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# Exploring the Impact of Interrupted Education on Earnings: The Educational Cost of the Chinese Cultural Revolution

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# ABSTRACT

## Exploring the Impact of Interrupted Education on Earnings: The Educational Cost of the Chinese Cultural Revolution*

During the Chinese Cultural Revolution many schools stopped normal operation for a long time, senior high schools stopped student recruitment for up to 6 years, and universities stopped recruitment for an even longer period. Such large scale school interruptions significantly reduced the opportunity for a large cohort of individuals to obtain university degrees and senior high school qualifications. More than half of this cohort who would normally attain a university degree were unable to do so. We estimate that those who did not obtain a university degree, because of the Cultural Revolution, lost an average of more than 50 percent of potential earnings. Both genders suffered reduced attainment of senior high school certificates and more than 20 per cent prematurely stopped their education process at junior high school level. However, these education responses do not appear to have translated into lower earnings. In addition, at each level of education attainment most of the cohort experienced missed or interrupted schooling. We show, however, that given the education certificate attained, the impact on earnings of these missed years of schooling or lack of normal curricula was small.

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# 1 Introduction

In 1966, the Chinese Communist Party began a political event—the Cultural Revolution (CR)—during which most urban schools in China ceased normal operation for a long time, senior high schools stopped student recruitment for up to 6 years, while universities stopped student recruitment for an even longer period (Unger, 1982 and Meng and Gregory, 2002). Over the entire course of the 11-years of the Cultural Revolution a generation of urban young people was affected in terms of school outcomes. Some cohort groups missed as much as 4 to 6 years of schooling. Many individuals missed a chance to obtain a university degree or a senior high school qualification.

The question naturally arises as to how such large scale school interruptions affect lifetime earnings. Recent development of an IV-LATE approach (see, for example, Angrist, Imbens, and Rubin, 1996) provides a useful tool to examine this question. Ichino and Winter-Ebmer (2004) using this approach found, for a number of European countries, that those individuals who would have obtained higher education, but because of World War II did not, suffered a considerable loss of earnings. The Cultural Revolution experience can add a new dimension to this literature.

The emphasis of this paper is on two issues. First, the extent to which the interrupted education in urban China during the Cultural Revolution affected subsequent education attainment of the cohort (referred to as the *Interrupted Education Cohort*, IE cohort, or IEC, hereafter).[1] Second, the impact of interrupted education on subsequent earnings of the IE cohort in the 1990s and early 2000s due to the lack of educational achievement.[2]

The paper is structured as follows: Section 2 provides background on the education disruptions of the Cultural Revolution, defines the control groups, and discusses the data. Section 3 investigates the effect of the Cultural Revolution on educational attainment. Section 4 examines the earnings' effect of school interruptions. Section 5 pulls the various parts of the study together to investigate the long term cost of the interrupted education due to the Cultural

[1] The precise definition of the Interrupted Education Cohort (IE cohort) is given in Section 2.

[2] Individual earnings in the pre-economic reform era (before 1978) were administratively determined and this situation did not significantly change until the later stages of economic reform in the 1990s (Meng, 2000). Hence, the focus of this paper is on earnings of individuals during 1992 to 2002 period.

Revolution. Section 6 offers concluding comments.

# 2 Background and data

## 2.1 *Background*

Just before the Cultural Revolution, the structure of the school system in urban China varied slightly from city to city. The usual pattern was that students began formal schooling at age 7, followed by six years of primary school, three years of junior high and three years of senior high school (Deng and Treiman, 1997, Meng and Gregory, 2002). There were three degree types; a 4-year full-time degree, a 3-year full-time degree and a degree by correspondence or night school. The latter two degrees are regarded as the same in the labour market and all surveys group them together. We refer to them as semi-degrees.

The Cultural Revolution profoundly disrupted this urban education system. The history can be divided into four overlapping time periods.

The first period extends from the beginning of the Cultural Revolution in 1966 to 1968. No formal teaching was carried out in the urban education system and no new students were recruited to education institutions. It was usual for primary school age students to stay at home[3] and for junior and senior high school and university students to meet each day at school to undertake political activities. These were the peak years of education disruption.

The second period begins around 1968–1969 when primary and junior high school education recommenced. Those, who under normal circumstances would have completed primary school during 1966–1968 could go on to junior high schools. Children aged 7–9 could begin primary school. However, teachers were not allowed to follow standard curricula. Instead, students spent much of their school time going to factories and the countryside to do manual work. It was not

[3] It is not completely clear how many primary schools were closed in urban areas. Deng and Treiman (1997) cite Unger (1982) and Bernstein (1977) to claim that most primary schools continued to operate as usual during the first two years of the Cultural Revolution. This does not appear to be the case in the majority of urban areas where primary schools were closed and students stayed at home or went to school but without any formal education. Deng and Treiman (1997) appear to have misinterpreted Unger (1982). In his book Unger explicitly states "In as much as two years had passed since classes had been temporarily suspended at the Cultural Revolution's start, three years'worth of children would enter the first grade of primary school in the autumn of 1968." (Unger, 1982, p274). In addition, as almost all students who returned to junior high school in 1968 had been primary school students in 1966, he states that "They had been out on the streets running wild for two years, and many of them were little inclined to return passively to their school desks" (Unger, 1982, pp.149).

until 1970 that normal curricula were gradually resumed at primary and junior high schools.

During this period, formal education at senior high schools continued to be suspended. Those who were in junior or senior high school at the beginning of the Cultural Revolution were given qualifications at the normal graduation age, even though they had missed various years of standard schooling. Some of this group, and new graduates from junior high schools, were sent to the countryside to become peasants or to work in factories. Others were given jobs in the city or in the army.

The third period begins from 1972 when senior high schools began recruiting new students directly from junior high school. Those who had missed senior high school, as a result of the Cultural Revolution, were not allowed to return to the high school system. After the Cultural Revolution, however, many were able to obtain senior high school certificates by correspondence or at night school. From around this time the standard school curricula was gradually resumed throughout the school system, although factory and farm work was retained as an important part of the curricula, especially in high schools.

Education disruption at university level extended over a longer period. No standard university teaching or recruitment was undertaken from 1966 to 1970–71. Those who began university before the Cultural Revolution, and had not completed their degrees, were allowed to stay at university without formal teaching until 1970–71. They were then given their degree and assigned jobs usually as schoolteachers, factory workers, or army recruits.

From 1972, universities began restricted and small-scale recruitment, based upon political attitudes or family background rather than on academic merit. New students were drawn only from those who were workers, peasants, or soldiers. New senior high school graduates were not allowed to proceed to university directly. They were sent to the countryside or assigned jobs. The quality of university education dropped as a result of lower student intake quality and lack of qualified lecturers and professors, many of whom had been sent to the countryside for re-education. In recognition of this quality reduction, the authorities now also refer to degrees acquired during this period as semi-degrees.

The final period began when the Cultural Revolution ended in 1977, and extends until 1981. During 1977, universities returned to normal, resumed entrance exams and began recruiting on

academic merit. Everyone who had missed a chance to go to university because of the Cultural Revolution was entitled to sit entrance exams. Thus, the accumulation of eleven years of candidates began to compete with new senior high school graduates for a limited number of positions. This lasted for four years until 1981, when those who were older than twenty-five years of age were excluded from university entrance. The Interrupted Education Cohort, however, could still acquire semi-degrees by correspondence.

The best data for interrupted education during this period would be the details of the actual education experience of each individual in our sample but these data are not available. However, to the best of our knowledge, the education interruption during the Cultural Revolution is closely associated with an individual's date of birth.

The assumed relationship between birth date and interrupted education is presented in Table 1 which summarises the level and number of school years interrupted for each birth cohort group and the age at which university entrance was a possible choice. Although school years missed, and years at school without normal curricula, are slightly different, our analysis suggests that they may be grouped together as one variable which we label as interrupted education (Meng and Gregory, 2002). Thus, the interrupted education in Table 1 includes both school years missed and years at school but without normal curricula periods.

Table 1 indicates that about 15 urban cohort groups were affected by missed schooling, or lack of normal curricula. These cohorts were aged between 5 and 19 years when the Cultural Revolution began in 1966 (those born between 1947 and 1961). Some cohorts missed all six years of junior and senior high school. Some missed many years of primary schooling and others missed various combinations of primary, junior and senior high school. Missed schooling was most serious for middle cohort groups. These 15 cohort groups form the *Interrupted Education Cohort* (IE cohort).

### 2.2 *Defining control groups*

Our analytical purpose is two fold. First, we seek to evaluate the effect of interrupted education, due to the Cultural Revolution, on subsequent education attainment. Second, we evaluate the effect of interrupted education, through the change in education attainment, on earnings later

in life.

In the first instance, the *outcome* is the highest level of education certificate attained or years of schooling achieved and the *treatment* is education disruption due to the Cultural Revolution. As selection into treatment (whether an individual belongs to the IE cohort) is based on birth cohort, which is exogenous, the evaluation of the change in education attainment can be estimated using OLS. In the second instance, the *outcome* is earnings and the *treatment* is educational attainment. Because selection into treatment in this instance is not exogenous, an IV estimate is required. The instrument used is the IE cohort dummy, which is exogenous. For our purpose it is convenient to interpret the IV estimates as a Local Average Treatment Effect (LATE) (see Imbens and Angrist, 1994; Angrist and Imbens, 1995; and Angrist, Imbens, and Rubin, 1996). The IV/LATE estimates indicate the earnings loss for individuals of the IE cohort whose education was reduced because of interrupted education during the Cultural Revolution. Detailed discussion as to the estimation and interpretation of the education and earnings equations will be provided in Sections 3 and 4. Here the focus is mainly on the choice of control groups.

The effect of interrupted education on an outcome, $\alpha$, can be defined as:

$$\alpha = E(Y^1 - Y^0) \tag{1}$$

where $Y^1$ is the observed outcome for the treatment group (IE cohort) and $Y^0$ is the "would-have-been" outcome had the Cultural Revolution not interrupted education of the cohort. For each individual in the treatment group we observe $Y^1$ but not $Y^0$ and a control group is needed to calculate $Y^0$. The control group should be as similar to the treatment group as possible, except for the treatment. In particular, the control group must have experienced the Cultural Revolution and be affected in the same way as the IE cohort, except for education interruption.

In natural experiments it is not possible to find a perfect control group and we are in a similar position as other researchers who use this technique. We explore two possible control groups, each with particular strengths and weaknesses. The first control group is an urban before-after group which includes those who were born between 1942 and 1946 (the before group)

and those who were born between 1962 and 1966 (the after group). The before group started their education after the communists took power in 1949 and completed their education under the same communist system as our treatment group. When the Cultural Revolution began they were 20 to 24 years old and had already finished schooling or entered university[4] and did not experience interrupted education. The after group experienced the Cultural Revolution in their early life but when the oldest of this group was at primary school entry age in about 1969, schools were open and soon restored the standard school curricula. When the Cultural Revolution ended the youngest of the after group was around 10 and the oldest around 14 years of age.

The strength of the before-after control group is that they lived in urban areas and experienced a similar economic environment, education system, and general Cultural Revolution effect as the treatment group, except for interrupted schooling. We choose a narrow birth cohort range (5 years before and 5 years after the IE cohort) to increase the probability that control and treatment groups share similar experiences. Nevertheless, treatment and control groups were at different ages when the Cultural Revolution occurred and this may be a weakness. More formally, the outcome, $Y^1$ and $Y^0$ for the urban IE cohort and control groups may be defined as:

$$Y_U^1 = \alpha + AGE_{IEC} + EU + X \text{ and } Y_U^0 = AGE_{NIEC} + EU + X \tag{2}$$

where $\alpha$ is the effect of interrupted education due to the Cultural Revolution, $AGE_{IEC}$ and $AGE_{NIEC}$ are any age specific Cultural Revolution effect (such as psychological effect of the political turmoil) particularly related to the treatment (IEC) and control groups (NIEC), respectively. $EU$ is any general Cultural Revolution effect which applies to everybody from the urban sector who experienced the Cultural Revolution and $X$ is a vector of other relevant variables.

