Educational Attainment and Mid-Life Health: Evidence from the Chinese Cultural Revolution Cohort

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Abstract

During the decade-long Cultural Revolution (1966-76) in China, many primary and secondary schools stopped normal operation for up to 6 years, and colleges stopped recruitment for up to 10 years. Using data from the *State and Life Chances in Urban China Survey* (Zhou and Moen 2002) conducted in 20 cities in 1994, this paper examines the effect of coming of age during the Cultural Revolution on self-reported health in midlife (ages 34-45), as well as the effect of education on self-reported health, by exploiting exogeneous variation in persons' exposure to the closing of high schools and colleges around that time. Results show a reduced educational attainment due to the Cultural Revolution of about 1 year, the odds of attaining a senior-high degree and a college degree are reduced by up to 50% and 70%, respectively, for those coming of age in the Cultural Revolution. However, these individuals do not exhibit substantially worse health in midlife compared to individuals from adjacent cohorts, and instrumental variables methods reveal that the missed years of schooling do not appear to have translated into worse health. These results challenge the prevailing wisdom that education has a universal beneficial effect on health, and emphasize the value of incorporating historical timing and social context of education into studies of the educational effect on health.

Introduction

In May 1966, the Chinese Communist Party initiated the decade-long Cultural Revolution, a sociopolitical movement that aimed to enforce communism by removing capitalist and bourgeois elements from Chinese society. The impact of the Cultural Revolution (CR) was both immediate and long-lasting. The former was evidenced by the breakdown of social norms, the disruption of social stability, and economic stagnation (Chen 1999; Davis 1992; Walder and Su 2003). In the long run, because most urban schools ceased normal operations for a long time during the Cultural Revolution (up to 6 years for senior high schools and up to 10 years for colleges, see Pepper 1991; Unger 1982), it created a whole cohort who came of age during the period whose educations were disrupted with possible long term consequences (Qian and Hodson 2011; Xie, Jiang, and Greenman 2008; Zhou and Hou 1999). The Cultural Revolution cohort, also referred to as the lost generation (Hung and Chiu 2003) or children of the Cultural Revolution (Zang 2000; Zhou and Hou 1999) in the literature, is defined in this paper as those who were aged between 6 and 17 at the outset of the Cultural Revolution in 1966 (i.e., those who were born between 1949 and 1960). I focus specifically on the urban portion of this cohort, whose lives were arguably the most disrupted.

The gloomy life chances of the Cultural Revolution cohort have been the focus of a number of scholarly investigations (Deng and Treiman 1997; Pan 2002; Qian and Hodson 2011; Xie et al. 2008; Zhou and Hou 1999). However, to date this body of research has limited the outcome focus to education (Deng and Treiman 1997; Meng and Gregory 2002; Qian and Hodson 2011; Xie et al. 2008; Zhou and Hou 1999), employment (Davis 1992; Hung and Chiu 2003; Qian and Hodson 2011; Xie et al. 2008; Zhou and Hou 1999; Zhou and Moen 2001), earnings (Giles et al. 2008; Qian and Hodson 2011; Xie et al. 2008; Zhou and Hou 1999), marriage (Qian and Hodson 2011; Zhou and Hou 1999), political behavior (Zang 2000), and happiness with life (Qian and Hodson 2011). No single study has systematically examined the impact of the Cultural Revolution on an important component of well-being – health – despite strong theoretical reasons to expect such an association. Decades of research on the education-health relationship conducted in industrialized societies (Grossman 1972; House, Lantz, and Herd 2005; Mirowsky and Ross 2003) have yielded the conclusion that education serves as a fundamental cause of health disparity (Link and Phelan 1995), and as such, it is natural to suspect that the loss of education for the Cultural Revolution cohort would translate into lower

levels of health in their later lives than what otherwise would have been had they grown up during another period. By answering this question, this paper also addresses a question of vital importance to sociologists who are interested in health, that is, is there a causal relationship between educational attainment and health, and to what extent can such a pattern be expected in societies that differ in fundamental ways from Western ones. The Cultural Revolution produces a naturally occurring experiment, permitting me to identify the effects of educational attainment on health for members of this particular cohort.

The value of treating the Cultural Revolution as a natural experiment derives from its two hallmarks, distinguishing it sharply from other periods of social turmoil: (1) it created a rare setting in which the schooling of many Chinese youth was delayed or cut short due to state policies, with long-term consequences for other later life events (e.g., Chen 1999; Hung and Chiu 2003; Meng and Gregory 2002), and (2) its immediate impacts were deliberately aimed at existing high SES groups (Walder and Hu 2009), especially those whose parents were well educated (Deng and Treiman 1997). This leads to the three research questions this paper addresses. First, what is the impact of coming of age during the Cultural Revolution on midlife (ages 34-45) health? Second, what is the effect of educational attainment on health for this particular cohort? Third, is the effect of the Cultural Revolution moderated by social stratification structures and processes, that certain social groups – such as offspring of families headed by fathers who held a senior-high degree or who were middle-class or intellectuals – were more adversely affected in terms of their midlife health and the education-health relationship?

Understanding the impact of the Cultural Revolution and the resulting education loss on the midlife health of those ages 6 to 17 at its outset is of vital importance. The Cultural Revolution provides a distinct but ideal research site in which to assess current Western theories, especially regarding the universal effects of education on health. A common theme emerging from a tremendous body of Western research is that education is consequential in structuring inequality in health over the life course (Grossman 1972; Link and Phelan 1995; Mirowsky and Ross 2003). The reasons scholars offer for the beneficial health effects of education are multifaceted, but almost all of these studies have taken place in Western market societies (e.g., U.S., Britain, and Canada) where education is a desirable resource that determines all other aspects of life chances. But over much of the life course of the Cultural Revolution cohort,

education had been at most a dubious asset until the early 1990s. Education was not viewed as desirable among Chinese leaders during the Cultural Revolution, and low education returns (in earnings) have been repeatedly reported in various studies conducted in the 1980s and 1990s China (e.g., Xie and Hannum 1996). From a methodological angle, one problem associated with much of the prior education-health research is the endogeneity issue (Grossman 2006). Specifically, due to the inability to measure and control for all potential confounders, the repeatedly observed relationship between education and health may in reality reflect unobserved "third variables." The Cultural Revolution, as an exogeneous shock, addresses endogeneity, given that growing up during this period is determined solely by birth date, and it would be far-fetched to suggest that parents could predict the occurrence of such an event and plan their birth timing accordingly. In addition, the Cultural Revolution (1966-76) provides the optimal forum in which the taken-for-granted link between parental education and own education was severed or even reversed, so as to remove the influence of one of the biggest confounders – parental status – and also to better understand the processes and contexts involved in the education-health relationship.

The paper proceeds as follows. In the next section I review previous studies on the relationship between education and health conducted in both Western countries and China. This is followed by a brief introduction of the historical background of the Cultural Revolution, with a focus on how the education system was hit from the initial chaotic stage to the later recovery stage. I then describe the identification strategy (instrumental variable method) and discuss the validity of assumptions (independence and exclusion restriction in particular). Data and measures are introduced thereafter. I next report the results and this paper concludes with a discussion of the findings.

Previous Studies

Effects of Educational Attainment on Health: Evidence from Western Societies

The association between educational attainment and health is one of the strongest links in social sciences (Elo and Preston 1996; Herd, Goesling, and House 2007; House et al. 1994; Mirowsky and Ross 2003). For example, while the major causes of mortality have changed over the 20th century from infectious disease to chronic conditions, socioeconomic health disparities have either persisted or increased (Lauderdale 2001; Lynch 2003; Pappas et al. 1993). Moreover,

the same pattern has been consistently observed in different populations. The more educated are more likely to live longer, not just in the US, but also in Britain (Marmot et al. 1991), Denmark (Arendt 2005), Israel (Manor et al. 2000), Sweden (Torssander and Erikson 2010) and other Western and Eastern European countries, including Russia (Shkolnikov et al. 1998).

Three theoretical explanations have been proposed to account for this persistently observed educational gradient in health. Figure 1 provides a visual illustration showing the distinctions between the three theoretical arguments. The first explanation comes from human capital theory, arguing that education shapes people into better decision makers ("productive efficiency," see Grossman 1972) and/or more educated people have more information about the true nature of health production ("allocative efficiency," see Rosenzweig and Schultz 1981). Essentially human capital theorists suggest education has an inherent beneficial effect on health. The timing and place of educational attainment is largely ignored in this literature, however, leading to its tendency to claim a universal positive effect of education.

[Figure 1 about here]

The fundamental cause theory offers a second explanation of the education-health link. Link and Phelan (1995) suggest education operates as a fundamental cause of health, providing individuals with a wide range of serviceable resources, including money, knowledge, prestige, power and beneficial social conditions that can be used to their health advantage. In agreement with human capital theorists, the fundamental cause theory also predicts education to be causal of better health, but unlike human capital theory, the core feature of the fundamental cause theory centers on the importance of health-promoting resources conferred by education rather than education in and of itself. In other words, it is the utilization of resources instead of education alone that give rise to health advantage. Of course, external resources also play a role in the "allocative efficiency" variant of the human capital theory, but it tends to view individuals have freedom in choosing whatever resources they want, which may not hold in reality. A good test of the fundamental cause theory is when resources associated with higher status are useless in preventing death (Deaton 2011; Phelan et al. 2010), e.g., potentially fatal diseases that no one knows how to prevent or treat. Livi-Bacci (1990) showed that from the sixteenth to the eighteenth centuries, English aristocrats had no life expectancy advantage over the rest of the population, despite their presumably high SES. Likewise, Preston and Haines (1991) found that children survival had no bearing on parental education in the last decade of the nineteenth

century U.S. These findings suggest that having a college degree is useless in promoting health without knowing how to fight particular afflictions (Deaton 2011).

A third explanation of the education-health link views education as a spurious correlate. In other words, it is not education but some omitted variables – innate ability, social origins, etc. – that are the underlying driving forces of the association between education and health. Theses confounders, or "third variables," lead to both higher levels of educational attainment and better health, creating between them a spurious link. For example, decades of status attainment research in sociology have cumulated a mounting amount of evidence regarding transmission of parental advantage to children's educational outcomes (Blau and Duncan 1967; Sewell and Hauser 1972), and given the importance of early-life family environment in shaping health (Case and Paxson 2011; Cohen et al. 2010), social origins confounds the education-health link.

Empirically, observational studies have yielded a large body of evidence supporting the positive relationship between education and health (e.g., Adler et al. 1994; Deaton and Paxson 2001; Elo and Preston 1996; Kitagawa and Hauser 1973; Meara 2001). However, this line of research does not establish whether the observed relationship is *causal* or not. In comparison, one set of quasi-experimental studies examined whether individuals who were forced to continue schooling through various policies in developed countries were subsequently healthier than those who were not. In an ingenious design, Lleras-Muney (2005) employed compulsory schooling laws in effect from 1915 to 1939 to obtain estimates of the effect of education on mortality using the successive 1960-80 U.S. censuses. The OLS estimates suggested that an additional year of schooling lowered the probability of dying in the next ten years by 1.3 percentage points. The instrumental variables estimate was higher, showing that individuals born in states that forced them to remain in school longer enjoyed significantly higher survival rates in adulthood (3.6 percentage points higher). Similarly, Arendt (2005), Oreopolous (2006), Meghir et al. (2012) and Spasojevic (2003) also found that increases in minimum schooling laws in Denmark, England and Ireland, and Sweden respectively, improved the health of those who were affected. For instance, Oreopoulous (2006) estimated that an additional year of compulsory schooling lowered the likelihood of reporting a disability that limited personal care by 1.7 percentage points, and that of reporting a disability that limited daily activity by 2.5 percentage points. For the United Kingdom, a one-year increase in schooling lowered the probability of reporting being in poor

health by 3.2 percentage points, and raised the chances of being in good health by 6 percentage points.

To empirically test these three theoretical arguments, it is worthwhile to pause for a moment delineating what patterns one would expect to observe for each theory to hold, and to what extent the Cultural Revolution cohort provides a unique setting to assess these predictions. First, if education has an inherent causal effect on health, as argued in human capital theory, the Cultural Revolution cohort, especially those whose schoolings were disrupted, should have a lower level of health than what would have been were the Cultural Revolution not initiated. Second, the spurious correlate argument predicts a null education-health relationship once the confounders are taken care of by exploiting the schooling year loss of the Cultural Revolution cohort as a natural experiment. The case of fundamental cause theory is more complicated: Depending on whether resources can be mobilized, it leads to two predictions for the Cultural Revolution cohort: (1) education has positive effects on health, and education is linked to other desirable resources (such as income, occupation); and (2) education has no effects on health, and education is not linked to other desirable resources (such as income, occupation). Previous research indicates that over much of the life course of the Cultural Revolution cohort (at least through the time when the survey data used in this study were collected), the linkage between education and other desirable resources is severed or at least attenuated purposefully by the state, so the second prediction is more plausible based on the fundamental cause theory.

