., 2013; Meng and Zhao, 2013; Magnani and Zhu, 2015).

Samples of the CHIP study were drawn from larger National Bureau of Statistics (NBS) samples using a multistage stratified probability sampling method. To generate a nationally representative sample, CHIP includes sample provinces from eastern, central, and western regions of China. The survey has been conducted in five waves including CHIP 1988, CHIP 1995, CHIP 2002, CHIP 2007, and CHIP 2013, and the data we use for this paper (CHIP 2013) is the most recent one, in which the children of those who experienced the Cultural Revolution have completed their schooling. The CHIP 2013 is conducted in 15 provinces including Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Guangdong, Henan, Hubei, Sichuan, Chongqi, Yunnan, Gansu, Shandong, Hunan, and Xinjiang. The sample includes 6866 households in urban China and 10,759 households in rural China.

For the purpose of our study, we match the parents-children pair according to the

following procedure. For each household head, we record his/her years of schooling as well as his/her spouse and children education. Then we form parents-children pairs for each child. We do not track the household head' parents because their education information is largely missing.

The Chinese Cultural Revolution (CR) occurred between 1966 and 1976. It was a political event that disrupted everyone's life during that period. However, in terms of education, only those who should be in school during the CR experienced school interruption. In addition, the degree of school interruption during the CR was quite different across years (as detailed below in the next section). This generated an exogenous variation of educational attainment, which is irrelevant to individuals' innate abilities.

In order to capture the effect of CR and make use of it as an instrument, we impose some birth year restrictions on our sample. According to Meng and Gregory (2002) and Chen (2010), people born in the period of 1947-1961 experienced different degree of school interruption. Thus, we include people whose parents were born during this time period as the treatment group. For comparison, we include people whose parents were born before or after this time period (e.g., 1942-1946 and 1962-1966) as the control group. As shown in Chen (2010), these parents were not directly affected by CR in terms of interrupted education, but all experienced the Mao era and thus are more comparable with the treatment group. In addition, the reason for excluding parents who were born before 1942 is that those parents obtained their education mainly under the pre-communist system, which may differ from the system that operated after 1949, and part of their education may have also been interrupted by World War II and the Civil War. The reason for excluding parents who were born after 1966 is mainly to make sure that their children would have finished schools at the time of the survey implemented in 2013. Furthermore, we exclude children who were born in 1961 or before to guarantee that children themselves were not affected by CR directly. In the survey questionnaire, there is a question asking whether the

children have completed their education. Accordingly, we restrict our sample such that all the children have completed their education at the time of the survey.

In summary, the reason we restrict parental and children's birth cohorts to these ranges is to ensure the instrument we are using is valid. By restricting the sample to the birth cohorts who experienced the CR but their children did not, school interruption during the CR provides a valuable chance to identify the nurture effect in intergenerational education mobility.

The final sample includes 5,850 children with their parents' information. In order to utilize the different sets of instruments in urban and rural areas, we need to divide the entire sample into urban and rural sample, respectively. To best capture the location where the parents receive their education, we divide the urban and rural sample based on the hukou status of the household head (where the child comes from) at the age of 13. The household head is either the father or mother of the child. For instance, if a household head holds urban hukou status at 13, he or she is more likely to attend the school in urban areas.[2] By this division, we obtain 1,052 urban sample and 4,798 rural sample. The summary statistics of the key variables are shown in Table 1.

Table 1 Inserted Here

As can be seen, children in this sample on average receive 11 years of schooling, with the standard deviation equal to 3 years. In China, the formal education typically consists of 6 year primary school, 3 year middle school, 3 year high school, 4 year college and above. That is, children in our sample on average reached high school level and aged 30 in the survey year. According to the Compulsory Education Law implemented in 1986, people whose age were below 16 should complete 9 years of

[2] People inherit the hukou status at birth from their parents, and it is very hard to convert hukou from rural to urban for the parents' generation (Song, 2014). Accordingly, the urban/rural divide is roughly applicable for children generation as well. Moreover, we use the 13 years old as the age cutoff because the survey questionnaire only uses this age cutoff to identify the hukou type.

compulsory schooling (including 6 year primary school and 3 year middle school). Thus, most children have completed 9 year compulsory schooling while their parents only have 6-7 years of schooling.

71% of the children sample are male and only 7 percent belongs to minority group.[3] Since there is a very large rural–urban gap in terms of education levels as documented in previous literature (Song, 2012), we separate our sample by urban and rural division as defined above and show the descriptive statistics in Panel B and C of the Table 1 , respectively.

The descriptive statistics verify the large educational inequality between urban and rural China. Urban sample on average receive 3 more years of education than rural sample do, including both children and their parents. An average urban child in our sample has received 13 years of formal schooling meaning that the average group has completed high school. Notably, given the mean value and standard deviation of the children education in rural sample, we can infer that a large proportion of children still have not completed 9 years of compulsory schooling.

