Long-Term Consequences of Early Life Exposure to War: An Examination of Life Outcomes of Children Born or Conceived During the Vietnam War

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Abstract

This paper explores the long-term effects of early-life exposure to war on children born or conceived in times of war. While war is known to have harmful consequences, such as raised mortality, displaced populations, and destruction of infrastructure in the short-term, the medium to long-term effects of exposure to war are less clear. Examining the case of the Vietnam War, this paper investigates the war's effects on socioeconomic outcomes using census data. The results show some indication of adverse effects on upper and lower secondary school completion, literacy, marriage, and employment, but it is unclear whether these effects can be attributed solely to exposure to the war.

1 Introduction

A growing number of studies in the fields of demography, epidemiology, and economics has shown that early life circumstances are critical determinants of morbidity, lifespan prospects, and socioeconomic outcomes. Research has shown that childhood conditions such as exposure to infectious diseases, nutritional deprivation, health status, height and weight, and economic conditions, have been associated with later life mortality and morbidity, such as heart disease and its risk factors, cancer, and respiratory disease [23, 24, 12, 17]. Other studies also have examined the relationship between early life conditions and demographic and socioeconomic outcomes such as fertility, marital status, education, and employment [30, 15, 4, 18].

One way to study this phenomenon is through the use of abrupt changes in conditions as a natural experiment. To this end, numerous studies have examined early life exposures to famines and their long term effects on adult life outcomes. Prominent famines that have been examined for this purpose include the 1959-1961 famine in China during the Great Leap Forward, the Dutch Famine of 1944-1945, the 1941-1944 siege of Leningrad, and the Finnish famine of 1866-68. Studies of famines are compelling because famines present a situation where there is a sharp shock in the nutritional status of mothers and children. However, the results of such studies have been mixed. While some studies have found that exposure to famine *in utero* or during infancy has negative impacts on later life health, mortality, fertility, and socioeconomic outcomes [4, 11, 15, 22, 21, 40, 47, 56], other studies have found mixed or no long-term effects of exposure to famine [28, 32, 31, 54, 55]. In addition, similar approaches have been used to study exposure to other events, such as the 1918-1919 influenza pandemic, maternal fasting during Ramadan, and industrial accidents on later life mortality and socioeconomic outcomes [4, 5, 6, 34].

This approach can be extended to the study of long-term effects of early-life exposure to war. In times of war, food may be less available and maternal and child malnutrition may be prevalent. Mothers may also experience other sources of stress, including spousal separation, deaths in the family, and insecure living conditions. If we presume that children who are born or conceived during war time experience harsher early life conditions than those born and conceived in peace time, then we can hypothesize that the war-exposed children would be more likely to be unhealthy during childhood, which then may prevent them from attending school or receiving other training, leading to lower socioeconomic status in adulthood. In addition, these individual level effects may be magnified by other factors at the household and community levels. At the household level, families whose assets were destroyed or who lost family members in the war may have greater need for children to work rather than go to school. At the community level, school infrastructure may be more likely to have been destroyed in areas where more fighting had occurred. The infrastructure may not have been rebuilt by the time the children were of school age.

Existing theories on how early life events may impact later life outcomes are conflicting. On one hand, the fetal origins or the Barker hypothesis would suggest that people who experienced poor conditions *in utero* or in infancy would be susceptible to a range of negative adult life outcomes. Under this hypothesis, people are designed to adapt to their environment especially early in life when the body is still developing. Conditions in the womb and in early childhood act as a signal for the environment that a person may face later in life and the body responds by adapting in such a way as to best cope under such circumstances. This hypothesis has been used to explain the links between poor *in utero* and early childhood environments and chronic diseases among adults, such as coronary heart disease [10]. To the extent that poor health affects economic outcomes rather than vice versa [53], this hypothesis could be extended to socioeconomic outcomes in adult life. For example, poor early life conditions may lead to poor health in childhood. Poor health may prevent children from attending school, which then leads to lower educational attainment, lower employment rates, lower income, and lower rates of marriage.

On the other hand, notions of frailty and selectivity would lead us to expect positive outcomes for those who experienced poor childhood environments and survived. Those who are more frail would die earlier, leaving healthier individuals among the surviving population [58]. Given the empirical evidence supporting higher neonatal and infant mortality among babies conceived in adverse conditions [50, 31], it is plausible that frailty and selectivity may be operating.

Empirical evidence thus far on long-term impacts of war does not provide clear support for either of the theories. An examination of the effect of war on cohort mortality shows some evidence for a higher pattern of mortality among cohorts that experienced war during childhood or adolescence. Horiuchi [26] found that the cohort of males of the Federal Republic of Germany who were about age 15 at the end of the First World War had higher mortality later in life compared to other cohorts surrounding it. He observed similar patterns in other countries such as France and Austria, as well as in middle-age mortality among those who experienced the Second World War as adolescents in Japan and Federal Republic of Germany. Horiuchi suggests that the effect of malnutrition during adolescence on the development of vascular structures as a possible mechanism. Similar cohort effects of war exposure on mortality have been observed for other countries [46, 13]. However, the effect is inconclusive since cohort effects from those born around the time of World War I have been observed in countries that did not participate in the war intensively [59].

The evidence to date on the role of armed conflicts in economic development and schooling is also ambiguous. Miguel and Roland investigated the impact of the U.S. bombing of Vietnam on later economic development at the district level and found no impact on poverty rates, consumption levels, infrastructure, literacy or population density through 2002 [38]. However, Akresh and de Walque [3] examined the effect of the Rwandan genocide on schooling and found that children exposed to the genocide were less likely to complete third or fourth grade and that educational attainment of children exposed to the genocide was about one-half year lower than for those who were not exposed. Furthermore, in Tajikistan, Shemyakina [52] showed that exposure to civil conflicts had a negative effect on the school enrollment and completion of mandatory schooling of girls but not of boys.

Hence, while more is known about the immediate effects of war, the long-term effects of wars on cohorts who experienced them during their critical ages of development are less clear. The aim of this study is to explore the long-term socioeconomic effects of war on the children who experienced it at the youngest of ages: *in utero* and during the first year of life. These cohorts will be compared to those conceived and born just after the war. Using the 1999 Vietnamese Census data and data on the U.S. bombing of Vietnam, this paper examines education, literacy, employment, and marital status outcomes of children born or conceived during the tail end of the Vietnam War.

The rest of the paper will flow as follows. First, I will give a brief background on the Vietnam War. Then, I will review the existing literature on demographic and mortality trends in Vietnam to see whether mortality shocks during the period of the war which would signal poor *in utero* or early-life environments are evident. Next, I will discuss the data and the methods. Finally, I will present and discuss the results before concluding.

2 Background on the Vietnam War

The origins of the Vietnam War date back to the 19th century with the French colonization of Vietnam. At the beginning of World War II, Vietnam fell under Japanese control and suffered one of the worst famines in recent history, when between 400,000 to two million lives were said to have been lost [29, 60]. At the end of the Second World War, Vietnam experienced a brief period of independence, before another war broke out as the French attempted to regain control. The French colonial rule officially ended in 1954 and resulted in a country divided between the North and the South. The last stage in this struggle for independence was what is commonly known as the Vietnam War (or the "American War", as it is called in Vietnam) which officially lasted from 1954 to 1975 and was fought between North and South Vietnam. While American support of South Vietnam began early in the war, the war escalated in the mid-1960s when American troops were sent into Vietnam and aerial bombing raids were conducted. Between 1963 and 1973, a total of 6,162,000 tons of bombs and other ordinance were dropped in Vietnam, almost three times as much as was expended during World War II [16]. The war ended with the fall of Saigon in April of 1975.

Reports of Vietnamese mortality from the war range from about one to three million. A detailed review of previous estimates is given by Hirschman, et al.[25]. Their demographic analysis using the 1991 Vietnam Life History Survey on deaths of siblings and parents resulted in a figure of approximately one million war-related deaths between 1965 and 1975. Another analysis using sibling mortality data from the 2002-3 World Health Survey reported 1.7 million violent war deaths between 1965 and 1974, which were also similar to the figures recorded by the database of passive reports of violent deaths maintained by Uppsala University and the Peace Research Institute, Oslo [42].

Soon after the war, Vietnam's economic situation deteriorated. The industrial centers in the north had been damaged by the war. Much of the agricultural land in central and southern Vietnam had been poisoned by Agent Orange or other chemical agents, as well as scattered with land mines and other unexploded ordinances rendering it unusable for agricultural production. Moreover, foreign aid, upon which Vietnam had grown dependent during war time, was withdrawn by both China and the Soviet Union. The termination of U.S. aid to South Vietnam and the lack of reconstruction aid also crippled the economy [35]. Faced with these challenges, combined with the U.S.-led trade embargo, natural disasters, and internal political turmoil, Vietnam entered a serious economic crisis characterized by food shortages and declining standard of living in the late 1970s and the early 1980s [35, 57, 33].

Furthermore, shortly after the war, the Vietnamese government launched a massive population redistribution program, aimed at easing urban congestion, addressing food distribution problems as well as internal and external security issues [19]. In addition to the internal migration was the exodus of refugees fleeing the country for political, economic, religious, or other reasons. Approximately 1.79 million people are estimated to have left Vietnam between 1975 and 1995 [36].

In addition, although the war with the Americans had ended, peace did not last. Vietnam entered war with Cambodia in December of 1978 over border disputes, then overthrew the Khmer Rouge in Cambodia, and maintained troops in Cambodia until 1989. There was also a brief war with China in 1979, which started as China's response to the Vietnamese attack against the Khmer Rouge [33].

These challenges may have led to declining health infrastructure in the period following the war. One report cited in Banister [7] notes:

> During the past several years as a result of economic difficulties of the entire country and shortcomings on the part of the health sector, the quality of public health activities has declined somewhat (Dang Hoi Xuan, 1983, p.48 as cited in Banister[7]).

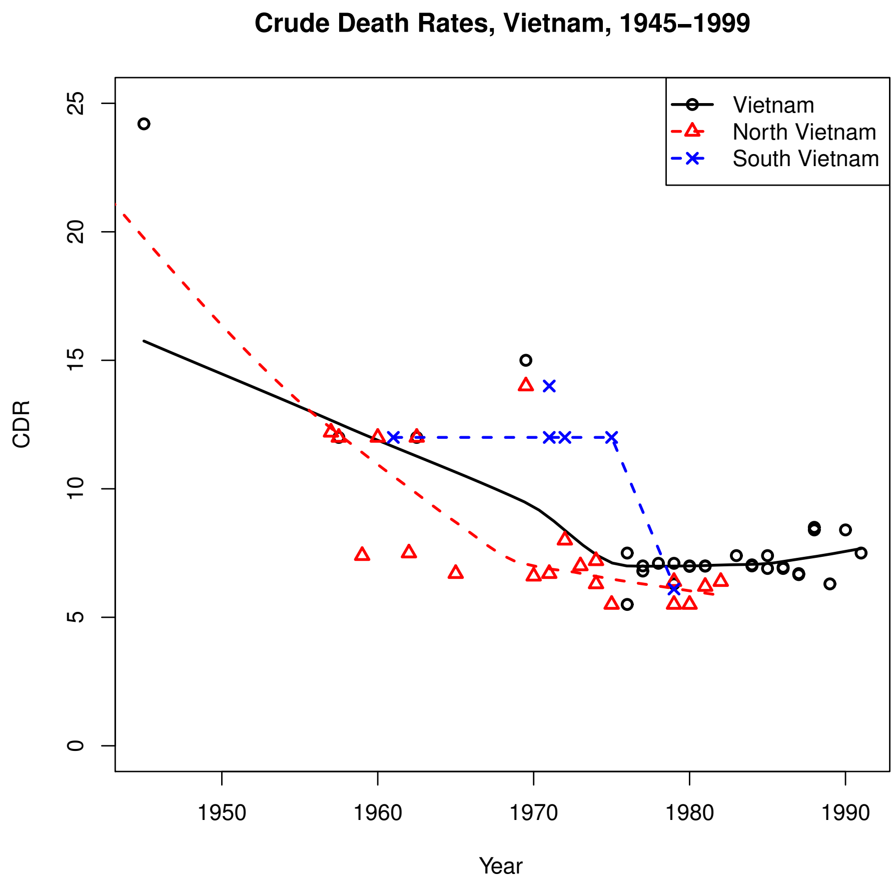
Furthermore, in the south, some one million persons may have been sent to reeducation camps or were incarcerated for political reasons [20], in addition to those who may have been relocated to the rural New Economic Zones established by the government to populate underdeveloped and politically strategic areas [19].

3 Evidence of a mortality shock on the Vietnamese population during the war

In order to understand the long-term effects of the Vietnam War on populations, it is useful to examine mortality trends in Vietnam over the past few decades to see whether mortality shocks can be observed as a result of the war, and if so, whether there is any evidence of mortality peaks during the period in which heaviest fighting had occurred. Observations of mortality shocks could be used in identifying the timing of war intensity.

Published data on mortality trends in Vietnam dating back to before the end of the war are sparse. The following set of figures presents available data on crude death rates, age-specific death rates, under-five mortality, and infant mortality. Published estimates of crude death rates in Vietnam between 1945 and 1999 are shown in Figure 1. For Vietnam as a whole, a steady decline in crude death rates is observed. There is some indication of a mortality peak around 1969.

Figure 1: Crude death rates, Vietnam, 1945-1991. The lines indicate loess curves fitted on the data. (Data sources: 1989 and 1999 Census[43], 1979 Census[7, 8], 1988 DHS[9], Ministry of Health, GSO, 1979[27], National Statistics Office[39], vital registration data, GSO[41])



Age-specific death rates from 1979 to 1999 are available through the censuses of 1979, 1989, and 1999. Figure 2 shows the age-specific death rates for men and women from the three censuses and the Vietnam Life History Survey. The age-specific death rates from the 1979 census are those calculated by Banister (Table D-2, p.88)[7] from the age-specific life expectancies reported in the 1979 census report. These were derived using deaths reported in the vital registration system in 1978 and 1979, and the 1979 census population counts [Verify in the 1979 census report and cite].

The vital registration death counts are likely to be incomplete and therefore, the mortality rates are also likely to be underestimated [7].

The 1989 census mortality uses the census question in the five percent sample schedule on deaths in the household between the Tet Holiday in 1988 and the census date, March 31, 1989 [44]. To account for the underreporting of deaths typical in responses from household retrospective mortality questions, the Preston-Coale method was applied to correct for the problem. However, as noted by others [37, 25], the Preston-Coale method assumes a stable population and therefore, if mortality before the census had been declining, then the method underestimates the completeness of death reporting. Given the trend seen in Figure 1, the adjusted 1989 census mortality estimates are likely to be overestimated.