Relationship between Educational Attainment and Health in China

To date, most studies seeking to capture the causal relationship between education and health were based on data collected from developed countries. Among the few studies examining the education-health relationship in China, most are done by demographers (especially those who have an interest in aging) and gerontologists, and as a result, limit their study population to the elderly. Most of them reveal an inverse association of education with activity limitations, mobility decline, and disability (Anson and Sun 2002; Beydoun and Popkin 2005; Gu and Xu 2007; He et al. 2007; Liang, Liu, and Gu 2001; Strauss et al. 2010; Zeng, Gu, and Land 2007). But given that the study population received their schooling in a different education system before the establishment of the communist regime (year 1949), it is not entirely clear whether the findings are applicable to the Cultural Revolution cohort, and omitted variables bias are treated carefully in this line of studies.

Using growth curve models, Chen, Yang, and Liu (2010) reported significant cohort variations in educational disparities in the mean level of self-reported health, but the size of the education by cohort (coded 1 to 6) interaction is tiny, -0.01 for an outcome ranging from 1-4 (Table 2: 136). So is the coefficient for the main effect of education (primary school or not): 0.05, rendering it difficult to attach any practical meaning to this finding. Zhang (2012) exploited high-school closings in rural China immediately after the Cultural Revolution to study the causal effect of maternal high school completion on birth outcomes. Her instrumental variables estimates indicate that one more year of maternal high school education has no effect on a variety of outcomes including prematurity, low birthweight, neonatal mortality and infant mortality. Taken together, the causal link from education to health, if exists at all, seems to be at least quite weak in China.

Unraveling the Historical Background of the Cultural Revolution

Since the founding of the People's Republic in 1949, its political priorities underlying education policy have shifted dramatically, with direct consequences regarding the extent to which opportunity structures and allocative mechanisms were available for persons born in different years (Hannum 1999; Lu and Treiman 2008; Pepper 1991; Zhou, Moen and Tuma 1996). Education opportunities display distinct patterns even within the Cultural Revolution cohort, depending on the stage one was at in the education system (e.g., primary school, junior high) at the outset of the Cultural Revolution.

Before the Cultural Revolution, students began primary schooling at age 7, which lasted for five years, followed by three years of junior high and three (or two) years of senior high school (Deng and Treiman 1997; Meng and Gregory 2002). Through examinations, the academically talented students – disproportionately from intellectual and cadre families – were assigned to high-quality schools. All of these changed beginning from May 1966, when the Chairman Mao Zedong thought Chinese society was becoming too bureaucratic and elitist and consequently initiated the Cultural Revolution (Pepper 1991). The education system was at the center of the movement (Shirk 1979), as Pepper insightfully summarized, "education emerged as both a means and an end during the Cultural Revolution decade" (1991, p. 540). Correspondingly, the Cultural Revolution could be divided into several stages according to the extent to which the education system was affected (see Figure 2).

The 1966-67 period was the mobilization phase and the peak years of education disruption (Meng and Gregory 2007; Pepper 1991). The national college entrance examinations ceased to be held from 1966 to late 1977. The "key school" (i.e., schools of high quality) system and the two-track distinction between the full-time and work-study schools were abolished (Broaded 1983; Pepper 1991). New enrollments for primary and secondary schools were delayed to allow schools to carry out the Cultural Revolution and thoroughly reform the education system, and to allow students to participate in political activities (Unger 1984). The first call from the central government to return to school to make revolution was issued in early 1967 (Pepper 1991), but remarkable regional differences existed.

The second period was year 1968, when most primary and junior high school education recommenced. In addition to receiving military training and Mao Thought study classes, students were organized to criticize their textbooks and other features of the school system, or else go to factories and the countryside to do manual work (Hannum 1999; Meng and Gregory 2007). Midterms and final exams were given, but students were to repeat grades only if they and their parents agreed (Pepper 1991).

From 1968 on, universal provision of basic education became the priority, with the goal of education being supplied to all youths through senior high school (Kwong 1985; Unger 1984). Accordingly, the number of primary and secondary schools skyrocketed (Hannum 1999), and many students who otherwise would have had no chance to receive more schooling benefited from this school expansion, although at the expense of education quality. This marked the beginning of the third period. From around 1968 the standard school curricula were gradually resumed (Meng and Gregory 2007). From 1972 on, after approximately 6 years of being closed (since 1966), colleges began extremely restricted recruitment, based on family background rather than academic merit (Meng and Gregory 2007; Pepper 1991), with those from worker, peasant, and soldier families favored.

The Cultural Revolution ended in 1976. In 1977, the exam-based system of progression was reinstated. Those who had missed a chance to go to college because of the Cultural Revolution were entitled to sit entrance exams regardless of their ages. This lasted for four years until 1981, when an age requirement (younger than 25) was issued (Meng and Gregory 2007), but people could acquire semi-degrees by correspondence (Han et al. 2010). Given that the purpose of secondary schooling was to prepare for college and only a small proportion of those

graduating from secondary school could continue their studies, enrollment in academic secondary schools declined from 7.2 million in 1979 to 4.8 million by 1981 (Hannum 1999; Pepper 1991).

In sum, there is a consensus among scholars that educational institution during the Cultural Revolution served as a means for leveling differences among youths, not so much as a means for modernizing China (Pepper 1991; Unger 1984). Consequently, three features characterize the education experience of the Cultural Revolution cohort. First, throughout the whole decade, the disruption was most pronounced and persistent at the college level (Shirk 1979), given that one primary target of the Cultural Revolution was to eliminate any elitism. Second, high school education was not affected in a monotonic fashion throughout the period; rather, distinct patterns existed, with the year 1968 serving as a watershed. The initial chaotic years from 1966 to 1967 witnessed the closing of high schools, but from 1968 on, emphasis on universal mass education at the basic- and middle-level led to an unrestrained expansion of high schools (Pepper 1991; Shirk 1979). This historical fact has not received its due recognition in prior empirical studies. For example, Meng and Gregory (2007) reported "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" (p. 14). Third, given that the principal motive of the Cultural Revolution was to provide better opportunities to young people from proletarian families, the children of the intellectuals, who before 1966 were among the best students, appeared to be the biggest losers (Broaded 1983; Deng and Treiman 1997; Giles et al. 2008; Unger 1984). The children of the cadres (i.e., Party and government officials), however, were usually able to take advantage of their parents' political positions and good family background (Shirk 1979; Unger 1982). These three features provide the institutional knowledge that is key to identifying any education effect on health, as described in the next section.

Methods

Construction of Cohorts

The Cultural Revolution lasted from 1966 to 1976; accordingly, the CR-cohort is defined as persons aged 6-17 at 1966 (or born between 1949-60, inclusive). These persons experienced different degrees of education interruption/delay or expansion during the CR period. For example, many of the oldest ones (aged 17 at 1966) had no opportunities to finish their senior

high education due to closing of high schools for at least one year from 1966 to 1968 and when schools reopened these children were at high risks of being sent to rural areas instead of resuming their education. On the other hand, the youngest ones (aged 6 at 1966) typically had to wait for one or two years before they were able to enter primary school.

To study the effect of coming of age during the Cultural Revolution, a natural comparison group seems to be those born in adjacent years to the Cultural Revolution cohort so that they either had spent their adolescent years before the Cultural Revolution or were too young to be affected by the Cultural Revolution. My analytic sample thus includes those who were born between 1940 and 1969. They are further divided into four cohorts:

pre-cohort: pre-Cultural Revolution cohort (aged 18-26 at 1966)

early-CR-cohort: early-Cultural Revolution cohort (aged 14-17 at 1966)

late-CR-cohort: late-Cultural Revolution cohort (aged 6-13 at 1966)

post-cohort: post-Cultural Revolution cohort (aged <= 5 at 1966)

The pre-cohort refers to persons born 1940-48; they mostly had finished their senior high school (if they did enter that level) before the Cultural Revolution. The post-cohort refers to those born 1961-69, and their education were largely unaffected by the Cultural Revolution (primary school resumed classes as late as 1968).

As described, even within the Cultural Revolution cohort, they faced different structure opportunities of educational attainment depending on their ages at that period. Although senior high schools were mostly closed during the initial chaotic years (1966-68), after 1968 senior high schools actually experienced a nationwide expansion in order to achieve the goal of universal high school education. In view of this, I divide the CR-cohort into early-CR-cohort and late-CR-cohort, based on the different structural opportunities of obtaining a senior-high diploma presented to them. The late-CR-cohort persons were aged 8-15 at 1968 and were able to enjoy the high school expansion programs since then, whereas the senior-high schooling of the early-CR-cohort persons were largely disrupted due to the closing of schools in the early stage of the Cultural Revolution (1966-68).

Constructed this way, I am able to make two comparisons. First, I compare the early-CR-cohort persons with the pre-CR cohort persons, and second, the late-CR-cohort is compared with the post-CR cohort. The results derived from these two sets of comparisons may be particularly interesting when identifying the causal effect associated with senior-high degree. Specifically,

the pre vs. early comparison investigates the schooling *loss* effect on mid-life health, whereas the post vs. late comparison examines how schooling *gains* due to school expansion affected mid-life health. These two estimates may as well differ due to the asymmetric effect of schooling gains and loss on health, as well as the different compositions of persons who were affected (i.e., the compliers, see below).

Table 1 summarizes the operational definitions of pre-cohort, early-CR-cohort, late-CR-cohort, and post-cohort, as well as their ages in some important years.

[Table 1 about here]

Analytic Strategy

To assess whether coming of age during the Cultural Revolution had any long-term consequences on midlife health (H_{ij}), I use the following OLS model to predict health of person *i* from city *j*:

$$H_{ij} = f(Age_{ij}) + \beta \times CR_{ij} + \lambda_j + \eta_j \times f(Age_{ij}) + u_{ij} \qquad (1)$$

where $f(.)$ is a flexible polynomial function of age (measured to month), CR_{ij} is an indicator variable denoting cohort membership that is equal to 1 if person *i* comes from the early-CR-cohort (or late-CR-cohort), city fixed-effect is indicated by λ_j, and u_{ij} represents unobserved determinants of health. One U.S. study indicates that when exploiting compulsory schooling laws as an instrument, results may be sensitive to the inclusion of state-specific time trends (Mazumder 2008), so I control for city-specific trends in the model ($\eta_j \times f(Age_{ij})$).

The key coefficient of interest is β, which captures the systematic differences in mid-life health between persons from the early-CR (or late-CR) cohort and persons born in the same city but from pre-cohort (or post-cohort), after controlling the age impact (as captured by $f(Age_{ij})$). If education does improve health, then β is expected to be negative and significant for the early-CR-cohort, and to be positive and significant for the late-CR-cohort.

Instrumental variables method is used to answer the second question, is there a causal effect of educational attainment on health for the Cultural Revolution cohort? Intuitively, this effect is quantified by the extent to which difference in educational attainment induced by school closures/expansions during the Cultural Revolution is related to differences in midlife health. The instrument is the cohort indictor variables that I discussed above, CR_{ij}, which represent either early-CR-cohort or late-CR-cohort dummies.

To account for the possibility of a direct effect of coming of age during the Cultural Revolution on mid-life health (in addition to the effect channeled by reduced education), I develop another instrument. Given that the impacts of the Cultural Revolution varied by family background with offspring from intellectual family hit most, I use an interaction term between a CR-cohort dummy variable (CR_{ij}) and a "bad" family background (mid-class/intellectual) dummy variable as the instrument. Hence, the health of person *i* from city *j* and family background *k* at age Age_{ijk} is:

$$H_{ijk} = f(Age_{ijk}) + \beta \times CR_{ijk} + \rho_k + \lambda_j + \eta_j \times f(Age_{ijk}) + u_{ijk} \qquad (2)$$

where ρ_k and λ_j are family background and city fixed-effects, respectively. Using this interaction term as an instrument does not require the assumption of no direct effect because such effect, even it exists, is differenced out when comparing persons from the same CR cohort.

For the third question of effect heterogeneity, I repeat the same analyses for different groups constructed by gender, father's education (at least senior high, and less than senior high), and family background (cadre, working-class/peasants, middle-class/intellectual). The coefficients are then compared across these social groups.

