

Long-term Economic Consequences of the 1959-1961 China Famine

by

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ABSTRACT

The China famine, which occurred between 1959 and 1961, is the largest that has occurred in the world's history. The intention of this paper is to approximate the impacts of the malnutrition that the mothers had to endure during the famine's period. From the sample of CHNS 2011 wave panel survey, it was established that the exposure of infants to malnutrition through their mother's inability to obtain the necessary nutrients had no effect on one's future education level. One thing that could actually influence one's education level is the whether the child was born in urban area or rural area. That could be caused by the quality, the ease of accessing and the cost of healthcare service. Additionally, it was established that there is a differences in outcomes for men and women. It seems that famine had a relatively larger impact on women than men.

Introduction

The Great Leap Forward experienced in China led to the most terrible famine that has ever been witnessed in the world's history. Precisely, the death toll from that famine was 16.5 million-30 million (Weigelin-Schwiedrzik 2003). After long years from the time in which the famine occurred, it has now become instrumental in studies related to the study of the long-term effects that the famine had on the population, with a bias on the maternal undernourishment that it caused (Zheng 2011; Xu 2009; Chen and Zhou 2007). The motivation behind the use of the period before birth of the children is the fact that most literature forms indicate a close, and direct relationship between healths during adulthood to the form of care offered during the re-birth period to the mother (Weigelin-Schwiedrzik, 2003). The prevalence of maternal undernourishment across nations is the basis for the selection of the aspect for consideration in this paper. Moreover, the extent to which the problem affects children through their mothers makes the topic necessary for research work.

The Barker's hypothesis, which was introduced in 1992, argues that there is a perfectly strong correlation that exists between fetus' subsequent health and health of the mothers, including fetus' brain development (Nales and Barker 1992). Moreover, based on the brain reserve theory, "People with a high level of education are presumed to possess a larger brain reserve capacity than people with less education (Schmand et al 1997). Therefore it is evident, and correct to conclude that improvements of the quality of nutrition offered to mothers before birth of new born has the capacity to improve the health results of the offspring, as well as the level of education by extension (Huang et al, 2010; Alderman, 1984; Jean, 2013). However, by studying the individuals who were born

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between 1956 and 1964 according to the CHNS 2011 wave panel survey, it was established that the famine has very small and statistical insignificant impact on men education level in the event that famine was experienced by their mothers before birth. On the contrary to men, famine has positive influence on women's education level, even though the effect is still statistical insignificant.

Another finding of this research is the fact that famine affect urban and rural area differently as far as education level goes. People who were born in urban area will have a higher level of education than people who were born in rural area when famine hit China. The implication of this revelation is the fact that the health service in cities was better than the one in countryside if we assume both urban and rural area had the same quality of education. And it could also be the case that there were more people in urban area could afford the health service than people who live in village (Jean, 2013).

The control population of this research paper is the group that did not experience the effects of the famine, and are thus expected to be leading normalized lives. The famine did not discriminate, but hit the urban, as well as rural populations. The problems experienced in obtaining the control group, the section of the population that did not experience the famine's effects motivated the adoption of two more means of establishing the effects of the famine on long-term basis (Huang et al, 2010). The adverse effects of the famine made it such that it was difficult for anyone to escape the effects of the disaster, whereas the positive effect made cohort less competitive which increased the chance for individuals to enroll into schools.

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The famine's background is explained in the paper, and is followed by a review of the various literatures that have been documented in relation to the same. Following that section is the study of CHNS dataset. Some of the biases that were likely to be experienced are also discussed, and finally the conclusion of the research paper.

Background of the famine

The China famine started after 1959, and was reported to have had adverse effects across all of China's regions. Some of the direct effects witnessed were the decline in grain level outputs by 16% in 1959, and a further decline by 16.2% in 1960. However, by 1962, normalcy had returned to the birth, as well as mortality rates (Weigelin-Schwiedrzik, 2003). Whereas the famine is partly attributed to the adverse weather conditions, some economic policies have also been pointed at, as the reasons for the situation. Attempts to defeat Britain, as well as the United States by China led to diversion of laborers from the agricultural sector to the industrial sector, while at the same time increasing the grain sourced from rural areas (Li & An, 2015). The collective nature associated with production of agricultural products led to declining production levels.