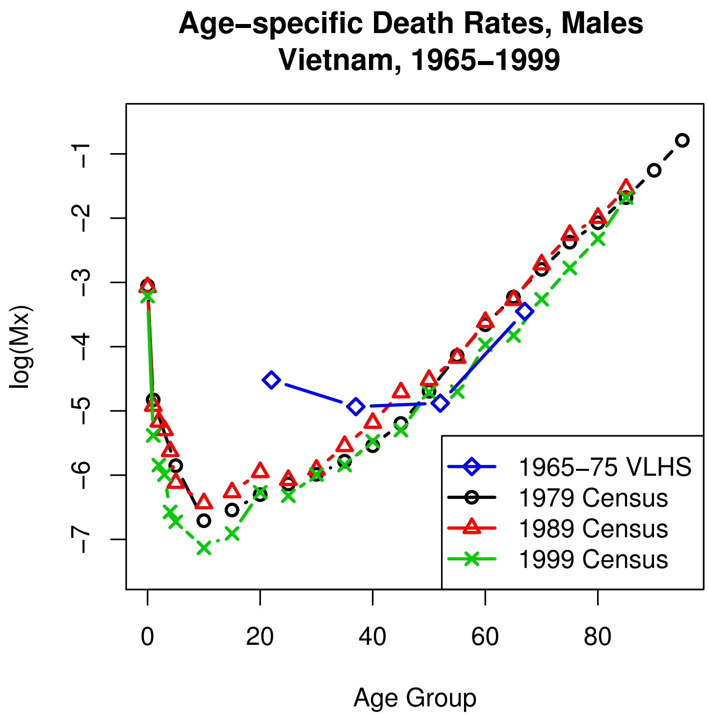
Similar to the 1989 census, the mortality estimates from the 1999 census are from the 3 percent sample questionnaire which asked about the number of deaths that occurred in the household from the last day of the lunar year to the census date, March 31, 1999 [43]. The number of deaths was adjusted using adjustment factors estimated from the post-enumeration survey on fertility and mortality.

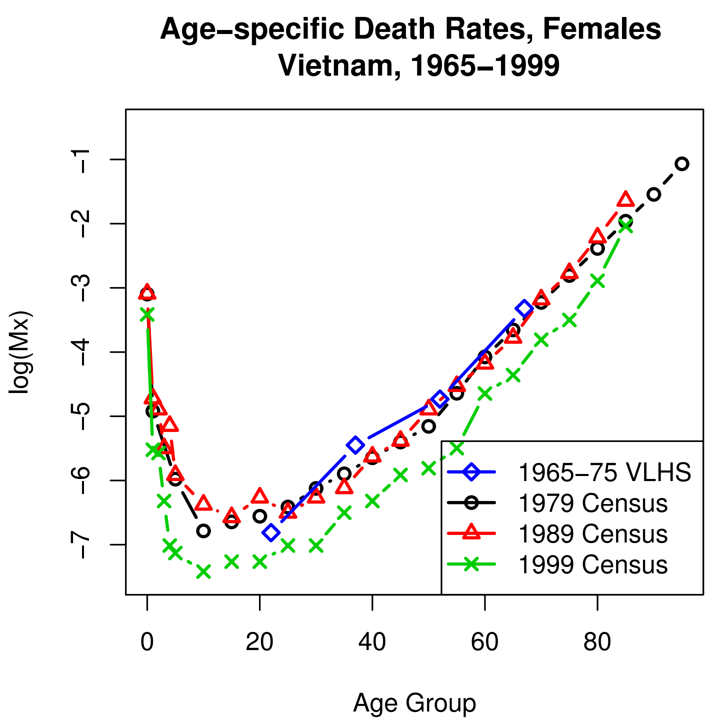
The 1965-1975 mortality rates are from reported deaths of parents and siblings from the 1991 Vietnam Life History Survey, a small sample survey (403 households) conducted in four select areas of Vietnam, using direct methods of estimation [25]. Although the sample size is small and a sub-national sample was used, the resulting estimates were fairly consistent with the life tables from the 1979 and 1989 censuses.

In comparing the four estimates of age-specific mortality by sex over time (Figure 2), all four sources show the typical J-shaped pattern of mortality for the years 1979, 1989, and 1999 for both males and females. However, for the 1965-1975 estimates calculated from the Vietnam Life History Survey, while the female rates are consistent with the general pattern, the male rates show elevated mortality in the 15-29 and the 30-44 age groups which are attributable to higher war mortality among males in this age group.

Infant and child mortality rates are examined to see whether any mortality peaks during the war can be observed. An examination of under-five and infant mortality rates do not show any

Figure 2: Age-specific death rates by sex, 1965-1999, Vietnam *(Data sources: 1979 Census[7], 1989 and 1999 Census[43], Vietnam Life History Survey[25])*





mortality peaks among children during the conflict period (Figure 3 and 4). Rather than a peak in infant mortality during the war years, mortality seems to drop, then level off during the period of intense warfare between 1965 and 1975. However, the drop may be due to under-reporting or recall bias during the war rather than an actual decline in mortality. For both under five and infant mortality, a peak is observed in the postwar period in the late 1980s. These results are consistent with Savitz et al.'s analysis [51] using the 1988 Demographic and Health Survey data to examine the Vietnamese infant and child mortality in relation to the Vietnam War. They did not find evidence for increased mortality during the war period.

In sum, available data show inconclusive evidence for increased mortality during the war. Based on the data, mortality seems to have been steadily declining as Barbieri[9] has observed. However, data collection during war time are not likely to have been complete. In addition, there are some indications of a rise in mortality during the period of intense fighting with the crude death rates showing a peak around 1969. Reports of age-specific death rates from 1965-1975 seem to indicate some increase in mortality for males from this period. Obermeyer and colleague's[42] estimates also show a peak in the number of violent war deaths during 1965-1974.

While mortality shocks are one way to measure war intensity with regard to time, given this lack of conclusive evidence for mortality shocks during the war, this study will focus on a different measure of war intensity based on geography: the U.S. bombing of Vietnam.

4 Data and methods

4.1 Data

This study uses two sources of data: data on U.S. bombing of Vietnam and the 1999 Vietnam census microdata. Data on bombing activities in Vietnam by the United States Air Force and Navy from 1965 to 1975 are used to identify intensity of war activity at the province level. The original database is from the Unites States National Archives, Record Group 218, "Records of the U.S. Joint Chiefs of Staff", compiled by the Defense Security Cooperation Agency from the 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia (SEADAB), and the Combat

Figure 3: Estimates of under-five mortality rates, Vietnam, 1960-2003. (Data sources: 1979 Census[7], 1999 Census[43], 1994 Intercensal Demographic Survey[48], 1988 DHS[9, 51], 1997 and 2002 DHS[1, 2], MICS3[45])

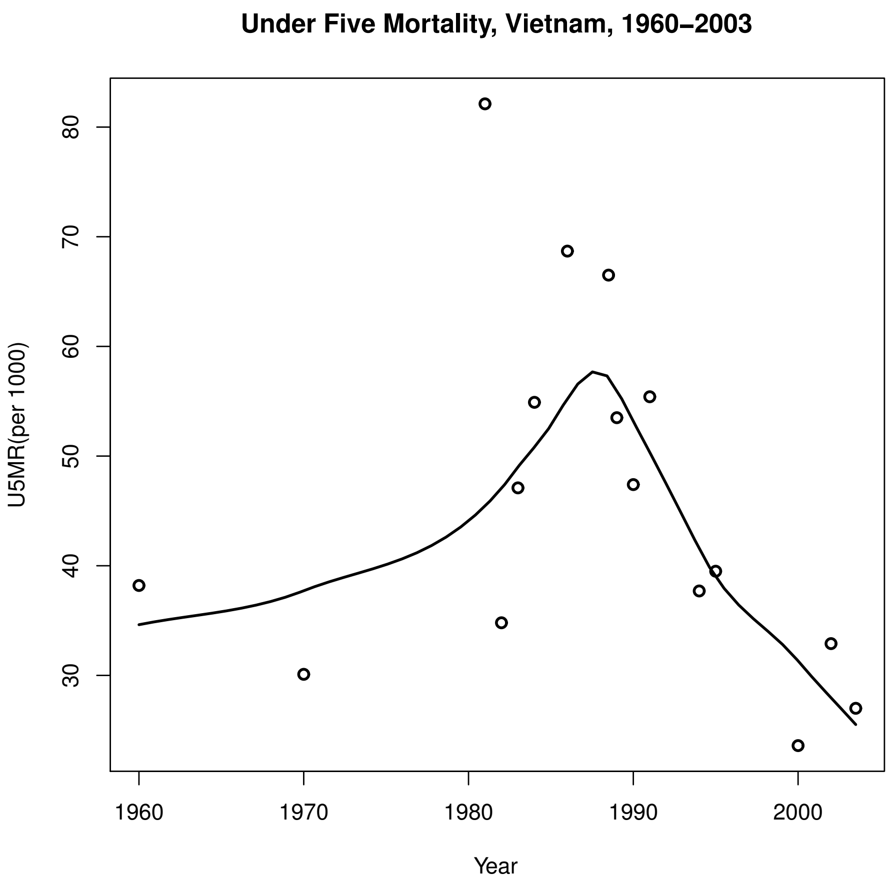
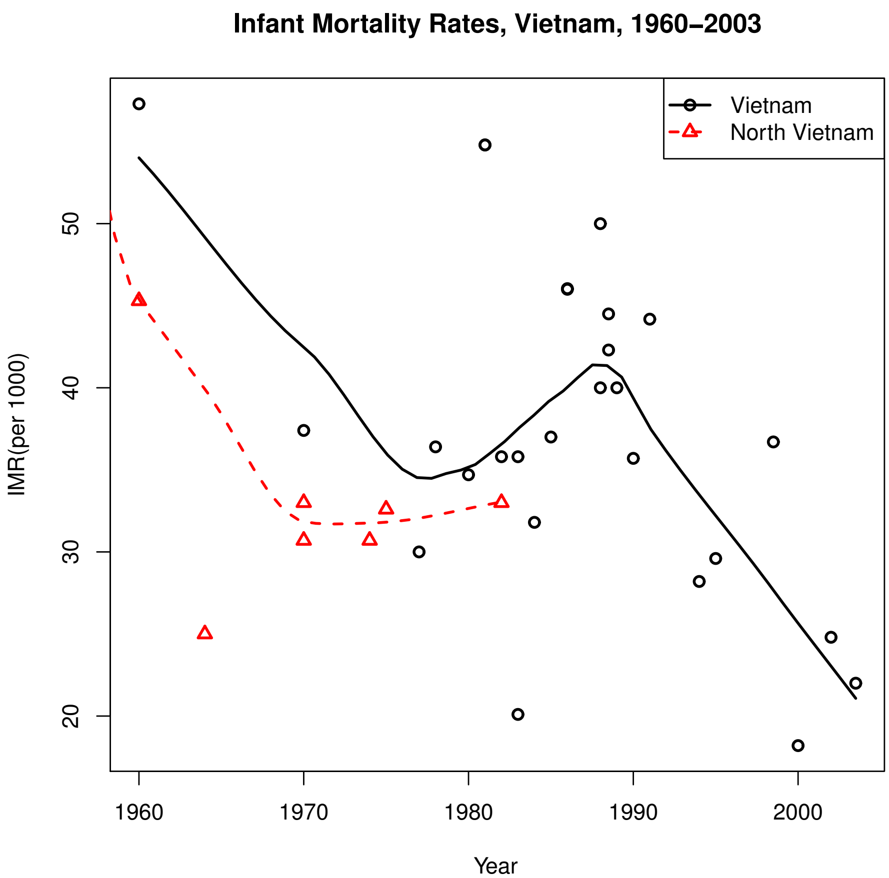


Figure 4: Estimates of infant mortality rates, Vietnam, 1960-2003. (Data sources: 1979 Census[7], 1999 Census[43], 1994 Intercensal Demographic Survey[48], 1988 DHS[9, 51], 1997 and 2002 DHS[1, 2], MICS3[45])



Naval Gunfire (CONGA) databases. The data contain information about ordnance dropped from U.S. and allied airplanes and helicopters, as well as those fired from naval ships per mission. The Vietnam Veterans of America Foundation (VVAF) geocoded the original data on the number of American bombs dropped in Vietnam to the district level using the 1999 Vietnam Population and Housing district boundaries. A more detailed description and evaluation of the data are provided by Miguel and Roland [38]. Figure 5 shows the bomb density by province between 1965 and 1975[1] There are some limitations to this dataset. First, the data do not include ground activity, therefore may not be representative of all war activity. However, if we assume that there was strong correlation between ground fighting and aerial bombing, the bombing data would provide a reasonable set of indicators of war intensity by geographic region. Further, several months of data may be missing from the dataset due to damages to the original tape archives. The extent of the missing data is unknown. Finally, the dataset presents only U.S. war activities, not Vietnamese war activities, but the study assumes that the two were highly correlated.

In addition to the bombing data, this study uses the 1999 Vietnamese census microdata, available through the Integrated Public Microdata Series–International: Version 5.0 [14]. The census was implemented on March 31, 1999 and constituted a 3 percent sample with 2,368,000 persons. Because of the potential differences in socioeconomic status by ethnic group, only those respondents belonging to the Kinh ethnic group are used in the analysis. Approximately 83.4% of the population in the 1999 census belong to the Kinh ethnic group. Table 1 presents the summary statistics of the key variables used in the analysis.

4.1.1 Outcomes examined in the analysis

The socioeconomic outcomes that are examined in the analysis include education, literacy, marital status, and labor market status. The educational variables included are completion of primary, lower secondary, and upper secondary education. Completion of primary education is defined as having completed five years of primary school. Lower secondary school completion is defined as

[1]The district level data are aggregated to the province level and bomb density is calculated by dividing the number of bombs per square kilometer for each province.

Figure 5: Total number of bombs dropped per square kilometer by province, Vietnam, 1965-1975 *(Data source: 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia(SEADAB), and Combat Naval Gunfire (CONGA) databases)*