Assumptions

One key assumption is the exogeneity of coming of age during the Cultural Revolution, that is, the instrument is "as good as randomly assigned." This assumption is plausible because the occurrence of the Cultural Revolution was unexpected (Han et al. 2010; Pepper 1991; Shirk 1979). It is unlikely that parents of the CR-cohort were able to predict such an event and respond accordingly. It is also testable by comparing the ascribed characteristics across cohorts. As shown in Appendix Figures 1-8, there is no noticeable jump or drop from one cohort to another in a set of pre-determined characteristics including gender, father's education, mother's education, father's party membership, mother's party membership, and family background.

Given that the Cultural Revolution occurred at a much more intense level in urban areas, compliance is a potential issue if people could respond by migrating from urban to rural areas in order to avoid the influences of the Cultural Revolution. However, this is most unlikely, because both rural-to-urban and urban-to-rural migration had been strictly restricted by the household registration system in place until the 1990s (Wu and Treiman 2004).

Another key assumption in IV identification is exclusion restriction, that is, the Cultural Revolution had no effect on mid-life health other than by affecting educational attainment. Two other mechanisms might violate this assumption. Some CR-cohort persons were sent to the countryside for several years, which might have affected their health, as the work on farms was hard and the diet was often limited (Zhou and Hou 1999). I examine this possibility by conducting a sensitivity analysis restricting the analytic sample to those who were not sent to rural areas. The other one is the declined education quality during that decade. To the extent that reduced schooling years, declining education quality, and the send-down experience are all expected to lead to worse health, and since no distinction is made between reduced schooling years and declining education quality in this paper, the current analysis is more likely to identify a significant effect of educational attainment than when such distinction is made. In other words, the IV estimates reported in this paper can be conceived as an overestimate of the true effect, and if a null effect is found, the true effect should be even smaller.

Data and Measures

Data and Sample

I use data collected from the *1994 State and Life Chances in Urban China Survey* (Life Chances thereafter) to answer my research questions. The Life Chances survey used a multistage sampling procedure, covering 20 cities in 6 provinces in mainland China (Zhou and Moen 2002). The six provinces were selected to represent a variety of geographic locations and types of urban economies in China in the survey year. One advantage of this survey is its life course orientation and correspondingly, it contains detailed information on a variety of important life events collected through life history calendar. Of particular importance to this paper, it has collected detailed educational history for each respondent, recording their beginning and ending years of each schooling level with possible disruptions in between.

My analytic sample is composed of respondents born between 1940 and 1969. I exclude a few who reported to have received their primary school education in rural areas given the distinctly different opportunity structures of education between rural and urban China around the Cultural Revolution. Another 260 respondents who returned to school for further education after the Cultural Revolution are removed from my analysis given the highly selective process

involved in the decision of school reentry (for a study of re-schooling conducted in the U.S. setting, see Elman and O'Rand [2004]).

Table 2 provides summary statistics for the sample, first combined and then disaggregated by cohort.

[Table 2 about here]

Measures

Health

Respondents were asked to rate their health status on a scale from 1 to 10 with 1 being very unhealthy and 10 being very healthy. Self-reported health has been shown to be a valid measure of health and a reliable predictor of subsequent survival (Idler and Benyamini 1997).

Educational Attainment

Years of Schooling. I use beginning year and ending year to construct years of schooling. For a few respondents who only provided a final education level, I added what was the norm of years of schooling until that level. For example, if one only gave the final education level of senior-high, I added another nine years (= 6 + 3) to her reported schooling years.

Senior-High Completion. This variable is equal to one if the respondents had finished at least senior high school when surveyed.

College Completion. This variable is equal to one if the respondents had obtained a college degree or higher when surveyed.

Covariates

In most analysis, I control for *gender* (women = 1), *age* (measured in month), *age squared*, *age cubic*, *city of residence*, and an *age-specific city trend* (i.e., interaction between age and city). I control for city because health profiles in China exhibit huge regional variations (Wang 2007). City of current residence might be different from the city where respondents received their education, but given the restrictive migration policies in China by the early 1990s (Wu and Treiman 2004), this should not pose a severe threat to the results.

To examine heterogeneity in the education-health relationship across social groups, I consider two effect modifiers including father's education and family background as defined by the state. *Father's education* is dichotomized with less than senior-high as the reference group. *Family background* was a label directly defined by the state and was a critical basis of political discrimination in the Mao era. Before the abolition in 1979 of official family class labels,

individuals routinely were required to report this label on applications for educational enrollment, jobs, and promotions. The Life Chances survey listed 12 categories for family background. Following Zhou (2004), I reduce them into three categories: (1) Cadre or Military, (2) Worker or Poor/Lower-Mid Peasant, (3) Mid/Up-Mid/Rich peasant, Landlord, Clerk, or Intellectual. I also examine several potential mediators linking education and health, including *personal income in 1993*, *marital status* (currently married vs. other) and *first occupation unit* (state-owned vs. other).

Results

Effects of the Cultural Revolution on Midlife Health

If education indeed has a protective effect on health, there should be a drop in self-reported health from the 1949 birth cohort on, corresponding to the drop in education outcomes. However, Figure 3 does not conform to such a pattern, in which health appears to be perfectly explained by age alone. In fact, if anything, there seems to be a sudden jump in health for those aged 17 at the start of the Cultural Revolution (born in 1949).

[Figure 3 about here]

Table 3 shows the reduced-form estimates of the health costs of coming of age during the Cultural Revolution. To disentangling any biologically-determined age effects from the effects of coming of age during the Cultural Revolution, it is important to carefully control for age when health is the outcome. Health is usually assumed as a continuous and smooth function of age, so I model age effect using its linear form. The estimates shown in Table 3 are from models with various kinds of specifications. Results are robust to the use of cubic of age.

[Table 3 about here]

I find self-reported health is not significantly different between persons who came of age during the Cultural Revolution and those either in pre-cohort or post-cohort. According to the full model (Models 3 and 6), coming of age during the Cultural Revolution led to a (not significant) higher level of self-reported health in mid-life by 0.237 (95% CI: -0.249 – 0.723) using the comparison between early-CR-cohort and pre-cohort. The sign is positive against expectation. Comparing late-CR-cohort and post-cohort, the estimated effect is negative but again not statistically distinguishable from zero: health reduction is at an amount of 0.096 (95% CI: -0.433 – 0.241) on a 1-10 scale.

Effects of Educational Attainment on Midlife Health

Before proceeding to the instrumental variables method, I first test the assumption of first stage, that is, the instrument does affect the probability of getting the treatment (educational attainment). Appendix Figures 9-11 show mean levels of educational attainment (years of schooling, senior-high completion, college completion) across different cohorts. Consistent with expectations, a sharp drop in schooling years and senior-high completion is observed for those aged 17 at the outset of the Cultural Revolution (born in 1949). Distinct within-cohort differences exist between early- and late-CR-cohort. Although the early-CR-cohort persons (aged 14-17 at 1966) suffered from the Cultural Revolution by not being able to finish senior high school, the late-CR-cohort persons (aged 6-13 at 1966) actually had higher-than-expected chances of finishing senior-high, due to the unrestrained expansion of high schools. In terms of college completion, consistent with historical accounts, individuals in the CR-cohort were less likely to receive a college education than either the pre- or the post-cohort. OLS models confirm these visual impressions showing that for the early-CR-cohort, the schooling loss is 0.95 year or about 11 months ($p < .05$); their odds of obtaining a senior-high diploma were reduced by 48% ($p < .05$). The late-CR-cohort persons, in contrast, had more than twice as high odds to be senior-high-educated as the post-cohort persons ($p < .001$), but their odds of college education were reduced by almost 70% ($p < .01$) due to closing of universities.

The estimated educational effects on health from the instrumental variables method are provided in Table 4. I show three sets of IV estimation using different instruments: cohort membership, interaction between cohort and paternal education, and interaction between cohort and "bad" family background (middle-class or intellectual). I first discuss the quality of the instruments used. Staiger and Stock (1997) suggest that if the F-statistic on the excluded instruments in the first stage is less than 5, it could signal weak instruments. Using this criterion, interaction between cohort and paternal education seems to be the most appropriate one: almost all of the F-statistics shown at the bottom of Panel B are larger than 5, except for high school completion when late-CR-cohort is compared with post-cohort. In any case, none of the IV estimates, regardless of which instrumental variables are used or which cohorts are analyzed, are statistically distinguishable from zero.

[Table 4 about here]

Table 5 reports OLS estimates of the education-health relationship by cohort. The OLS estimates are viewed as the average return for the sample as a whole in the absence of confounders. Given that virtually all confounders – innate ability, good social origins – are associated with education and health in the same direction, OLS estimates usually set the upper bound of the true education effect. As can be seen in Table 5, even OLS models reveal no significant educational effects on midlife health for the Cultural Revolution, so the true educational return in health is probably even more non-existent. I do observe a positive and significant coefficient of education for the post-cohort, but note that this has no causal interpretation because of omitted variables bias. In particular, given the highly selective admission procedures after the Cultural Revolution, ability is a potential third variable that induces the association between education and health. In sum, both IV and OLS estimates suggest that educational attainment (schooling years, senior-high completion, and college completion) has no causal effect on mid-life health for the Cultural Revolution cohort.

[Table 5 about here]

Effects of Educational Attainment on Health-Promoting Resources

I examine several mechanisms that presumably could explain why no effect of education on health is observed. The first possibility is income. Many previous studies have shown that the return of schooling in income is either very low or negative in China (Nee 1994; Peng 1992; Xie and Hannum 1996). In Panel A of Table 6, I report the IV estimates of the educational effect on personal income in 1993. None of them are significant. Therefore, the usually taken-for-granted relationship between education and income is absent in China, which might contribute to the null education effect on health.

[Table 6 about here]

Social relationships such as marriage are a mechanism linking education and health. Using a linear probability model, Table 6 again indicates no significant effect of education on probability of being married (Panel B). The Life Chances survey did not ask eligibility for medical care, but given that the provision of medical care was almost universal in state-owned entrepreneurs (SOEs), I look at whether higher levels of education leads to a higher chance of working in the SOE as the first job. It does not seem to be the case as evidenced by the null coefficients in Panel C. Taken as a whole, many of the mechanisms linking education and health

– income, marriage, job – as found in developed countries are missing in China, to some extent explaining why no education effect is found for midlife health.

Heterogeneous Effects

It is widely recognized among scholars that educational system during the Cultural Revolution became a means for leveling differences among youths (Pepper 1991; Unger 1984). Consequently, the Cultural Revolution should have particularly severe effects for previously advantaged groups: men, offspring of fathers who held a senior-high degree, and children born into middle-class or intellectual families, whereas children whose fathers were cadres might benefit from the Cultural Revolution, given that cadre parents tended to exploit their power and social connections towards their children's advantage.

Nevertheless, I do not find any group to be especially adversely affected in terms of self-reported health at midlife. I also compare IV estimates of educational effects on mid-life health across subgroups. Using cohort membership as the instrument, none of the IV estimates are significant, and I find no consistent pattern concerning which group has more/less health returns of schooling.

Sensitivity Analysis

One reasonable concern is that the Cultural Revolution affected mid-life health through channels other than educational attainment. The sent-down event may be such a mechanism. I re-estimated all the models excluding those who were sent to the rural areas (11%), and the IV estimates remain to be non-significant. Mortality selection is another concern. Is it possible that those who were affected by the Cultural Revolution most adversely had already died before the survey? If coming of age during the Cultural Revolution had a non-negligible effect on premature mortality, we should observe a deviation of the mortality experience of the CR-cohort from adjacent cohorts. I plotted age-specific mortality compiled from published yearbooks based on the 1982 and 1990 censuses, which recorded mortality in the immediately previous year (Figures 4 and 5). The CR-cohort does not seem to have experienced a sudden increase in mortality in years 1981 and 1989, compared with adjacent cohorts. This provides some reassuring evidence that the lack of health effect of coming of age during the Cultural Revolution is unlikely to be primarily due to mortality selection.

[Figures 4 and 5 about here]

Discussion

Born between 1949-60, the cohort who came of age (aged 6-17 at 1966) during the Cultural Revolution (1966-76) is moving toward later adulthood, a period associated with increasing disability and chronic health problems. However, it is not clear whether and to what extent their experiences during the Cultural Revolution might complicate this aging process. This study attempts to fill this gap and promote understanding of the complex interplay between education and health in the Chinese context.