The difference between the two groups provides:

[4] Those who began university before the Cultural Revolution, and had not completed their degrees at the time the Cultural Revolution started, were given their degree and assigned jobs in 1970-1971. Thus, the qualification attained by this group are not affected by "Interrupted Education" as defined in this study.

$$Y_U^1 - Y_U^0 = \alpha + \Delta AGE \tag{3}$$

where $\Delta AGE = AGE_{IEC} - AGE_{NIEC}$, refers to any difference in age specific Cultural Revolution effects between control and treatment groups. Thus, with this control group the evaluation may measure both the effect due to interrupted education and an age specific Cultural Revolution effect. If this is the case, the ignorability assumption for interpreting the IV earnings equation as LATE would be violated. However, by narrowing the before-after group to a small range of birth cohorts we hope to minimise possible contamination from this source and in Section 4 we also explicitly check whether $\Delta AGE > 0$.

Another possible control group is a rural sample. The Cultural Revolution affected the general political, economic, and social environment of both urban and rural areas, but large-scale school interruption did not generally occur in rural areas. Although no official documents have been found to record the history of school closures, conventional wisdom is that rural schools suffered much less disruption than urban schools.[5] Our data, presented later, show that unlike urban workers, the education level of the rural IE cohort (the cohort born between 1947 and 1961) does not appear to have been significantly affected.

The strength of the rural control group is that it allows comparison of age groups, which exactly match each age cohort of the urban before-after control and each age cohort of the treatment groups, but the rural "treatment group" was not treated (did not experience large

[5] Documented information on rural schools' responses during the Cultural Revolution is difficult to find. The authors communicated with Professor Jon Unger, who is the author of the first and classic book discussing schooling during the Cultural Revolution. He indicated that he collected a large quantity of materials and interview records about rural schooling during the Cultural Revolution. Unfortunately due to word limits he did not put these materials into his book. His materials suggest that large scale school interruption did not occur in rural areas. Schools, especially primary schools, were mostly open during the first few years of the Cultural Revolution while their counterparts in urban areas were closed. Regarding junior and senior high schools, his impression was that in the commune headquarter towns, where the only high schools were located, sometimes these were closed during 1967 and in the first half of 1968 if the Cultural Revolution was active there. In addition, Andreas (2004) includes a table (Table 4) of new student enrollment for all of China in regular junior high schools, which indicates that in 1965 (one year before the Cultural Revolution begun), the total number of new *rural* enrollments was 1,719,000, while *urban* area enrollments were 1,279,000. In 1967 the split of rural/urban new enrollment data are not available, but the total enrollment number is 1,983,000, slightly higher than the rural enrollment number in 1965. Given that neither junior nor senior high schools in urban areas started recruitment until 1968 (Unger, 1982; Deng and Treiman, 1997; Meng and Gregory, 2002) we may assume that the majority of the total new enrollments was in rural areas and therefore large scale prolonged school interruption was absent, although short term disruptions may have occurred in some areas, where the Cultural Revolution was active.

scale school interruptions) or was treated at a much lower level (school interruption for a short time in some areas). Formally, the outcomes for the rural IE cohort and the rural before-after cohorts may be defined as:

$$Y_R^1 = \widetilde{\alpha} + AGE_{IEC} + ER + X, \text{ and } Y_R^0 = AGE_{NIEC} + ER + X \tag{4}$$

where $\widetilde{\alpha}$ is the interrupted education effect for the rural population and $0 \leqq \widetilde{\alpha} < \alpha$ and $ER$ indicates any general Cultural Revolution effect. The difference between the two outcomes for the rural sample is $Y_R^1 - Y_R^0 = \widetilde{\alpha} + \Delta AGE$, which is similar to equation (3). On the assumption that any age specific Cultural Revolution effects, which is not related to interrupted education, are the same in rural and urban areas the difference-in-differences estimate is:

$$(Y_U^1 - Y_U^0) - (Y_R^1 - Y_R^0) = \alpha - \widetilde{\alpha} \tag{5}$$

which may allow us to remove any age specific Cultural Revolution effects. However, a by-product of this approach is that the difference-in-differences result may be contaminated if $\widetilde{\alpha} > 0$, that is schools were closed in rural areas. If that is the case, the estimate from equation (5) should be an underestimate. As indicated earlier, we believe large scale school interruptions did not occur in rural areas, and hence, $\widetilde{\alpha}$ should be very small, if not zero (see footnote 5).

There are other problems, however, from using the rural sample as a control group. First, very few rural workers have above senior high school qualifications. Thus, the effective comparison with the urban sample is limited to pre-university schooling only. Second, most rural workers are self-employed rather than wage earners, and hence, only a relatively small sample of rural wage earners is available as a control group and there may be a sample selection bias.[6]

Considering the strengths and weaknesses of both control groups, our strategy is to place most emphasis on the urban before-after control group but to use both control groups as much as possible and to use the findings from each to reach the best possible judgement as to the

[6] Of course, there may be other problems. Rural and urban workers may have very different family backgrounds and other systematic differences. However, it is unlikely that such differences will differ between cohorts which experienced education interruptions during the Cultural Revolution and those who did not (before-after cohort). Thus, a difference-in-differences approach should allow us to remove family background differences and any other systematic differences between rural and urban samples.

interrupted education effect of the Cultural Revolution on subsequent earnings. In all natural experiments some component of individual judgement as to the degree of validity of the control groups is unavoidable.

### 2.3 *Data*

The data are from two collection agencies. One data source is The Household Income Distribution Surveys collected by the Institute of Economics at the Chinese Academy of Social Sciences (CASS) for the years 1995 (IDS95), 1999 (IDS99), and 2002 (IDS02) (see Appendix A for summary statistics). The CASS surveys use consistent questionnaires and include individual and household characteristics for both urban and rural samples. The urban survey was conducted in 10, 6, and 10 provinces for 1995, 1999, and 2002, respectively. We use 7635, 3906 and 6214 employed urban workers who report full-time wage and salary income. The rural sample includes 19 and 22 provinces for 1995 and 2002 samples, respectively. For the purpose of estimating the interrupted education effect on education attainment, 11786 and 11785 full-time rural workers are included for the two years, respectively. For the purpose of estimating the interrupted education effect on earnings, however, only those individuals, who are full-time employed and reported wage or salary related incomes, are included. There are 1,197 and 3,671 rural wage and salary earners for 1995 and 2002 data, respectively.[7]

The other data source is the Urban Household Income and Expenditure Survey (UHIES) conducted annually by the National Statistical Bureau of China (NSB). The NSB sample includes 15 provinces and consists of data collected from 1992 to 2000. Similar to the CASS data, the NSB survey also collects basic individual and household characteristics. The main advantage of these data is that they consist of nine years of repeated cross-sections, which give us considerable leverage to separately identify a IE cohort effect, defined with respect to individuals' year of birth and an age effect. In addition, the nine years give us a large sample for the before and after control group. The disadvantage of the NSB surveys is that they do not

[7] The earnings measure for the rural sample is not straightforward. Most members of the rural sample in IDS95 and IDS02 work on family farms or in family businesses and individual earnings cannot be identified from the survey. But there is a small sample of rural workers, who were employed in the rural industrial sector or worked in the cities and reported individual monthly earnings.

include a rural sample.

The samples used include individuals born between 1942 and 1966 and aged 20 to 60 at the survey year. Appendix A reports summary statistics of the outcome variables (education and earnings) and explanatory variables for both CASS and NSB surveys. They show that in urban areas, the IE cohort on average possesses less years of schooling than both the before and after cohorts and less than half of the proportion of university degree holders. Regarding earnings, after deflating by the consumer price index for each year, the IE cohort earns less than the before cohort and more than the after cohort although the difference is marginal. This is true whether we examine the average of all survey years or each survey separately and is largely a reflection of a steep age-earnings profile. The gender distribution of the sample seems to be biased towards men for the before cohort, which is due to the earlier retirement age for women than for men. For the IE cohort and after cohorts, the gender distribution is quite balanced.

Table A2 reports two rural samples: the left panel reports the full sample and the right panel reports the sample of individuals who have an earnings measure. Relative to the urban sample, the IE cohort in the rural sample has more education than the before cohort and less education than the after cohort. This is true for both the total sample and the sample with an earnings measure. In the rural sample, therefore, there is a general upward trend in years of schooling. A similar general trend can be seen in income: the younger age groups earn more. One noticeable difference between the total sample and the sample with an earnings measure is that more than 80 per cent of those who reported earnings are males whereas this ratio is around 54 per cent for the full sample. This is because the majority of those who are involved in non-agriculture production are males.

# 3 The impact of interrupted education on subsequent educational attainment

This section focuses on two measures of educational attainment: the highest level of qualification obtained and an aggregate measure of years of schooling. We define years of schooling as the number of years *normally required* to achieve the highest level of qualification attained rather than the actual number of years of schooling individuals experienced.

### 3.1 *Years of schooling*

Figure 1 presents average years of schooling for our selection of urban and rural birth cohorts. The different data sources are indicated in the headings of each panel and education outcomes for the IE cohort fall between the two vertical bars. Left hand panels present raw data and right hand panels present the residual years of schooling from gender specific regressions which include a cubic polynomial in age.[8]

Figure 1 delivers three clear visual messages: First, the urban IE cohort acquired significantly less years of schooling than the before-after cohorts. Second, there is no detectable rural IE cohort reduction in schooling years. Third, the patterns are similar across data sources.

These messages are reinforced by linear regressions where the educational choice variable $E_i$ is determined by:

$$E_i = X_i\gamma + \sum_{j=1}^{n} \delta_j Z_{ij} + u_i \tag{6}$$

where $X_i$ is a vector of individual characteristics, including age, age squared, age cubed, gender, year of survey, and regional dummy variables and $Z_{ij}$ is a treatment indicator(s). When the IE cohort is treated as a single treatment, $n = 1$, and $Z_i = 1$ indicates that an individual belongs to the IE cohort, 0 otherwise. When the IE cohort with different levels of education interruption are identified as different treatments, for example, those who missed primary school only, missed primary and junior high school, and missed junior and senior high school, then, $n > 1$, and $Z_{ij}$ indicates a vector of dummy variables for different levels of education interruption.

The top left panel of Table 2 presents the estimated results of Equation (6) when the IE cohort is specified as a single treatment. The IE cohort indicator is a statistically significant determinant of schooling years in the urban sample and the coefficient estimate suggests that, on average, the urban IE cohort has 43 and 78 per cent of a year less schooling than before-after cohorts, using NSB and CASS urban data, respectively. These estimates are about two to four times the education attainment effect of World War II in Austria and Germany, as estimated

[8] The results are not sensitive to the functional form imposed. See Bound and Jaeger (1996) and Ichino and Winter-Ebmer (2004) for an explanation as to the importance of de-trending as a technique to facilitate the separation of age and cohort effects.

by Ichino and Winter-Ebmer (2004). For the rural sample we find no statistically significant IE cohort effect on years of schooling. If we combine the urban and rural sample and include an urban dummy variable and an interaction term between it and the IE cohort dummy variable we find that the difference-in-differences estimate indicates 83 per cent of a year less schooling for the urban IE cohort.[9]

Table 2 also shows that school interruptions at every level of schooling (multiple treatments) had significant impacts on years of schooling achieved by the urban population (top right panel). Those who experienced interrupted junior and senior high school were most affected, acquiring 0.85 (NSB data) to 1.2 (CASS data) years less of schooling than before-after cohorts. Those who missed primary school only, and those who did not miss any schooling, but were subject to delayed university entry, were least affected. In general, the interrupted education effect on school years completed is less for women than for men. Rural results, which are not reported, are statistically insignificant as expected since rural students did not experience large scale education interruption.