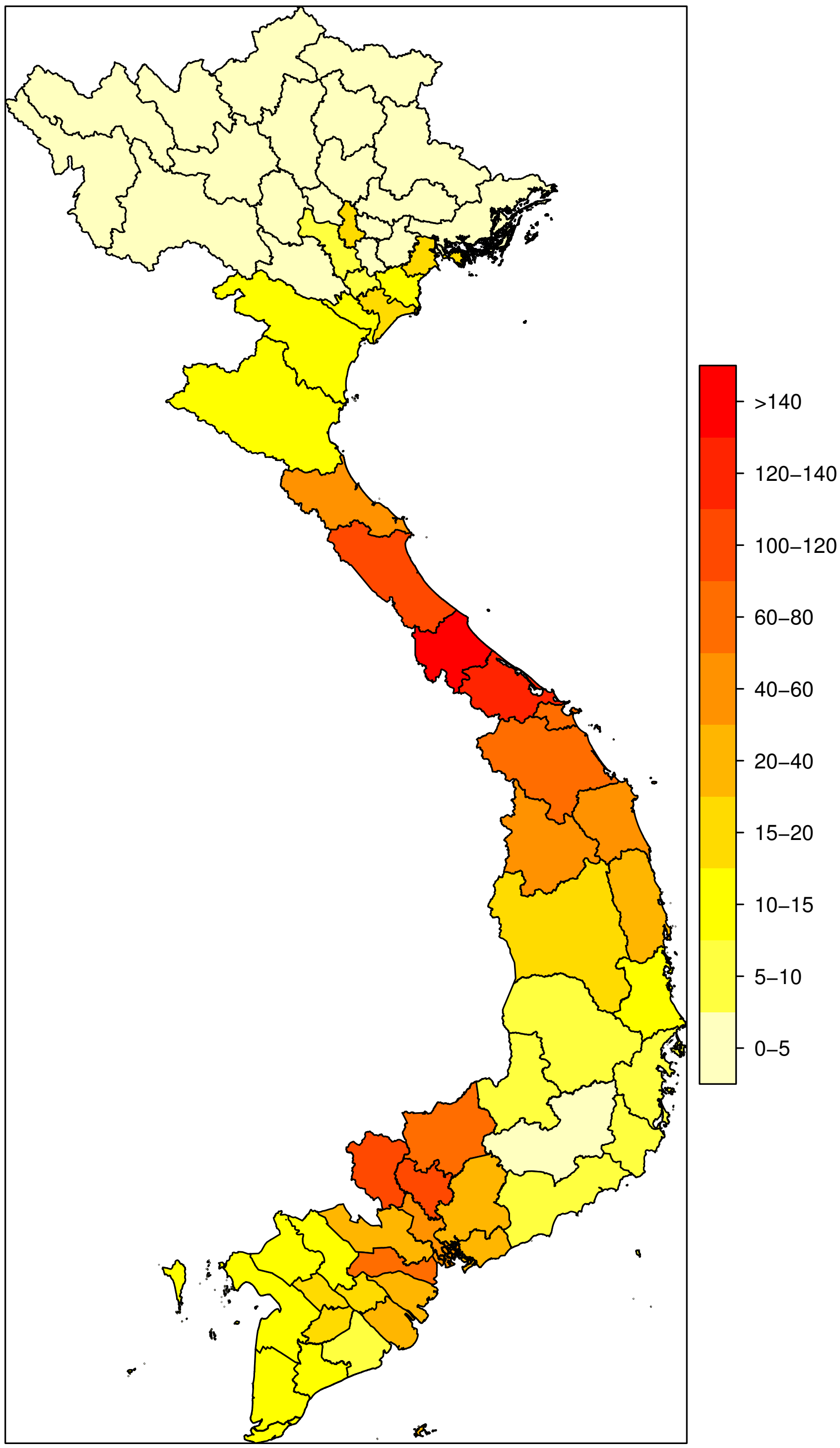


Table 1: Summary Statistics

Variable	N	Proportions	S.D.
Primary School Completed	70675	0.8695	0.3369
Lower Secondary School School Completed	70675	0.3658	0.4817
Upper Secondary School Completed	70675	0.1466	0.3537
Literate	72233	0.9667	0.1795
Married	72173	0.4965	0.5000
Employed	63225	0.9195	0.2720
War Cohort	72244	0.3222	0.4673
War Conceived Cohort	72244	0.3338	0.4716
Post War Cohort	72244	0.3440	0.4751
Low War Intensity Area	72244	0.6806	0.4663
Medium War Intensity Area	72244	0.2286	0.4199
High War Intensity Area	72244	0.0909	0.2874
Female	72244	0.5227	0.4995
Urban	72244	0.5102	0.4999

completing nine or more years of schooling. Upper secondary school completion is defined as finishing at least 12 years of schooling. Generally, lower secondary school is finished by age 15 and upper secondary school is completed by age 18. At the time of the 1999 census, the cohorts of interest are between the ages of 22 and 24. At these ages, most people who would eventually finish their education up to upper secondary school would have completed it even at the youngest age of 22. This chapter examines proportions completing primary and secondary schools as indicators of educational attainment rather than the number of years of schooling because at these ages, some who go on to post-secondary schools may not be finished with their schooling. Literacy is defined as ability to read or write in any language. Marital status is measured by whether the person was ever-married, which includes married/in union, separated/divorced/spouse absent, and widowed. Labor market status is indicated by the proportion of people employed out of those in the labor force. [2]

[2] Also examined are school attendance from the 1989 census and employment disability from the 1999 census. However, the results from school attendance are excluded because the age effect in school attendance was a major factor in the differences between cohorts. The 1989 census captured the cohorts between the ages of 12 and 14 when there was considerable drop out. Therefore, school completion would be a better indicator of educational outcome. In addition, employment disability was also examined. However, this indicator was also excluded from the final analysis because it only captures the proportion disabled who are economically inactive and therefore, would not be a true representation of the proportion of the population who are disabled.

4.1.2 Quality of the Census Data

An examination of the census data for data quality, including checking for age heaping, consistency in the number of households and household heads, and abnormalities in age and sex structure and cohort survival, reveals that the overall quality is good, but some abnormalities exist in the age and sex structure. Age heaping does not seem to be a significant problem and the patterns of age reporting are consistent between the sexes, although the levels are different. There is some evidence of heaping by birth year around years ending in "0". However, this heaping seems to be more problematic in cohorts born in 1960 or earlier and therefore is not a concern for the purpose of this paper. The consistency between the number of households and household heads is also good. However, an examination of the age and sex structure indicates that there may have been under-enumeration of males who were in the 20-24 age group in 1999 and of males in older age groups (see Figures 6 and 7). The deficit of 20-24 year old men may be of concern, since the cohorts of interest in this study fall within this age group. Another point of concern is that cohort survival between the 1989 and 1999 censuses shows a pattern of fluctuation that is not consistent with the increases in mortality associated with aging, and differs substantially by sex, especially for the age groups of interest in this analysis. A sharp drop is observed in the ten-year cohort survival rate for males in the age group that is 10-14 in 1989 and 20-24 in 1999, accompanied by a peak above unity in the cohort survival rate for the age group that is 20-24 in 1989 and 30-34 in 1999. For females, the pattern is less dramatic, showing stable cohort survival rates until the age group 40-44 after which survival declines steeply (Figure 8).

4.1.3 Evidence of the war's imprint on the population structure in the 1989 and 1999 census data.

In addition, since wars have been known to leave an imprint on the population age and sex structures, the 1989 and 1999 Vietnamese census data are inspected to see what the impact of the war may have been on the Vietnamese population. A similar investigation is conducted for the 1979 and 1989 censuses by Hirschman et al. [25]. This section extends their work by examining the characteristics of the Vietnamese population between the 1989 and 1999 censuses for the war's imprint on the population age and sex structure.

The population pyramids of Vietnam from the 1989 and 1999 censuses provide some indication that the war had a lasting impact in the population age and sex structure (Figure 6). Three indentations in the 1999 population pyramid are visible: one at the base of the pyramid, another around age 20, and finally, one around age 55. The first indentation at the base of the population pyramid reflects Vietnam's demographic transition which began during the 1990s. In contrast to the 1989 population pyramid, the base of the pyramid is no longer wide reflecting the fall in fertility, partially spurred by strong family planning policies. The latter two "dents" are possibly related to the impact of the war, and these can be explored further through the inspection of the age-specific sex ratios between 1989 and 1999. Interestingly, evidence of the war's impact on the population age and sex structure of the sort that is commonly seen in other countries is absent. The population pyramids show no evidence of a drop in fertility during the period of heavy fighting. Similarly, no indications of a baby boom are seen in the period after the war.

Figure 7 shows the age-specific sex ratios. The sex ratios in 1999 display a departure from the pattern observed in 1989. While in the 1989 census, the sex ratios drop sharply starting in the 20-24 age group and stay constant until ages 50-54, the 1999 sex ratio drops in the 20-24 age group but not so low as in 1989. The sex ratios recover to a level close to one in the 25-29 and 30-34 year age groups and decline again starting in the 35-39 age group. That the drop in the sex ratio for the 20-24 year age group is consistent for both 1989 and 1999 censuses suggests that it is systematic in nature. It is likely that this drop is due to the under-enumeartion of men due to military service. The sex ratio may be much lower in 1989 because the Vietnamese military was still occupying Cambodia in March of 1989. Other possible causes of the drop in the sex ratio includes the under-enumeration of men studying or working in other countries or other forms of sex-selective migration. The drop in sex ratio in this age group is similar to that observed by Hirschman et al. [25] in the 1979 and 1989 censuses.

An additional drop in the sex ratios is observed in the 45-49 and 50-54 age group in 1989 and for the same cohort who are 55-59 and 60-64 in 1999. It is possible that the low sex ratios in these older age groups are attributable to excess mortality of males during the Vietnam War, since these cohorts would have been in their 20s and 30s during the period with the heaviest fighting between 1965 and 1975. However, other demographic processes and reporting errors may be confounding this phenomenon, such as selective emigration of refugees who left Vietnam after the end of the war in 1975, sex-selective age misstatement, or sex-selective under-enumeration.

Cohort survival rates between 1989 and 1999 provide further indication that the drop in the sex ratio in the 20-24 age group is not likely to be due to the war (see Figure 8). As shown earlier, the drop in ten-year cohort survival rate for males in the age group that is 10-14 in 1989 and 20-24 in 1999 is accompanied by a cohort survival rate of greater than one among the age group that is 20-24 in 1989 and 30-34 in 1999. This peak in male cohort survival rates implies that there is return migration or counting of a previously under-enumerated population. If the drop in the cohort survival rate is due to the war, we would not expect to see a corresponding peak. Therefore, this drop in cohort survival likely reflects emigration, the under-enumeration of military personnel, students studying abroad, or laborers working overseas rather than a delayed mortality impact of the war. A similar pattern is observed between the 1979 and 1989 censuses [25].

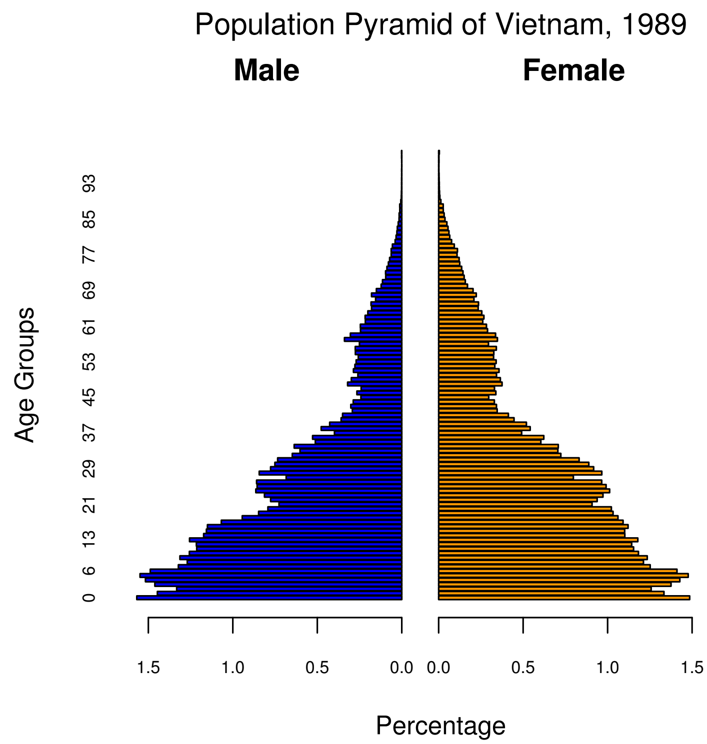
In sum, based on the examination of the population pyramid, age-specific sex ratios, the war's impact on the population structure is seen in the age groups between 55 to 64 in 1999. While a dent in the population pyramid and a deficit in males is observed in the younger age groups, the evidence from the cohort survival rates indicates that these are more likely to be due to other causes.

4.2 Method

This study applies the difference-in-differences method by making use of two sources of variation in exposure to the war: variations in the effects of war across birth cohorts and by war intensity. Using the census and bombing data, I compare the difference in outcomes between "treatment" cohorts and the "control" cohort in both "treatment" provinces and "control" provinces.

The first source of control is established through birth cohorts. The treatment cohorts are those that are born or conceived during the war. The cohort born after the war is considered the control cohort. Table 2 shows the cohorts, their birth months and years, and their ages at the time of

Figure 6: Population Pyramid, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International[14])*



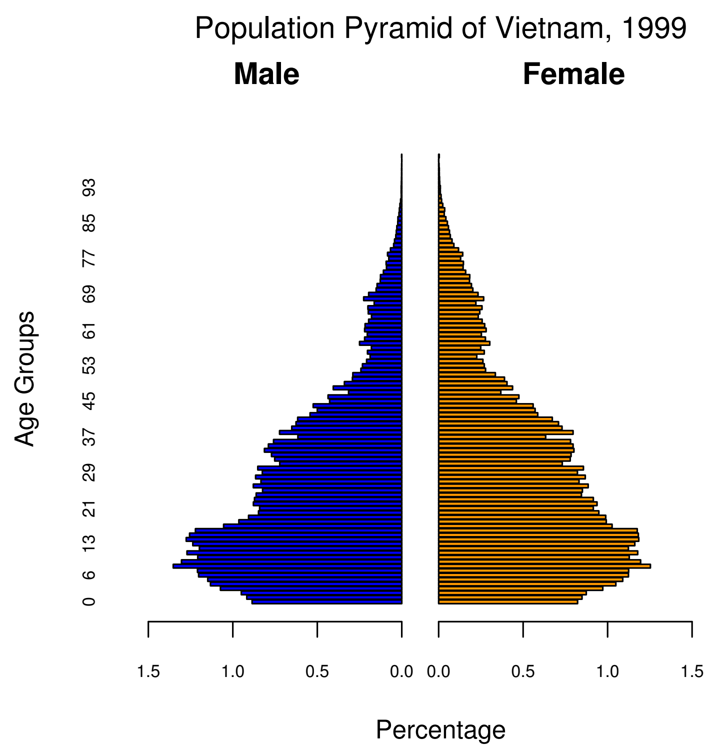


Figure 7: Sex Ratios by five-year age groups, Vietnam, 1989, 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International[14])*