By examining the experience of a whole cohort whose lives, and especially their educational attainment, were disrupted because of the Cultural Revolution, this study reveals social forces otherwise marked as seemingly natural or fixed features of society. Specifically, the powerful role education plays in influencing both health and health-related determinants in the U.S. and other Western countries has motivated some scholars to refer to education as a "fundamental cause" (Link and Phelan 1995) or "root cause" (Mirowsky and Ross 2003: 31) of health. It is therefore worthwhile to test this thesis in a different cultural and historical context, to see how individual lives are changed by exogeneous events, such as the Cultural Revolution. To do so, I investigate whether historical timing of one's education matters, and what cumulative effects the absence of education has on health at midlife.

Previous studies as well as findings from this paper show that coming of age during the Cultural Revolution associates with it considerable human capital costs. However, despite these substantial education losses, children growing up during the Cultural Revolution do not appear to suffer from worse health at mid-life. This finding is all the more unexpected given that, presumably, this cohort was exposed to a number of health risks when they grew up, schooling year loss being one of them. Many youth from this cohort were sent to rural areas, where the standard of living was much lower than what was like in the urban areas; education quality experienced a dramatic decline during the Cultural Revolution period when political thoughts and military training dominated the class. Nevertheless, all of these channels conspired together did not appear to result in long-lasting adverse effect on midlife health, suggesting that even for a social disruption like the Cultural Revolution with such a large scale and such a long duration, it may nevertheless lead to less striking consequences than conventional logic suggests, not necessarily because of its intrinsic harmlessness but possibly resulting from individuals' undoing of the adverse effects on their own initiatives.

Given the null effect of coming of age during the Cultural Revolution on midlife health, it is not surprising that the instrumental variables method yields the conclusion of no causal linkage translating from education to health for this particular cohort. Sensitivity analysis suggests that mortality selection is unlikely to drive the insignificant findings. To explain the absence of causal relationship, I looked at three possible mechanisms: personal income, marital status, and occupation unit of first job (as a proxy of medical care availability). Results indicate that education has no causal bearing on any of the three mechanisms in China, which might explain why more education does not lead to better health for this cohort. Future studies could look at other possible mechanisms, such as health behaviors. For example, more educated persons are found to be more likely to smoke and drink in China (Du et al. 2002). Another reason to account for the lack of relationship might be the relatively small health variability for this age range (34-45), so using data collected from a more recent survey might yield a different pattern.

The finding of no education effect on health for the Cultural Revolution cohort has important theoretical, methodological, and practical implications. Theoretically speaking, it casts doubts on the claim regarding the universal role of education in structuring health disparities. In industrialized market societies, market plays the central role in allocating resources, and education, serving as a human capital signal, is naturally associated with desirable resources beneficial for promoting health. In China's particular macropolitical environment, however, state policies are the underneath social force allocating resources across different social groups (Zhou et al. 1996). In particular, state policies may change the very meaning of "resources", and the most extreme case is during the Cultural Revolution period when education was considered as a liability rather than a resource (Zhou et al. 1996). This situation changed with the end of the Cultural Revolution, but even in current China, education is still on the way to become as a fundamental shaping force of life chances as what is like in Western societies. In view of this, the meaning of education and its implication for health could as well exhibit different patterns in China from what is observed in developed countries. Consequently, there is no way to map history and biography, as well as the impacts of education on life chances in the absence of locating individuals in a historically bounded life course context, and recognizing such variation by historical timing and social contexts is key to unravel the social determinants of health.

From a methodological perspective, what is identified by the instrumental variables method is the so-called local average treatment effect or LATE (Imbens and Angrist 1994),

"local" in the sense that it is applicable only for a segment of the population who are directly affected by the instrument. During the Cultural Revolution period, obtaining a senior-high diploma was not common, which was even more true for a college degree. As such, many of the Cultural Revolution cohort would not be affected by the closing of senior high schools or colleges because they would not go to that schooling level anyway even in the absence of the Cultural Revolution. Therefore, it was children located at the higher end of the education scale who were directly and most severely affected by the Cultural Revolution. This is distinctly different from previous U.S. studies that used compulsory schooling laws as the instrument, in which the directly affected individuals were generally from the lower end of the education distribution (Grossman 2006; Lleras-Muney 2005), partially explaining why their IV estimates are usually higher than OLS estimates (which represent the average treatment effect across the whole population). Therefore, in the present of effect heterogeneity, there might be a significant education effect on health for individuals with relative low education, but once their education crosses a certain threshold (e.g., senior high), receiving more education does not seem to provide any further boost on health. Future research is needed to offer a more thorough understanding of the education-health linkage across different education levels, and such information would be of vital importance for policy designs aiming for promoting population health, particularly in developing countries where resource is limited.

There is no doubt that the Cultural Revolution represents an extreme case not only in China's political history but perhaps also in human history. This naturally leads to the question of generalizability as well as practical value of the current study. According to the China 2005 1% population survey (National Bureau of Statistics 2005), the Cultural Revolution cohort constitutes 16.45% of the current Chinese population. Therefore, understanding their life experience and aging process has in itself practical meanings. Furthermore, although the focus here is a unique cohort in China, my discussion is motivated by the broad sociological questions of how social processes such as dramatic social upheavals produce variations in individual life chances, as well as how the timing of large-scale social events in individual biographies matters for their later lives. The Cultural Revolution, rare as it is, provides a unique natural experiment where some key social parameters were pushed to their limits so as to shed lights on whether some seemingly important factors are indeed magic pills. The arguments and findings in this

study therefore have implications for many other societies where macropolitical environment matters for individual life chances.

This study is an initial step towards understanding the long-term consequences of the Cultural Revolution and the resulting education loss on mid-life health. Future work is needed as this cohort ages to yield more insights. To conclude, this study casts doubt on the universal beneficial effect of educational attainment on health. It reveals that the historical timing and social contexts of educational attainment are equally important parameters that need to be incorporated into studies of education and health. Only through discoveries of how education is linked to different health outcomes in different ways at different historical times can our understanding of the society advances.

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Table 1: Definitions of Pre-Cohort, CR-Cohort (Early- and Late-), Post-Cohort, and Their Ages at Various Years

	Pre-Cohort	CR-Cohort		Post-Cohort
		Early-CR-Cohort	Late-CR-Cohort	
Birth Year	1940-48	1949-52	1953-60	1961-69
Ages at 1966 (see Note 1)	18-26	14-17	6-13	<= 5
Ages at 1968 (see Note 2)	20-28	16-19	8-15	<= 7
Ages at 1994 (see Note 3)	46-54	42-45	34-41	25-33

Notes: 1. This is the year when the Cultural Revolution began.

2. This is the year when the primary and high school expansion began.

3. This is the year when the *1994 States and Life Chances in Urban China Survey* was conducted.

Table 2: Summary Statistics of the Cultural Revolution Cohorts (ages 34-45 in 1994) and Non-Cultural Revolution Cohort (ages 25-33 and 46-54)

	Total (N = 2504)		Pre-CR Cohort (N = 541)		CR Cohort (N = 1097)						Post-CR Cohort (N = 866)	
					Whole (N − 1097)		Early-CR Cohort (N − 250)		Late-CR Cohort (N − 847)			
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Self-Reported Health	7.46	1.93	6.8	2.12	7.36	1.83	7.33	1.73	7.37	1.86	8.01	1.76
Schooling Years	9.38	3.01	8.72	3.8	8.97	2.51	8.47	2.87	9.12	2.37	10.3	2.81
Senior-High or More (%)	0.46	0.5	0.34	0.47	0.4	0.49	0.24	0.43	0.44	0.5	0.61	0.49
College or More (%)	0.09	0.28	0.09	0.28	0.03	0.16	0.02	0.14	0.03	0.16	0.16	0.37
Women (%)	0.46	0.5	0.49	0.5	0.46	0.5	0.46	0.5	0.46	0.5	0.43	0.5
Age	38	8.37	50.02	2.51	39.32	3.39	44	0.82	37.94	2.51	28.81	2.63
Married (%)	0.85	0.36	0.92	0.27	0.94	0.24	0.94	0.24	0.94	0.24	0.68	0.47
Party Member (%)	0.14	0.35	0.24	0.43	0.13	0.34	0.18	0.38	0.12	0.32	0.08	0.26
Personal Income in 1993	5662.51	9492.42	5306.95	6001.08	5924.16	12477.8	6857.66	23137.55	5645.61	6526.17	5543.46	6198.88
Father's Schooling Years	6.48	4.42	5.29	4.68	6.07	4.1	5.67	4.07	6.19	4.1	7.71	4.36
Mother's Schooling Years	3.79	4.39	2.27	3.81	3.2	3.97	2.59	3.49	3.38	4.08	5.45	4.7
Father is a Party Member (%)	0.24	0.43	0.08	0.27	0.24	0.43	0.18	0.39	0.26	0.44	0.37	0.48
Mother is a Party Member (%)	0.06	0.24	0.02	0.12	0.05	0.22	0.03	0.17	0.06	0.23	0.1	0.3
Family Background (%)												
Cadre (Party and government officials)	0.09	0.29	0.03	0.16	0.08	0.26	0.04	0.2	0.09	0.28	0.15	0.36
Working Class	0.74	0.44	0.7	0.46	0.76	0.42	0.74	0.44	0.77	0.42	0.73	0.45
Middle Class	0.1	0.3	0.17	0.37	0.09	0.29	0.13	0.34	0.08	0.27	0.06	0.25
Intellectuals	0.03	0.16	0.02	0.14	0.03	0.16	0.02	0.16	0.03	0.17	0.03	0.18
Proprietor, Capitalist, or Rightist	0.03	0.17	0.06	0.24	0.03	0.17	0.05	0.23	0.03	0.16	0.01	0.1

Source: 1994 States and Life Chances in Urban China Survey.

Table 3: Reduced-Form Models Predicting the Effects of Coming of Age during the Cultural Revolution (1966-76) on Self-Reported Health at Midlife

	Early-CR vs. Pre-CR			Late-CR vs. Post-CR		
Age	-0.034	-0.034	-0.033	-0.063***	-0.056***	-0.090***
	(0.033)	(0.032)	(0.070)	(0.017)	(0.016)	(0.027)
Woman	-0.514***	-0.470***	-0.448**	-0.366***	-0.338***	-0.329***
	(0.142)	(0.140)	(0.144)	(0.087)	(0.085)	(0.086)
Cultural Revolution Cohort	0.310	0.193	0.237	-0.062	-0.102	-0.096
	(0.250)	(0.243)	(0.248)	(0.176)	(0.171)	(0.172)
Constant	8.753***	8.717***	8.638*	9.999***	9.783***	10.962***
	(1.670)	(1.637)	(3.403)	(0.497)	(0.498)	(0.891)
Observations	790	790	790	1,711	1,711	1,711
R-squared	0.032	0.121	0.134	0.048	0.124	0.131
Gender	X	X	X	X	X	X
City Fixed Effects		X	X		X	X
City-Specific Quadratic Trend			X			X

Notes: 1. X indicates models control for these variables.
2. Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1
Source: 1994 States and Life Chances in Urban China Survey.