### 3.2 *Highest level of qualification attained*

Figure 2 presents highest level of qualification attained for each age cohort.[10] Again there are three clear visual messages.

The first visual message, evident in both data sources, is that the IE cohort has a noticeable lower incidence of four-year degrees, relative to the before-after cohorts. The education regression model applied to whether an individual has a university degree or not (middle left panel of Table 2) produces a highly significant coefficient attached to the IE cohort indicator (single treatment), indicating that the IE cohort achieved a 5 to 7 percentage points lower four year degree acquisition rate than the before-after cohorts. Furthermore, every level of interrupted

[9] Family background is an important determinant of individual educational attainment. However, in our data only a small sub-sample has information on parental years of schooling. We use this sub-sample to test if the inclusion of father and mother's years of schooling changes our results and find that it reduces the estimated reduction of school years for the IE cohort slightly but does not change the qualitative conclusions. For example, the estimated difference-in-difference result for the sample including parental information is a reduction of 0.65 of a year schooling for the urban worker, and when parental information is excluded the reduction is 0.73 of a school year. The full results including parental education variables are available upon request from the authors.

[10] De-trended figures are consistent with Figure 2 but not reported here. They are available upon request from the authors.

schooling (multiple treatments) had a significant and negative effect on university degree acquisition (the middle right panel of Table 2). The largest effects were experienced by those with interrupted junior and senior high school education and those with interrupted senior high school only. Those with no interrupted schooling but with delayed university entry were least affected.

A second message of Figure 2 is that although access to all degrees was limited in much the same way, the Cultural Revolution does not appear to have had an adverse impact on semi-degree acquisition. After the Cultural Revolution there was considerable take-up of semi-degree courses that could be acquired by correspondence or part-time enrolment. The IE cohort used these pathways to achieve three year degrees and the acquisition levels are similar to the before cohort (Meng and Gregory, 2002). There are no statistically significant IE cohort effects for three-year degrees and results are not presented.[11] Regression results are also not reported for the rural sample because very few rural residents possess university or three-year degrees.

A third visual message of Figure 2 is that there is a clear Cultural Revolution impact on the acquisition of junior and senior high school certificates. Within urban areas there is a decreased attainment of senior high school certificates and an increased attainment of junior high school certificates for cohorts affected by senior high school closure (cohorts born during 1950 to 1955, which we refer to as the sub-IE cohort). The urban regression results indicate a significantly negative sub-IE cohort effect for senior high school acquisition (the bottom left panel of Table 2). Those with interrupted junior and senior high school are mostly affected with 16 to 17 percentage points less chance of obtaining a senior high school certificate (the bottom right panel of Table 2). Those with interrupted senior high school only, experience a 11 to 14 percentage points reduction. All effects are statistically significant and once again the results are consistent across data sources.[12]

[11] It is noticeable that there is a significant increase in semi-degrees among post IEC cohorts, perhaps in response to enhanced opportunities presented by the growth of correspondence courses and the provision of part-time places.

[12] Data on senior and junior high school trends in Figure 2 show that there is a large expansion of senior high school in later cohorts (born between 1958 to 1960). At this stage we are not clear why this happened. Are our estimated results influenced by this expansion? To test this we exclude cohorts born after 1957 from our sample. This restriction reduces the estimated effect of interrupted education only very slightly, with those with interrupted junior and senior high school having a 14 per cent less chance of obtaining a senior high school qualification and those with interrupted senior high school experiencing a 10 to 13 per cent reduction in senior

Rural outcomes are quite different and, as expected, there is no obvious IE cohort effect. There is an increase in senior high school attainment among rural people towards the end of the Cultural Revolution period that also occurs in the urban sample once senior high schools re-opened.

To conclude, the evidence shows that education interruption associated with the Cultural Revolution had widespread effects on urban years of schooling and certificate attainment relative to the urban before-after control groups but no statistically detectable effect in rural areas. Among the urban IE cohort, completed years of schooling fell between 43 and 78 per cent of a year, acquisition of a university degree fell by about 5 to 7 percentage points and senior high school attainment fell by 11 percentage points. Furthermore, the evidence provides direct links between the level of schooling interrupted and education attainment. Perhaps, as might be expected, the combination of interrupted junior and senior high school affects years of schooling the most. With regard to university degree attainment all levels of school interruption have similar effects.

# 4 The impact of interrupted education on subsequent earnings

Figure 3 presents real monthly earnings for employed full-time workers classified by birth cohort and subject to a three year moving average to smooth the series. The strong downward trend in the urban data is a product of the age earnings profile with the young birth cohorts earning less than older cohorts. The earnings pattern of the much smaller rural sample reflects an age earnings profile for a less skilled workforce subject to rapid technological change in that the younger age groups earn more than older age groups.

To facilitate a preliminary glance at the data we regressed individual earnings, from each data set, against a dummy variable for survey year and a cubic defined on age. While the rural de-trended data exhibit no obvious pattern, the residual pattern of earnings for each urban cohort reveals a consistent pattern across the two data sets. On average, the IE cohort residuals are negative and particularly so for age groups subject to the interrupted primary and junior high school, those born between 1956 and 1959. For these cohorts the residuals

high school attainment.

average around 2 to 4 per cent less than the before-after groups. Could these lower earnings of IE cohort urban workers be attributed to reduced educational attainment as analysed in the previous section?

The impact of reduced educational attainment on subsequent earnings depends on the economic return to education. To estimate the average education-earnings link during our data period, 1992-2002, we regress $\ln W_i$, log monthly earnings of individual $i$, against normal Mincer type variables

$$\ln W_i = X_i\beta + E_i\alpha + \epsilon_i \tag{7}$$

where $E_i$ indicates individual $i$'s educational attainment and $X$ is the vector of exogenous variables included in Equation (6). Equation (7), fitted by ordinary least squares, provides an estimate of the average rate of return for different education levels. The OLS results from Table 5, for example, indicate that a male university graduate earns approximately 24 to 28 per cent more than an average male without a university degree and a senior high school male graduate earns around 14 to 17 per cent more than a male with less than a senior high qualification. Across all education categories, male workers receive, on average, a 5 per cent wage premium for each additional year of schooling. In all cases the education return for females is higher than for males. These estimates are similar to those found in other studies based on Chinese data over this period (Liu, Meng, and Zhang, 2000).

If we assume the rate of return to schooling is the same for the control and treatment groups, we may combine the OLS estimates of average education returns with the reductions in schooling estimated in the previous section to estimate the impact of education interruption on individuals' earnings. If, however, we assume the rate of return to schooling is different for the treatment and control group but constant within each group, equation (7) may be estimated with an interaction term between the IE cohort dummy and $E_i$, which provides an estimate of the *Average Treatment Effect* (ATE). However, these average education returns may be inappropriate if returns to schooling are different between treated individuals who responded to the treatment (compliers) and those who did not (always takers and never takers), that is $\alpha$

in equation (7) should have a subscript $i$.

To explore this issue we estimate the earnings effect of reduced education attainment due to interrupted education by adopting the *Local Average Treatment Effect* (LATE) interpretation of the instrumental variable approach proposed by Imbens and Angrist (1994), Angrist and Imbens (1995), and Angrist, Imbens, and Rubin, (1996). To estimate the LATE we jointly estimate the education equation (6) and the earnings equation (7) using an IV method. The IE cohort dummy(ies) is(are) used as the instrument(s).

Before reporting the results we focus on some of the assumptions that must be satisfied to legitimately interpret the IV estimate as a Local Average Treatment Effect (see Angrist, Imbens and Rubin, 1996). Although it is not possible to fully test whether all assumptions are met we took the following steps.

One important assumption is that if interrupted education due to the Cultural Revolution affects IE cohort earnings this effect operates only through our education measures and there should be no other channels through which interrupted education impacts on earnings (the exclusion restriction). This restriction implies that for those whose schooling was not affected by interrupted education there should be no change in earnings because of interrupted education. For those whose schooling was affected by interrupted education the only source of lower earnings should be the education change. There is no test to ensure that the exclusion restriction is fully satisfied because we can never observe the counterfactual situation. However, we can build confidence in the restriction by investigating possible sources of violation.

One possible source of violation arises because we measure $E_i$ as the highest level of school certificate attained, or as years of schooling which are calculated as the highest level of school certificate attained adjusted by the school years normally required for each level. *Given* the level of education certificate, however, years of schooling missed was not taken into account. For example, those with a senior high school certificate who missed two or more years of schooling are assumed to have the same years of schooling as those with a senior high school certificate who completed all the required years. If those with more missed schooling years earned less, for any given education attainment, the exclusion restriction would be violated.

To provide some indication of this possible violation we estimate separate earnings equations

for each education certificate level. These earnings equations include all variables from equation (7) except $E_i$ and include a variable indicating the number of years schooling missed.[13] The results are reported in Table 3. At each education certificate level (university, 3-year degree, senior high, and junior high), missed school years do not significantly affect earnings, except for the junior and senior high school certificates when using NSB data, where very small (0.002 and 0.005), positive, and statistically significant coefficients are obtained.[14] Given the small size of the coefficients (0.2 to 0.5 per cent of earnings) and that these effects are only found in one data set, we assume that the effect of missed schooling on IE cohort earnings should mainly be through our measure of $E_i$, the highest level of school certificate attained or calculated years of schooling. The bias brought about by the possible violation of the exclusion restriction for those with senior and junior high school certificates should be very small but should be borne in mind when the results are discussed.

To further investigate whether we may meet the exclusion restriction, we estimate earnings equations including an IE cohort dummy variable for urban and rural samples separately. The results, listed in Table 4, indicate that for urban workers the IE cohort earns statistically significantly less earnings than the before-after control group, if education variables are excluded from the regressions. Once education variables are included, however, the education coefficients are statistically significant but no statistically significant IE cohort effect is observed. For the rural sample, the IE cohort dummy is not statistically significant with or without education variables. These results suggest that there does not seem to be an obvious and substantial interrupted education effect on earnings other than through its effect on education attainment.

Another important assumption required when interpreting the IV estimate as LATE is that earnings of those subject to interrupted education should not be affected by other factors which are different from but correlated with interrupted education (the ignorability assumption). Our major concern is that there may be other age specific Cultural Revolution effects for the IE cohort, which may adversely affect the earnings of this group independent of interrupted

[13] The years of schooling missed for each cohort are explained in Section 2.1 and Table 1.

[14] Further investigation reveals that the positive and significant effects of missed schooling, given the certificate level, are driven by the female sample. For males no significant effect is found at any certificate level. Hence, any bias is confined to the female results.

education. An example would be that everybody who went through the Cultural Revolution would have experienced some kind of psychological shock, which might vary for different age cohorts. We purposely chose the birth cohorts of the before-after control group to be as close to our treatment group as possible so that any age specific Cultural Revolution effect are more likely to be common across the treatment and before-after control groups.