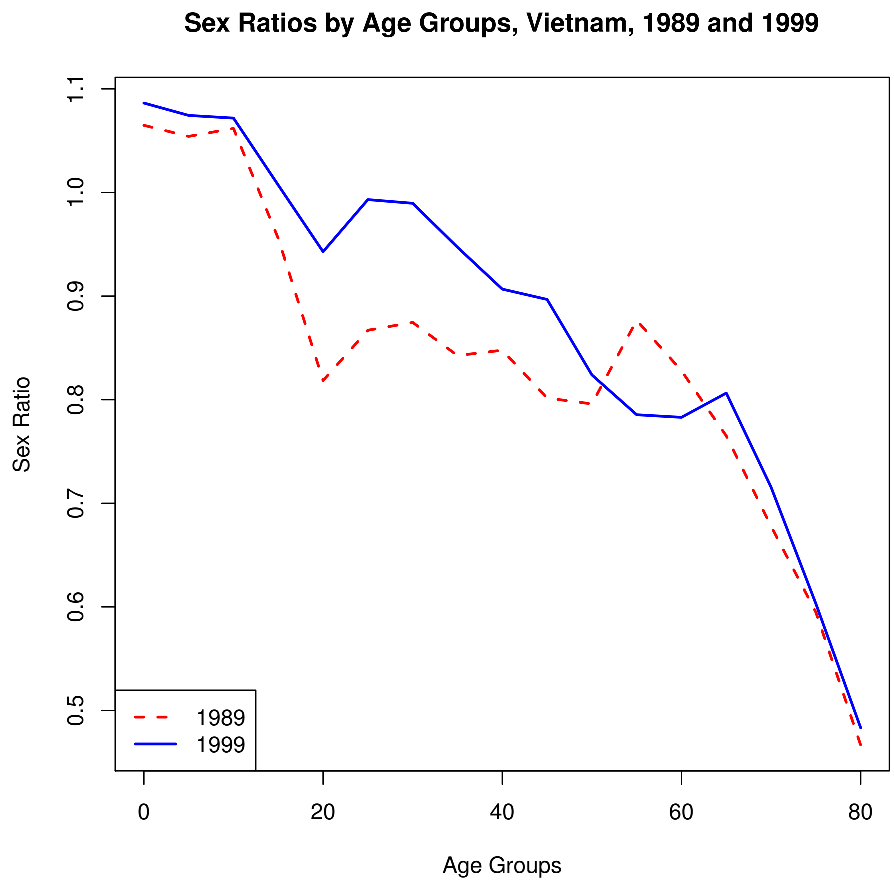
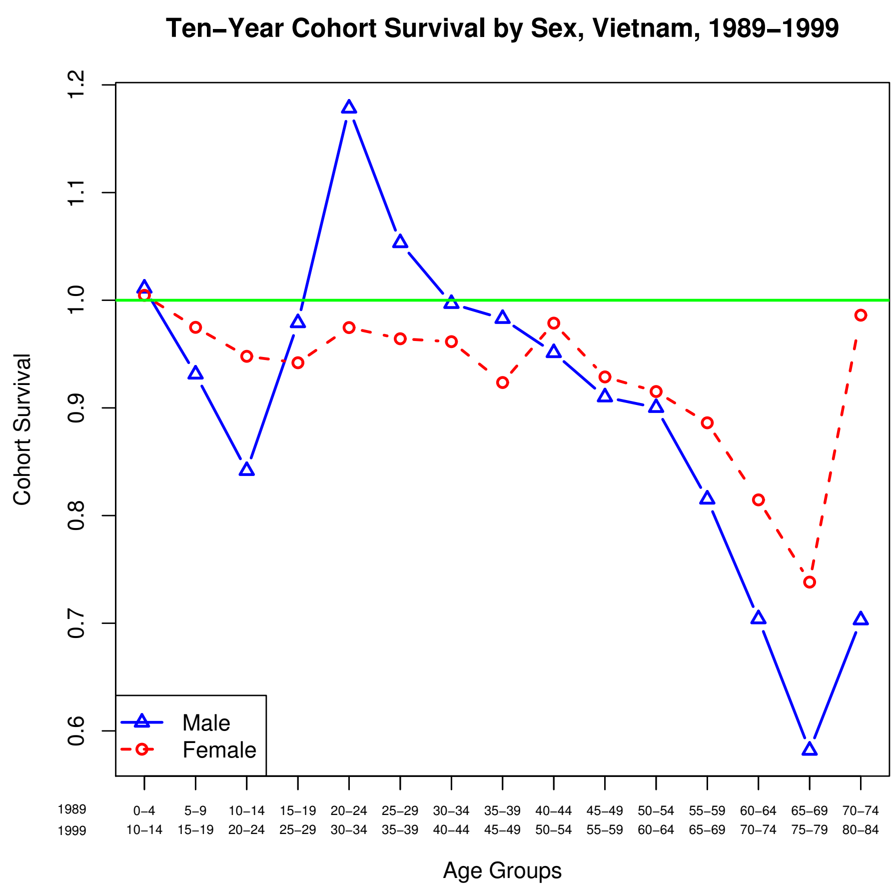


Figure 8: Ten-year Cohort Survival Rates, Vietnam, 1989-1999*(Data source: 1989 and 1999 Vietnam Census, IPUMS International[14])*



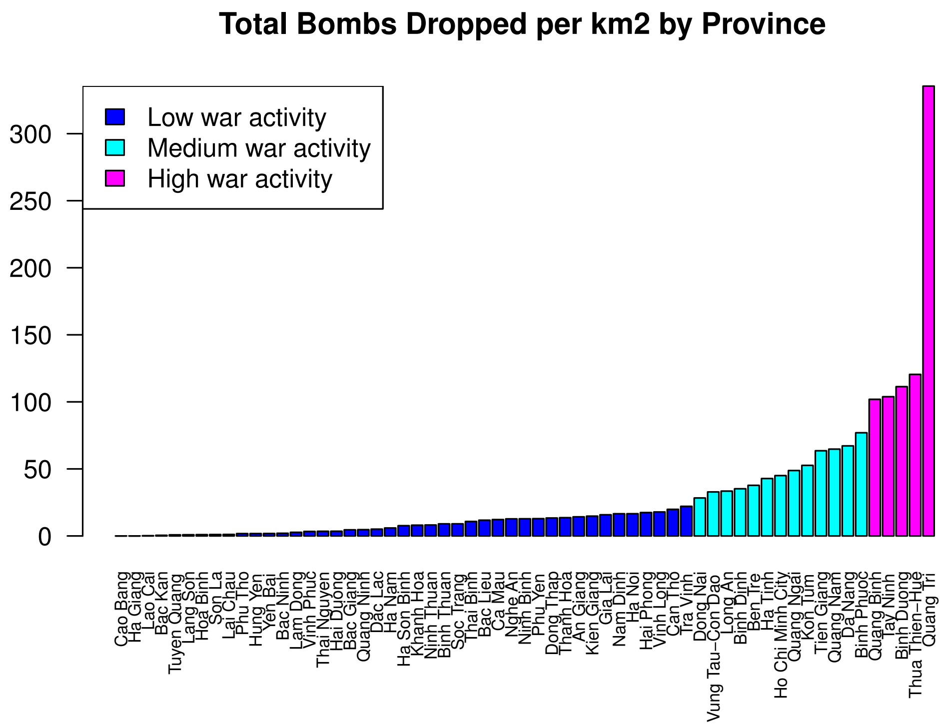
the 1999 census. The war-conceived cohort consists of those who are exposed to the war *in utero* before the fall of Saigon on April 30,1975, but not exposed to the war after birth. The date of conception is determined based on the month and year of birth, assuming nine months of gestation. The war-born cohort includes those born exactly one year before the war-conceived cohort. The control cohort, the postwar conceived group, is selected based on having been born one year after the war-conceived cohort. The cohorts are chosen in this manner to control for the possible effects of month of birth on later life outcomes.

Table 2: Age of cohorts

Cohort	Birth Period	Age at 1999 Census
War-born	May 1974-Jan 1975	24
War-conceived	May 1975 - Jan 1976	23
Postwar	May 1976 - Jan 1977	22

Additional controls are established through a measure of war intensity, based on where the heaviest bombing had occurred. Provinces are assigned as having experienced high, medium, and low bombing activity according to the number of bombs dropped per province by Americans between 1965 and 1975. High war intensity provinces are provinces where more than 100 bombs were dropped per square kilometer. Medium war intensity provinces saw between 25 and 100 bombs per square kilometer. Finally, less than 25 bombs per square kilometer were dropped on low war intensity provinces. Figure 9 shows the bomb density by province and corresponding war activity classification. Ideally, war intensity in the place of birth would be used as an indicator of war exposure. However, since the census data do not include place of birth, the place of residence in 1999 is used as a proxy for the location of conception and birth. To mitigate the effects of migration since conception and birth, analysis is conducted only on those who had lived in the same province five years prior to the time of the census. Furthermore, bombing density ideally would be determined by dividing the number of bombs dropped by the population in the province, but since population estimates by province during the war are not available, the total area of the province is used.

Figure 9: War activity classification and total U.S. ordnance dropped per square kilometer by province, Vietnam, 1965-1975. (Data source: U.S. ordnance data)



The difference-in-differences can be estimated in two ways. First is the unadjusted difference-in-differences which can be calculated through a series of 2x2 tables. The difference between outcome proportions between the treatment and control cohorts are calculated separately for the treatment and control areas. Then, the difference-in-differences is calculated by taking the difference between the two differences. In the example shown in Table 3, the difference between proportions completing upper secondary school in high war intensity areas between the war cohort (treatment) and the postwar cohort (control) is first calculated (0.0818-0.0602=0.0216). The same is done for low war intensity areas (0.2053-0.1564=0.0489), which represents the difference that can be observed between the cohorts in areas with minimal war exposure. Then the difference-in-differences is calculated by subtracting the difference between the cohorts in the low war intensity areas from the difference in the high war intensity areas (0.0216-0.0489 = -0.0273). As illustrated in

Figure 10, the difference-in-differences of -0.0273 represents the difference between the proportion completing upper secondary school in the "treatment" cohort (i.e. the war-born cohort) and what the proportion would have been if the cohort had not been exposed to high levels of bombing. Hence, the difference-in-differences estimate attempts to capture the causal effect of war exposure on upper secondary school enrollment. In this example, it tells us that the upper secondary school school completion rate of individuals exposed to the war are 0.0273 lower than it would have been if the difference between the war and postwar cohorts was the same as that in the low war intensity areas.

Table 3: Example of Difference-in-Differences Calculation: Upper Secondary School Completion, North Vietnam

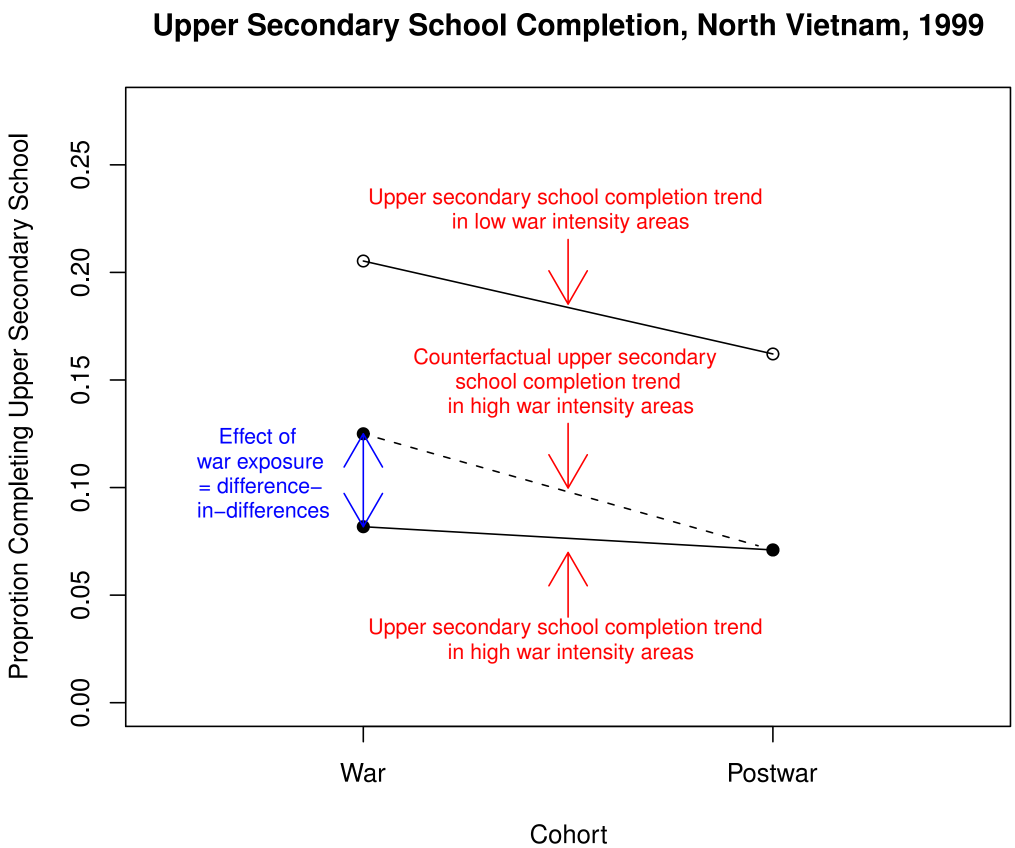
	War cohort	Postwar cohort	Difference
High war intensity	0.0818	0.0602	0.0216
Low war intensity	0.2053	0.1564	0.0489
Difference	-0.1235	-0.0962	-0.0273

Another way to estimate the difference-in-differences is through regression. The advantage of using the regression method is that it allows for adjustment for other factors, namely sex and urban residence. The long-term effects of the war on the outcomes are estimated by applying the following model:

$$Y_{ijc} = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i + \epsilon_{ijc} \tag{1}$$

where Y is a binary outcome variable. A is the set of dummy variables for medium and high war intensity areas, C is the set of dummy variables for the war-conceived and war-born cohorts, F is the dummy for being female, U represents the dummy variable for urban, and ϵ is the error term. In addition, i indexes the individual, j indexes the war-activity areas (high and medium), and c indexes the cohorts (war-born and war-conceived). Also included in the estimated equation are two-way interaction terms between the cohort variables and variables for sex and urban, as well as those between the war-intensity variables and sex and urban indicators (not shown). Robust

Figure 10: Illustrated example of difference-in-differences in proportion completing upper secondary school comparing the war and postwar cohorts in high and low war intensity areas, North Vietnam.



standard errors are calculated using the Huber-White method, clustered at the province level. R programming language was used for the analysis [49].

The difference-in-differences estimates of interest are the coefficients on the interaction terms between war activity and cohort, β_{3jc}. These coefficients measure the estimated effects of exposure to the war on socioeconomic outcomes. The difference-in-differences estimates can be interpreted in several different ways depending on the trends in the outcome variable. The underlying conditions that produce the difference-in-differences estimates and the potential outcomes of the difference-in-differences estimates are summarized in Table 4.

The expected outcome of the difference-in-differences estimates vary by the dependent variable of interest. For educational attainment, we would expect the postwar cohorts to have higher or the same level of educational attainment than the war or war-conceived cohort for a couple of reasons. First is that in developing countries, we generally would expect each successive birth cohort to have progressively higher educational levels than the cohorts before them. At a minimum, we would not expect the levels to decline. Second, if our hypothesis is correct in that early life exposure to the war would result in negative socioeconomic outcomes, then we should see lower levels of educational attainment among the war and war-conceived cohorts and in areas more heavily affected by the war.

Similar arguments can be made for literacy. Therefore, as shown in Table 5, the possible conditions from Table 4 and the expected outcome of the difference-in-differences for educational attainment and literacy are 1A (-), 1B(+), 5(-), 6(+), 7(+), and 8(+). The degree to which we can attribute a causal effect of war exposure on the outcomes depends on whether the observed conditions match the expected conditions underlying the difference-in-differences estimates. Note that the expected difference-in-differences estimates can be either positive or negative. Therefore, care must be taken to not simply interpret negative difference-in-differences as an adverse effect and a positive difference-in-differences as a beneficial impact of exposure to the war. While all of the conditions mentioned in Table 5 can be explained by the effect of war exposure, Conditions 1A, 5, and 8 are more directly interpretable as the effects of war exposure because the war exposed cohorts display worse outcomes than the postwar cohort.

For marriage, we would expect the postwar cohorts to have lower proportion ever-married by virtue of being younger. In addition, we would also expect the areas more heavily impacted by the war to have lower proportion ever-married since exposure to the war may delay marriage. Similarly, for employment, we would expect lower proportion employed among the postwar cohorts based on the age at which people enter the labor market. We would expect the war and war-conceived cohorts which have one to two years more work experience to have higher employment rates than the postwar cohort. Table 5 displays the possible trends that can be expected from the difference-in-differences for marriage and employment. Of the expected conditions mentioned in Table 5, Conditions 2B, 4, and 9 have more straightforward interpretations explaining the effects of war exposure.

In order to see the differential impact of the war on women and in urban areas, two additional models are applied that interacts the difference-in-differences estimators with a female dummy variable (Model 2) and an urban dummy variable (Model 3). The three-way interaction terms shown in the two equations below represent the difference in the difference-in-differences or the added effect of being female and the added effect of living in an urban area on the effect of war-exposure (β_{11jc}).

$$Y_{ijc} = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i + \boldsymbol{\beta_{11jc}}(\mathbf{A_j} * \mathbf{C_c} * \mathbf{F_i}) + \epsilon_{ijc} \qquad (2)$$

$$Y_{ijc} = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i + \boldsymbol{\beta_{11jc}}(\mathbf{A_j} * \mathbf{C_c} * \mathbf{U_i}) + \epsilon_{ijc} \qquad (3)$$

The above models do not control for family characteristics such as father's education, mother's education, and number of siblings, because the data only contain information on the current household of the individuals, not their family background. Therefore, it would be possible to control for family characteristics only for those living with a parent at the time of the census. This would introduce an additional bias to the analysis since those who live with parents may have different

Table 4: Conditions that produce the difference-in-differences estimators.