Table 4: IV Estimates of Educational Effects on Self-Reported Health at Midlife

	Panel A: Cultural Revolution Cohort as Instrument					
VARIABLES	Early-CR vs. Pre-CR			Late-CR vs. Post-CR		
Age	-0.041	0.047	-0.229	-0.156	-0.119**	-0.051
	(0.073)	(0.146)	(0.539)	(0.117)	(0.044)	(0.092)
Woman	-0.672*	-0.669*	0.279	-0.380**	-0.332***	-0.313***
	(0.293)	(0.305)	(2.213)	(0.139)	(0.086)	(0.095)
Schooling Years	-0.250			-0.322		
	(0.284)			(0.640)		
Senior-High Completion		-2.471			-0.569	
		(2.954)			(1.027)	
College Completion			23.334			2.586
			(69.238)			(4.860)
Constant	11.800**	6.039	15.270	16.629	12.276***	9.327**
	(3.994)	(5.874)	(18.110)	(10.859)	(2.134)	(3.583)
Observations	790	790	790	1,711	1,711	1,711
R-squared	-0.082	-0.195	-6.366	-0.093	0.098	0.022
Cragg-Donald Stat.	5.387	2.923	0.114	1.676	13.92	1.840
Prob > F	0.0206	0.0877	0.736	0.196	0.000197	0.175

	Panel B: Cultural Revolution Cohort * Father's Education as Instrument					
VARIABLES	Early-CR vs. Pre-CR			Late-CR vs. Post-CR		
Age	-0.080	-0.136	-0.083	-0.085+	-0.071	-0.088*
	(0.071)	(0.088)	(0.069)	(0.048)	(0.102)	(0.040)
Woman	-0.193	-0.318+	-0.384*	-0.296**	-0.307***	-0.303***
	(0.266)	(0.191)	(0.165)	(0.092)	(0.086)	(0.085)
Father >= Senior High	0.007	0.201	0.044	0.086	0.051	0.111
	(0.434)	(0.308)	(0.391)	(0.315)	(0.451)	(0.226)
Schooling Years	0.336			0.067		
	(0.255)			(0.266)		
Senior-High Completion		1.852			0.735	
		(1.354)			(2.950)	
College Completion			3.560			0.492
			(2.579)			(1.954)
Constant	7.429+	12.827***	10.728***	9.975*	9.726+	10.737***
	(3.800)	(3.869)	(3.235)	(4.341)	(5.387)	(1.479)
Observations	751	751	751	1,667	1,667	1,667
R-squared	-0.042	0.033	0.050	0.134	0.109	0.130
Cragg-Donald Stat.	6.541	11.42	10.97	7.882	1.632	10.02
Prob > F	0.0108	0.000765	0.000976	0.00505	0.202	0.00158

	Panel C: Cultural Revolution Cohort * "Bad" Family Background as Instrument					
VARIABLES	Early-CR vs. Pre-CR			Late-CR vs. Post-CR		
Age	-0.089	-0.095	-0.087	-0.129	-1.153	-0.109**
	(0.071)	(0.105)	(0.067)	(0.099)	(24.935)	(0.040)
Woman	-0.429	-0.438*	-0.444*	-0.344**	-0.460	-0.322***
	(0.286)	(0.218)	(0.182)	(0.119)	(3.384)	(0.086)
"Bad" Family Background	0.291	0.305	0.314	0.418	4.045	0.311
	(0.435)	(0.326)	(0.267)	(0.558)	(89.751)	(0.239)
Schooling Years	0.032			-0.170		
	(0.271)			(0.540)		
Senior-High Completion		0.217			-29.101	
		(1.835)			(687.982)	
College Completion			0.454			-0.573
			(3.834)			(1.762)
Constant	11.004**	11.558**	11.212***	14.022	66.863	11.568***
	(3.549)	(4.430)	(3.174)	(9.126)	(1,316.847)	(1.482)
Observations	778	778	778	1,701	1,701	1,701
R-squared	0.142	0.138	0.142	0.057	-51.174	0.118
Cragg-Donald Stat.	4.818	5.598	4.418	2.071	0.00180	12.85
Prob > F	0.0285	0.0182	0.0359	0.150	0.966	0.000347

Notes: 1. All models control for gender, linear age, city fixed-effect, and city-specific age trend.
2. Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1
Source: 1994 States and Life Chances in Urban China Survey.

Table 5: OLS Estimates of Educational Effects on Self-Reported Health at Midlife

	Schooling Years				Senior High Completion				College Completion			
VARIABLES	Pre-CR	Early-CR	Late-CR	Post-CR	Pre-CR	Early-CR	Late-CR	Post-CR	Pre-CR	Early-CR	Late-CR	Post-CR
Age	0.022	-0.003	-0.134*	-0.029	0.023	-0.008	-0.127*	-0.047	0.015	0.052	-0.141*	-0.032
	(0.112)	(0.384)	(0.060)	(0.061)	(0.113)	(0.384)	(0.061)	(0.062)	(0.113)	(0.387)	(0.059)	(0.062)
Woman	-0.393*	-0.512*	-0.232+	-0.368**	-0.427*	-0.556*	-0.235+	-0.381**	-0.419*	-0.537*	-0.237+	-0.378**
	(0.190)	(0.242)	(0.126)	(0.119)	(0.190)	(0.241)	(0.126)	(0.119)	(0.188)	(0.241)	(0.126)	(0.119)
Father >= Senior High	0.638*	-0.018	0.124	0.051	0.700**	0.017	0.125	0.137	0.627*	-0.001	0.147	0.129
	(0.269)	(0.403)	(0.190)	(0.145)	(0.269)	(0.403)	(0.189)	(0.144)	(0.272)	(0.403)	(0.190)	(0.143)
Schooling Years	0.046+	0.063	0.012	0.089***								
	(0.027)	(0.046)	(0.031)	(0.024)								
Senior-High Completion					0.107	0.429	0.102	0.224+				
					(0.208)	(0.290)	(0.148)	(0.130)				
College Completion									0.533	1.072	-0.441	0.435*
									(0.351)	(0.855)	(0.395)	(0.168)
Constant	5.213	7.053	12.354***	8.118***	5.614	7.845	12.170***	9.460***	5.992	5.182	12.734***	9.135***
	(5.617)	(16.969)	(2.363)	(1.870)	(5.628)	(16.945)	(2.352)	(1.842)	(5.621)	(17.101)	(2.259)	(1.844)
Observations	510	241	817	850	510	241	817	850	510	241	817	850
R-squared	0.185	0.227	0.132	0.132	0.181	0.228	0.132	0.120	0.184	0.226	0.133	0.124

Notes: 1. All models control for gender, linear age, city fixed-effect, and city-specific age trend.
2. Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1
Source: 1994 States and Life Chances in Urban China Survey.

Table 6: IV Estimates for Educational Effects on Potential Education-Health Mediators

	Panel A: Logged Personal Income in 1993					
Schooling Years	-0.123	0.107				
	(0.106)	(0.091)				
Senior-High Completion			-0.624	1.309		
			(0.484)	(1.496)		
College Completion					-1.195	0.812
					(0.899)	(0.694)
Observations	693	1,528	693	1,528	693	1,528
R-Squared	-0.140	0.324	0.077	-0.235	0.131	0.311
Weak Instrument Test	5.688	7.835	11.23	1.257	10.88	8.679
Prob > F	0.0174	0.00519	0.000850	0.262	0.00102	0.00327
	Panel B: Married					
Schooling Years	0.041	-0.061				
	(0.034)	(0.057)				
Senior-High Completion			0.224	-0.664		
			(0.180)	(0.786)		
College Completion					0.431	-0.445
					(0.350)	(0.407)
Observations	751	1,667	751	1,667	751	1,667
R-Squared	-0.124	0.146	-0.036	-0.349	-0.063	0.194
Weak Instrument Test	6.541	7.882	11.42	1.632	10.97	10.02
Prob > F	0.0108	0.00505	0.000765	0.202	0.000976	0.00158
	Panel C: First Job in State-Owned Entrepreneurs					
Schooling Years	0.109	0.071				
	(0.077)	(0.053)				
Senior-High Completion			0.608	0.810		
			(0.378)	(0.786)		
College Completion					1.105	0.550
					(0.703)	(0.420)
Observations	660	1,409	660	1,409	660	1,409
R-Squared	-0.431	0.012	-0.124	-0.649	-0.179	-0.021
Weak Instrument Test	4.206	10.39	7.166	1.985	7.320	10.80
Prob > F	0.0407	0.00130	0.00763	0.159	0.00701	0.00104

Notes: 1. All models control for gender, linear age, city fixed-effect, and city-specific age trend.
2. Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1
Source: 1994 States and Life Chances in Urban China Survey.

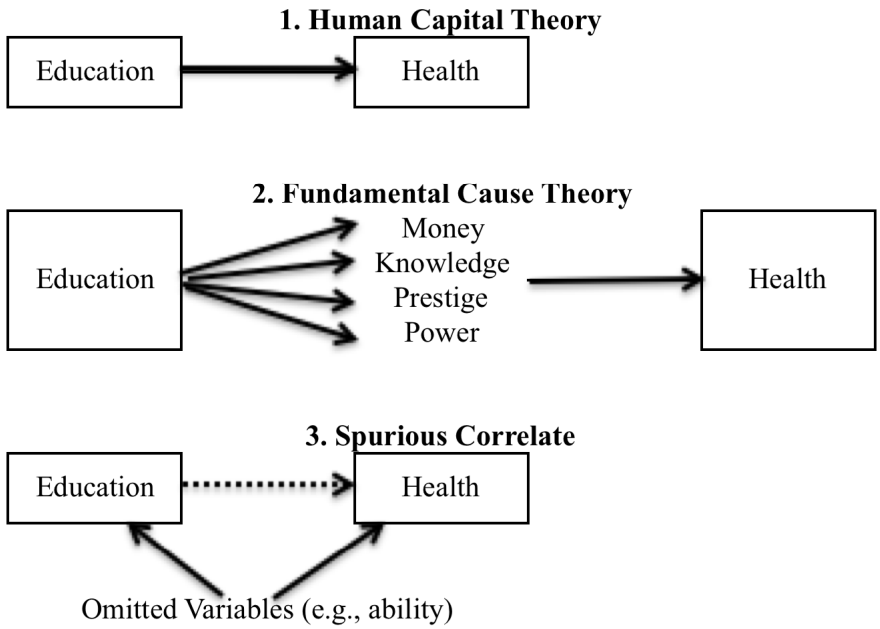


Figure 1: An Illustration of Three Theories Explaining the Education-Health Link

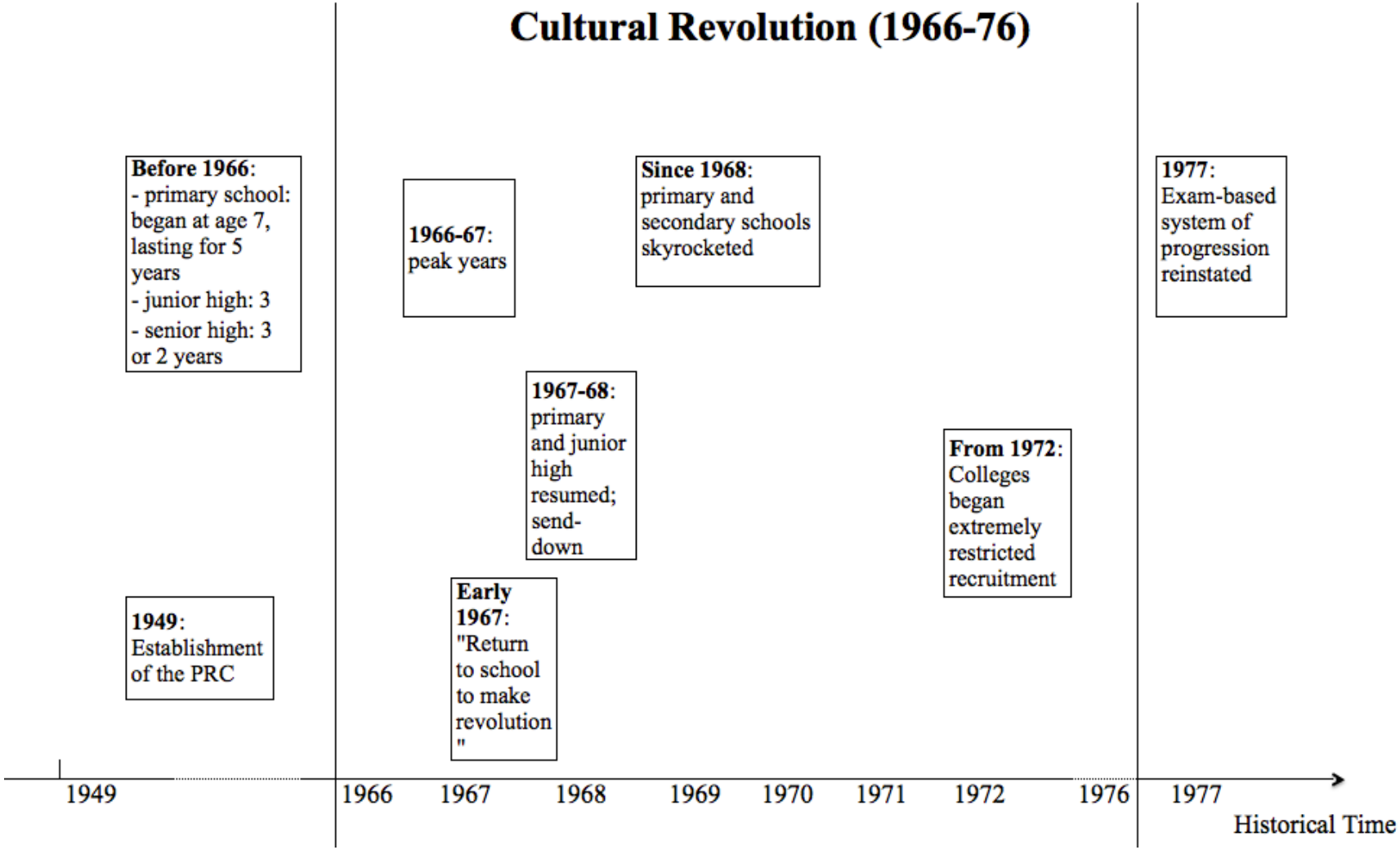


Figure 2: Major Events Around the Cultural Revolution (1966-76)