However, one possible effect that stands out is that a large proportion of the IE cohort was sent to the countryside for many years. This may have affected their health, as many were working on farms for extended periods and the work was hard and the diet often limited. Farm work also gave the cohort a different kind of work experience, which may have been less valuable than non-agricultural work experience and may have affected subsequent earnings. The CASS data identifies those who went to the countryside because of the Cultural Revolution and the 1999 and 2002 surveys also include self-assessed health information. Although the 1995 survey did not include this question, it inquired as to the number of sick leave days taken during 1995. We looked for any correlation between countryside experience and health or sick leave days and failed to find a relationship. The earnings equation (7) was also estimated including a dummy variable for "country work experience" but the coefficient is statistically insignificant.[15]

Given this background we now turn to the LATE estimates reported in Table 5, with the top and bottom panels reporting results from CASS and NSB data, respectively.[16] To test the strength of the instrument(s), the F-Statistics for inclusion of the instrument(s) are presented at the bottom row of each panel. The tests show that the instruments have very strong explanatory power and that even considering the finite sample problem any bias from weak instruments should be limited (Staiger and Stock, 1997). Since the estimated coefficients attached to other variables appear to be similar to those found in the west, and similar to other studies based on CASS data (Gustafsson and Li, 2000), the comments focus mainly on education results.[17]

The LATE estimates for acquisition of a university degree are listed in the first three columns

[15] There are other assumptions required to interpret IV estimate as LATE. For example, Monotonicity and the Stable Unit Treatment Value Assumptions. For a detailed discussion, see Angrist, Imbens, and Rubin (1996).

[16] Note that the adjusted R-Squared reported in Table 5 is often quite high. The important contributors to the high R-squared are the wage variation across regions and over time, captured by regional and year dummy variables.

[17] The full results are available upon request from the authors.

titled "Below University" of Table 5. They indicate that male compliers (those who did not obtain a university degree, just because of interrupted schooling during the Cultural Revolution) experienced 46 to 51 per cent lower earnings and for female compliers the estimates are 73 to 76 per cent, using a single IE cohort dummy as an instrument. When five instruments are used they provide a weighted average of the effects of different levels of education interruption on earnings and produce similar but slightly lower results (Angrist and Imbens, 1995).

The earnings effect of reduced senior high school attainment of the sub-IE cohort are reported in Columns 4 to 6 of Table 5 entitled "Below Senior High". The IV estimates with one sub-IE cohort dummy (those who were born between 1950 and 1955) as the instrument suggest an average earnings loss for men of around 8 to 11 per cent although the estimate is only significant when the NSB data are used. For women the estimated earnings effect is positive but not statistically significant.

To provide an indication of the combined earnings effect of the reduction of university and senior high school attainment, we estimate the LATE for years of schooling (Columns 7 to 9, entitled "Years of schooling"). When the single IE cohort dummy variable is used as an instrument the estimated rate of return to an additional year of education is around 8 per cent for males and 11 per cent for females. The weighted average rate of return using five instruments are 4.5 to 4.7 per cent for an additional year of education for males and 3.0 to 5.5 per cent for females.

We are now in a position to compare LATE and OLS estimates. There seems to be four clear results (i) for four year university degrees the LATE estimates are very much larger than the OLS estimates; (ii) for senior high school certificates the LATE are lower than the OLS estimates—indeed in all but one instance not statistically different from zero; (iii) for years of schooling the LATE estimates are larger when one instrument is used and lower when five instruments are used, especially for women.

The difference between the OLS and the IV/LATE estimates suggest the difference between the average rate of return for the sample as a whole and the average return for those in the treated group who responded to the treatment (compliers). A particularly interesting aspect of these results is the different impacts of interrupted education across education levels. We find

that those who were unable to obtain a university degree, because of interrupted education, lost considerable income, much more than the average rate of return to a degree. For those who missed out on a senior high school qualification, however, the LATE estimates imply that they received much the same earnings as they would have done had they obtained the qualification. The reasons for this marked difference are not entirely clear. One conjecture is that the ability to substitute for lack of a senior high school qualification by on-the-job training is much greater than the ability to substitute for the lack of a university degree.

In the years of schooling estimations we find noticeable differences between estimates using single and multiple instruments. The reason for this may be related to the V-shaped curve in Figure 1 where we observe that years of schooling differ considerably across the IE cohorts. The impact of this V-shape may not be adequately summarised by one single dummy variable. Thus, we tend to trust more the IV/LATE results from the multiple instruments.

There does seem to be a gender pattern underlying these results. For years of schooling, the IV estimates for male sample are about the same as those obtained from the OLS estimates, indicating that perhaps, on average, the degree of reduction in earnings for the IE cohort due to their interrupted education is about the same as the average rate of return to schooling. The situation, however, is different for the female sample, where a lower than average rate of return is observed. This result may be mainly driven by the sub-IE cohort where women who did not obtain a senior high school certificate due to interrupted education, earn roughly the same earnings, if not higher, than they would have earned had they not experienced interrupted education.

Inter-generational transfers are an important factor which may affect individuals' education and earnings (see for example, Solon, 1992; Chevalier, 2004; and Oreopolos, Page and Huff-Stevens, 2004). However, as our main data source do not include parental information we have not controlled for this potentially important factor. Nevertheless, the CASS data IDS99 and IDS02 have some information on parental schooling. To test the sensitivity of our above results with respect to the inclusion of parental information, Table 6 reports the results of equations (6) and (7) with and without parental education variables for a sub-sample of individuals.[18]

[18] CASS 1999 survey asks every individual their parental information directly, whereas the CASS 2002 survey

Columns 1-4 report results from the years of schooling equation, which show that the children of better educated parents receive more education and the inclusion of parental education variables reduces the negative IE cohort effect by around 5 percentage points for the urban sample alone and around 14 percentage points for using the combined rural and urban data to obtain the difference-in-differences estimator. We then estimate the earnings equation (columns 5 to 10). Both OLS and IV/LATE estimations indicate that inclusion of parental education variables does not affect the estimated schooling effect significantly.

# 5 The cost of interrupted education due to the Cultural Revolution

The cost of interrupted education due to the Cultural Revolution, for those individuals whose earnings and education are affected, is provided by the LATE estimates in Section 4.[19] These costs can be calculated for the entire urban IE cohort by multiplying the average cost of interrupted education for compliers by their population share in the IE cohort.

Table 7 presents different cost measures calculated according to different IV/LATE estimators. The upper panel provides the costs of reduced university attainment. When interrupted education is used as a single instrument, the earnings of compliers who did not obtain a university degree, just because of education interruptions, are reduced by 49 to 57 per cent for the total NSB and CASS samples, 46 to 51 per cent for males and 73 to 76 per cent for females. Compliers are estimated to account for approximately 5 to 7 per cent of the IE cohort. Consequently the average earnings loss to the IE cohort due to reduced university attainment is measured between 2.5 and 4.2 per cent.

When interrupted education is measured as 5 different instruments, the weighted average

only asks parental information of household heads and spouses. We use the full 1999 data and data for household heads and spouses from the 2002 survey plus children who still lived at home at the time of survey, and hence their parental information is available.

[19] Our estimates refer to the cost to individuals and not necessarily to the cost for the economy as a whole, which would require much stronger assumptions than we have made. For example, if schooling is reduced because of interrupted education, the earnings of those affected will be less than they would have earned, as long as there is a causal link between education and individual earnings, whether or not this link is a reflection of more education leading to more productivity. For lower education, however, to impose a cost on the economy in aggregate requires a causal link between education and productivity. Since our model is not directed towards the determinants of productivity and economic growth our estimates should be interpreted as the cost borne by the individual and not by the economy.

cost to the compliers reduces slightly to 48 to 52 per cent for the total NSB and CASS samples, respectively. The average cost to the IE cohort as a whole also reduces slightly. The cost to each group who missed different levels of education differs because the proportion of compliers differs in each group. Those who lost the most earnings from the failure to obtain a university qualification are those that missed both junior high and senior school education. The average cost for this group is 3.5 to 4.4 per cent for males and 2.3 to 4.3 per cent for females.

The lower panel of Table 7 presents the average cost due to reduced years of schooling. When a single instrument is used, the average cost to compliers who reduced their schooling by one year because of interrupted education during the Cultural Revolution is 7.6 to 7.8 per cent for the total sample, and around 8 to 11 per cent for the male and female samples, respectively. The average cost to the IE cohort as a whole is calculated by multiplying the average number of years of schooling difference between the IE and Non-IE cohorts by the cost for one less year of schooling. The cost to females is much higher than that for males.

When using multiple instruments, the estimated cost to the compliers, who lost one year of schooling, reduced significantly to 4.5 to 4.7 (CASS data) and 3 to 5.6 per cent (NSB data) for male and female samples, respectively. For the cohort as a whole the average cost is calculated to be 3.5 to 5.1 and 2.6 to 5.6 per cent for men and women, respectively. Of course, individuals who missed different levels of schooling suffered differently. Once again, individuals with both interrupted junior and senior high schools lost most.[20]

# 6 Conclusions

The Cultural Revolution interrupted the education of a whole generation which, in turn, reduced subsequent school attainment. This political event provides an interesting and unique natural experiment to evaluate the impact of large-scale education interruptions on subsequent labour

[20] An important caution has to be borne in mind. For sub-groups of the IEC who obtained junior and senior high school certificates, there is a direct earnings' impact of interrupted education for a given qualification level in addition to its impact through reduced school attainment. These groups earn 0.5 and 0.2 per cent more for each year of schooling missed given their level of qualification. On average, the junior and senior high school groups missed 1.97 and 2.59 years of schooling, respectively, and hence, the additional earnings of this missed schooling effect is about 1 and 0.5 per cent, respectively, which is very small. As discussed in Angrist, Imbens, and Rubin (1996), such an additional effect violates the exclusion restriction and hence biases the LATE-IV estimators obtained in Section 4, but the effect should be very small.

market outcomes.

The major results and broad conclusions are the following.

• The effect of interrupted education on reduced years of schooling of the cohort affected, calculated from the data on the highest education qualification attained, is estimated to be approximately 44 to 79 per cent of a year. This is about 2 to 3 times the effect of World War II on the education attainment of Austrian and German WWII cohorts analysed in Ichino and Winter-Ebmer (2000). In addition, at each education qualification attained, many individuals of the IE cohort completed two or more years of schooling less than what was normal for the level of qualification.

• Attainment of a university degree was approximately halved for the IE cohort. Both men and women, who in normal times would have acquired a university degree, suffered a considerable loss of earnings of 46 to 76 per cent. These estimates of earnings loss are well above the normal average rate of return to a degree estimated from ordinary least squares regression.

• Although a large proportion of individuals failed to attain a senior high school certificate, because of the interrupted education during the Cultural Revolution, the individuals affected do not seem to have suffered any noticeable earnings loss that is statistically significant.

• *Given* the qualification level, those subject to less years of formal schooling did not suffer from a large loss of earnings.

To our knowledge this is the first paper to relate the impact of education disruption as a result of the Cultural Revolution to subsequent earning outcomes.[21] As can be expected, from such a large and new area of research, many questions related to the underlying mechanisms that link individual education interruption to subsequent education attainment and earning outcomes need to be further explored. In addition, a range of wider issues associated with potential macro economic effects of the Cultural Revolution is yet to be considered. For example, as a result of the Cultural Revolution the number of degree holders and senior high school graduates in China in the 1990s is probably lower than it would otherwise have been. Other things being equal this

[21] There are some studies that describe and estimate the effects of the Cultural Revolution on education attainment (Deng and Treiman, 1997, Meng and Gregory, 2002).

may have increased the return to all degree holders and senior high school graduates. However, this should not affect our estimated results significantly as long as the rate of education returns of treatment and control groups are not affected differentially by this change.