Possible Conditions	Difference-in-differences
1. Conditions improved after the war in all areas.[1]	
A. Conditions improved more in areas heavily affected by the war.[2]	–
B. Conditions improved more in areas less affected by the war.[3]	+
C. Conditions improved equally in all areas.	0
2. Conditions deteriorated after the war in all areas.	
A. Conditions deteriorated more in areas heavily affected by the war.	+
B. Conditions deteriorated more in areas less affected by the war.	–
C. Conditions deteriorated equally in all areas.	0
3. Conditions stayed the same in all areas after the war.	0
4. Conditions improved in areas heavily affected by the war but deteriorated in less affected areas.	–
5. Conditions improved in areas heavily affected by the war but stayed the same in less affected areas.	–
6. Conditions deteriorated in areas heavily affected by the war but improved in less affected areas.	+
7. Conditions deteriorated in areas heavily affected by the war but stayed the same in less affected areas.	+
8. Conditions stayed the same in areas heavily affected by the war but improved in less affected areas.	+
9. Conditions stayed the same in areas heavily affected by the war but deteriorated in less affected areas.	–

[1] By this I mean that the postwar cohort was better off than the war-conceived or war-born cohort.
[2] These include regions classified as high and medium war activity areas.
[3] These include regions classified as low war activity areas.

Table 5: Expected conditions and the resulting difference-in-differences for each of the outcome variables

Variable	Expected Conditions[1]	Difference-in-differences	Possible Explanations
Primary, lower secondary and upper secondary school completion, and literacy	1A*	-	Conditions improved more in areas more heavily affected by the war than in low war intensity areas because the more heavily affected areas are catching up to areas less affected by the war.
	1B	+	Conditions in areas more heavily affected by the war did not improve as fast as the conditions in less affected areas because of the lasting impact of the damages caused by the war.
	1C, 3	0	No effect of war exposure.
	5*	-	There is no change in conditions in low war intensity areas because the war did not affect those areas. The more heavily affected areas show improvement in conditions after the war because the damages from the war are no longer present.
	6	+	Conditions in were worse after the war in areas more affected by the war because of the lasting impact of the damages caused by the war.
	7	+	There is no change in conditions in low war intensity areas because the war did not affect those areas. The more heavily affected areas show worse conditions after the war because of the lasting impact of the damages caused by the war.
	8*	+	Conditions in areas more affected by the war stagnated because of the lasting impact of the damages caused by the war.

(Continued on next page)

[1] These refer to the possible conditions in Table 4. *These conditions reflect more direct effects of war exposure.

(Continued from the previous page)

Variable	Expected Conditions	Difference-in-differences	Possible Explanations
Marriage and Employment	2A*	+	The postwar cohort shows delayed marriage/employment in the war affected areas relative to the less affected areas.
	2B	-	The war-exposed cohorts show delayed marriage/employment in the war affected areas relative to the less affected areas.
	2C	0	No effect of war exposure.
	4*	-	The war-exposed cohorts show delayed marriage/employment in the war affected areas.
	9*	-	The war-exposed cohorts show delayed marriage/employment in the war affected areas.

*These conditions reflect more direct effects of war exposure.

characteristics from those who do not. Therefore, these characteristics are omitted from the model.

The results are reported separately for North and South Vietnam in order to account for the different experiences that North and South Vietnam may have had with regards to war intensity.[3]

5 Results

5.1 Descriptive Results

5.1.1 General trends

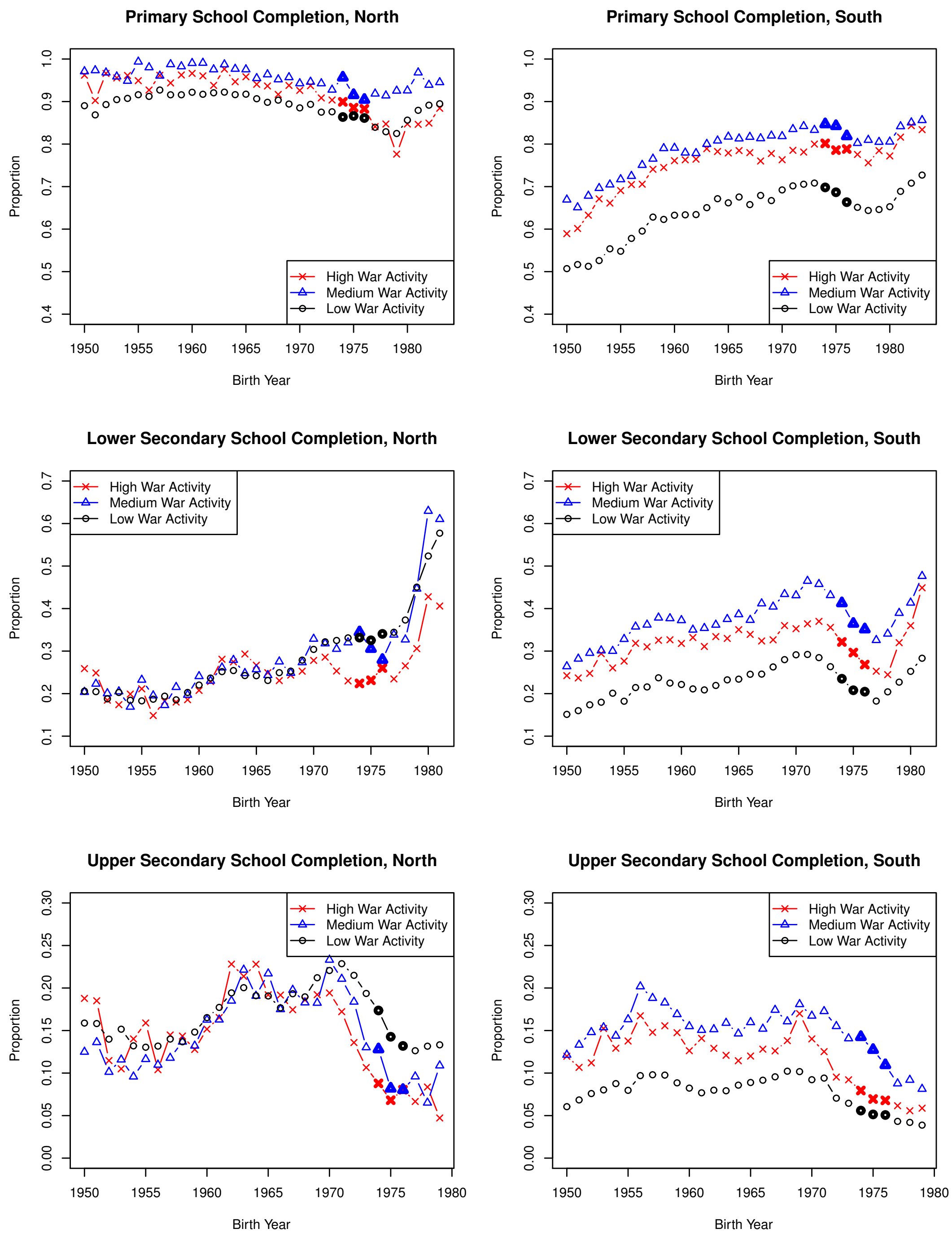
Figures 11 and 12 show the trends in the outcome variables by war intensity and north and south Vietnam. These figures reveal a few interesting trends. First, the patterns of education in north and south Vietnam are very different (Figure 11). Primary school completion is much higher in the north than in the south. In the south, the trends show a steady increase for cohorts born before 1975, after which there is a slight decline, but the cohorts begin to recover after 1978. In the north, the trends in primary school completion are fairly stable for those born during the war. A very gradual decline in proportion completing primary school is seen beginning with the cohorts born in the mid-1960s. The north shows a similar pattern to the south in that proportion completing primary school reaches a trough around the same cohort as the south, but recovers among the cohorts born later.

Furthermore, in the north, the high war activity areas show the lowest rates of lower and upper secondary school completion. The proportion completing upper secondary school in the medium war activity areas is also lower than that in the low war activity areas in the north. In contrast, the south shows much lower rates of school completion in the low war activity areas than in the medium or high war activity areas.

In examining the proportions ever-married, the low war intensity areas show higher proportions married than the high and medium war activity areas in both north and south Vietnam. Similarly, the low war intensity areas show higher rates of employment than the high and medium war activity areas in the south, but the same pattern is not observed in the north.

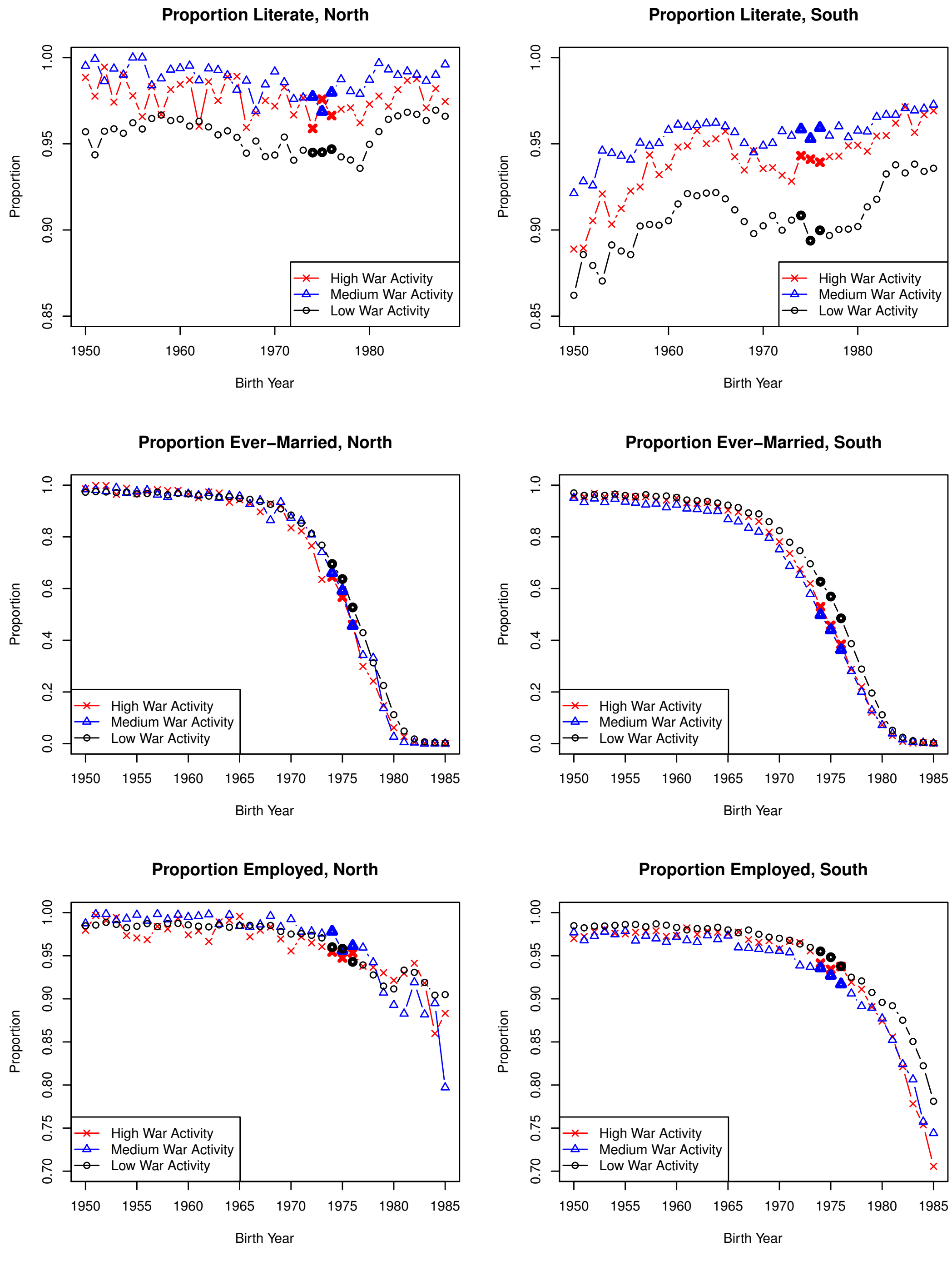
[3]Quang Tri Province was included as part of South Vietnam because the majority of the province lies in South Vietnam, although technically, Quant Tri Province was split between North and South Vietnam.

Figure 11: Trends in educational outcomes by birth year and war intensity, Vietnam, 1999.[1]



[1] The approximate cohorts of interest are indicated in bold. The cohorts do not correspond exactly to the cohorts used in the difference-in-differences analysis. Each of the cohorts spans two birth years, but the cohorts are represented with only one birth year in the figures. The birth year which encompass the majority of the cohort is bolded. Further, the bolded cohorts represent the entire birth year rather than a partial year.

Figure 12: Trends in literacy, marriage, and employment outcomes by birth year and war intensity, Vietnam, 1999.[1]



[1] The approximate cohorts of interest are indicated in bold. The cohorts do not correspond exactly to the cohorts used in the difference-in-differences analysis. Each of the cohorts spans two birth years, but the cohorts are represented with only one birth year in the figures. The birth year which encompass the majority of the cohort is bolded. Further, the bolded cohorts represent the entire birth year rather than a partial year.

5.1.2 Unadjusted proportions and difference-in-differences

Tables 6 and 7 summarize the basic unadjusted proportions of the outcome variables and the difference-in-differences in north and south Vietnam for the cohorts of interest.

North Examining educational attainment in the north (Table 6, a-c), areas exposed to high and medium war intensity show sizably lower educational attainment than the low war intensity areas for all cohorts with one exception (primary school completion for the war-born cohort in the medium war intensity areas). This is consistent with our expectation that war impacted areas would have lower levels of educational attainment.

Comparing across cohorts, contrary to our prediction that educational outcomes generally improve over each birth cohort, the data show that the war and war-conceived cohorts generally have higher primary and upper secondary school completion rates than postwar cohorts with a couple of exceptions. For lower secondary school completion in the north, the proportions in high and low war intensity areas are consistent with our expectations, but not in the medium war intensity areas.

Analyzing the difference-in-differences for these three educational outcomes presents a challenge because the educational attainment of the postwar cohort is not consistent with our expectation that educational attainment improves with each birth cohort. The lower educational attainment of the postwar cohort may indicate that postwar conditions did not improve in the north or that there may be other unobserved variables that are confounding the results. Because the control cohort may have experienced hardships indirectly related to the degree of war exposure, it is not clear whether the effect of war exposure can be garnered from these difference-in-differences. These difference-in-differences can be interpreted in the context of the conditions that produce the estimates presented in Table 4 and the list of expected conditions for each outcome of interest shown in Table 5. For example, the positive difference-in-differences for primary school completion contrasting high war intensity war cohort to low intensity postwar cohort (0.0120) can be interpreted as Condition 2A in Table 4, where the probability of primary school completion is lower for the postwar cohort, but the postwar cohort in high war intensity areas had even lower probability than those in areas that saw less war activity. Condition 2A is not one of the expected results shown in Table 5. Although it is apparent that whatever factor that caused the educational attainment for the postwar cohort to drop may have had a larger effect in the high war intensity area, it is difficult to conclude that the effect observed in this difference-in-differences estimate is related to the war.