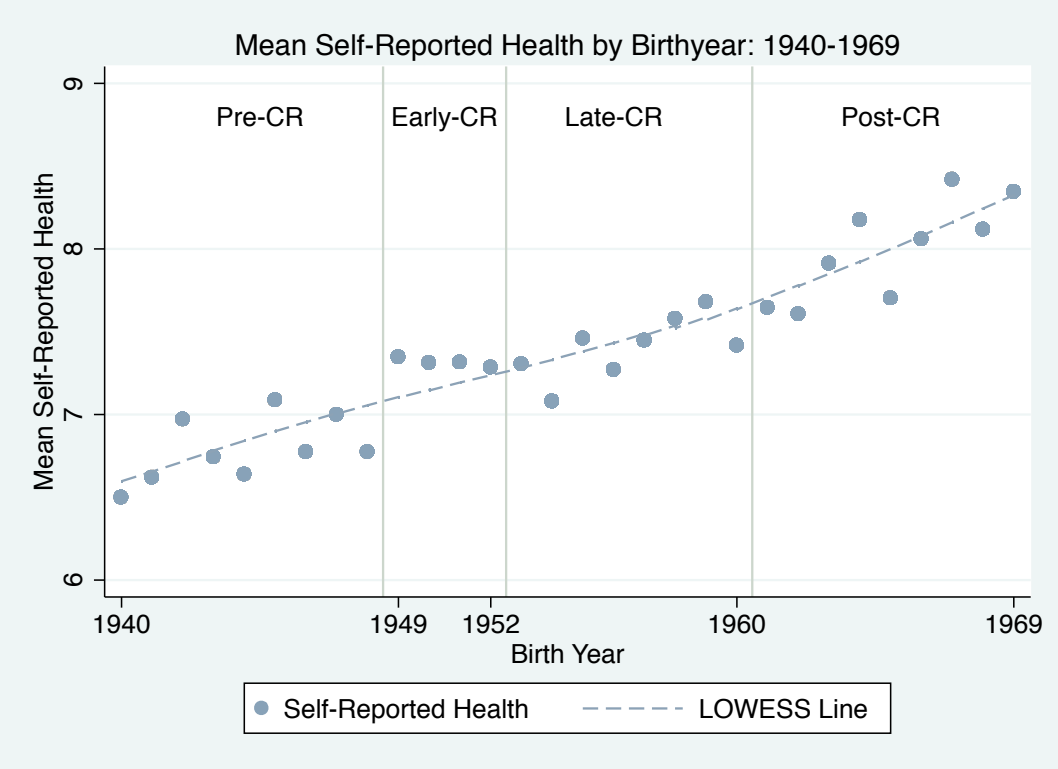


Figure 3

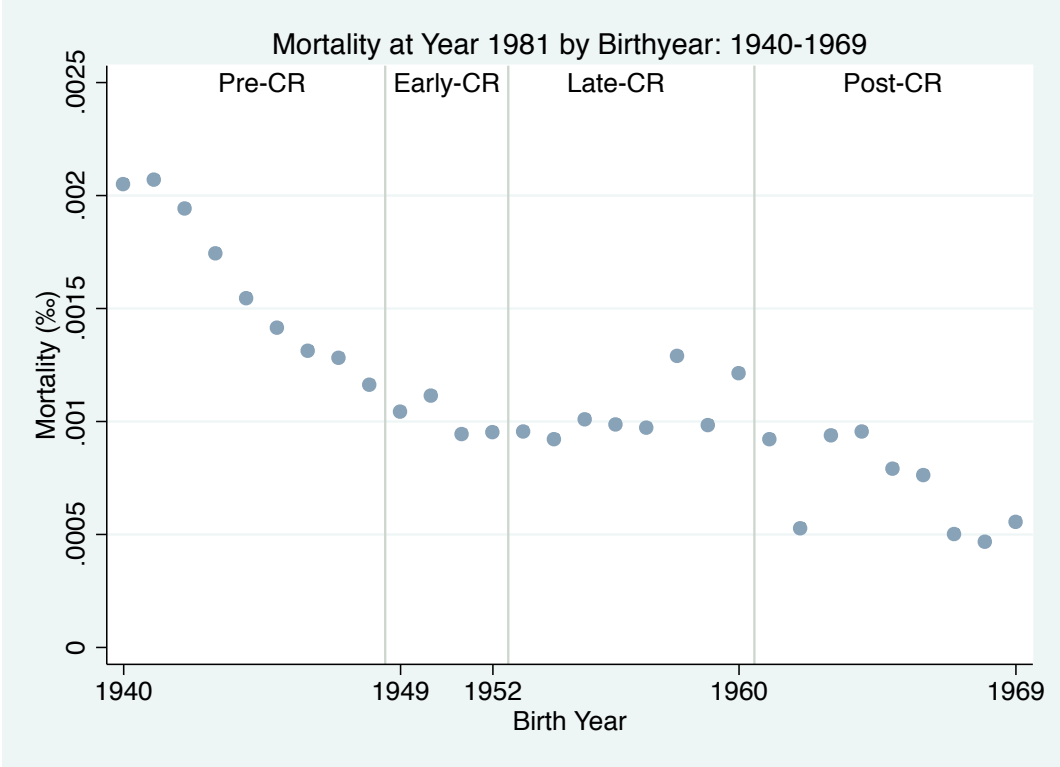


Figure 4

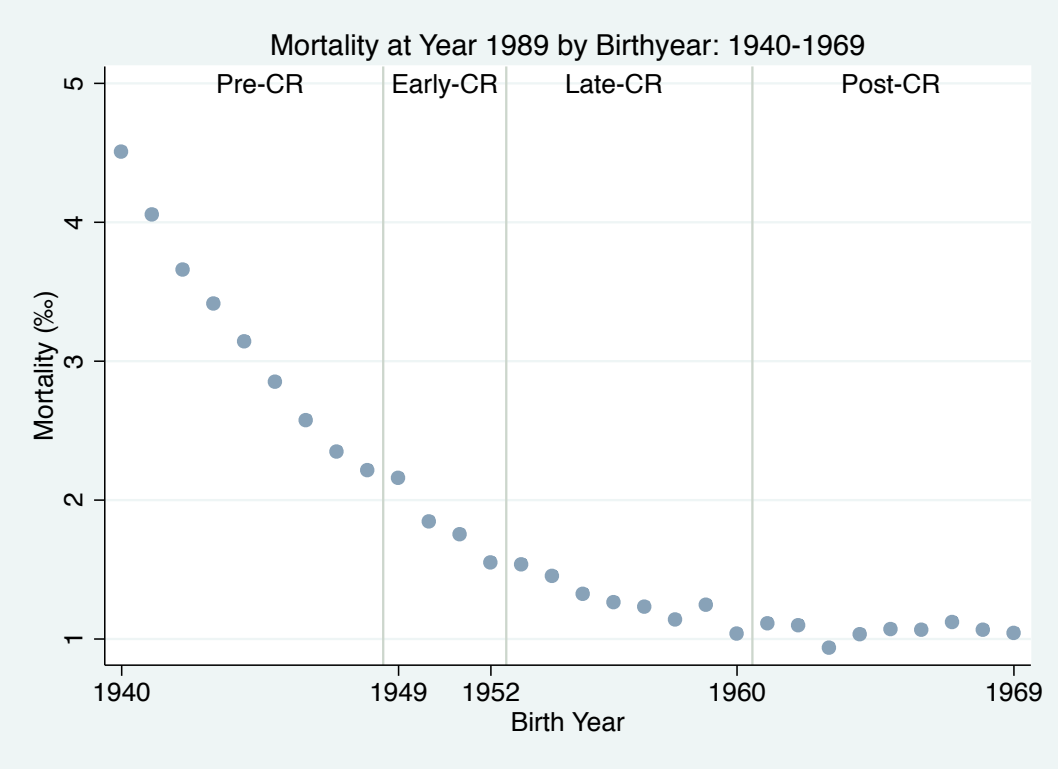
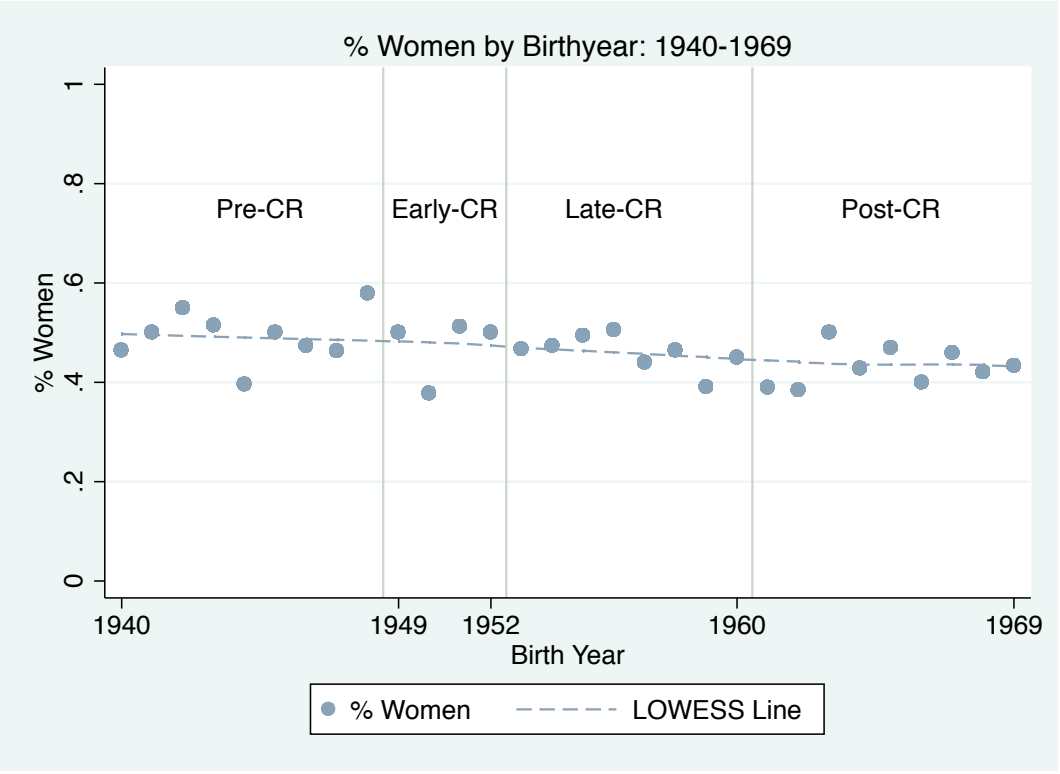
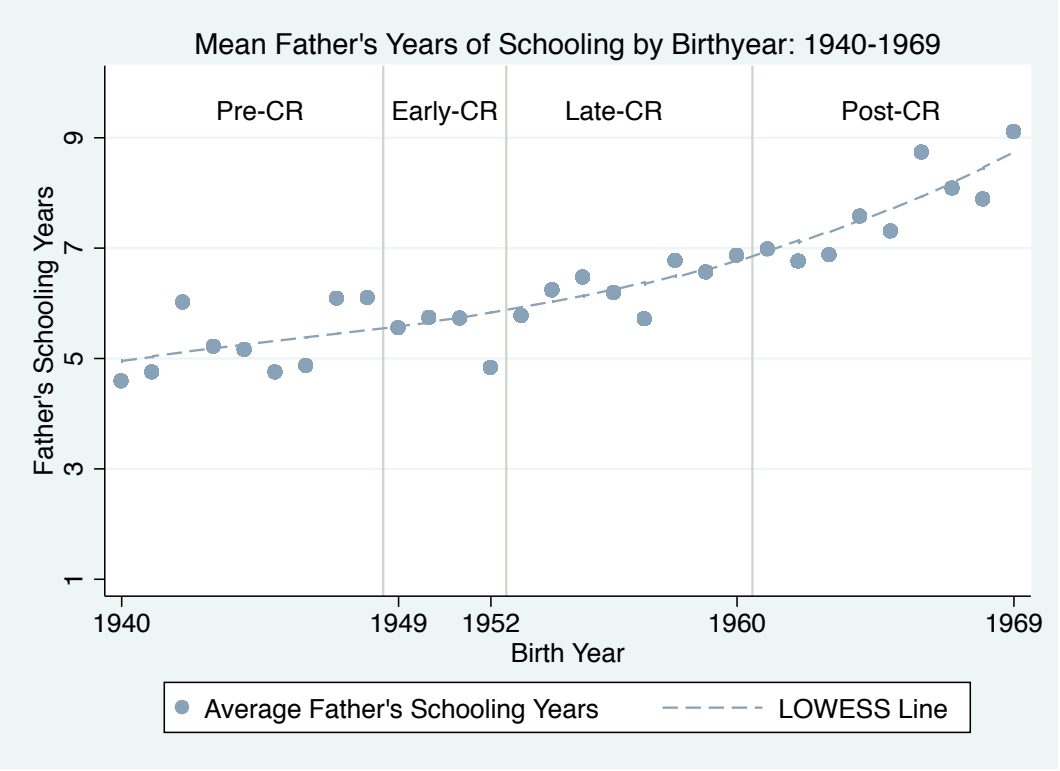