To further understand whether Compulsory Education Law implemented in 1986 have contributed to popularizing primary and middle schooling, we split our sample by children's birth cohort, and present the results in Table 2.

Table 2 Inserted Here

As can be seen, the average years of schooling increase with children's age. People who were born after 1985 have received nearly 12 years of education. It is noteworthy that although people born in the 1970s were affected by the Compulsory Education Law, many of them still have not completed 9-year compulsory schooling. For

[3] The authors also use the entire sample (without restricting our sample according to the parents and children's year of birth) to conduct the descriptive analysis, and the results show that 70% of the children are male, which is comparable to the value using our restricted sample.

instance, the average years of schooling for the 1970-1974 age cohort is only 8.51, indicating that the law is not strictly enforced as stated (Song, 2012).

4. Regression results of intergenerational education mobility

4.1 OLS estimations

We first use the following standard linear model to estimate the marginal effects of paternal years of education on the education attainment of the next generation. The estimation equation is as follows.

$$\mathrm{Edu}_i^C = \alpha_0 + \alpha_1 \mathrm{Edu}_i^P + \mathrm{X}_i'\beta + \varepsilon_i \quad (1),$$

where the superscripts c and p represent the child and the parent (either mother or father), respectively; Edu denotes years of formal schooling; X is a vector of control variables for the child including gender, minority dummy, birth cohort dummies, and residential province dummies, which explicitly control for demographic and locational factors that may affect years of schooling. Moreover, a number of existing studies have explored the quantity-quality tradeoff in that there may exist a negative relationship between the number of siblings and years of schooling for each person (Qian, 2009; Shen, 2017). Thus, we also control for the number of siblings in our regressions. In summary, this model captures the overall effect of parental education on children education after controlling for various covariates. The main results are displayed in Table 3. The coefficients found below are comparable to those in other studies such as Black and Devereux (2011) and Chen et al. (2015). For example, Chen et al. (2015) examined the effect of father's education on children education among urban Chinese. For the same birth cohort, their estimate is around 0.35, which is similar to our results for the urban sample.

Table 3 Inserted Here

Several interesting results stand out from the table above. First, on average, the regression coefficients on parental education are larger for the urban sample than for the rural one, suggesting lower intergenerational education mobility in urban China. This may occur for two reasons. On the one hand, rural parents on average receive significantly less education than urban parents, which makes more room for intergenerational mobility. On the other hand, urban areas have more good schools and educational resources, which enable people to accumulate their advantage over generations.

Second, if we compare the mobility between sons and daughters, we find that the regression coefficient is larger for sons in cities, but smaller for them in rural areas. As we know, the OLS results incorporate both the nature and nurture effects since we cannot control for unobserved inherent capabilities. However, the difference between sons and daughters in terms of the mobility pattern in different geographic areas is hard to explain by the nature effect. It is very likely that parents tend to allocate more educational resources to sons in both urban and rural areas, so we see more persistence in education for sons in urban areas where sufficient education resources are available. In contrast, more persistence occurs for girls in rural areas where education resources are scarce and thus low-level education is easier to transmit for daughters.

Finally, the coefficients on the control variables differ significantly between urban and rural sample. For example, the quantity-quality tradeoff is more relevant in rural areas in that the number of siblings is negatively associated with a person's years of schooling, but this effect seems non-existent in urban areas. Moreover, belonging in the minority group increases years of schooling for the urban sample but reduces education for the rural counterpart. One possible reason may be that urban minorities can obtain some priorities when entering high school or college, but minorities in rural areas may not have sufficient access to education resources.

We further run OLS regressions for fathers with different levels of education. As it turns out in Table 4, more persistence tends to occur for higher level of education in urban areas but for lower level of education in rural areas. That is, high educated people tend to accumulate their advantages over time by transmitting more education to the next generation. Besides, this persistence is indeed even larger in urban areas since the regression coefficient for people whose parents hold high school degree is 0.444 which is much larger than 0.281 for the rural counterpart.

Table 4 Inserted Here

The high persistence found in rural areas for the lowest education group is an important finding for policy purposes. This might be some evidence for educational poverty traps in that parents can pass their low education to their children which may create persistent poverty in income over generations.

To lend more support on the different mobility between urban and rural China, we show another piece of evidence using intergenerational education correlation which adjusts the differential variances in schooling across generations (Hertz et al., 2008; Black and Devereux, 2011). That is, the correlation coefficients can factor out the cross-sectional dispersion of education in two generations. The results are shown in Table 5.

Table 5 Inserted Here

As can be seen, our previous results keep unchanged. The correlation coefficient is larger in urban areas than that in rural China, implying larger intergenerational persistence in education for the urban sample. Additionally, the correlation coefficient is larger for sons in cities, but larger for daughters in rural areas. Finally, our results are comparable to previous studies such as Black and Devereux (2011). They find that the correlation coefficient is 0.34 for rural China, which is very similar to our

estimates below.