As this happened, the prevailing political situation of the country was such that the leaders were motivated to declare higher levels of grain levels. This shocked all of the world's nations because in spite of the famine that had hit China so hard, the country was still the leading producer of grain. Famine implied that the population was starving for lack of adequate food production, but ironically, the country had surplus to export to other nations for trade purposes. The intensity of famine across China varied, and

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ironically still, the rural population recorded increased mortality rates from the famine in spite of most of the grain production originating from them. Precisely, by 1960, the death rate was 80% more than the rate had been before the famine's outbreak (Weigelin-Schwiedrzik, 2003). Some of the provinces that were worst affected were such as Henan, and Anhui. On the other hand, Jilin is one of those provinces that were less affected by the famine's effects. The effects of the famine somewhat subsided by 1961 whereupon the mortality rates resumed normalcy by that year (Huang, Li, Wang & Martorell, 2010).

Literature review

In relation to Epidemiology

The Dutch famine of 1944 to 1945 is one of the studies, related to epidemiology, and which draws its findings from the effects that the famine had on unborn children whose mothers felt victim of the disease (Roseboom, de Rooij & Painter, 2006). In spite of the study being limited to 18 years of age, heart diseases, anti-social behaviors, as well as other personal health problems. The Dutch studies, as well as that, which focused on Finland, are similar to the one of China, under focus in this paper.

In relation to Economics

Famine has both short term as well as long-term effects, which are of economic nature. Most studies, including those that have been recently documented are such that they examine the effects of the famine on the survivors' social, as well as economic lives. Huang et.al undertook studies on the heights of persons who had suffered in their childhoods, because of the exposure of their mothers to the effects of famine. The findings of these authors revealed that the effects of famine were more amongst shorter individuals. Additionally, individuals who did not fall victim of any of the famine's effects were such that they did not experience any height-related problems. In spite of these findings, it is still unknown whether indeed the survivors of the famine were not affected by any of, the problems related to growth (Huang et al, 2010).

Bernstein(1990) reports that the Great Leap Forward , which occurred in China led to the most terrible famine that has ever been witnessed in the world's history. Precisely, the death toll from that famine was 16.5 million-30 million. In that connection,

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Chen (2011) indicated that after long years from the time in which the famine occurred, it had increased in popularity amongst researches related to the study of the long-term effects that the famine had on the population, with greater focus on the maternal undernourishment that it caused. The motivation behind the use of the period before birth of the children is the fact that there is a close, and direct relationship between healths during adulthood and the form of care offered during the pre-birth period to the woman.

Jean (2013) emphasize the fact that socioeconomic outcomes affect the response by infants to the health statuses of their mothers explains the perfectly strong correlation that exists between health of the mother, as well as the socioeconomic at an personal, as well as national level. By studying the individuals who were born between 1955 and 1966 according to the CHNS 2006, establishes that the likelihood of men being unlikely to work was 11.4%, and 1.3% likelihood to get diabetes for women in the event that famine was experienced by their mothers before birth. On the contrary, by using adding cohort size as a control, the likelihood of men being unlikely to work was 12.2%, and 1.31% likelihood to get diabetes for women in the event that famine was experienced by their mothers before birth. Therefore, by adding cohort size into the regression, both outcome got negatively reinforced.

The implication of such revelations is the fact that males are relatively highly vulnerable to malnutrition amongst their mothers before they are born as indicated by Riskin (1998). He also finds out the rampant nature of the echo effect in which children whose mothers suffered undernourishment when carrying them were at a higher risk to experience the same. The explanation he offered for this scenario is that the social implications of the famine on the children are responsible for the extended effects of the

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same. In more specific terms as used by Li & An(2015), those mothers who faced starvation because of exposure to the famine had higher chances of giving birth to baby girls. Whereas smaller birth intervals might be influential in research studies, the reliability of research studies' findings is enhanced by analysis of higher samples as in the case of Huang, Li, Wang & Martorell (2010).

Methodology

Data

The data in this thesis are drawn from the 2011 wave of the China Health and Nutrition Survey (CHNS). The survey is part of international collaborative project between the University of North Carolina and Chinese Center for Disease Control and Prevention. It was designed to see “how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population” (CHNS). So far, there have been nine waves of panel surveys conducted in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011. Because the famine happened in 1959-1961, this allows me to look into the educational results of survivors who should be around early-fifties in 2011. There has been no literature in economic examine the long-turn educational effects of the famine using this data.