Mortality at Year 1989 by Birthyear: 1940-1969
Pre-CR
Early-CR
Late-CR
Post-CR
Mortality (‰)
1
2
3
4
5
1940
1949
1952
1960
1969
Birth Year

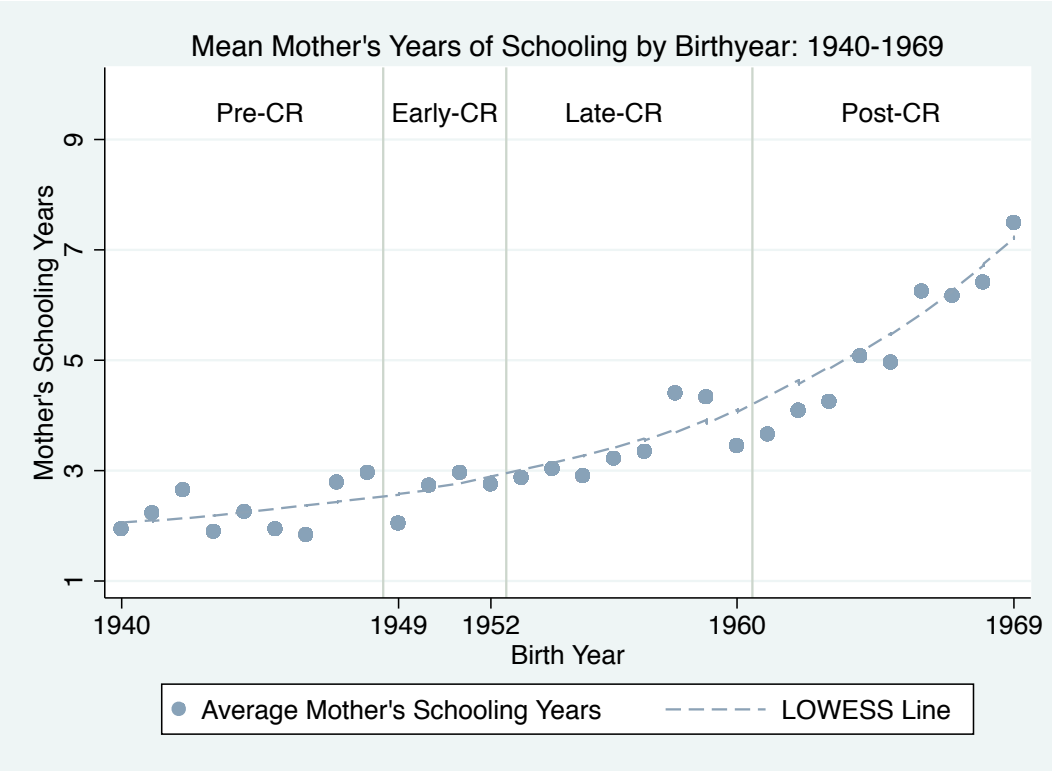
Figure 5



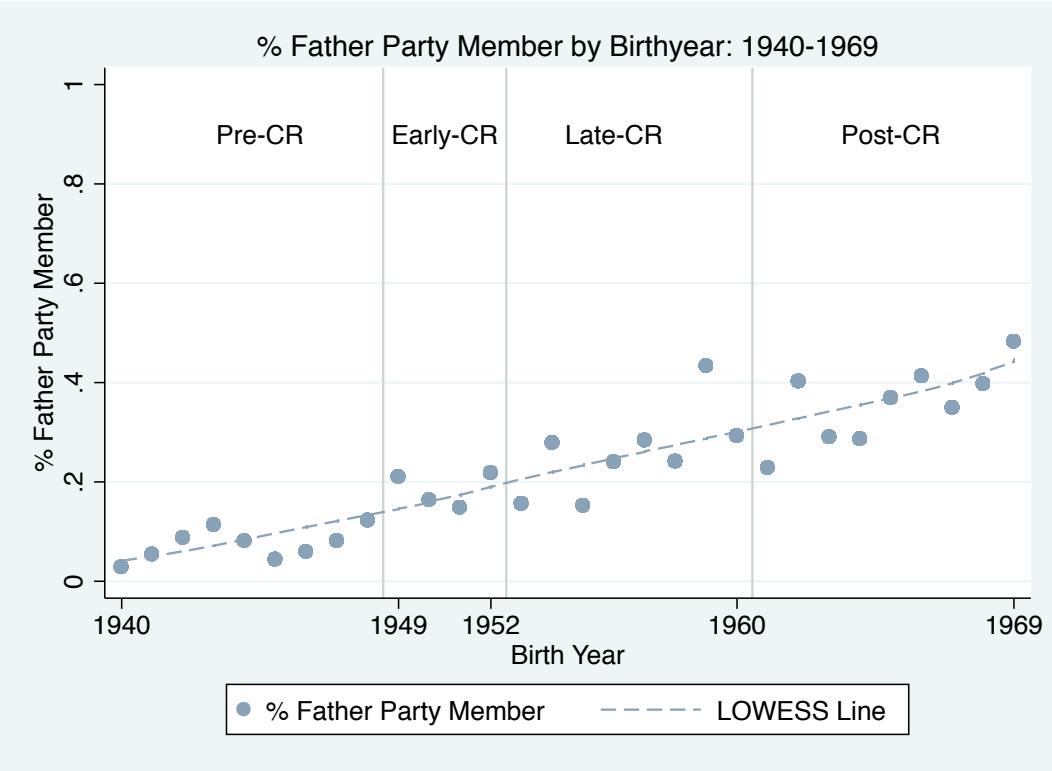
Appendix Figure 1



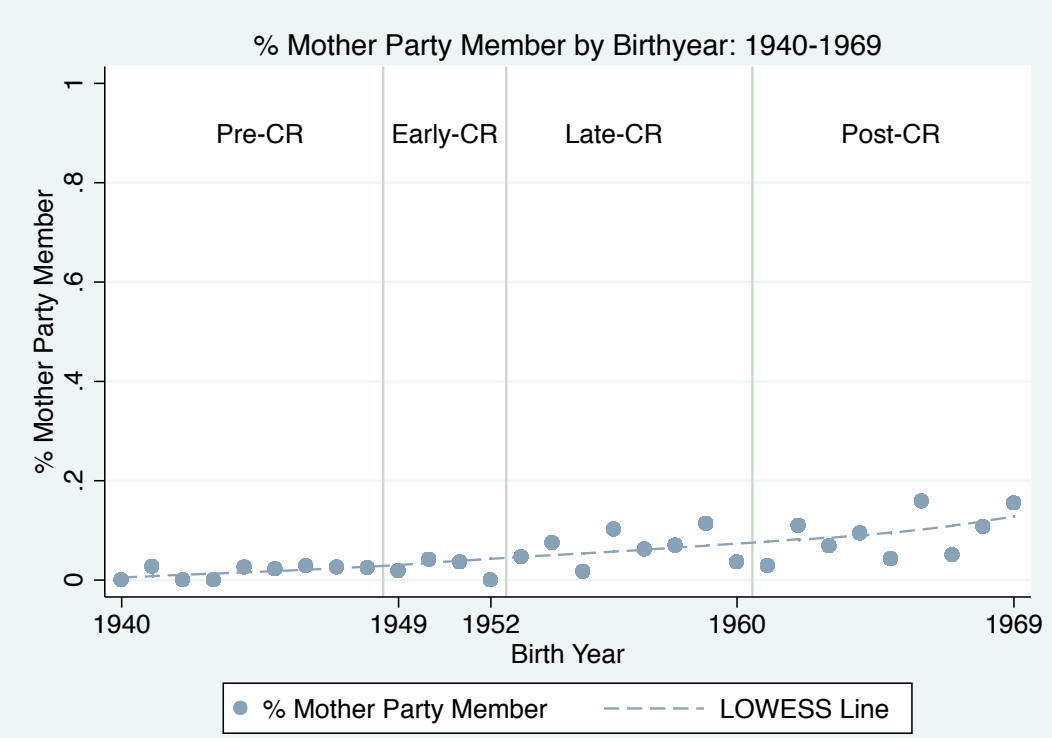
Appendix Figure 2



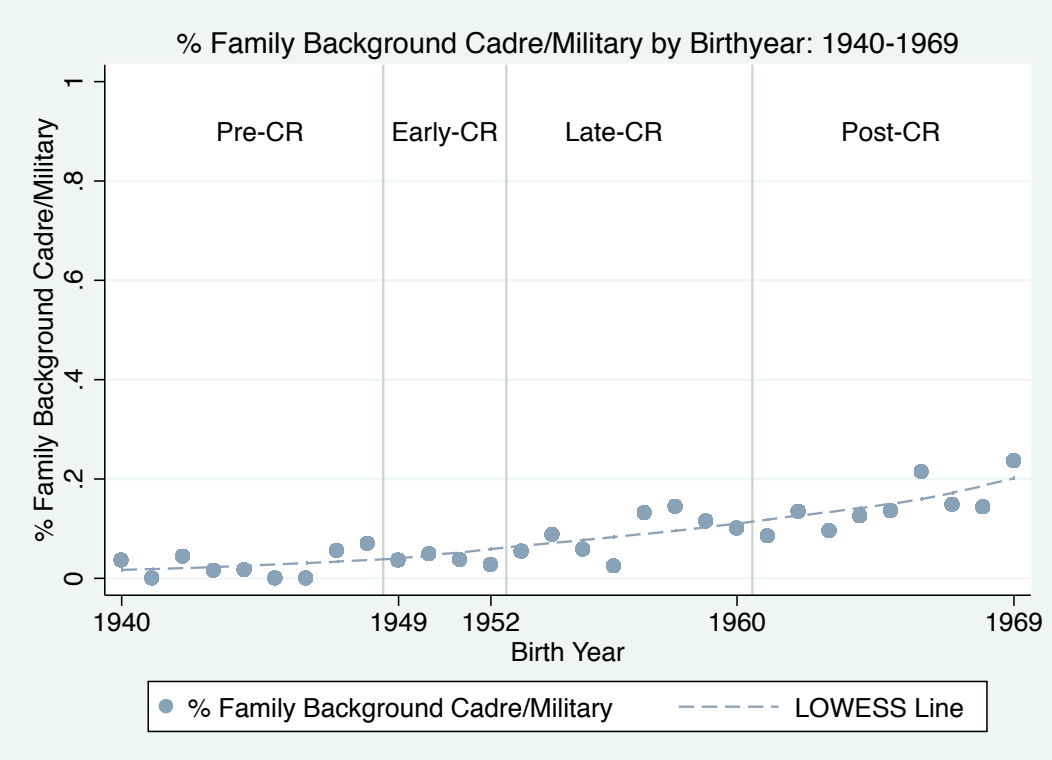
Appendix Figure 3