4.2 Instrumental variable estimations

This section aims to disentangle the nurture effect from the nature effect in intergenerational transmission of education. Estimating the nurture effect is important, because it can tell us the extent to which public policy can reduce education inequality in the current generation and subsequent generations, and hence can affect income inequality. As mentioned in previous sections, we will make use of the instrument generated by the Cultural Revolution since people born in different years were affected by this political event differently.

Several existing studies have summarized school interruption during the CR in terms of the impact on missed years of schooling for different age cohorts (Meng and Gregory, 2002; Chen, 2010; Meng and Zhao, 2013). These impacts on different birth cohorts in urban and rural areas are clearly displayed by Appendix Tables A1 and A2, respectively, which are revised versions from Chen (2010).[4] Since historical background has been detailed in these above-mentioned papers, we briefly summarize the key components here for simplicity.

4.2.1 School interruptions in urban areas

According to the historical documents and several existing studies (Pepper, 1996; Chen, 2010), the large scale school interruption in urban China can be divided into the following four periods: (1) 1966-68. Education at all levels was stopped; no teaching was carried out and no new students were admitted. (2) 1968-71. Primary and middle schools were reopened. Children aged 7-9 could begin primary school and students who would have completed primary school in 1966-68 were allowed to attend middle school. However, at the same time, in the reopened middle schools, the original

[4] Chen (2010) first proposed a set of instruments in both urban and rural areas according to historical documents he collected. However, the instruments he used were not exactly consistent with the text. In this paper, we double checked some historical materials and made up our revised instruments, which are slightly different from Chen's paper.

national standardized curriculum and teaching materials were completely abolished. Not until 1971 were recovered curricula made available. That is, although middle schools reopened in principle, most of children mainly took excursions to countryside to work rather than learning. Later, most of these students, the so-called "educated-youths" were sent to the rural areas to be "re-educated by peasants" due to the lack of employment opportunities in cities. Thus, in our analysis, we assume that middle schools were actually closed in this period. At the meantime, the original 6-3-3 schooling system (i.e. six years of primary, three years of middle school and three years of high school) was cut to be 5-2-2, which continued until 1973. (3) 1971-1976. High schools resumed the admission of new graduates directly from middle schools but had been cut to 2 years until 1973. Middle school curriculum was recovered during this time. (4) 1976-1981. After the Cultural Revolution officially ended in 1976, the original 6-3-3 schooling system was recovered. National College Entrance Examinations were resumed in 1977, and everyone who had missed their chances of college education because of the Cultural Revolution (e.g., "educated-youths") was permitted to take the exams.

Based on the events introduced above, Table A1 summarizes the expected interruptions encountered by urban individuals born in different years, assuming they had the potential to complete high school had the Cultural Revolution not occurred. The last column estimates the expected total years of interruptions encountered by an urban individual.[5] We will use this column as the instrument to estimate the nurture effect in intergenerational education mobility.

We take the 1956 birth cohort as an example to explain the appendix table A1. If these people started primary school on time at seven years of age, then they had completed three years of primary education when the CR began. Because all schools

[5] Note that Table A1 lists the expected, as opposed to the actual, education interruptions encountered by these individuals. Without further information, it is difficult to estimate the actual education interruptions they encountered since the schooling system may be slightly different across regions. The same is true for Table A2.

were closed between 1966 and 1968, their primary education was cut short by two years. In 1968, these students went back to the primary school and completed their primary education. In 1969, these students entered middle school even though they missed two-year primary education. However, as we claimed previously, middle school students in this period mainly took excursions to countryside to work rather than learning, and hence they missed another three years of middle school education. In 1971, they started to attend high schools and missed another year of high school education compared to earlier cohorts since high school has been cut to 2 years. Hence, this cohort missed two years in primary school, three years in middle school, and one year in high school during the CR.

4.2.2 School interruptions in rural areas

Indeed, popularizing education in rural China was on Chinese Communist Party (CCP)'s political agenda in the Maoist era. The effort to boost rural enrollment was made as early as in the Great Leap Forward (GLF) movement in 1958-1961, whose education component was known as "the Cultural Revolution in 1958" (Pepper, 1996). The major practice of the 1958 Cultural Revolution was the establishment of a large number of collectively-run agricultural primary and middle schools in 1958-1961. However, many middle schools in rural areas were closed in 1961-63 due to the economic crisis that followed immediately after the GLF, but revived in 1964-65. In 1965, there were more than 60,000 agricultural middle schools nationwide, almost tripling the number in 1958 (22,579).

Considered as a product of "Bourgeois ideology", however, all agricultural middle schools built in the late 1950s as well as many primary schools were closed during the initial stage of the Chinese Cultural Revolution (1966-69) (Pepper, 1996). Things started to change in 1969, when the government decided to implement a radical education reform in rural China. The central government in 1969 required that every village-level collective should build its own complete primary school and that each

commune should build its own combined middle/high school.[6] Despite the limited funding resources available from the state, most local governments managed to complete these tasks, an important reason being that many of these commune-run secondary schools were built on the foundation of the previously closed middle schools.[7] The national number of rural secondary schools soared from 604 in 1965 to 11,819 in 1971, and continued to grow to 50,916 in 1977.