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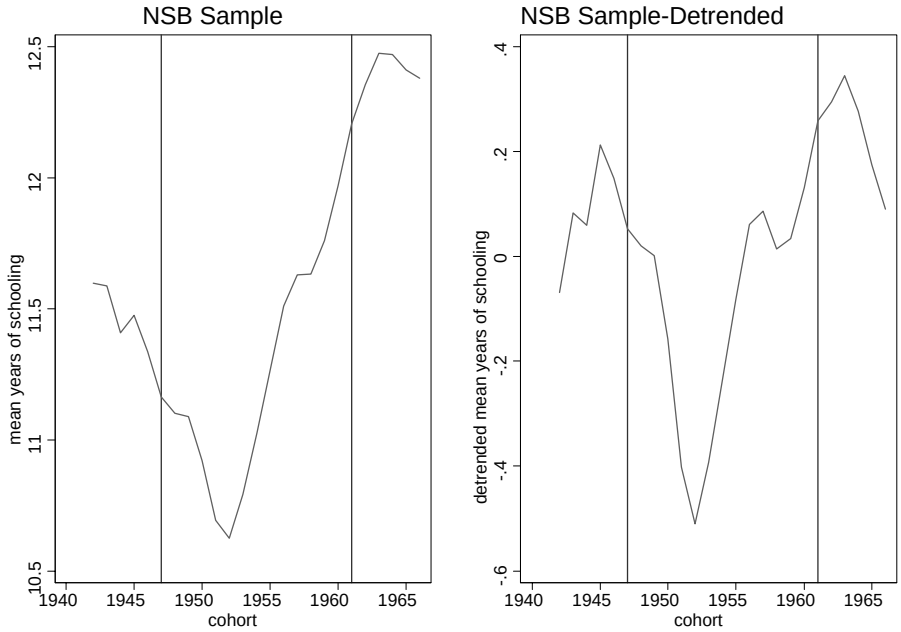
Figure 1: Years of schooling obtained by birth cohort
Panel 1: National Statistical Bureau Sample, 1992-2000




Panel 2: CASS Urban (1995, 1999, and 2002) and Rural (1995 and 2002) Samples

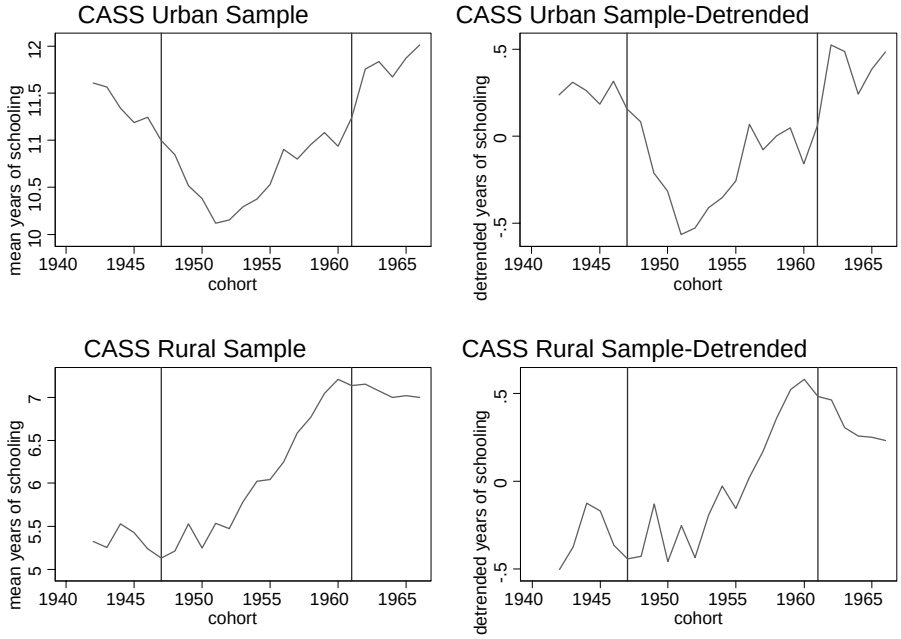
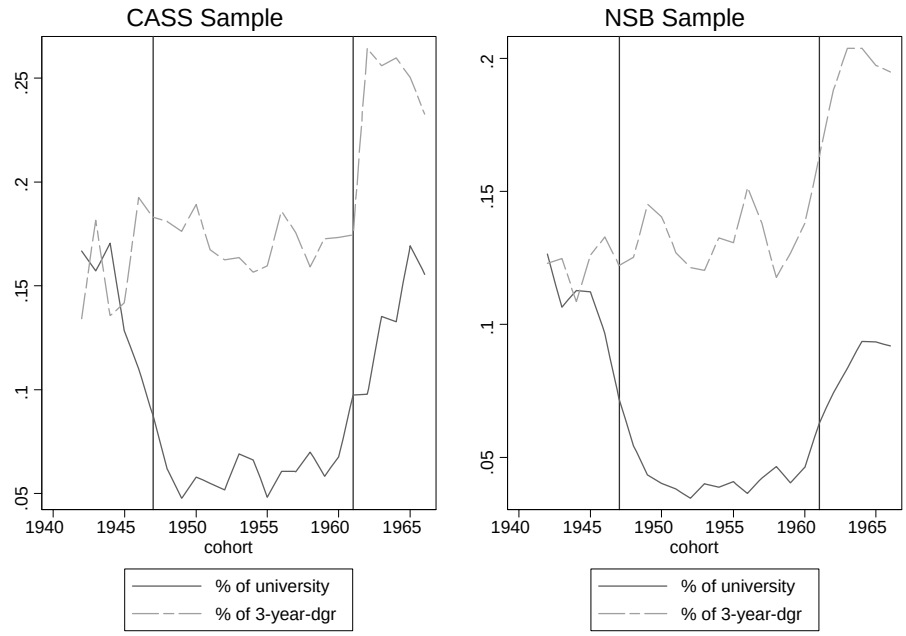


Figure 2: Proportion of individuals in different education categories, by birth cohort

Panel 1: Percentage of university and 3-year semi-degree (CASS and NSB)




Panel 2: Percentage of senior and junior high in urban and rural samples

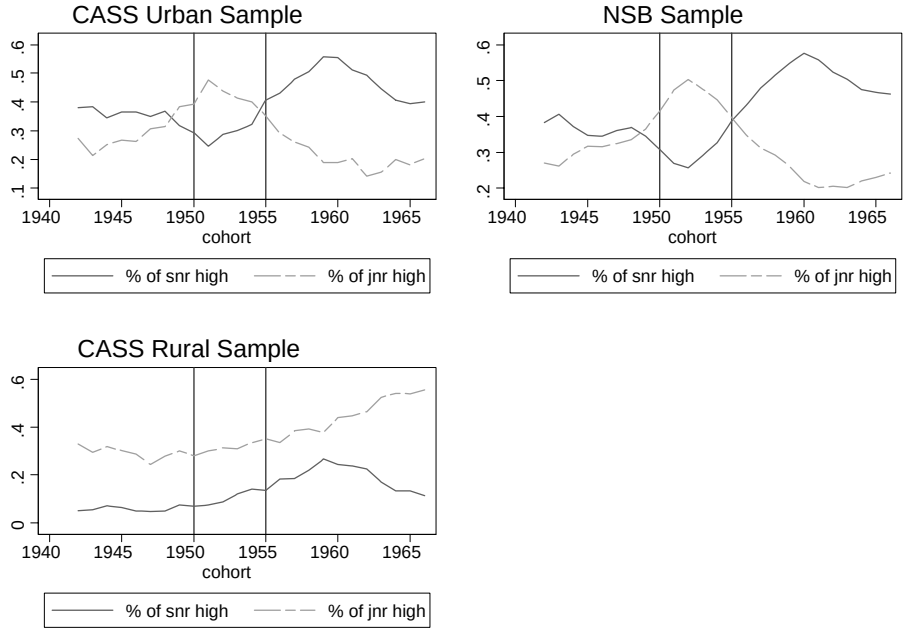
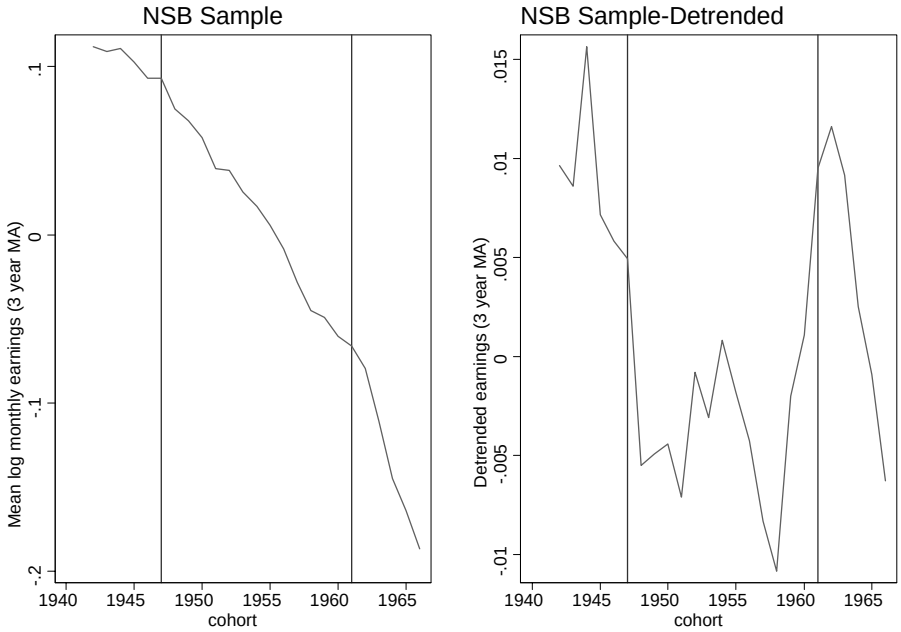


Figure 3: Mean earnings, by birth cohort
Panel 1: National Statistical Bureau Sample, 1992-2000




Panel 2: CASS Urban (1995, 1999, and 2002) and Rural (1995 and 2002) Samples

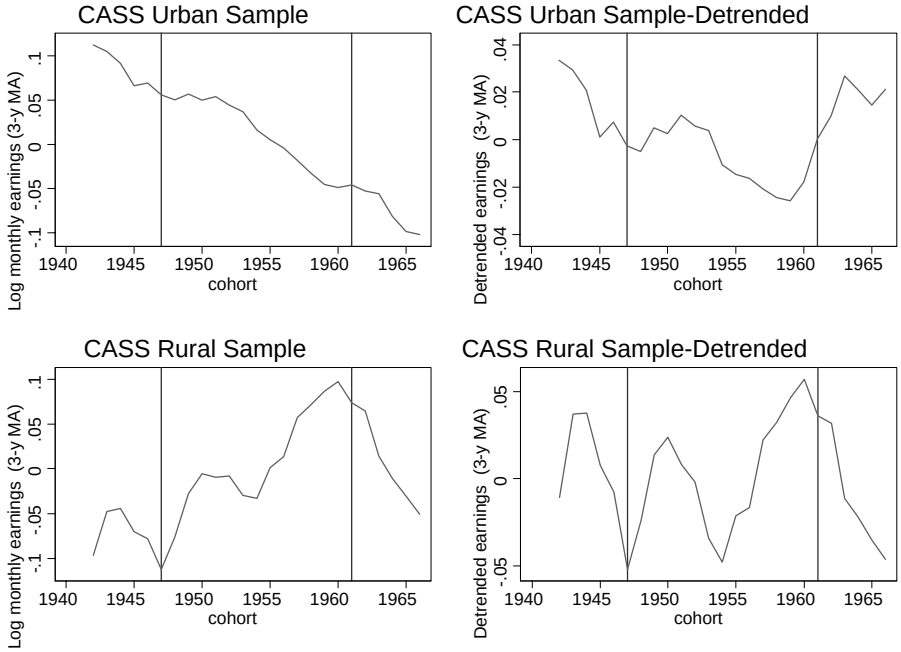


**Table 1**: Interrupted education for different birth cohorts

| Definition of the dummy variables measuring different levels of school interruption | Birth cohort (1) | Years of schooling in 1966 (2) | Number of years missed primary (3) | Number of years missed junior high (4) | Number of years missed senior high (5) |
|---|---|---|---|---|---|
| Interrupted Primary school | 1961 | | 1 | | |
| Interrupted Primary school | 1960 | | 2 | | |
| Interrupted Primary school | 1959 | | 3 | | |
| Interrupted Primary school | 1958 | 1 | 3 | | |
| Interrupted Primary&Junior High | 1957 | 2 | 3 | 1 | |
| Interrupted Primary&Junior High | 1956 | 3 | 3 | 2 | |
| Interrupted Junior&Senior High | 1955 | 4 | 2 | 3 | 3 |
| Interrupted Junior&Senior High | 1954 | 5 | 1 | 3 | 3 |
| Interrupted Junior&Senior High | 1953 | 6 | | 3 | 3 |
| Interrupted Junior&Senior High | 1952 | 7 | | 2 | 3 |
| Interrupted Junior&Senior High | 1951 | 8 | | 1 | 3 |
| Interrupted Senior High | 1950 | 9 | | | 3 |
| Interrupted Senior High | 1949 | 10 | | | 2 |
| Interrupted Senior High | 1948 | 11 | | | 1 |
| Delayed Uni entry | 1947 | 12 | | | |

Notes: 1. Number of years missed in columns (3), (4), and (5) includes both years of schooling missed and years at school but without normal curricula.