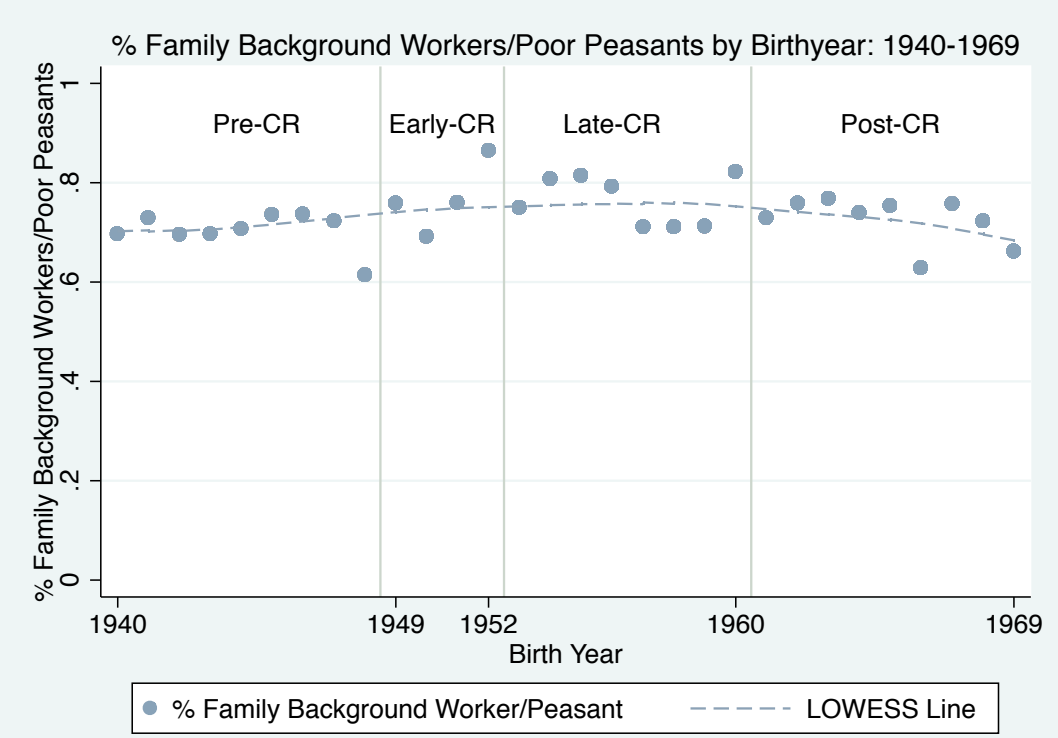
Appendix Figure 4



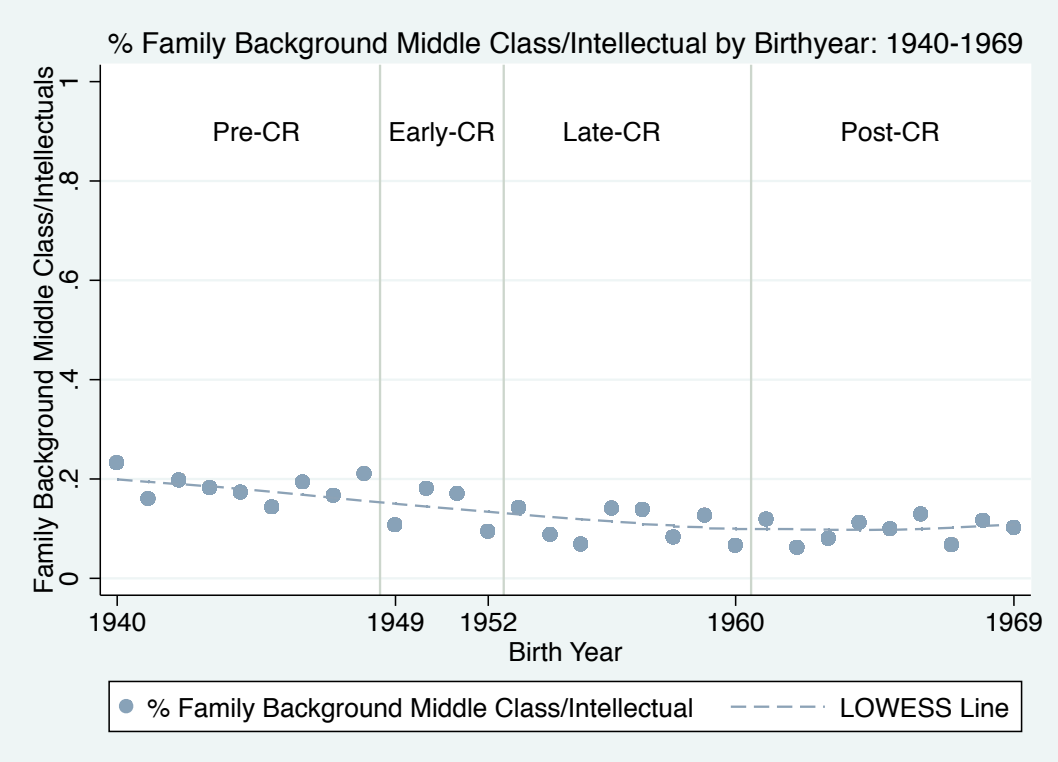
Appendix Figure 5



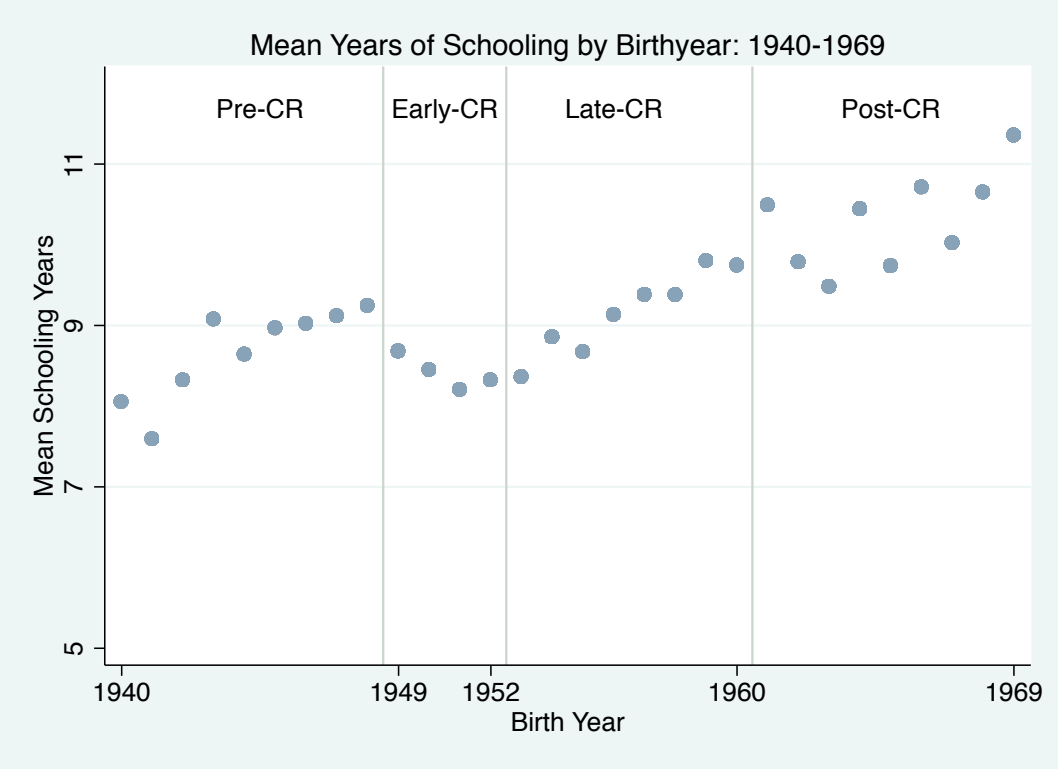
Appendix Figure 6



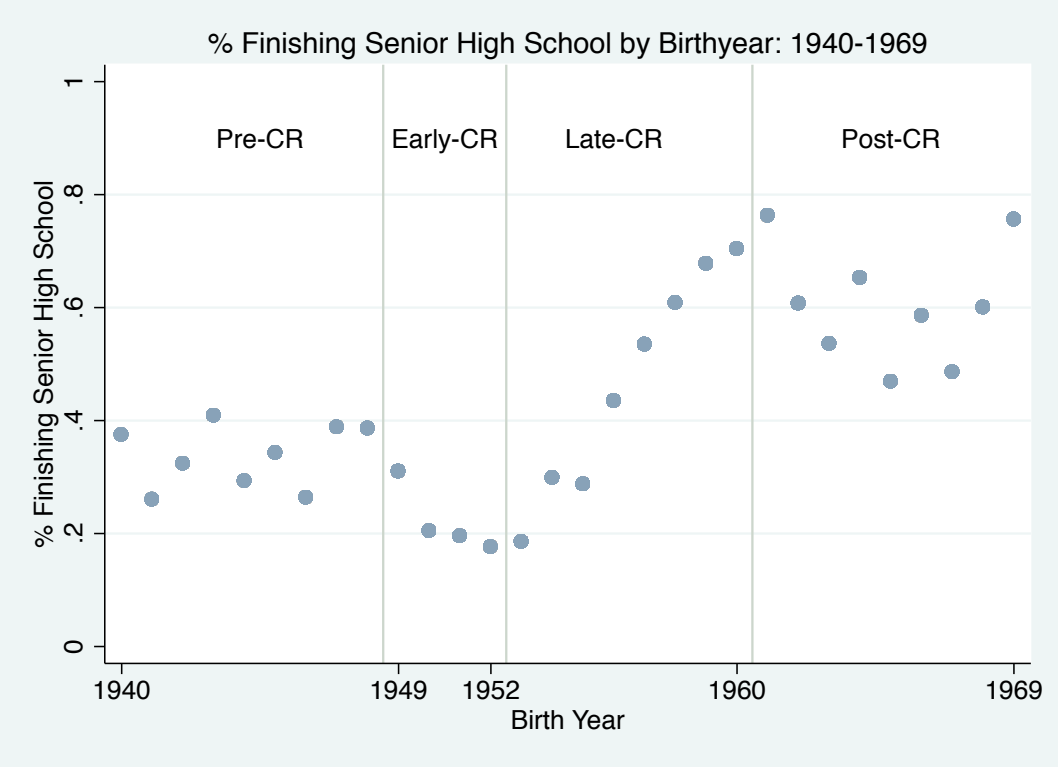
Appendix Figure 7



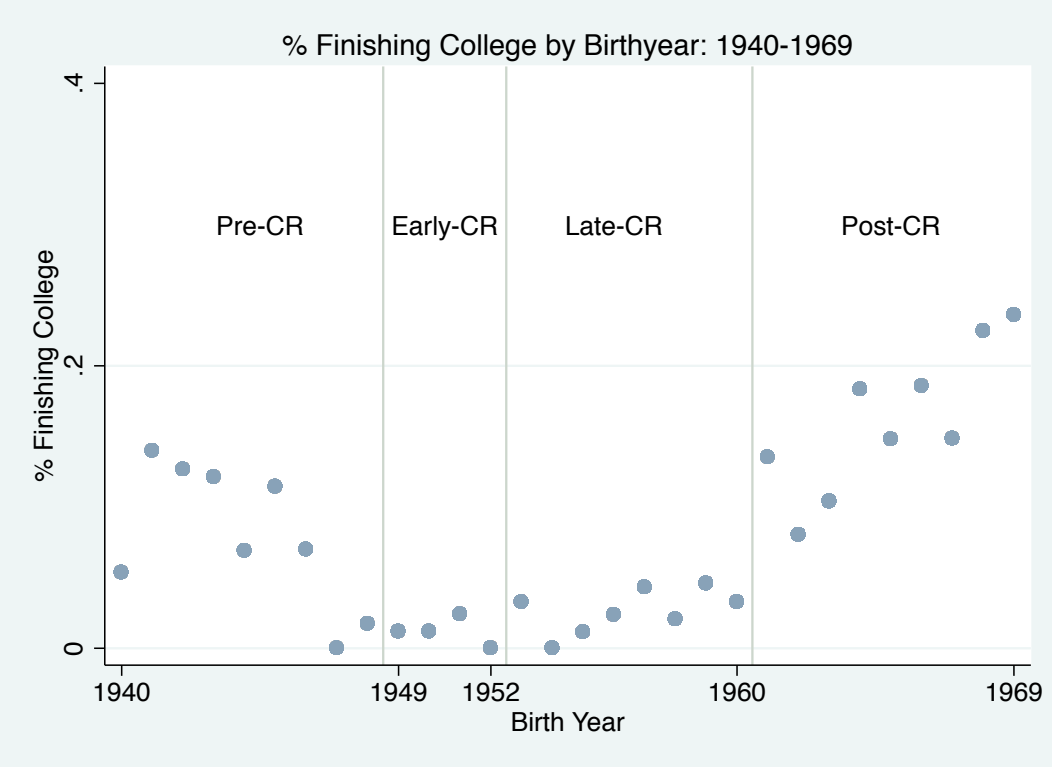
Appendix Figure 8



Appendix Figure 9



Appendix Figure 10



Appendix Figure 11