The CHNS 2011 wave covers twelve provinces- Beijing, Liaoning, Heilongjiang, Shanghai, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou, and Chongqing. In each of the province, “a multistage, random cluster process” was use to draw a sample from individuals (CHNS). For the 2011 survey, 14666 individuals were sampled from 5903 households. In this thesis, I will focus on the individuals who were born in 1956-1964, which includes people who were born pre and post the famine as well as those born during the famine. Table 1 in the Appendix section shows the descriptive statistics regarding to the selected sample.

Death rate

The data on provincial death rates are drawn from 全国各省、自治区、直辖市历史统计资料汇编(A Compilation of Historical Statistical Data of Provinces, Autonomous Regions, and Municipalities) which was collected by the State Statistical Bureau of China. The reliability of data have been confirmed in several previous studies ((Banister 1984; Coale 1984; Ashton et al. 1984). One thing I have to mention here is that because Chongqing became a municipality in 1997, there is no death rate data from this particular city during 1956-1964. Therefore I use Sichuan's data for Chongqing as Chongqing was one of the cities in Sichuan province. Because of the way I use these data which I will mention in later section, I believe this substitution is legit.

Education level

The question asked from the survey is “What is your highest level of education attained?” This measure ranges from 0 to 6, where 0 means having no education, 1 means having a primary school degree, and 6 means having a master degree. Because the last three categories only take relatively small proportion of the sample (roughly 6%, 6%, and 0% respectively), I have combined them into a single one called “Vocational or University” for the sake of simplicity.

Urban

This data recorded whether the survey participants lived in urban site or rural site when they took the survey. One may argue that the survey participants could move from urban site to rural site or vice versa during their lifetime. Although the CHNS data only

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provides the current living area and not the area of birth for a given individual, “China’s strict migration policy and the *hukou* system—to the extent that migration had to be approved by authorities on a case-by-case basis”. That means there is a high correlation between the region of birth and the region of current residence (Jean, 2013). In this study, I assume all survey participants’ current living regions are the same as their birth region.

Empirical Strategy

Measuring famine intensity

In order to reveal how the negative effect of famine impact on each unborn child, the all-age death rate data by province and year is used as an index of the level of famine intensity. For example, if a person was born in 1960 in Beijing, then he or she would be assigned with the death rate in 1960 in Beijing which is 9.1. That figure represents how much his or her mother suffer from the famine. Table 2 presents the death rates of the relevant provinces in 1956-1964.

Regression specification

In order to find out the long-term impacts of the Great Famine, I run the following regression on cohorts who born in 1956-1964 and using the method of OLS:

$$E_{itp} = c + dr_{tp} + u_i + \alpha_i + D_p + \varepsilon_{itp} \quad (1)$$

where E_{itp} represents the highest education level attained for individual i born in province p in period t . dr_{tp} represents the famine intensity in province p in period t . u_i is a dummy variables for birth region where rural area=0 and urban area=1. α_i is the age for individual i . D_p stands for province dummies. The significant level is set to 10%.

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Expectation

Before doing any regression, based on the previous studies, I am expecting to see following results to show up:

- 1) Based on the Barker's hypothesis and the brain reserve theory, I expect to see people's education level decrease as the intensity increase.
- 2) The famine should affect the male and female survivors differently (Mu, 2011).
- 3) The famine should affect the urban and rural region differently (Jean, 2013)

Results

Basic regression results

The results from estimating (1) are reported in Table 3. In this case, while the famine intensity turns out to be not significant, a switch from rural to urban birth region is found to be linked with an increase in the education level. And that effect is relatively larger on female than on male.

As the death rates used in the estimation are at 0.1% level, which means that a 1% increase in the death rate, there should be a 3.6% decrease in education level for men. Bear in mind that the education level only range from 0 to 6, which means a 3.6% change would mean one year difference in primary school or half a year change in the following education level. Based the on Table 2, the highest famine intensity happens to be Chongqing in 1960, and the lowest famine intensity is Shanghai in 1958. This could mean the men cohorts whose mother experienced the highest famine intensity should have 17.316 %.(3.6%*4.81%) lower education level compare to those whose mother experienced the lowest famine intensity. That is equivalent to one unit change in level of education. However, as the standard error shows, it turns out to be the case that this statistic is insignificant. Therefore, I conclude that the famine intensity has very small influence on individuals' education level. A similar analysis can be applied to women, and it is also insignificant.

On the other hand, the birth region dummy turns out to be the key in this regression. From Table 3, if we switch an individual's birth region from rural to urban,

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there would be 0.96 unit increase in education level for men, and 1.17 unit increase for women.