In retrospect, rapid expansion of rural schools seems to represent the general theme of China's rural education system in the Maoist era. Both the "Cultural Revolution in 1958" and rural education reform in 1969 aimed to achieve universal secondary school enrollment in rural China. The initial phase of the Chinese Cultural Revolution in 1966-69, along with the GLF crisis in 1961-63, however, broke the continuity of these two campaigns to expand rural school systems, and thus represented the major interruptions.[8] Table A2 summarizes the expected education interruptions experienced by the cohorts at school age around the Cultural Revolution years for rural residents. It lists the expected years of education interruptions encountered by rural individuals born in different years, assuming the "counterfactual" of China's rural education system was that the peak years of rapid school expansion extended from 1958 and uninterrupted to the early 1970s. It is noteworthy that the interruptions in rural areas were generated by both the CR and post-GLP crisis, which is different from interruptions in urban China solely generated by the CR.

4.2.3 Identification strategy

The comparison in terms of formal years of schooling between cohort groups who encountered CR (the treatment groups) and those who did not encounter these shocks (the control groups) provides exogenous variation in individuals' educational attainment. Control groups should be chosen in a way that they are similar to the

[6] Refer to People's Daily on May 12, 1969.
[7] See Chen (2010) for more details.
[8] We keep the assumption made by Chen (2010) that the interruption started in early 1961 and ended in late 1963, so the 1961-1963 period is corresponding to a three-year interruption.

treatment groups in all aspects, except that they did not encounter education interruptions.

There are two appropriate control groups: (1) the group of individuals born in 1962-66 (the After-CR group), and (2) the group of individuals born in 1942-46 (the Before-CR group). The After-CR group consists of those whose education was not interrupted, even though they were born before the Cultural Revolution and were attending school during the Cultural Revolution. For urban residents, these individuals started their primary education after schools were reopened (in 1968) and finished their secondary school education after colleges and universities resumed normal recruitment (in 1977). The Before-CR group is the group of individuals who had completed their high school education just before the outbreak of the Cultural Revolution. This group would have entered universities by 1965 before the Cultural Revolution. The reason to restrict the Before-CR group to individuals born after 1942 is that those parents obtained their education mainly under the pre-communist system, which may differ from the system that operated after 1949, and part of their education may have also been interrupted by World War II and the Civil War.

For rural residents, the Before-CR and After-CR are also suitable control groups, although with somewhat different reasons. The After-CR group consists of those who were fully exposed to the radical education reform of 1969, entering primary school after 1969 and entering secondary schools in the peak years of school expansion. The Before-CR group consists of individuals whose middle school education was exposed to the peak years of another school expansion campaign, i.e. the "Cultural Revolution in 1958". These two cohorts represented those who were exposed to the peak years of rapid school expansion at their school age.

4.2.4 Results of IV estimations

In what follows, we make use of the total expected years interrupted provided by the

two appendix tables as instruments for parental education. The first-stage results are provided in Table 6. As is seen, the exposure to the CR indeed leads a reduction in parental years of schooling in both urban and rural areas. Females tend to be affected more by the Cultural Revolution, especially in rural areas.

Table 6 Inserted Here

Since the instrumental variable approach employed exogenous instruments for parental education which are not correlated with parents' inherent abilities, it captures the nurture effect. The results estimated by the 2SLS are provided in Table 7.[9] First, the F-statistics of testing the joint significance of IVs in the first-stage are mostly larger than the rule-of-thumb value 10, partly verifying the use of our instruments. Second, the IV results show that the nurture effect is larger and more significant for fathers, especially in urban areas. That is, fathers' education has a more significant impact on children education through the nurture effect. Specifically, the empirical results suggest that one year decrease in father's schooling because of school interruption during the CR leads to 0.596 and 0.540 year decrease in the child's schooling for urban and rural areas, respectively.[10]

Table 7 Inserted Here

Finally, several previous findings from the OLS regressions remain true. For example, the regression coefficients on parental education are larger in urban than in rural areas.

[9] Because our instruments are not region or province-specific, we employ usual standard errors instead of clustered ones.

[10] Several existing studies have found that the effect tends to be larger in magnitude when using the IV estimation (Meng and Zhao, 2013; Song et al., 2016). When the nurture effect is heterogeneous, the IV estimate could be lower or higher than the OLS estimate as it is a weighted Local Average Treatment Effect (LATE), which captures the effect for the particular group the instruments identify. That is to say that it identifies an effect for a subgroup of individuals whose (parental) treatment status is changed by the random shock identified by the instrument. The degree to which the LATE is applicable to the whole population depends on how `local' the estimate is and how heterogeneous the population is.