In another example, the negative difference-in-differences observed for the war-conceived cohort in high war intensity areas can be interpreted as Condition 5 in Table 4. The postwar cohort has higher proportion completing primary school than the war-conceived cohort in the high war intensity area, but in the low war intensity areas, the proportions are about the same across the two cohorts. Condition 5 is included in one of the expected results shown in Table 5, and therefore, we should not rule out the possibility of the effect of war exposure on primary school completion.

The results for lower secondary school completion in the north are the most consistent with our expectations. Both high and medium war intensity areas show lower probabilities than low war intensity areas and the postwar cohort in the low war intensity areas has higher educational attainment than the war and war conceived cohort. The resulting difference-in-differences estimates are close to zero for the two cohorts in high war intensity areas, which fall under Condition 1C in Table 4 and positive in medium war intensity areas, which can be characterized under Condition 6. Both of these conditions are in accordance with the expected outcomes outlined in Table 5.

Descriptive results on literacy, marriage and employment in the north are more consistent with our theory of lower socioeconomic outcomes among war-exposed populations. With literacy (Table 6, d), again, the high and medium war intensity areas have lower rates of literacy as compared to the low war intensity areas as expected. The cohorts generally have about the same level of literacy, which is also not surprising since the literacy levels are close to 100% in all cohorts. The one exception is in the medium war intensity areas where the rates are lower among the war and war-conceived cohorts. The difference-in-differences estimates for literacy are mixed but the estimates are very close to zero (<0.01) in most cases.

For marriage (Table 6, e), similar to what was observed in Figure 12, the low war intensity areas have higher proportion ever-married than the other two areas with one exception. Further, as expected, the postwar cohort has lower proportion who had ever married. The difference-in-differences estimates are mostly negative and fall under Conditions 2A and 2B as expected.

With regard to employment (Table 6, f), the rate is higher in medium war intensity areas than in low war intensity areas, but lower in high war intensity areas than low war intensity areas except in one case. Therefore, the interpretation of the effect of war intensity is unclear. High war intensity areas show employment levels that are consistent with our theory, but it is unclear why the medium war intensity areas would have higher rates of employment than the low intensity areas. There may be some unobserved variables that are confounding the results in the medium war intensity areas. Across cohorts, the results are more consistent with our expectations. The postwar cohorts have lower levels of employment than the older cohorts as we would expect with one exception in the medium war intensity areas. The difference-in-differences estimates are all negative and can be described under Condition 2B and 4 in Table 4 and as explained in Table 5.

South The patterns in the south (Table 7) are very different from those seen in the north. Educational attainment in the south (Table 7, a-c) shows that school completion in high and medium war intensity areas is higher than in low war intensity areas. This is contrary to our expectations. The trends across cohorts also display unpredicted patterns where the postwar cohorts have lower educational attainment than the war or war-conceived cohorts.

In four cases, the difference-in-differences estimates are observed as expected in Table 5. These fall under Condition 6 (upper secondary school completion for the war cohort in high and medium war intensity areas) and Condition 7 (lower secondary school completion for the same groups). For the others, because the trend in the control areas shows declining educational attainment contrary to expectations, it is difficult to understand the difference-in-differences as the true effects of war exposure. Most of the difference-in-differences estimates do not fall under the expected conditions shown in Table 5. However, in most of these unexpected cases, the difference-in-differences is small (0.01), suggesting that there was almost no effect.

With literacy in the south, (Table 7, d), the levels are higher in high and medium war intensity areas than in the low war intensity areas. This is inconsistent with our expectation. Across cohorts, the levels are approximately the same. The difference-in-differences estimates for literacy are mostly positive but estimates are all very close to zero.

As in the north, the results for marriage and employment are more consistent with our expectations. Lower proportions married are found in high and medium war intensity areas relative to low war intensity areas and the war and war-conceived cohorts have higher proportions married. The same is mostly true for employment with a couple of exceptions. The difference-in-differences for marriage and employment are mostly negative or close to zero and mostly fall under Condition 2B or 2C, except one, which is categorized under Condition 4 (employment, for war conceived cohort in high war intensity areas).

Table 6: Unadjusted proportions and difference-in-differences of selected outcomes, North Vietnam

(a) Primary School Completion

War Intensity	War	War Conc.	Postwar
High	0.9162	0.8875	0.9026
Medium	0.9546	0.9081	0.8976
Low	0.9411	0.9418	0.9395
Difference-in-Differences			
High	0.0120	-0.0174	
Medium	0.0554	0.0082	

(b) Lower Secondary School

War Intensity	War	War Conc.	Postwar
High	0.2332	0.2384	0.2465
Medium	0.3560	0.2874	0.2715
Low	0.3836	0.3822	0.3920
Difference-in-Differences			
High	-0.0049	0.0017	
Medium	0.0929	0.0257	

(c) Upper Secondary School

War Intensity	War	War Conc.	Postwar
High	0.0818	0.0710	0.0602
Medium	0.1373	0.0652	0.0742
Low	0.2053	0.1621	0.1564
Difference-in-Differences			
High	-0.0273	0.0051	
Medium	0.0143	-0.0147	

(d) Literacy

War Intensity	War	War Conc.	Postwar
High	0.9717	0.9749	0.9702
Medium	0.9768	0.9684	0.9830
Low	0.9810	0.9833	0.9821
Difference-in-Differences			
High	0.0025	0.0035	
Medium	-0.0051	-0.0158	

(e) Marital Status

War Intensity	War	War Conc.	Postwar
High	0.6327	0.5695	0.4663
Medium	0.6759	0.5609	0.4425
Low	0.6676	0.6060	0.4855
Difference-in-Differences			
High	-0.0156	-0.0173	
Medium	0.0513	-0.0021	

(f) Employment Status

War Intensity	War	War Conc.	Postwar
High	0.9493	0.9442	0.9395
Medium	0.9728	0.9537	0.9627
Low	0.9510	0.9515	0.9338
Difference-in-Differences			
High	-0.0074	-0.0130	
Medium	-0.0071	-0.0267	

Table 7: Unadjusted proportions and difference-in-differences of selected outcomes, South Vietnam

(a) Primary School Completion

War Intensity	War	War Conc.	Postwar
High	0.8173	0.7972	0.7926
Medium	0.8728	0.8539	0.8294
Low	0.7261	0.7246	0.6993
Difference-in-Differences			
High	-0.0021	-0.0207	
Medium	0.0166	-0.0007	

(b) Lower Secondary School

War Intensity	War	War Conc.	Postwar
High	0.3134	0.2919	0.2642
Medium	0.3940	0.3606	0.3251
Low	0.2474	0.2104	0.2090
Difference-in-Differences			
High	0.0108	0.0264	
Medium	0.0305	0.0341	

(c) Upper Secondary School

War Intensity	War	War Conc.	Postwar
High	0.0717	0.0714	0.0602
Medium	0.1289	0.1152	0.0871
Low	0.0573	0.0509	0.0529
Difference-in-Differences			
High	0.0071	0.0132	
Medium	0.0374	0.0300	

(d) Literacy

War Intensity	War	War Conc.	Postwar
High	0.9526	0.9463	0.9467
Medium	0.9656	0.9625	0.9642
Low	0.9330	0.9241	0.9305
Difference-in-Differences			
High	0.0033	0.0059	
Medium	-0.0011	0.0047	

(e) Marital Status

War Intensity	War	War Conc.	Postwar
High	0.5255	0.4595	0.3717
Medium	0.5004	0.4410	0.3664
Low	0.6107	0.5608	0.4570
Difference-in-Differences			
High	0.0002	-0.0160	
Medium	-0.0197	-0.0293	

(f) Employment Status

War Intensity	War	War Conc.	Postwar
High	0.9429	0.9274	0.9291
Medium	0.9262	0.9243	0.9121
Low	0.9524	0.9422	0.9275
Difference-in-Differences			
High	-0.0110	-0.0164	
Medium	-0.0109	-0.0025	

5.2 Regression results

Tables 8 through 13 show the results from fitting the three regression models described above for each of the outcome variables.[4] Columns labeled (1) show the results of the basic regression model presented in equation (1) with controls for sex and urban. Columns (2) and (3) present results from the models that interact the difference in difference estimators with being female and living in an urban area. Appendix A Figures A.1 through A.37 illustrates the trends in the outcome variables from each of the models.

5.2.1 Primary School Completion

Table 8 presents results from the regression that examines the effect of war exposure on primary school completion.

North

Model 1 In the north, the main effects are significantly negative for high and medium war intensity areas, which suggest that these areas have lower primary school completion rates than for low war intensity areas (see Table 8, North, Column 1). The main effects for the female and urban variables are positive, indicating that being female and living in an urban area increases the probability of completing primary school. These effects are significant at the five percent level. The main effects for the war and war-conceived cohorts are not statistically significant, suggesting that belonging to the war or war-conceived cohort is not associated with increased or decreased probability of completing primary school.

Examining the interactions between cohort and war intensity, adverse effects are seen for the war-conceived cohort in high war intensity regions with a coefficient of -0.0186 which means that the proportion completing primary school is 1.86 percentage points more negative for those exposed to war *in utero* in high war intensity areas, in addition to the negative main effects for high war

[4] Two-way interactions between cohort and sex and urban, those between war intensity and sex and urban, as well as between sex and urban are included in the model but are not displayed in the tables.

intensity areas (Table 8, North, Column 1).[5] The coefficient is negative because in high war intensity areas, the postwar cohort has higher rates of primary school completion than the war-conceived cohort as expected, but in low war intensity areas, the postwar cohort shows slightly lower primary school completion than the war-conceived cohort. That the proportion for the postwar cohort is higher than that for the war-conceived cohort implies that conditions were worse for the war-conceived cohort in areas with high level of bombing and improved for the cohort conceived after the war (Table 4, Condition 4). As discussed in the previous section, that the educational attainment of the postwar cohort is lower in low war intensity areas is not consistent with our expectations (see Table 5). Therefore, it is unclear whether this negative difference-in-differences can be interpreted as a negative effect of war exposure.

Model 2 When the heterogenous effects of war exposure on women are examined by interacting the two-way interaction terms with the female variable (Model 2), the main effects and the difference-in-differences estimates do not change very much (Table 8, North, Column 2). However, the significance on the coefficient on the two-way interaction term between the war-conceived cohort and high war intensity disappears. The three-way interaction terms with the female variable are generally negative in the north, but none is statistically significant, suggesting that there are no added effects of being female and exposed to the war.

Model 3 The added effects of living in an urban area are analyzed by interacting the difference-in-differences with the variable for urban residence (Model 3). The inclusion of the three-way interaction terms with the urban variable in the north does not change the main effects in the model (Table 8, North, Column 3). However, all of the coefficients on the two-way interaction terms have become significant in Model 3, although their magnitudes have not changed.

The coefficients on the two-way interaction terms are positive except for the one for the war-conceived cohort in high war intensity areas. The positive effect in the war cohort in high war intensity areas and the war-conceived cohort in medium war intensity areas are offset by the negative

[5] Note that the regression estimates the mean proportion or the probability of completing primary school. Therefore, the coefficient on the interaction term refers to the difference in *level* rather than a percentage change in the proportion.

main effects of being in high or medium war intensity areas. Therefore, the overall probabilities of completing primary school for these two groups are lower than that of the postwar cohort in low war intensity areas. For the war cohort in medium war intensity areas, the positive difference-in-differences more than offsets the negative main effect of being in medium war intensity areas. Hence, the proportion completing primary school for the war cohort is higher in high war intensity areas than in low war intensity areas.

The positive difference-in-differences estimates here fall under Conditions 2A, 4, and 7 in Table 4. The difference-in-differences estimates for the war cohort in both medium and high war intensity areas fall under Condition 7, which is one of the expected outcomes included in Table 4 for this outcome. Therefore, the difference-in-differences estimates may be interpreted as negative consequences of war exposure. Conditions 2A and 4 are not part of the expected conditions described in Table 5. Hence, it is difficult to conclude whether these effects are due to war exposure even though the overall proportions are lower in both high and medium war intensity areas than in low war intensity areas. The negative difference-in-differences for the war cohort in high war intensity areas is similar to that seen in Model 1.

Examining the coefficients on the three-way interaction terms, the additional effects of being in an urban area are negative ranging from -0.0025 to -0.0914 (Table 8, North, Column 3). All except the war-conceived cohort in urban high war intensity areas show statistically significant results. For the war cohort in urban high war intensity areas, the coefficient on the three-way interaction term almost entirely cancels out the positive main effect of urban residence. In the case of the war cohort in urban medium war intensity areas, the effect of being war-born in urban medium intensity areas cancels out the positive main urban effect entirely, resulting in lower probability of primary school completion for the urban war cohort in medium war intensity areas than their rural counterparts. For the war-conceived cohort in medium war intensity areas, the negative three-way interaction term is offset by the urban main effect but the overall probability of completing primary school is still higher for the urban war-conceived cohort in medium war intensity areas than their rural equivalents.

South

Model 1 In the south, under Model 1 with primary school completion as the outcome variable, the main effects for the war and war-conceived cohorts are positive, indicating that the proportions completing primary school are higher for these cohorts and lower for the postwar cohort, which is inconsistent with our expectations (Table 8, South, Column 1). Furthermore, the main effect for medium war intensity areas is positive by 11.35 percentage points, suggesting that medium war intensity areas have higher primary school completion rates than low war intensity areas, which again is contrary to expectations. The coefficient for the urban variable is also positive (0.1124), which tells us that primary school completion in urban areas is higher than in rural areas. The difference-in-differences estimates examining the effect of war exposure on primary school completion are mostly close to zero and do not show any clear results.

Model 2 Including the three-way interaction terms with being female in the south (Model 2), the main effects and the coefficients for the two-way interactions do not change very much. The coefficients for the three-way interaction terms with the female variable are positive in the south, but the effect is very small and none is statistically significant (Table 8, South, Column 2).

Model 3 Similarly, the addition of the three-way interaction terms with the urban variable (Model 3) does not vary the main effects or the two-way interaction terms from those seen in Model 1. No significant added effects of living in an urban area on primary school completion are observed in the south (Table 8, South, Column 3).

5.2.2 Lower Secondary School Completion

The results from the regression that estimates the effect of war exposure on lower secondary school completion are reported in Table 9.

North

Model 1 Under Model 1, the main effects for the war and war-conceived cohorts and for high and medium war intensity areas in the north, are negative implying that war-exposed cohorts and areas have lower probabilities of completing lower secondary school compared to the postwar cohort in low war intensity areas. The coefficients are statistically significant for all of the main effects with one exception. These results are consistent with our expectation that early life war exposure results in worse educational outcomes. The results also show that being female is associated with lower probability of completing lower secondary school (by 2.66 percentage points) and living in an urban area greatly increases the probability of completing lower secondary school (by 25.79 percentage points). These main effects are also consistent with our understanding of the relationship between gender, urban residence, and educational attainment. Further, the coefficient for the interaction terms in Model 1 are all positive, but none is statistically significant.