Alternative Specification: Introducing the Positive Effect

As the previous regression fail to present overall effect of famine intensity on individuals' education level, a further specification is needed. This specification introduces the cohort size of each year as a control variable. In theory, the famine would hinder people's brain development and thus had an adverse effect on their education level. It also could be the case that because of the famine, the cohort size shrank, and made the cohort less competitive. As long as the Gaokao, and Zhongkao system exist, that usually lead to an increase in education level for all cohort members.

The cohort size for each year is shown in Figure 1. There is a direct correlation between cohort size and the severity of the famine. As the famine peaked in 1960, the cohort size also hit its minimum point in the next year. The higher famine intensity was, the less the cohort size it would be which means the larger positive effect was applied to a given year. In short, introduction cohort size into my model would allow a more accurate measure of the impact of the famine.

After adding cohort size into the model as a control, since both positive and negative effect is presented, I would expect that the coefficients on dr_{tp} should decrease if the negative effect dominates, and increase if the positive effect dominates.

The new OLS regression is now becoming as the following:

$$E_{itp} = c + dr_{tp} + u_i + \alpha_i + D_p + C_t + \varepsilon_{itp} \quad (2)$$

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where as in (1), E_{itp} represents the highest education level attained for individual i born in province p in period t . dr_{tp} represents the famine intensity in province p in period t . u_i is a dummy variables for birth region where rural area=0 and urban area=1. α_i is the age for individual i . D_p stands for province dummies, and C_t measures the cohort size for a given year t . The significant level is set to 10%.

As shown in Table 4, after introducing the cohort size, dr_{tp} does change in a way as I expected. As the dr_{tp} decreases for men and women, it could be the case that negative effect dominates, but since the variable is still insignificant, it means famine intensity has no effect on education level. The birth region dummy does not change even a new control is introduced.

Ignoring the significant issue, the impact of famine intensity on both women and men are negatively reinforced. In the case of men, a 1% increase in the death rate, there should be a 4.46% decrease in education level for men. This could mean the men cohorts whose mother experienced the highest famine intensity should have 21.453 %.($4.46\% * 4.81\%$) lower education level compare to those whose mother experienced the lowest famine intensity. That is equivalent to 1.3 unit change in level of education. However, as the standard error shows, it turns out to be the case that this statistic is insignificant. Therefore, I conclude that the famine intensity has very small influence on individuals' education level. A similar analysis can be applied to women, and it is also insignificant.

The birth region dummy for both men and women from estimating (2) is as the same as the ones in (1). if we switch an individual's birth region from rural to urban,

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there would be 0.96 unit increase in education level for men, and 1.17 unit increase for women.

Further Thoughts on Results

The results from estimating (1) and (2) do not support, but oppose the idea of the Barker's hypothesis and the brain reserve theory. More specifically, the effect of famine on individuals' education level is negligible. The overturn my first expectation before I run the regression. However, my second and third expectation do have been confirmed- the famine affects men and women differently and also affects rural and urban region differently. While the methodology behind the gender differences is beyond the cover of this paper, I do have one possible explanation for the birth region differences.

In the case of famine, one huge difference between city and countryside is the quality of healthcare service. The way how Chinese healthcare system works is the bigger city gets the better healthcare service (Eggleston, 2008). Though rural area does have its own township hospitals, and village clinics, they are usually underutilized (Eggleston, 2008). Therefore, it is fair to say that people who lived in rural area will have a hard time accessing the healthcare service. Not to mention the fact that "For many survey participants, and particularly those in rural areas where the closest county hospital is a considerable distance away." (Jean, 2013). Assuming the quality of all healthcare services in China is the same, and even ignoring the distance issue, the cost of healthcare is still a problem. A study shows that 43% of rural people choose not to go a hospital or clinic when they were sick because of the costs (Yip, 2009). Back to 1959-1961, the famine period, rural people had an even harder to access healthcare service as quite a lot

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hospitals and clinics became dysfunctional due to the Great Leap Forward (Hesketh, 1997). All in all, if people were born in the city rather than village during the famine, then they would have access to a better health care, and thus indirectly influence their level of education.

Conclusion

The Chinese famine, which was witnessed between 1959 and 1961, is the largest that has occurred in the world's history. The intention of this paper was to approximate the long-term impacts of the malnutrition that the mothers had to endure during the famine's period. From the sample of CHNS, it was established that the exposure of infants to malnutrition through their mother's inability to obtain the necessary nutrients had no effect on one's future education level. One thing that could actually influence one's education level is the whether the child was born in urban area or rural area. That could be caused by the quality, the ease of accessing and the cost of healthcare service.