2. For the cohorts born in 1954 and 1955, interruption in junior and senior high school dominates, therefore they are included in the "interrupted junior&senior high" category.

**Table 2**: Effect of interrupted schooling on educational attainment (OLS estimations)

| | **One Treatment** | | | | **Multiple Treatments** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CASS DATA | | | NSB DATA | CASS DATA | | | NSB DATA | | |
| ***Years of schooling*** | Urban Total | Rural Total | Combined Urban and Rural | Total | Urban Total | Urban Males | Urban Females | Total | Males | Females |
| Dummy for IE cohort | -0.788*** | 0.047 | -0.009 | -0.436*** | | | | | | |
| | (0.059) | (0.100) | (0.087) | (0.022) | | | | | | |
| IE-Cohort*Urban | | | 3.992*** | | | | | | | |
| | | | (0.085) | | | | | | | |
| Urban | | | -0.833*** | | | | | | | |
| | | | (0.094) | | | | | | | |
| Interrupted primary school | | | | | -0.627*** | -0.672*** | -0.541*** | -0.290*** | -0.392*** | -0.180*** |
| | | | | | (0.069) | (0.099) | (0.097) | (0.026) | (0.038) | (0.035) |
| Interrupted primary and junior high | | | | | -0.758*** | -0.787*** | -0.688*** | -0.379*** | -0.462*** | -0.284*** |
| | | | | | (0.083) | (0.114) | (0.121) | (0.031) | (0.045) | (0.043) |
| Interrupted junior and senior high | | | | | -1.212*** | -1.276*** | -1.068*** | -0.849*** | -0.922*** | -0.747*** |
| | | | | | (0.074) | (0.099) | (0.116) | (0.028) | (0.039) | (0.040) |
| Interrupted senior high | | | | | -0.873*** | -0.861*** | -0.822*** | -0.529*** | -0.512*** | -0.526*** |
| | | | | | (0.094) | (0.119) | (0.156) | (0.033) | (0.044) | (0.049) |
| Delayed university entry | | | | | -0.382*** | -0.259 | -0.638*** | -0.276*** | -0.191*** | -0.376*** |
| | | | | | (0.140) | (0.172) | (0.245) | (0.049) | (0.067) | (0.073) |
| Number of observations | 17755 | 4868 | 22623 | 122271 | 17755 | 9927 | 7828 | 122271 | 63065 | 59206 |
| Adjusted $R^2$ | 0.05 | 0.11 | 0.24 | 0.07 | 0.06 | 0.05 | 0.07 | 0.07 | 0.05 | 0.07 |
| ***University degree*** | Urban Total | Rural Total | Combined Urban and Rural | Total | Urban Total | Urban Males | Urban Females | Total | Males | Females |
| Dummy for IE cohort | -0.073*** | | | -0.049*** | | | | | | |
| | (0.006) | | | (0.002) | | | | | | |
| Interrupted primary school | | | | | -0.066*** | -0.081*** | -0.048*** | -0.044*** | -0.063*** | -0.025*** |
| | | | | | (0.007) | (0.011) | (0.008) | (0.002) | (0.004) | (0.003) |
| Interrupted primary and junior high | | | | | -0.083*** | -0.100*** | -0.062*** | -0.056*** | -0.081*** | -0.030*** |
| | | | | | (0.008) | (0.012) | (0.010) | (0.003) | (0.005) | (0.003) |
| Interrupted junior and senior high | | | | | -0.081*** | -0.095*** | -0.063*** | -0.058*** | -0.082*** | -0.032*** |
| | | | | | (0.007) | (0.011) | (0.010) | (0.003) | (0.004) | (0.003) |
| Interrupted senior high | | | | | -0.084*** | -0.103*** | -0.053*** | -0.057*** | -0.072*** | -0.039*** |
| | | | | | (0.009) | (0.013) | (0.013) | (0.003) | (0.005) | (0.004) |
| Delayed university entry | | | | | -0.050*** | -0.058*** | -0.034 | -0.028*** | -0.037*** | -0.017*** |
| | | | | | (0.014) | (0.019) | (0.021) | (0.004) | (0.007) | (0.005) |
| Number of observations | 17755 | | | 122271 | 17755 | 9927 | 7828 | 122271 | 63065 | 59206 |
| Adjusted $R^2$ | 0.03 | | | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 |
| ***Senior high school*** | Urban Total | Rural Total | Combined Urban and Rural | Total | Urban Total | Urban Males | Urban Females | Total | Males | Females |
| Dummy for Sub-IE cohort | -0.167*** | -0.020 | 0.015 | -0.153*** | | | | | | |
| | (0.010) | (0.016) | (0.016) | (0.004) | | | | | | |
| Sub-IE Cohort*Urban | | | 0.380*** | | | | | | | |
| | | | (0.012) | | | | | | | |
| Urban | | | -0.196*** | | | | | | | |
| | | | (0.018) | | | | | | | |
| Interrupted junior and senior high | | | | | -0.170*** | -0.173*** | -0.160*** | -0.159*** | -0.160*** | -0.156*** |
| | | | | | (0.011) | (0.015) | (0.016) | (0.004) | (0.006) | (0.006) |
| Interrupted senior high | | | | | -0.145*** | -0.143*** | -0.136*** | -0.106*** | -0.105*** | -0.103*** |
| | | | | | (0.022) | (0.029) | (0.034) | (0.008) | (0.011) | (0.011) |
| Number of observations | 12856 | 4797 | 17653 | 96726 | 12855 | 6741 | 6114 | 96726 | 46147 | 50579 |
| Adjusted $R^2$ | 0.08 | 0.05 | 0.14 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.08 | 0.09 |

Notes: 1. ***, **, and * indicate that the coefficient is significant at the 1, 5, and 10 per cent levels, respectively.

2. Other control variables include age, age squared, and age cubed, dummy variable for gender, and a group of year and regional dummy variables.

3. The senior high school equation excludes individuals with above senior high school qualifications.

**Table 3**: Effect on earnings of schooling missed at various levels of qualification

| CASS Survey | Coefficient | SE | No. of obs. | Adj. R2 |
|---|---|---|---|---|
| University | 0.006 | 0.005 | 1517 | 0.502 |
| 3-year degree | 0.001 | 0.004 | 3384 | 0.446 |
| Senior high school | 0.001 | 0.003 | 7179 | 0.35 |
| Junior high school | 0.005 | 0.004 | 5033 | 0.282 |
| | | | | |
| NSB Survey | Coefficient | SE | No. of obs. | Adj. R2 |
| University | -0.003 | 0.002 | 7207 | 0.652 |
| 3-year degree | 0.000 | 0.002 | 18210 | 0.587 |
| Senior high school | 0.002*** | 0.001 | 50059 | 0.494 |
| Junior high school | 0.005*** | 0.002 | 39273 | 0.429 |

Notes: 1. ***, **, and * indicate that the coefficient is significant at the 1, 5, and 10 per cent levels, respectively.

2. Other control variables include age, age squared, and age cubed, dummy variable for gender, and a group of year and regional dummy

**Table 4**: Comparison of the impact of the Cultural Revolution on earnings between the urban and rural samples

| | NSB DATA | | CASS DATA | | | |
|---|---|---|---|---|---|---|
| | | | Urban Sample | | Rural Sample | |
| | Without education | With education | Without education | With education | Without education | With education |
| Constant | 2.974*** | 3.668*** | 3.207*** | 3.843*** | 0.390 | 0.740 |
| | (0.268) | (0.257) | (0.711) | (0.667) | (1.943) | (1.954) |
| IE cohort dummy | -0.034*** | -0.003 | -0.062*** | -0.012 | 0.008 | 0.005 |
| | (0.005) | (0.004) | (0.010) | (0.010) | (0.029) | (0.030) |
| Age | 0.163*** | 0.122*** | 0.191*** | 0.158*** | 0.379*** | 0.361*** |
| | (0.020) | (0.019) | (0.051) | (0.048) | (0.135) | (0.135) |
| $Age^2$ | -0.003*** | -0.002*** | -0.004*** | -0.003** | -0.008*** | -0.008** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.003) | (0.003) |
| $Age^3$ | 0.000*** | 0.000** | 0.000** | 0.000* | 0.000** | 0.000** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Dummy for males | 0.202*** | 0.161*** | 0.184*** | 0.149*** | 0.214*** | 0.208*** |
| | (0.003) | (0.003) | (0.008) | (0.007) | (0.028) | (0.029) |
| Education dummies | No | Yes | No | Yes | No | Yes |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Regional dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of observations | 120620 | 120620 | 17755 | 17755 | 4868 | 4868 |
| Adjusted $R^2$ | 0.47 | 0.52 | 0.33 | 0.41 | 0.18 | 0.19 |

Notes: 1. ***, **, and * indicate that the coefficient is significant at the 1, 5, and 10 per cent levels, respectively.