The rationale might be that urban areas have more good schools and educational resources, which enable people to accumulate their advantage over generations. Lastly, we find that the regression coefficient is much larger for sons than for daughters in cities, suggesting the son preference in terms of allocating educational resources.

4.3 Possible mechanisms

We know from the last section that fathers' education significantly affects children education through the nurture effect, but the specific mechanism is unknown. Fortunately, we have the information for fathers' annual income in the CHIP dataset, which enables us to test the income channel proposed by previous literature (Black and Devereux, 2011).[11] Table 8 and 9 report the OLS and IV regression results after controlling for father's annual income, respectively.

Tables 8 and 9 Inserted Here

As it turns out, most of the coefficients become smaller than their counterparts without controlling for father's income, suggesting that father's education pass on to children's education partly through the income channel. That is, better-educated fathers earn higher income which offers children more educational resources, making their children more educated. In contrast, low-educated fathers earn less income and can offer fewer educational resources, making their children less educated. Accordingly, creating more equal educational opportunities and offer low-income family educational subsidies would reduce intergenerational education persistence and lower inequality.

Meanwhile, it should be noted that even after controlling for father's income, parental education still has a significantly positive effect on children education through the nurture effect, as suggested in Table 9. This indicates that beyond the income channel,

[11] In the dataset, father's income in urban areas is measured by the annual labor earnings in the survey year, while rural income is only defined as father's labor earnings from non-agriculture work.

there exist other channels through which parental education can affect children education, such as better home environment, and so on.

5. Conclusion

In this paper, we estimate the effect of parental education on children education in China using OLS and IV regressions with the newly-released CHIP 2013 dataset. By virtue of the instruments generated by the Cultural Revolution in China as proposed by Meng and Gregory (2002), Chen (2010), and Meng and Zhao (2013), we estimate the nurture effect of the intergenerational transmission and its potential mechanisms.

Several important findings stand out from our empirical analyses. First, on average, the regression coefficients on parental education are larger in cities than in rural areas, suggesting lower intergenerational education mobility in urban China. This may occur because urban areas have more good schools and educational resources, which enable people to accumulate their advantage over generations. Second, more intergenerational persistence in education tends to occur for higher level of education in urban areas but for lower levels of education in rural areas. The high persistence found in rural areas for the lowest education group might be some evidence for educational poverty traps in that parents can pass their low education to their children which may create persistent poverty in income over generations.

The results from instrumental variable estimation show that the nurture effect is larger and more significant for fathers than for mothers. Specifically, the empirical results suggest that one year decrease in father's schooling because of school interruption during the CR leads to 0.596 and 0.540 year decrease in the child's schooling for urban and rural areas, respectively. A deeper investigation of the mechanism behind this nurture effect informs us that father’s education pass on to children’s education partly through the income channel. That is, better-educated fathers earn higher income which offers children more educational resources, making their children more

educated. Another notable finding is that even after controlling for father's income, parental education still has a significantly positive effect on children education through the nurture effect. This indicates that beyond the income channel, there exist other channels such as better home environment. Future research to test these channels would thus be desirable and valuable.

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Tables

Table 1 Descriptive Statistics of Key Variables

Panel A: All Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Children's Education	5850	11.02	3.34	0	22
Father's Education	5850	7.70	3.09	0	20
Mother's Education	5850	6.37	3.52	0	19
Age	5850	30.73	5.30	23	51
Urban	5850	0.18	0.38	0	1
Male	5850	0.71	0.45	0	1
Minority	5850	0.07	0.25	0	1
Number of siblings	5816	2.43	1.91	0	12

Panel B: Urban Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Children's Education	1052	13.71	2.88	0	22
Father's Education	1052	10.07	3.17	0	20
Mother's Education	1052	9.33	3.36	0	19
Age	1052	30.12	4.90	23	50
Male	1052	0.61	0.49	0	1
Minority	1052	0.06	0.23	0	1
Number of siblings	1047	2.11	1.87	0	10

Panel A: Rural Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Children's Education	4798	10.44	3.14	0	21
Father's Education	4798	7.18	2.82	0	18
Mother's Education	4798	5.72	3.21	0	16
Age	4798	30.86	5.37	23	51
Male	4798	0.74	0.44	0	1
Minority	4798	0.07	0.25	0	1
Number of siblings	4769	2.51	1.91	0	12

Note: Urban (rural) means that the head of the household where the child comes from held urban (rural) hukou at the age of 13. Education is measured by years of schooling. The other variables

are self-explanatory.