Additionally, it was established that there is a differences in outcomes for men and women. It seems that famine had a relatively larger impact on women than men. Further study is require in order to find out the whole methodology behind this phenomenon.

The original intention of this thesis is to see how famine, especially the intensity of famine, impacts on individuals' education level. However, the results turn to be that the famine intensity is irrelevant to education level. Since there isn't that much study that focus mainly on education in the context of famine, one problem I can think of is the sample size. This thesis use a sample roughly 2400 observation from 12 provinces and 9 cohorts. A large sample size might change the result. In the world today, based on the finding in this paper, Chinese policymakers should start to pay attention to the rural healthcare system so that the whole nation education level could be improved.

Appendix

Table 1: Descriptive Statistics of CHNS Population, born 1956-1964

Variable	Total (N=2657) Distribution (%) or mean (SD)	By Gender	
		Male (N=1288) Distribution (%) or mean (SD)	Female (N=1369) Distribution (%) or mean (SD)
Age	51.0 (2.73)	51.0 (2.77)	50.9 (2.70)
Urban residence	42.03%	42.35%	41.73%
Education Level			
None	12.19%	6.06%	17.97%
Primary school	13.77%	12.11%	15.37%
Junior High school	35.49%	39.13%	32.05%
Senior High school	25.78%	27.33%	24.33%
Vocational or University	12.76%	15.30%	10.27%
Province			
Beijing	7.69%	8.19%	7.21%
Liaoning	10.16%	9.58%	10.71%
Heilongjiang	8.55%	8.96%	8.16%
Shanghai	9.90%	8.96%	9.98%
Jiangsu	7.27%	6.88%	7.65%

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Shandong	9.64%	9.04%	10.20%
Henan	8.02%	8.11%	7.94%
Hubei	9.90%	10.12%	9.51%
Hunan	7.87%	7.57%	8.16%
Guangxi	9.11%	9.89%	8.38%
Guizhou	4.65%	5.02%	4.30%
Chongqing	7.24%	6.80%	7.65%

Table 2: Death Rates in the CHNS Provinces and Nation (unit 0.1%)

Province	1956	1957	1958	1959	1960	1961	1962	1963	1964
Beijing	7.7	8.2	8.1	9.7	9.1	10.8	8.8	8.1	8.3
Liaoning	6.6	9.4	6.6	11.8	11.5	17.5	8.5	7.9	9.3
Heilongjiang	10.1	10.5	9.2	12.8	10.6	11.1	8.6	8.6	11.5
Shanghai	6.8	6.0	5.9	6.9	6.8	7.7	7.3	7.0	6.1
Jiangsu	13.0	10.3	9.4	14.6	18.4	13.4	10.4	9	10.1
Shandong	12.1	12.1	12.8	18.2	23.6	18.4	12.4	11.8	12.0
Henan	14.0	11.8	12.7	14.1	39.6	10.2	8.0	9.4	10.6
Hubei	10.8	9.6	9.6	14.5	21.2	9.1	8.8	9.8	10.9
Hunan	11.5	10.4	11.7	13.0	29.4	17.5	10.2	10.3	12.9
Guangxi	12.5	12.4	11.7	17.5	29.5	19.5	10.3	10.1	10.6
Guizhou	7.5	8.8	13.7	16.2	45.4	17.7	10.4	9.4	10.5
Chongqing	10.4	12.1	25.2	47.0	54.0	29.4	14.6	12.8	13.9

Table 3: The Long-term Impacts of the Famine on Health and Education Outcomes, using dr_t .

Independent Variable	Education	
	Men	Women
dr_t	-0.003560 (0.007)	0.003668 (0.007)
age_i	-0.054044 (0.011)	-0.08436 (0.012)
urban	0.961048 (0.069)	1.166836 (0.068)
Beijing	1.056288 (0.182)	1.033723 (0.172)
Liaoning	0.662138 (0.174)	0.622595 (0.157)
Heilongjiang	0.819041 (0.182)	0.53441 (0.163)
Shanghai	0.635388 (0.180)	0.590773 (0.166)
Jiangsu	0.463256 (0.180)	-0.081753 (0.163)
Shandong	0.749080 (0.165)	0.434201 (0.150)
Henan	0.473738 (0.172)	0.156258 (0.160)