**Table 5**: The OLS and IV/LATE estimation of earnings reduction due to interrupted education on educational attainment

| | Highest level of schooling attained | | | | | | Years of schooling (3) | | |
|---|---|---|---|---|---|---|---|---|---|
| **CASS DATA** | Below University (1) | | | Below Senior high (2) | | | | | |
| ***OLS*** | Total | Males | Females | Total | Males | Females | Total | Males | Females |
| Schooling | -0.359*** | -0.329*** | -0.429*** | -0.191*** | -0.155*** | -0.242*** | 0.054*** | 0.048*** | 0.063*** |
| | (0.013) | (0.015) | (0.025) | (0.009) | (0.012) | (0.013) | (0.001) | (0.002) | (0.002) |
| $e^b$ -1 | -0.302*** | -0.280*** | -0.349*** | -0.210*** | -0.168*** | -0.274*** | | | |
| | (0.009) | (0.011) | (0.016) | (0.019) | (0.014) | (0.017) | | | |
| Number of observations | 17755 | 9927 | 7828 | 12855 | 6741 | 6114 | 17755 | 9927 | 7828 |
| Adj R-squared | 0.36 | 0.37 | 0.30 | 0.33 | 0.33 | 0.30 | 0.39 | 0.39 | 0.35 |
| ***IV/LATE with single instrument*** | | | | | | | | | |
| Schooling | -0.846*** | -0.722*** | -1.444*** | 0.030 | -0.105 | 0.124 | 0.078*** | 0.078*** | 0.114*** |
| | (0.145) | (0.149) | (0.348) | (0.063) | (0.080) | (0.107) | (0.013) | (0.015) | (0.025) |
| $e^b$ -1 | -0.571*** | -0.514*** | -0.764*** | 0.030 | -0.111 | 0.117 | | | |
| | (0.062) | (0.069) | (0.082) | (0.061) | (0.089) | (0.095) | | | |
| Number of observations | 17755 | 9927 | 7828 | 12855 | 6741 | 6114 | 17755 | 9927 | 7828 |
| Adj R-squared | 0.30 | 0.32 | 0.15 | 0.30 | 0.33 | 0.21 | 0.38 | 0.37 | 0.30 |
| F-test for incl. of IV in the 1st stage | 156.88 | 110.36 | 48.56 | 261.43 | 144.92 | 104.36 | 156.88 | 110.03 | 57.19 |
| ***IV/LATE with multiple instruments*** | | | | | | | | | |
| Schooling | -0.726*** | -0.656*** | -1.208*** | 0.032 | -0.101 | 0.124 | 0.039*** | 0.047*** | 0.056*** |
| | (0.139) | (0.142) | (0.324) | (0.063) | (0.080) | (0.107) | (0.010) | (0.012) | (0.020) |
| $e^b$ -1 | -0.516*** | -0.481*** | -0.701*** | 0.031 | -0.106 | 0.117 | | | |
| | (0.067) | (0.074) | (0.097) | (0.061) | (0.089) | (0.095) | | | |
| Number of observations | 17755 | 9927 | 7828 | 12855 | 6741 | 6114 | 17755 | 9927 | 7828 |
| Adj R-squared | 0.33 | 0.34 | 0.21 | 0.30 | 0.33 | 0.21 | 0.39 | 0.39 | 0.35 |
| F-test for incl. of IVs in the 1st stage | 79.56 | 55.34 | 22.32 | 148.76 | 82.60 | 59.22 | 104.21 | 62.76 | 33.04 |
| **NSB DATA** | Below University (1) | | | Below Senior high (2) | | | Years of schooling (3) | | |
| ***OLS*** | Total | Males | Females | Total | Males | Females | Total | Males | Females |
| Schooling | -0.314*** | -0.270*** | -0.432*** | -0.195*** | -0.129*** | -0.260*** | 0.059*** | 0.046*** | 0.077*** |
| | (0.006) | (0.007) | (0.013) | (0.004) | (0.005) | (0.005) | (0.001) | (0.001) | (0.001) |
| $e^b$ -1 | -0.269*** | -0.237*** | -0.351*** | -0.215*** | -0.138*** | -0.297*** | | | |
| | (0.004) | (0.005) | (0.008) | (0.005) | (0.006) | (0.006) | | | |
| Number of observations | 120620 | 62717 | 57903 | 95203 | 45844 | 49359 | 120620 | 62717 | 57903 |
| Adj R-squared | 0.48 | 0.52 | 0.42 | 0.47 | 0.50 | 0.43 | 0.51 | 0.54 | 0.47 |
| ***IV/LATE with single instrument*** | | | | | | | | | |
| Schooling | -0.680*** | -0.607*** | -1.311*** | -0.001 | -0.077** | 0.023 | 0.076*** | 0.082*** | 0.111*** |
| | (0.092) | (0.082) | (0.276) | (0.028) | (0.037) | (0.045) | (0.010) | (0.011) | (0.022) |
| $e^b$ -1 | -0.493*** | -0.455*** | -0.730*** | -0.001 | -0.080** | 0.023 | | | |
| | (0.062) | (0.062) | (0.062) | (0.028) | (0.040) | (0.044) | | | |
| Number of observations | 120620 | 62717 | 57903 | 95203 | 45844 | 49359 | 120620 | 62717 | 57903 |
| Adj R-squared | 0.47 | 0.50 | 0.37 | 0.45 | 0.50 | 0.39 | 0.51 | 0.52 | 0.46 |
| F-test for incl. of IV in the 1st stage | 591.57 | 447.65 | 141.09 | 1523.72 | 748.46 | 727.21 | 389.24 | 265.42 | 101.69 |
| ***IV/LATE with multiple instruments*** | | | | | | | | | |
| Schooling | -0.656*** | -0.622*** | -1.310*** | 0.010 | -0.058 | 0.026 | 0.028*** | 0.045*** | 0.030*** |
| | (0.087) | (0.077) | (0.255) | (0.028) | (0.036) | (0.044) | (0.006) | (0.007) | (0.011) |
| $e^b$ -1 | -0.481*** | -0.463*** | -0.730*** | 0.010 | -0.060 | 0.026 | | | |
| | (0.045) | (0.041) | (0.069) | (0.028) | (0.038) | (0.043) | | | |
| Number of observations | 120620 | 62717 | 57903 | 95203 | 45844 | 49359 | 120620 | 62717 | 57903 |
| Adj R-squared | 0.47 | 0.50 | 0.37 | 0.45 | 0.49 | 0.39 | 0.50 | 0.54 | 0.45 |
| F-test for incl. of IVs in the 1st stage | 326.46 | 244.31 | 80.51 | 862.08 | 424.59 | 410.76 | 311.98 | 188.53 | 112.49 |

Notes: 1. ***, **, and * indicate that the coefficient is significant at the 1, 5, and 10 per cent levels, respectively.

2. Other control variables include age, age squared, and age cubed, dummy variable for gender, and a group of year and regional dummy variables.

3. The senior high school equation excludes individuals with above senior high school qualifications.

**Table 6**: Test for inclusion of parental education variables

| | **Years of schooling equation** | | | | **Earnings equation** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban sample | | Urban and Rural sample | | OLS | | IV/LATE single instrument | | IV/LATE multiple instruments | |
| | with parental education | no parental education | with parental education | no parental education | with parental education | no parental education | with parental education | no parental education | with parental education | no parental education |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Dummy for IE cohort | -0.487*** | -0.537*** | 0.184 | 0.275 | | | | | | |
| | (0.100) | (0.103) | (0.239) | (0.245) | | | | | | |
| Dummy for urban | | | 3.718*** | 4.388*** | | | | | | |
| | | | (0.225) | (0.229) | | | | | | |
| IE chort*Urban | | | -0.696*** | -0.838*** | | | | | | |
| | | | (0.235) | (0.241) | | | | | | |
| Years of schooling | | | | | 0.065*** | 0.069*** | 0.136*** | 0.135*** | 0.042 | 0.052** |
| | | | | | (0.002) | (0.002) | (0.042) | (0.038) | (0.026) | (0.024) |
| Father years of schooling | 0.091*** | | 0.093*** | | 0.007*** | | 0.001 | | 0.009*** | |
| | (0.008) | | (0.008) | | (0.002) | | (0.004) | | (0.003) | |
| Mother years of schooling | 0.082*** | | 0.082*** | | 0.005*** | | -0.001 | | 0.007** | |
| | (0.008) | | (0.008) | | (0.002) | | (0.004) | | (0.003) | |
| Number of observations | 9930 | 9930 | 10532 | 10532 | 9930 | 9930 | 9930 | 9930 | 9930 | 9930 |
| Adj R-squared | 0.09 | 0.04 | 0.19 | 0.15 | 0.28 | 0.27 | 0.18 | 0.18 | 0.27 | 0.27 |

Notes: 1. ***, **, and * indicate that the coefficient is significant at the 1, 5, and 10 per cent levels, respectively.

2. Other control variables include age, age squared, and age cubed, dummy variables for gender, and a group of year and regional dummy variables.

**Table 7**: The educational cost of disrupted education during the Cultural Revolution

| **Reduced university attainment** | CASS DATA | | | NSB DATA | | |
|---|---|---|---|---|---|---|
| ***Single Instrument*** | Total | Male | Female | Total | Male | Female |
| Cost to compliers | 57.10 | 51.40 | 76.40 | 49.30 | 45.50 | 73.00 |
| Cost to the IE cohort | 4.18 | 4.48 | 4.23 | 2.51 | 3.03 | 2.26 |
| ***Five Instruments*** | | | | | | |
| Cost to compliers | 51.60 | 48.10 | 70.10 | 48.10 | 46.30 | 73.00 |
| Cost to IE cohort | 3.78 | 4.19 | 3.88 | 2.45 | 3.08 | 2.26 |
| Of which: Cost to miss primary | 3.25 | 3.26 | 3.45 | 2.21 | 2.48 | 2.23 |
| Cost to miss primary & JH | 4.03 | 4.31 | 4.28 | 2.63 | 3.28 | 2.42 |
| Cost to miss JH & SH | 4.02 | 4.38 | 4.29 | 2.69 | 3.47 | 2.31 |
| Cost to miss SH only | 4.21 | 5.20 | 3.51 | 2.44 | 3.19 | 2.40 |
| Cost to delayed uni entry | 2.45 | 3.34 | 2.10 | 1.02 | 1.77 | 0.41 |
| **Reduced years of schooling** | CASS DATA | | | NSB DATA | | |
| ***Single Instrument*** | Total | Male | Female | Total | Male | Female |
| Cost to compliers who reduced 1 year sch | 7.80 | 7.80 | 11.40 | 7.60 | 8.20 | 11.10 |
| Cost to the IE cohort | 8.13 | 8.38 | 11.38 | 6.41 | 6.41 | 9.74 |
| ***Five Instruments*** | | | | | | |
| Cost to compliers | 3.90 | 4.70 | 5.60 | 2.80 | 4.50 | 3.00 |
| Cost to the IE cohort | 4.07 | 5.05 | 5.59 | 2.36 | 3.52 | 2.63 |
| Of which: Cost to miss primary | 2.53 | 2.71 | 3.72 | 1.54 | 2.09 | 1.77 |
| Cost to miss primary & JH | 3.32 | 3.96 | 4.69 | 1.54 | 2.09 | 1.77 |
| Cost to miss JH & SH | 5.42 | 6.89 | 7.22 | 3.47 | 5.30 | 3.80 |
| Cost to miss SH only | 4.48 | 5.68 | 6.31 | 3.02 | 4.48 | 3.72 |
| Cost to delayed uni entry | 2.74 | 3.27 | 5.26 | 2.60 | 3.58 | 3.51 |

# *Appendix A: Summary Statistics*

**Table A1**: Urban CASS sample

| Urban CASS | Total Urban (1942-1966) | IE cohort (1947-1961) | Before cohort (1942-1946) | After cohort (1962-1966) |
|---|---|---|---|---|
| Years of schooling | 10.99 | 10.66 | 11.36 | 11.81 |
| | (2.86) | (2.78) | (3.43) | (2.72) |
| Monthly earnings | 782.41 | 787.56 | 797.48 | 762.47 |
| | (534.26) | (538.48) | (491.48) | (535.28) |
| Age | 42.47 | 43.79 | 52.88 | 35.16 |
| | (6.41) | (4.73) | (3.05) | (3.38) |
| % of IE Cohort | 0.68 | | | |
| % of university | 0.09 | 0.06 | 0.14 | 0.13 |
| % of 3-year collage | 0.19 | 0.17 | 0.16 | 0.26 |
| % of senior high school[a] | 0.40 | 0.40 | 0.37 | 0.43 |
| % of junior high school[a] | 0.28 | 0.33 | 0.25 | 0.17 |
| % of primary school | 0.04 | 0.04 | 0.08 | 0.00 |
| Males | 0.56 | 0.56 | 0.74 | 0.50 |
| 1995 | 0.43 | 0.44 | 0.61 | 0.35 |
| 1999 | 0.22 | 0.22 | 0.19 | 0.23 |
| 2002 | 0.35 | 0.34 | 0.20 | 0.42 |
| Beijing | 0.10 | 0.11 | 0.11 | 0.06 |
| Shanxi | 0.06 | 0.06 | 0.05 | 0.09 |
| Liaoning | 0.13 | 0.13 | 0.12 | 0.11 |
| Jiangsu | 0.12 | 0.12 | 0.14 | 0.10 |
| Anhui | 0.05 | 0.05 | 0.05 | 0.06 |
| Henan | 0.10 | 0.09 | 0.08 | 0.13 |
| Hubei | 0.08 | 0.08 | 0.06 | 0.08 |
| Guangdong | 0.07 | 0.07 | 0.07 | 0.05 |
| Chongquing | 0.02 | 0.02 | 0.01 | 0.02 |
| Sichuan | 0.13 | 0.13 | 0.16 | 0.12 |
| Yunnan | 0.08 | 0.07 | 0.08 | 0.09 |
| Gansu | 0.07 | 0.07 | 0.08 | 0.08 |
| No. of observations | 17755 | 12154 | 1400 | 4201 |