Model 2 When the three-way interaction terms with the female variable are included in the model (Model 2), the main effects remain similar to those in Model 1, but the standard error on two of the difference-in-differences estimates are reduced such that they become statistically significant (Table 9, North, Column 2). The positive coefficients on the interaction terms between the war cohort and medium war intensity and between the war-conceived cohort and medium war intensity are now significant. The difference-in-differences estimates are sizable with 0.1028 and 0.0709 respectively for war and war-conceived cohorts in medium war intensity areas. Referring to Table 4, both of these positive difference-in-differences estimates fall under Condition 6, where conditions deteriorated in areas more heavily affected by war but improved in less affected areas, which is included in the expected outcomes shown in Table 5. When these difference-in-differences estimates are seen in the context of the lower probabilities of lower secondary school completion in medium war intensity areas, these positive difference-in-differences may suggest a lasting impact of the war as observed by worse postwar conditions in medium war intensity areas.

Further, analyzing the heterogenous effect of war exposure on women, a negative effect is found in the north for the cohort of war-conceived women in medium war intensity areas which shows a coefficient of -0.0813 for the three-way interaction term. This indicates that in addition to the negative main effect of being female, being female and war-conceived in medium war intensity areas further lowers the probability of completing lower secondary school by 8.13 percentage points.

Model 3 In addition, the inclusion of the three-way interaction terms with the urban variable (Model 3) does not change the main effects, but as in Model 2, Model 3 shows smaller standard errors for two of the difference-in-differences estimates making them statistically significant. The coefficients for the war and the war-conceived cohorts in medium war intensity areas are both positive and significant at the one percent level in Model 3 (Table 9, North, Column 3). These difference-in-differences estimates can be interpreted in a similar way as described in Model 2.

The three-way interaction terms with the urban variable show that the added effects of living in an urban area on lower secondary school completion in the north are negative (except one) and two are statistically significant at levels less than five percent (Table 9, North, Column 3). However, these negative effects are offset by the large positive main effect of living in an urban area (0.3589). As a result, the overall probability of completing lower secondary school is higher for urban residents of the war-born cohort in medium war intensity areas than for their rural counterparts. For the war cohort in urban high war intensity areas, a positive coefficient on the three-way interaction term is observed, which means that the combined effect of being urban, war-born, and in high war intensity areas makes the positive main effect of being urban even more positive.

South

Model 1 The main effects in the south present a different picture from those seen in the north. In the south, being born during the war is positively associated with lower secondary school completion (p-value<0.5), while being conceived during the war is negatively associated, but not statistically significant (Table 9, South, Column 1). Further, both high and medium war intensity areas have higher proportion completing lower secondary school as compared to low war intensity areas, but only the coefficient on medium war intensity areas is significant at the five percent level. As in the north, being female is associated with lower proportion completing lower secondary school but the magnitude of the deficit is much greater. Being a woman in the south is associated with a 9.19 percentage point lower rate of completing lower secondary school as compared to the men. In addition, similar to the north, living in an urban area is positively associated with lower secondary school completion. The difference-in-differences estimates are positive but none is statistically significant.

Model 2 Further, when the three-way interaction terms with the female variable is added (Model 2), the main effects and the two-way interaction terms remain similar to those in Model 1 with one exception (Table 9, South, Column 2). The sign on the difference-in-differences estimate for the war cohort in high war intensity areas change from positive to negative, but the estimate remains statistically insignificant. No significant heterogenous effect of being female are observed in the south.

Model 3 In Model 3, the main effects are similar to those observed in Model 1, but the inclusion of the three-way interaction terms has turned the coefficients for the interaction terms with the war-conceived cohort statistically significant at five and ten percent levels (Table 9, South, Column 3). Being both war-conceived and in a high war intensity area is associated with an additional 2.9 percentage point higher probability of completing lower secondary school over the positive main effects of being in a high or medium war intensity area despite the offset from the smaller negative main effect of the war-conceived cohort. Further, being war-conceived in a medium war intensity area is associated with an additional 1.28 percentage point greater probability.

Both of these difference-in-differences estimates fall under Category 6 in Table 4 where conditions deteriorated in areas heavily affected by war but improved in less affected areas, which is consistent with the expected outcomes presented in Table 5. That these difference-in-differences estimates may suggest an adverse impact of war exposure may seem counterintuitive because the main effect for high war intensity areas is positive and the overall probability of completing lower secondary school is higher in high war intensity areas than in low war intensity areas. However, the difference-in-differences indicates that the probability of completing lower secondary school for the postwar cohort in areas more heavily affected by war would have been higher if not for the lasting effect of the war. No additional effect of urban residence is observed in the three-way interaction terms.

5.2.3 Upper Secondary School Completion

The effects of exposure to war on upper secondary school completion are presented in Table 10.

North

Model 1 The main effects in the north show that areas that experienced high and medium war intensity have lower probabilities of upper secondary school completion (Table 10, North, Column 1), which is consistent with our expectation that war affected areas have lower levels of educational attainment. Belonging to the war cohort is associated with a greater probability of upper secondary school completion, but the statistic is only significant at the 10 percent level. As with lower secondary school completion, being female is associated with a lower probability of completing upper secondary school and living in an urban area is associated with a higher probability.

Further, the Model 1 results show that the difference-in-differences estimate for the war cohort in high war intensity areas in the north is negative (Table 10, North, Column 1). This estimate is negative because in high war intensity areas, the postwar cohort has higher rates of upper secondary school completion than the war cohort, but in low war intensity areas, the postwar cohort shows lower upper secondary school completion than the war cohort (see Table 4, Condition 4). Because upper secondary school completion shows a decreasing trend contrary to expectations, it is unclear whether this result can be interpreted as an adverse impact of war exposure. However, the overall proportions completing upper secondary school in high war intensity areas are much lower than those in low war intensity areas.

Model 2 When the the female variable is interacted with the difference-in-differences (Model 2), the main effects and the two-way interaction terms remain similar to those found in Model 1 (Table 10, North, Column 2). The coefficient on the three-way interaction term for the female war cohort in medium war intensity areas is positive, but the effect is partially offset by the main female effect which is negative. However, overall, women who were born during the war and are in medium war intensity areas have a higher probability of completing upper secondary school than their male counterparts.

Model 3 In Model 3 with the addition of the three-way urban interaction terms to the model, the main effects do not show much difference from those seen in Model 1, but two difference-in-differences estimates have gained statistical significance (Table 10, North, Column 3). The difference-in-differences estimate for the war cohort in medium war intensity areas is positive and should be interpreted under Category 2A in Table 4, where the probability of completing upper secondary school is lower for the postwar cohort than for the war cohort but the difference between the probabilities for the war and postwar cohorts is much bigger in medium war intensity areas than in low war intensity areas. In addition, the coefficient for the interaction between war-conceived cohort and medium war intensity is negative but the magnitude of the estimate is small at -0.0077. Category 5 in Table 4 applies in this case where the proportion completing upper secondary school improved between the war-conceived cohort and the postwar cohort in medium war intensity areas but stayed about the same in low war intensity areas.

Examining the additional effects of being in an urban area in the north, both negative and positive coefficients on the three-way interaction terms are observed (Table 10, North, Column 3). The biggest positive effect is seen among the war-conceived cohort in urban high war intensity areas with a coefficient of 0.0813, which means that those in urban areas who were conceived during the war in high war intensity areas have an additional 8.13 percentage point higher probability of completing upper secondary school over the positive main urban effect, as compared to their rural counterparts. This sizable difference is consistent with the notion that urban areas have higher educational attainment, but that the urban war-exposed cohort do better than the urban postwar cohort in areas less affected by the war is counterintuitive.

The biggest negative effect is seen among the war-born cohort in urban medium war intensity areas with a coefficient of -0.1199, but this is offset by the large positive main effect of being urban, and therefore, the overall probability of completing upper secondary school for the war-born cohort in urban medium war intensity areas is higher than those of their rural counterparts.

South

Model 1 Observing the Model 1 main effects on upper secondary completion in the south (Table 10, South, Column 1), both the war and war-conceived cohorts show a significantly negative association with upper secondary school completion, indicating that these cohorts have lower secondary school completion than the postwar cohort. This is consistent with our expectations. No effects are seen for the war intensity areas. Similar to the north, being female is associated with lower rates of upper secondary school completion and living in an urban area is associated with higher rates of school completion.

In examining the difference-in-differences estimates, the coefficient on the interaction term between the war cohort and medium war intensity areas is positive. This is because in medium war intensity areas, the postwar cohort have lower proportion completing upper secondary school than the war cohort, but in low war intensity areas, the postwar cohort has a higher proportion completing upper secondary school than the war cohort. The difference between the war and postwar cohorts in low war intensity areas is greater than that in medium war intensity areas, resulting in a positive difference-in-differences. Referring to Table 4, Condition 6 applies to this case which is consistent with the expected difference-in-differences outcome outlined in Table 5. The result suggests worse postwar conditions for high war intensity areas in the south. The same is true for the difference-in-differences estimate for the war-conceived cohort in medium war intensity areas.

Model 2 When the difference-in-differences are interacted with the female variable in the south (Model 2), the main effects are mostly similar to those in Model 1, except for the main effect for the war cohort. The association between the war cohort and upper secondary school completion is now less than half of the association observed in Model 1 and the effect is no longer significant (Table 10, South, Column 2).

Furthermore, adding of the three-way interaction terms also changes the significance of the two-way interaction terms. The positive coefficient for the interaction term for the war-conceived cohort in medium war intensity areas is now significant at the five percent level rather than at the ten percent level seen in Model 1. The difference-in-differences estimate can be categorized under Condition 6 in Table 4, which is one of the expected outcomes in Table 5. The coefficient on the interaction term between the war cohort and high war intensity is changed from positive to negative and significant at the ten percent level. This offsets the positive main effect seen for high war intensity areas and makes the negative main effect more negative, hence the resulting overall effect is negative. This negative coefficient is seen because conditions improved in both high and low war intensity areas but they improved more in the high war intensity areas (Table 4, Condition 1A), which is consistent with the expected difference-in-differences outcomes and implies that high war intensity areas are catching up to low war intensity areas. In addition, the difference-in-differences estimate for the war cohort in medium war intensity areas is much smaller and no longer significant.

Analyzing the three-way interaction terms, the war-born women in both high and medium war intensity areas show positive added effects (Table 10, South, Column 2). The effect for the female war cohort in high war intensity areas is slightly offset by the negative main female effect, but overall, being female seems to improve the probability of completing upper secondary school for the cohort born during the war in high war intensity areas relative to their male counterparts. For the war-born women born in medium war intensity areas, the positive added effect is almost entirely canceled out by the negative main female effect and the overall difference in the probabilities of completing upper secondary school between the sexes who were war-born in medium war intensity areas is very small.

Model 3 The addition of the three-way interaction terms with the urban variable changes both the main effects and the difference-in-differences estimates (Table 10, South, Column 3). Examining the main effects, the main war cohort effect is less negative and no longer significant. The main urban effect is still highly significant and the effect is even more positive than in Model 1.

Further, the significances of the difference-in-differences estimates have changed. The coefficient on the interaction term between the war cohort and medium war intensity is much smaller and is no longer significant, but the one between the war-conceived cohort and high war intensity is much larger and has become strongly significant. The positive difference-in-differences estimate can be explained by Condition 6 under Table 4, where the postwar cohort in areas heavily affected by war has lower educational attainment than the war-conceived cohort, while the opposite is true in the less affected areas. This is in accordance with our expectations as shown in Table 5.

Moreover, in analyzing the three-way interaction terms with the urban variable, only the coefficient for the war-born cohort in urban medium war intensity areas shows statistical significance. The magnitude of the effect is 0.0761, indicating that for the war-born cohort in medium war intensity areas, living in an urban area further increases the probability of completing upper secondary school in addition to the already large positive main urban effect.

5.2.4 Literacy

The results for literacy as an outcome are presented in Table 11.

North

Model 1 First, examining the main effects, Model 1 results reveal that in the north, high war intensity areas have a slightly lower literacy rate, while medium war intensity areas have a slightly higher literacy rate than low war intensity areas (Table 11, North, Column 1). The main cohort effects do not show any significant results. Furthermore, the main effects for female and urban are both positive, indicating that women and urban residents have higher literacy levels.

For the difference-in-differences estimates, the coefficient on the interaction term between the war-conceived cohort and medium war intensity areas is negative (p-value < 0.05), suggesting that having been conceived during the war in a medium war intensity area lowers the probability of being literate and offsets the positive main effect for medium war intensity areas. The difference-in-differences is negative because in medium war intensity areas, the postwar cohort has higher levels of literacy than the war-conceived cohort, but in low war intensity areas, the postwar cohort shows a slightly lower level of literacy than the war-conceived cohort (see Table 4, Condition 4). The lower level of literacy in the postwar cohort in low war intensity areas is not consistent with our expectations and therefore, it is difficult to attribute this effect to war exposure. The size of the estimate, however, is not very large at 0.0167.

Model 2 When the difference-in-differences estimates are interacted with the female variable (Model 2), the main effects remain about the same as in Model 1, but two of the coefficients on the two-way interaction terms show some changes (Table 11, North, Column 2). The coefficient on the interaction term between the war cohort and medium war intensity is more negative than in Model 1 (-0.0154 as compared to -0.0049 in Model 1) and strongly significant (p-value < 0.01), lowering the overall probability of literacy for the war cohort in medium war intensity areas. Condition 4 in Table 4 applies here. In addition, the difference-in-differences estimate of the war-conceived cohort in medium war intensity areas is no longer significant under Model 2. Analyzing the interaction terms, the added effects of being female on literacy are mostly negative in the north, but this is largely offset by the positive main effect of being female and none of the coefficients is statistically significant.

Model 3 The addition of the three-way interaction terms with urban (Model 3) does not vary the main effects or the two-way interaction terms much, with one exception (Table 11, North, Column 3). In Model 3, the coefficient on the interaction term for the war-conceived cohort and high war intensity becomes slightly significant (p-value < 0.10), the estimate is close to zero at 0.0037 and is about the same as in Model 1. Condition 2A in Table 4 describes this difference-in-differences.

The coefficient on the three-way interaction term among the war-born cohort, in urban medium war intensity areas is negative and statistically significant. This added effect of being urban, war-born, and in medium war intensity areas is almost completely offset by the positive main urban effect of about the same size. The resulting literacy rate is similar to those found in their rural counterparts. Further, the added effect of being urban, war-conceived, in medium war intensity areas is positive, making the already positive main urban effect even larger.

South

Model 1 Analyzing the effect of war exposure on literacy in the south, the main effects in Model 1 show that medium war intensity, being female, and living in an urban area are associated with a higher literacy rate (Table 11, South, Column 1). Urban residence has the largest positive association at 0.0346. The differences-in-differences estimates are mostly positive, but none is statistically significant.

Model 2 The inclusion of the three-way interaction terms with the female variable shows no change in the main effects or the difference-in-differences estimates in the south (Table 11, South, Column 2). Further, none of the three-way interaction terms is significant, suggesting that there is no added effect of being female on literacy for the war-exposed groups.

Model 3 When the three-way interaction terms with the urban variable is added, the main effects and the difference-in-differences estimates are similar to those seen in Model 1 (Table 11, South, Column 3). The coefficient for the interaction term for the war-conceived cohort in medium war intensity areas shows that there is a slight positive effect for belonging to the war-conceived cohort in medium war intensity areas (p-value < 0.10). The difference-in-differences estimate falls under Condition 7 in Table 4 which is consistent with our expectations. No added effects of urban residence on the difference-in-differences estimates are seen.

5.2.5 Marriage

Table 12 displays the regression results of the effect of war exposure on the proportions ever-married.