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Hubei	0.750959 (0.167)	0.273483 (0.155)
Hunan	0.563425 (0.172)	0.309825 (0.159)
Guangxi	0.477975 (0.164)	0.414999 (0.157)
Guizhou	0.230642 (0.192)	0.242119 (0.189)
Constant	4.231102 (0.614)	5.363653 (0.622)
Observation	1288	1369
R-squared	0.214	0.279

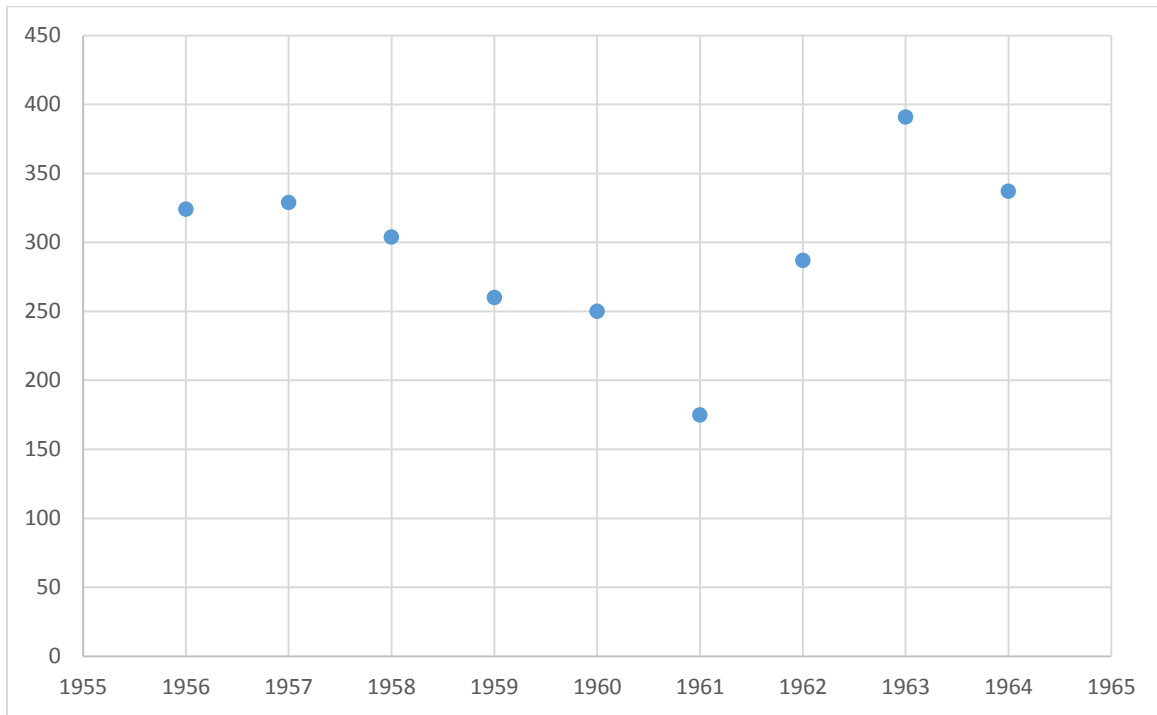
Table 4: The Long-term Impacts of the Famine on Health and Education Outcomes, using dr_t , adjusting for cohort size

Independent Variable	Education	
	Men	Women
dr_t	-0.00446 (0.007)	0.000461 (0.007)
age_i	-0.05491 (0.012)	-0.08719 (0.012)
urban	0.961206 (0.069)	1.166962 (0.068)
Beijing	1.043893 (0.186)	0.993849 (0.176)
Liaoning	0.652497 (0.176)	0.588874 (0.160)
Heilongjiang	0.809543 (0.175)	0.501611 (0.166)
Shanghai	0.620167 (0.189)	0.540086 (0.173)
Jiangsu	0.455686 (0.181)	-0.10797 (0.165)
Shandong	0.743762 (0.166)	0.413683 (0.151)
Henan	0.467946 (0.173)	0.140454 (0.161)

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Hubei	0.74167 (0.170)	0.24456 (0.157)
Hunan	0.558098 (0.173)	0.296727 (0.160)
Guangxi	0.473796 (0.164)	0.394968 (0.158)
Guizhou	0.22505 (0.193)	0.233766 (0.189)
Cohort	-0.0002 (0.001)	-0.00069 (0.001)
Constant	4.356028 (0.614)	5.780352 (0.728)
Observation	1288	1369

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Figure 1: Cohort Size in CHNS Data, Cohorts born 1956-1964

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