Note: a. The figures presented here for the IE cohort include cohort born in 1947-1949 and 1956-1961. The figures for the sub-IE cohort (1950-1955) with senior and junior high school certificates are 0.31 and 0.41, respectively, and for non-IE cohort they are 0.44 and 0.27, respectively

**Table A2**: Rural CASS Sample

| | Without income | | | | With income | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | IEC | Before | After | Total | IEC | Before | After |
| Variable | (1942-1966) | (1947-1961) | (1942-1946) | (1962-1966) | (1942-1966) | (1947-1961) | (1942-1946) | (1962-1966) |
| Years school | 6.18 | 6.03 | 5.36 | 7.05 | 7.63 | 7.53 | 7.20 | 7.99 |
| | (3.00) | (3.05) | (3.02) | (2.62) | (2.65) | (2.77) | (2.63) | (2.36) |
| Mnthly real earning | | | | | 623.61 | 629.75 | 572.41 | 629.20 |
| | | | | | (547.17) | (574.83) | (548.43) | (483.36) |
| Age | 43.54 | 44.58 | 53.70 | 35.03 | 44.19 | 45.74 | 55.09 | 37.04 |
| | (7.32) | (5.21) | (3.69) | (3.78) | (6.84) | (4.82) | (3.63) | (2.97) |
| % of IE Cohort | 0.63 | | | | 0.60 | 1.00 | 0.00 | 0.00 |
| % of university | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| % of 3-year collage | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| % of senior high[a] | 0.13 | 0.14 | 0.06 | 0.16 | 0.25 | 0.27 | 0.15 | 0.24 |
| % of junior high[a] | 0.38 | 0.34 | 0.31 | 0.53 | 0.47 | 0.43 | 0.48 | 0.56 |
| % of primary school | 0.48 | 0.51 | 0.63 | 0.31 | 0.27 | 0.29 | 0.36 | 0.19 |
| Males | 0.55 | 0.54 | 0.62 | 0.51 | 0.81 | 0.81 | 0.92 | 0.78 |
| 1995 | 0.48 | 0.51 | 0.63 | 0.31 | 0.27 | 0.29 | 0.36 | 0.19 |
| 2002 | 0.50 | 0.49 | 0.41 | 0.56 | 0.75 | 0.73 | 0.63 | 0.84 |
| Beijing | 0.01 | 0.02 | 0.02 | 0.01 | 0.04 | 0.05 | 0.06 | 0.03 |
| Hebei | 0.05 | 0.05 | 0.06 | 0.04 | 0.06 | 0.06 | 0.09 | 0.03 |
| Shanxi | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 |
| Liaoning | 0.04 | 0.05 | 0.05 | 0.03 | 0.04 | 0.04 | 0.05 | 0.02 |
| Jilin | 0.04 | 0.04 | 0.03 | 0.05 | 0.03 | 0.03 | 0.01 | 0.04 |
| Jiangsu | 0.06 | 0.06 | 0.07 | 0.05 | 0.09 | 0.10 | 0.12 | 0.07 |
| Zhejiang | 0.05 | 0.05 | 0.06 | 0.05 | 0.10 | 0.10 | 0.09 | 0.10 |
| Anhui | 0.05 | 0.05 | 0.05 | 0.06 | 0.04 | 0.03 | 0.05 | 0.06 |
| Jiangxi | 0.05 | 0.05 | 0.04 | 0.05 | 0.04 | 0.04 | 0.04 | 0.05 |
| Shandong | 0.08 | 0.08 | 0.09 | 0.07 | 0.09 | 0.09 | 0.11 | 0.07 |
| Henan | 0.07 | 0.07 | 0.07 | 0.08 | 0.06 | 0.06 | 0.06 | 0.06 |
| Hubei | 0.06 | 0.06 | 0.05 | 0.06 | 0.03 | 0.03 | 0.02 | 0.04 |
| Hunan | 0.05 | 0.05 | 0.04 | 0.07 | 0.04 | 0.04 | 0.03 | 0.07 |
| Guangdong | 0.07 | 0.07 | 0.06 | 0.05 | 0.07 | 0.07 | 0.06 | 0.06 |
| Guangxi | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 | 0.03 |
| Chongqing | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.02 | 0.03 | 0.03 |
| Sichuan | 0.08 | 0.08 | 0.09 | 0.08 | 0.06 | 0.05 | 0.05 | 0.07 |
| Guizhou | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 |
| Yunnan | 0.03 | 0.03 | 0.03 | 0.04 | 0.01 | 0.01 | 0.00 | 0.01 |
| Shaanxi | 0.04 | 0.04 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 |
| Gansu | 0.03 | 0.03 | 0.03 | 0.04 | 0.02 | 0.02 | 0.01 | 0.03 |
| Xinjiang | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| No. of obs. | 23571 | 14952 | 3098 | 5521 | 4868 | 2945 | 508 | 1415 |

Note: a. The figures presented here for the IE cohort include cohort born in 1947-1949 and 1956-1961. The figures for the sub-IE cohort (1950-1955) with senior and junior high school certificates are 0.23 and 0.45, respectively, and for non-IE cohort they are 0.25 and 0.48, respectively.

**Table A3**: CASS Urban and Rural Real Earnings (1995=100)

| | 1995 | | 1999 | | 2002 | |
|---|---|---|---|---|---|---|
| Urban sample | Mean | SD | Mean | SD | Mean | SD |
| Total (1942-1966) | 555.43 | 289.2 | 778.73 | 411.76 | 1067.43 | 681.91 |
| IE Cohort (1947-1961) | 636.5 | 315.15 | 912.67 | 437.74 | 1170.27 | 699.35 |
| Before (1942-1946) | 562.91 | 285.15 | 781.65 | 422.76 | 1082.24 | 692.73 |
| After (1962-1966) | 481.94 | 271.71 | 733.41 | 362.57 | 1015.85 | 649.32 |
| Rural sample | | | | | | |
| Total (1942-1966) | 498.8 | 654.4 | | | 664.3 | 500.74 |
| IE Cohort (1947-1961) | 464.75 | 557.48 | | | 636.19 | 533.7 |
| Before (1942-1946) | 522.12 | 694.27 | | | 669.01 | 519.21 |
| After (1962-1966) | 444.85 | 578.37 | | | 663.32 | 455.82 |

**Table A4**: Urban NSB Sample

| | Total (1942-1966) | IEC (1947-1961) | Before (1942-1946) | After (1962-1966) |
|---|---|---|---|---|
| Years school | 11.55 | 11.29 | 11.51 | 12.42 |
| | (2.66) | (2.64) | (3.07) | (2.33) |
| Mnthly earning | 569.62 | 578.61 | 573.9 | 538.55 |
| | (462.94) | (466.07) | (479.71) | (443.21) |
| Age | 40.43 | 41.45 | 50.87 | 32.38 |
| | (6.46) | (4.53) | (2.76) | (2.83) |
| % of IE Cohort | 0.69 | | | |
| % of university | 0.06 | 0.04 | 0.11 | 0.09 |
| % of 3-year college | 0.15 | 0.14 | 0.13 | 0.2 |
| % of senior high school[a] | 0.42 | 0.4 | 0.37 | 0.49 |
| % of junior high school[a] | 0.33 | 0.36 | 0.29 | 0.21 |
| % of primary school | 0.04 | 0.06 | 0.10 | 0.01 |
| Males | 0.52 | 0.51 | 0.66 | 0.48 |
| 1993 | 0.12 | 0.12 | 0.16 | 0.09 |
| 1994 | 0.11 | 0.11 | 0.13 | 0.11 |
| 1995 | 0.11 | 0.11 | 0.13 | 0.11 |
| 1996 | 0.12 | 0.12 | 0.11 | 0.11 |
| 1997 | 0.11 | 0.11 | 0.09 | 0.11 |
| 1998 | 0.11 | 0.11 | 0.08 | 0.12 |
| 1999 | 0.1 | 0.1 | 0.07 | 0.12 |
| 2000 | 0.09 | 0.09 | 0.06 | 0.12 |
| Shanxi | 0.06 | 0.05 | 0.06 | 0.08 |
| Liaoning | 0.1 | 0.11 | 0.1 | 0.1 |
| Heilongjiang | 0.09 | 0.08 | 0.09 | 0.1 |
| Shanghai | 0.04 | 0.05 | 0.05 | 0.02 |
| Jiangsu | 0.07 | 0.08 | 0.08 | 0.07 |
| Anhui | 0.05 | 0.05 | 0.04 | 0.05 |
| Jiangxi | 0.06 | 0.05 | 0.07 | 0.06 |
| Shandong | 0.07 | 0.07 | 0.06 | 0.08 |
| Henan | 0.06 | 0.05 | 0.04 | 0.07 |
| Hubei | 0.08 | 0.08 | 0.07 | 0.07 |
| Guangdong | 0.07 | 0.07 | 0.07 | 0.05 |
| Sichuan | 0.11 | 0.11 | 0.12 | 0.1 |
| Yunnan | 0.07 | 0.07 | 0.06 | 0.08 |
| Gansu | 0.04 | 0.03 | 0.04 | 0.04 |
| Number of observations | 120620 | 83186 | 11731 | 25703 |

Note: a. The figures presented here for the IE cohort include cohort born in 1947-1949 and 1956-1961. The figures for the sub-IE cohort (1950-1955) with senior and junior high school certificates are 0.31 and 0.45, respectively, and for non-IE cohort they are 0.46 and 0.27, respectively.

**Table A5:** NSB Sample Real Earnings (1992=100)

| | Total | IE Cohort (1947-1961) | Before (1942-1946) | After (1962-1966) |
|---|---|---|---|---|
| 1992 | 252.21 | 254.23 | 287.94 | 213.48 |
| | (135.85) | (120.77) | (198.45) | (118.24) |
| 1993 | 303.22 | 306.63 | 336.31 | 264.53 |
| | (181.85) | (175.93) | (192.48) | (190.41) |
| 1994 | 388.12 | 395.58 | 440.69 | 335.3 |
| | (249.96) | (246.42) | (269.24) | (241.67) |
| 1995 | 507.92 | 516.2 | 577.36 | 445.82 |
| | (313.74) | (313.56) | (342.08) | (287.96) |
| 1996 | 614.8 | 622.42 | 713.54 | 544.33 |
| | (409.59) | (407.61) | (462.39) | (377.64) |
| 1997 | 705.76 | 718.76 | 790.78 | 632.72 |
| | (483.17) | (490.88) | (516.26) | (434.49) |
| 1998 | 760.82 | 768.59 | 839.27 | 713.95 |
| | (530.09) | (513.66) | (668.79) | (526.14) |
| 1999 | 817.75 | 832.4 | 917.8 | 751.98 |
| | (521.53) | (531.64) | (578.40) | (468.53) |
| 2000 | 898.34 | 920.59 | 1034.83 | 812.57 |
| | (640.29) | (658.56) | (720.67) | (560.34) |