Table 2 Descriptive Statistics by Children's Birth Cohorts

Birth cohort of child	Share %	Years of Schooling for Children				Years of Schooling for Fathers				Years of Schooling for Mothers			
		Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
1965-1969	0.8	7.87	3.24	0	16	5.53	3.43	0	15	3.57	3.56	0	15
1970-1974	4.27	8.51	2.92	0	17	5.50	3.12	0	15	3.82	3.00	0	15
1975-1979	9.66	9.68	3.02	0	19	6.58	3.40	0	18	4.60	3.62	0	18
1980-1984	21.01	10.45	3.18	0	21	7.31	3.10	0	17	5.93	3.50	0	17
1985-1989	42.65	11.52	3.32	0	22	8.12	2.89	0	19	6.90	3.32	0	18
1990-1994	21.61	11.82	3.15	0	19	8.28	2.91	0	20	7.15	3.37	0	19

Table 3 OLS Regression Results for Urban and Rural Sample

OLS	(1) Father-Child	(2) Mother-Child	(3) Father-Son	(4) Father-Daughter	(5) Mother-Son	(6) Mother-Daughter
Panel A: Urban Sample						
Father's education	0.368***		0.385***	0.328***		
	(0.0258)		(0.0345)	(0.0394)		
Mother's education		0.362***			0.405***	0.274***
		(0.0248)			(0.0319)	(0.0402)
Male	-0.608***	-0.666***				
	(0.164)	(0.162)				

Minority	0.677*	0.640*	1.030*	0.206	0.941*	0.196
	(0.354)	(0.353)	(0.526)	(0.468)	(0.513)	(0.481)
# of siblings	0.0135	0.0237	-0.0411	0.0936	-0.0421	0.107*
	(0.0422)	(0.0421)	(0.0577)	(0.0616)	(0.0563)	(0.0633)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,047	1,047	635	412	635	412
R-squared	0.264	0.271	0.276	0.206	0.311	0.164
Panel B: Rural Sample						
Father's education	0.280***		0.267***	0.316***		
	(0.0152)		(0.0168)	(0.0344)		
Mother's education		0.239***			0.214***	0.318***
		(0.0139)			(0.0155)	(0.0306)
Male	-0.808***	-0.767***				
	(0.0937)	(0.0943)				
Minority	-0.501***	-0.539***	-0.313	-0.755*	-0.290	-0.888**
	(0.188)	(0.189)	(0.214)	(0.398)	(0.216)	(0.394)
# of siblings	-0.0371*	-0.0301	-0.0463*	0.000104	-0.0393	0.00831
	(0.0215)	(0.0216)	(0.0240)	(0.0466)	(0.0242)	(0.0462)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,769	4,769	3,510	1,259	3,510	1,259
R-squared	0.219	0.212	0.197	0.219	0.183	0.232

Note: Birth cohorts are defined by five-year interval as displayed in Table 2. Education is measured by years of schooling. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4 OLS Regression Results by Fathers' Education Level

OLS	(1) Primary & Below	(2) Middle	(3) High	(4) College & Graduate
Panel A: Urban Sample				
Father's education	0.118	0.364*	0.444**	0.136
	(0.179)	(0.185)	(0.196)	(0.115)
Male	-0.398	-0.933***	-0.556**	-0.0345
	(0.691)	(0.269)	(0.280)	(0.308)
Minority	1.582	1.317*	0.661	-1.004
	(1.307)	(0.690)	(0.561)	(0.713)
# of siblings	-0.00715	0.133*	-0.0290	-0.116
	(0.184)	(0.0688)	(0.0743)	(0.0807)
Province dummies	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes
Observations	116	418	332	181
R-squared	0.305	0.196	0.080	0.145
Panel B: Rural Sample				
Father's education	0.143***	0.241***	0.281*	0.269
	(0.0351)	(0.0779)	(0.144)	(0.522)
Male	-0.500***	-0.939***	-0.943***	-0.666
	(0.153)	(0.134)	(0.258)	(0.897)
Minority	-0.489*	-0.726***	0.877	3.320
	(0.290)	(0.277)	(0.568)	(2.713)
# of siblings	-0.0307	-0.0386	-0.00168	-0.0855
	(0.0327)	(0.0321)	(0.0622)	(0.242)

Province dummies	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes
Observations	1,797	2,302	609	61
R-squared	0.164	0.134	0.206	0.484

Note: Birth cohorts are defined by five-year interval as displayed in Table 2. Education is measured by years of schooling. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 5 Correlation Coefficients for Urban and Rural Sample

Correlation coefficient	Urban			Rural		
	All Child	Son	Daughter	All Child	Son	Daughter
Father's education	0.441	0.4505	0.3898	0.3369	0.3309	0.3374
Mother's education	0.4518	0.4938	0.3372	0.3421	0.3171	0.3739
Observations	1047	635	412	4769	3510	1259

Note: Education is measured by years of schooling.

Table 6 Results from the First Stage Regression

First stage	Father's Education			Mother's Education		
	All	Urban	Rural	All	Urban	Rural
Father's interruption	-0.176***	-0.182***	-0.257***			
	(0.0186)	(0.0364)	(0.0204)			
Mother's interruption				-0.307***	-0.146***	-0.459***
				(0.0213)	(0.0398)	(0.0225)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,850	920	4,930	5,850	844	5,006
R-squared	0.015	0.027	0.031	0.034	0.016	0.077

Note: The dependent variable is the actual years of parental schooling. Father's interruption and Mother's interruption denote the expected years of interruption due to Cultural Revolution for fathers and mothers, respectively. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7 Instrumental Variable Estimations

2SLS	(1) Father-Child	(2) Mother-Child	(3) Father-Son	(4) Father-Daughter	(5) Mother-Son	(6) Mother-Daughter
			Panel A: Urban Sample			
Father's education	0.596***		0.683**	0.445		
	(0.228)		(0.347)	(0.287)		
Mother's education		0.0186			0.134	-0.211
		(0.231)			(0.314)	(0.359)
Male	-0.490**	-0.792***				
	(0.205)	(0.194)				
Minority	0.788**	0.506	1.114**	0.273	0.927*	-0.119
	(0.379)	(0.390)	(0.555)	(0.488)	(0.532)	(0.594)
# of siblings	0.0249	-0.00326	-0.0243	0.0992	-0.0559	0.0558

	(0.0447)	(0.0488)	(0.0630)	(0.0620)	(0.0605)	(0.0814)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,047	1,047	635	412	635	412
First-stage F-stat	13.897	13.738	6.589	7.194	6.845	6.442
Panel B: Rural Sample						
Father's education	0.540***		0.537***	0.511*		
	(0.118)		(0.126)	(0.277)		
Mother's education		0.178**			0.180**	0.202
		(0.0751)			(0.0905)	(0.131)
Male	-0.760***	-0.791***				
	(0.0986)	(0.0984)				
Minority	-0.474**	-0.536***	-0.345	-0.674	-0.288	-0.887**
	(0.193)	(0.189)	(0.222)	(0.414)	(0.216)	(0.392)
# of siblings	-0.0325	-0.0331	-0.0431*	0.00847	-0.0409*	0.000388
	(0.0221)	(0.0219)	(0.0248)	(0.0481)	(0.0245)	(0.0467)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,769	4,769	3,510	1,259	3,510	1,259
First-stage F-stat	84.589	168.416	67.122	19.275	104.745	70.337

Note: Birth cohorts are defined by five-year interval as displayed in Table 2. Education is measured by years of schooling. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8 OLS Estimations Controlling for Father's Income

OLS	(1) Father-Child	(2) Mother-Child	(3) Father-Son	(4) Father-Daughter	(5) Mother-Son	(6) Mother-Daughter
Panel A: Urban Sample						
Father's education	0.359***		0.361***	0.329***		
	(0.0286)		(0.0368)	(0.0473)		
Mother's education		0.369***			0.378***	0.317***
		(0.0270)			(0.0336)	(0.0481)
Log (father's income)	0.676***	0.646***	0.677***	0.757***	0.677***	0.677***
	(0.116)	(0.115)	(0.150)	(0.192)	(0.145)	(0.195)
Male	-0.735***	-0.782***				
	(0.181)	(0.178)				
Minority	0.422	0.353	0.648	-0.107	0.581	-0.176
	(0.404)	(0.397)	(0.577)	(0.558)	(0.562)	(0.563)
# of siblings	0.0431	0.0391	0.0203	0.0898	0.00874	0.0870
	(0.0460)	(0.0453)	(0.0600)	(0.0718)	(0.0584)	(0.0724)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	762	762	484	278	484	278
R-squared	0.330	0.351	0.345	0.292	0.379	0.280
Panel B: Rural Sample						
Father's education	0.257***		0.245***	0.300***		
	(0.0161)		(0.0175)	(0.0396)		
Mother's education		0.211***			0.190***	0.296***
		(0.0148)			(0.0162)	(0.0351)
Log (father's income)	0.531***	0.533***	0.532***	0.466***	0.532***	0.484***
	(0.0638)	(0.0642)	(0.0697)	(0.156)	(0.0704)	(0.154)

Male	-1.103***	-1.066***				
	(0.104)	(0.105)				
Minority	-0.461**	-0.426**	-0.231	-0.953**	-0.139	-1.070**
	(0.206)	(0.208)	(0.233)	(0.465)	(0.235)	(0.461)
# of siblings	-0.0270	-0.0254	-0.0242	-0.0163	-0.0207	-0.0225
	(0.0225)	(0.0226)	(0.0248)	(0.0519)	(0.0251)	(0.0514)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,733	3,733	2,887	846	2,887	846
R-squared	0.228	0.219	0.200	0.231	0.185	0.244

Note: Birth cohorts are defined by five-year interval as displayed in Table 2. Education is measured by years of schooling. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9 IV Estimations Controlling for Father's Income

2SLS	(1) Father-Child	(2) Mother-Child	(3) Father-Son	(4) Father-Daughter	(5) Mother-Son	(6) Mother-Daughter
Panel A: Urban Sample						
Father's education	0.742***		0.863**	0.436		
	(0.286)		(0.431)	(0.384)		
Mother's education		0.351			0.573*	-0.378
		(0.227)			(0.314)	(0.574)
log(father's income)	0.490***	0.656***	0.362	0.723***	0.561**	1.084***
	(0.188)	(0.169)	(0.320)	(0.222)	(0.237)	(0.419)
Male	-0.431	-0.794***				
	(0.301)	(0.227)				
Minority	0.432	0.355	0.661	-0.107	0.551	-0.0203
	(0.442)	(0.392)	(0.666)	(0.540)	(0.569)	(0.738)
# of siblings	0.0674	0.0383	0.0548	0.0958	0.0155	0.0523

	(0.0536)	(0.0460)	(0.0752)	(0.0727)	(0.0598)	(0.0978)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	762	762	484	278	484	278
F-stat	8.931	10.246	4.474	3.666	5.399	3.017
Panel B: Rural Sample						
Father's education	0.433***		0.405***	0.480		
	(0.124)		(0.127)	(0.348)		
Mother's education		0.154**			0.148*	0.200
		(0.0761)			(0.0890)	(0.141)
log(father's income)	0.497***	0.545***	0.505***	0.416**	0.541***	0.505***
	(0.0687)	(0.0662)	(0.0735)	(0.182)	(0.0726)	(0.155)
Male	-1.053***	-1.096***				
	(0.111)	(0.112)				
Minority	-0.476**	-0.430**	-0.278	-0.877*	-0.144	-1.073**
	(0.209)	(0.207)	(0.238)	(0.485)	(0.234)	(0.455)
# of siblings	-0.0248	-0.0267	-0.0229	-0.00907	-0.0219	-0.0244
	(0.0228)	(0.0226)	(0.0251)	(0.0535)	(0.0251)	(0.0509)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,733	3,733	2,887	846	2,887	846
F-stat	65.171	144.319	56.646	10.658	96.981	52.575

Note: Birth cohorts are defined by five-year interval as displayed in Table 2. Education is measured by years of schooling. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A1 Expected Education Interruptions: Urban Residents Born in 1947-1961

Treatment groups	(1) Birth year	(2) Primary school starting year	(3) Middle school starting year	(4) High school starting year	(5) Expected years of delayed enrollment	(6) Expected years interrupted in primary school	(7) Expected years interrupted in middle school	(8) Expected years interrupted in high school	(9) Expected years interrupted = (5) + (6) + (7) + (8)
Interrupted high school	1948	1955	1961	1964				1	1
	1949	1956	1962	1965				2	2
	1950	1957	1963	1966				3	3
Interrupted middle and high school	1951	1958	1964	1967			1	3	4
	1952	1959	1965	1968			2	3	5
	1953	1960	1968	1970			3	3	6
	1954	1961	1968	1970		1	3	3	7
	1955	1962	1968	1970		2	3	3	8
	1956	1963	1969	1971		2	3	1	6
	1957	1964	1970	1972		2	2	1	5

	1958	1965	1971	1973		2	1	1	4
	1959	1968	1973	1976	2	1			3
Interrupted primary education	1960	1968	1973	1976	1	1			2
	1961	1968	1973	1976		1			1

Note: This table assumes (1) an urban child started schooling at age 7; and (2) every child had the potential to attend senior high school. The number of years interrupted in Column (9) is calculated as the horizontal sum of the numbers in columns (5)-(8).

Table A2 Expected Education Interruptions: Rural Residents Born in 1947-1961

Treatment groups	(1) Birth year	(2) Primary school starting year	(3) Middle school starting year	(4) Interrupted primary school	(5) Interrupted middle school	(6) Expected years of interruption = (4) + (5)
CR1: post-GLF crisis at middle school	1947	1954	1960		2	2
	1948	1955	1961		3	3
	1949	1956	1962	2	2	4
	1950	1957	1963	3	1	4
CR2: post-GLF crisis at primary school; middle school closure in 1966-1968	1951	1958	1964	3	1	4
	1952	1959	1965	3	2	5
CR3: post-GLF crisis at primary school; middle school closure in 1966-1968	1953	1960	1966	3	3	6
	1954	1961	1967	4	2	6
	1955	1962	1968	3	1	4
CR4: primary education interrupted in 1966-68; 1969 Education Reform at middle school	1956	1963	1969	2		2
	1957	1964	1969	3		3
	1958	1965	1970	3		3
CR5: primary education interrupted in 1966-68; 1969 Education Reform at primary level	1959	1966	1971	3		3
	1960	1967	1972	2		2
	1961	1968	1973	1		1

Note: This table assumes (1) a rural child started schooling at age 7; (2) every child had the potential to attend middle school. The variable "expected years of interruption" includes years during the post-GLF crisis in 1961-63 and years exposed the chaotic years in 1966-68.