North

Model 1 Model 1 results in the north show that the main effects of war and war-conceived cohorts are positively associated with having ever-married (Table 12, North, Column 1). Since older cohorts are more likely to have married, this result is as expected. High and medium war intensity areas show lower proportions ever married. The lower rates of marriage in areas more heavily affected by war are also consistent with our expectations. In addition, being female is associated with a much higher proportion ever-married, confirming that women tend to marry at younger ages than men. Finally, being urban is associated with lower proportion ever-married.

Examining the interaction terms, the coefficient on the interaction term between the war-born cohort and medium war intensity areas is positive. The positive difference-in-differences is obtained because the proportion married among the postwar cohort is much lower than that of the war-born cohort and the difference between the war-born cohort and the postwar cohort is greater in medium war intensity areas than in areas that experienced less bombing (see Table 4, Condition 2A). This implies that marriage rates for the postwar cohort in medium war intensity areas are lower than expected and the war cohort is catching up to the levels seen in low war intensity areas. These results are consistent with the idea that negative events delay marriages. Other coefficients to the interaction terms are negative but not statistically significant.

Model 2 Introducing the three-way interaction terms with the female variable to the model (Model 2) does not seem to affect the main effects, but has changed the difference-in-differences estimates (Table 12, North, Column 2). The difference-in-differences estimate for the war cohort in medium war intensity areas is much smaller and is no longer significant. Further, the negative difference-in-differences estimate in the war-conceived cohort in high war intensity areas is more negative than in Model 1 and is strongly significant. The negative coefficient on the interaction term is seen because the postwar cohort in both high and low war intensity areas show lower proportions married, but the difference between the war and postwar cohort is greater in low war intensity areas than in high war intensity areas (see Table 4, Condition 2B), suggesting adverse effect of war exposure on marriage outcomes.

The added effects of being female are mostly positive, reflecting the younger ages at which women marry. However, in the north, only the coefficient on the interaction term for the female war-conceived cohort in high war intensity areas is significant albeit marginally. The positive coefficient on the three-way interaction terms suggest that being war-conceived in high war intensity areas further increases the probability of being ever married by 6.22 percentage points in addition to the large positive main female effect.

Model 3 When the three-way interaction terms with the urban variable are added (Model 3), again, the main effects remain unaltered, but all four difference-in-differences become statistically significant (Table 12, North, Column 3). The coefficient on the interaction term between the war cohort and high war intensity is more negative in Model 3 than in Model 1. This negative effect further depresses the probability of ever having married for the war cohort in high war intensity areas (Table 12, North, Column 3). The interaction terms for the war-conceived cohort in high war intensity areas and in medium war intensity areas also show negative coefficients. All of the difference-in-differences estimates fall under Category 2B in Table 4, where the proportion married in the postwar cohort is lower than the war or war-conceived cohort, but the difference between the war or war-conceived cohort and the postwar cohort is greater in low war intensity areas. The one positive difference-in-differences can be interpreted in the same way as described in Model 1.

Further, the added effect of being urban is positive for the war-born cohort in urban high war intensity areas, which partially offsets the large negative main effect for urban residents. Hence the probability of marriage for the urban war cohort in high war intensity areas is higher than their rural counterparts, but not as high as it would have been if they belonged to the postwar cohort in low war intensity areas.

South

Model 1 In the south, Model 1 results show patterns similar to the north, with the war and war-conceived cohorts showing higher proportions ever married and high and medium war intensity areas displaying lower proportions (Table 12, South, Column 1). In addition, females show higher proportions and urbanites have lower proportions ever married. The difference-in-differences estimates do not show significant effect of war exposure on probabilities of having ever-married.

Model 2 In Model 2, the main effects are not much different from those seen in Model 1 (Table 12, South, Column 2). However, the difference-in-differences estimate for the war cohort in medium war intensity areas now show a significant negative effect (-0.0373). Referring to Table 4, the negative difference-in-differences for the war cohort in medium war intensity areas fall under Condition 2B, where the proportion married for the postwar cohort in both medium and low war intensity areas are lower than that of the war cohort, but the probability of having ever-married for the war cohort in medium war intensity areas is lower than what it would have been if medium war intensity areas had the same difference in proportion between the war and postwar cohorts.

Examining the added effect of being female, the coefficient for war-born women in medium war intensity areas shows a significant positive effect of 0.0501. This makes the large positive main female effect (0.2915) even larger and reflects the earlier age at marriage for women as compared to the men of the same cohort in medium war intensity areas. However, war-born women in medium war intensity areas still have lower probability of marriage than war-born women in low war intensity areas because marriage rates are much lower in medium war intensity areas.

Model 3 When the added effects of urban residence is observed (Model 3), the main effects and the two-way interaction terms are mostly similar to those seen in Model 1 (Table 12, South, Column 3). The main effect for medium war intensity areas show about one percentage point more negative probability of ever having married in Model 3 as compared to Model 1.

Analyzing the three-way interaction terms, the added effects of urban residence show mixed results, but only the negative effect of having been conceived during the war and living in urban medium war intensity areas is significant. The coefficient for the three-way interaction term for the war-conceived cohort in urban medium war intensity areas is -0.0766, which makes the negative main urban effect even more negative.

5.2.6 Employment

The effects of exposure to war on employment are presented in Table 13.

North

Model 1 Examining the main effects in the north, the war and war-conceived cohorts both show a positive association with being employed, reflecting the age effects with the older cohort having higher employment rates (Table 13, North, Column 1). High war intensity areas have a lower employment rate (p-value < 0.01), but medium war intensity areas show a higher employment rate (p-value < 0.10) than low war intensity areas. While the former is consistent with our ideas about the effect of war on war affected areas, the latter is contrary to our expectations. Another surprising result is that being female is associated with a higher employment rate and being urban is associated with a lower employment rate. The main urban effect is negative at -0.1938, which could reflect the later age at which people enter the job market in urban areas as compared to the rural areas, or that unemployed people may move to the cities looking for work.

In the north, the coefficients on all of the interaction terms are negative in Model 1. The coefficient on the interaction term between the war-conceived cohort and medium war intensity areas is statistically significant at the one percent level. This coefficient is negative because in medium war intensity areas, the postwar cohort has a higher employment rate than the war-conceived cohort, but in low war intensity areas, the postwar cohort shows a lower employment rate than the war-conceived cohort (Table 4, Condition 4). This is consistent with our expectations as explained in Table 5. Further, the difference-in-differences estimate for the war cohort in high war intensity areas shows a marginally significant negative effect because it falls under Condition 9 in Table 4, where the postwar cohort in low war intensity areas has a lower employment rate than the war cohort, but in high war intensity areas, the two cohorts have about the same employment rates.

Model 2 When the female variable is interacted with the difference-in-differences (Model 2), the main effects in the north are mostly similar to Model 1, except for the coefficients on high and medium war intensity areas (Table 13, North, Column 2). The negative relationship between high war intensity and employment is less negative and no longer statistically significant. The positive main effect of being in a medium war intensity area is larger in Model 2 than in Model 1 and the effect is significant at the one percent level. Further, the difference-in-differences estimate for high war intensity areas is more negative than in Model 1, falling under Condition 4 in Table 4, and the estimate is now significant at the five percent level. No other changes are observed in the two-way interaction terms.

When the added effects of being female on the difference-in-differences are observed, the effects are positive for the war-born women in high war intensity areas and the war-conceived women in medium war intensity areas (0.0321 and 0.0410 respectively with p-values < 0.05). These positive added effects seen among the war-born women in high war intensity areas and the war-conceived women in medium war intensity areas further increases the probability of employment over the already positive main female effect.

Model 3 With the addition of the three-way interaction terms with the urban variable in the model with employment as an outcome (Model 3), the main effects remain about the same (Table 13, North, Column 3). However, the standard errors on the two-way interaction terms have decreased and the coefficients on the interaction terms all show negative statistically significant results. The two additional negative difference-in-differences that are now significant are for the war cohort in medium war intensity areas and for the war-conceived cohort in high war intensity areas, both of which fall under Condition 2B or 9 in Table 4. In high war intensity areas, the overall employment rates are lower than in low war intensity areas, so the employment rates appear to be catching up to those in low war intensity areas. On the other hand, the employment rates in medium war intensity areas are higher than in low war intensity areas. However, the effect can still be interpreted as a war effect because the war cohort would have had a higher employment rate, if the difference between the war and postwar cohort in medium war intensity areas had been the same as that in low war intensity areas. The other two difference-in-differences estimates are the same as explained under Model 1. All four difference-in-differences estimates show expected results as explained in Table 5.

The additional effects of living in an urban area on employment in the north are mixed, showing both positive and negative results, and no significant coefficients are observed.

South

Model 1 In the south, the main effects reveal that both the war and war-conceived cohorts have higher employment rates than the postwar cohort, again, reflecting the age effect, although the main effect for the war-conceived cohort is not statistically significant (Table 13, South, Column 1). Unlike the north, being female is associated with a lower employment rate, with women showing 4.7 percentage points lower probability of being employment than men. Like the north, urban residence is also associated with a lower employment rate. The difference-in-differences estimates are negative, but none is significant.

Model 2 The main effects do not show much difference with the addition of the three-way interaction terms with the female variable (Table 13, South, Column 2). However, in Model 2, the standard errors for the difference-in-differences estimate of war-conceived cohort in high war intensity areas is reduced and the slightly negative effect is now marginally significant at p-value < 0.10. The negative coefficient in this case is produced because the postwar cohort in low war intensity areas has a lower employment rate than the war-conceived cohort, but in high war intensity areas, the employment rate of the war-conceived and the postwar cohorts are about the same (see Condition 8, Table 4).

The added effects of being female on the difference-in-differences are mostly negative, but only one is marginally significant: the war-conceived female cohort in medium war intensity areas. Since the main female effect is negative, the combined effect of being female, war-conceived, and in medium war intensity areas further decreases the employment rate by 2.33 percentage points.

Model 3 In Model 3, the main effects are not changed very much by the addition of the three-way interaction terms with the urban variable (Table 13, South, Column 3). The main effect for the war-conceived cohort is now significant, but the magnitude of the effect is very small (0.0098).

On the other hand, the inclusion of the three-way interaction terms has modified the significance of three out of the four coefficients on the two-way interaction terms. Being war-born and in medium war intensity areas is now slightly more negative with smaller standard errors and is significant at the five percent level. This coefficient is explained by Condition 2B in Table 4, which is in agreement with our expectations as explained in Table 5. The coefficients for the war cohort in high war intensity areas and for the war-conceived cohort in medium war intensity areas also show slightly more negative effects that are only marginally significant. Both of these fall under Condition 9 in Table 4, where employment rates for the war-exposed cohorts and the postwar cohorts are about the same in areas more heavily affected by war, but the employment rates for the war-exposed cohorts are much higher in low war intensity areas. This is also in line with our expectations.

The coefficients on the three-way interaction terms among cohort, war intensity, and urban residence are all positive, but only the one for having been war-conceived and in urban medium war intensity areas shows some weak significance (p-value < 0.10). The positive added effect of being urban, war-conceived, and in medium war intensity areas largely offsets the negative main urban effect, but not entirely. As a result, the overall probability of being employed for the urban war-conceived cohort in medium war intensity areas is only about two percentage points more negative than their rural counterparts.

Table 8: The effect of exposure to the war on the probability of completing primary school: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
War Cohort * High	0.0108	0.0187	0.0150 **	-0.0049	-0.0039	-0.0020
	(0.0234)	(0.0430)	(0.0041)	(0.0183)	(0.0310)	(0.0093)
War Cohort * Medium	0.0552	0.0573	0.0625 **	0.0128	0.0121	0.0065
	(0.0411)	(0.0353)	(0.0042)	(0.0105)	(0.0171)	(0.0107)
War Conc. Cohort * High	-0.0186 **	-0.0232	-0.0184 **	-0.0266	-0.0326	-0.0229
	(0.0034)	(0.0173)	(0.0036)	(0.0228)	(0.0247)	(0.0140)
War Conc. Cohort * Medium	0.0078	0.0225	0.0098 **	-0.0045	-0.0113	-0.0085
	(0.0125)	(0.0255)	(0.0037)	(0.0103)	(0.0128)	(0.0094)
War Cohort * High * Female		-0.0147			-0.0022	
		(0.0365)			(0.0296)	
War Cohort * Medium * Female		-0.0039			0.0012	
		(0.0141)			(0.0200)	
War Conc. Cohort * High * Female		0.0087			0.0116	
		(0.0323)			(0.0167)	
War Conc. Cohort * Medium * Female		-0.0274			0.0134	
		(0.0275)			(0.0171)	
War Cohort * High * Urban			-0.0410 **			-0.0143
			(0.0124)			(0.0595)
War Cohort * Medium * Urban			-0.0914 **			0.0213
			(0.0114)			(0.0310)
War Conc. Cohort * High * Urban			-0.0025			-0.0184
			(0.0145)			(0.0613)
War Conc. Cohort * Medium * Urban			-0.0270 *			0.0134
			(0.0134)			(0.0318)
War Cohort	0.0021	0.0018	0.0016	0.0391 **	0.0393 **	0.0413 **
	(0.0067)	(0.0069)	(0.0063)	(0.0081)	(0.0111)	(0.0083)
War Conc. Cohort	0.0072	0.0068	0.0071	0.0363 **	0.0398 **	0.0375 **
	(0.0054)	(0.0055)	(0.0054)	(0.0091)	(0.0104)	(0.0098)
High	-0.0341 **	-0.0352 *	-0.0354 **	0.0680	0.0697	0.0659
	(0.0052)	(0.0137)	(0.0080)	(0.0500)	(0.0516)	(0.0493)
Medium	-0.0249 *	-0.0300 *	-0.0279 **	0.1135 **	0.1160 **	0.1167 **
	(0.0109)	(0.0125)	(0.0091)	(0.0304)	(0.0313)	(0.0300)
Female	0.0419 **	0.0414 **	0.0418 **	-0.0016	0.0009	-0.0016
	(0.0049)	(0.0051)	(0.0049)	(0.0088)	(0.0113)	(0.0088)
Urban	0.0517 **	0.0517 **	0.0508 **	0.1124 **	0.1124 **	0.1177 **
	(0.0136)	(0.0135)	(0.0134)	(0.0431)	(0.0431)	(0.0451)
Intercept	0.9102 **	0.9104 **	0.9104 **	0.6746 **	0.6733 **	0.6735 **
	(0.0054)	(0.0054)	(0.0054)	(0.0205)	(0.0209)	(0.0204)

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

Table 9: The effect of exposure to the war on the probability of completing lower secondary school: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
War Cohort * High	0.0043	-0.0130	0.0002	0.0032	-0.0218	0.0054
	(0.0253)	(0.0354)	(0.0068)	(0.0321)	(0.0400)	(0.0086)
War Cohort * Medium	0.1041	0.1028 *	0.1226 **	0.0164	0.0147	0.0021
	(0.0851)	(0.0459)	(0.0069)	(0.0124)	(0.0161)	(0.0085)
War Conc. Cohort * High	0.0017	-0.0314	0.0034	0.0162	0.0138	0.0290 *
	(0.0096)	(0.0527)	(0.0049)	(0.0224)	(0.0490)	(0.0136)
War Conc. Cohort * Medium	0.0271	0.0709 **	0.0327 **	0.0196	0.0160	0.0128 +
	(0.0261)	(0.0160)	(0.0049)	(0.0131)	(0.0142)	(0.0076)
War Cohort * High * Female		0.0327			0.0503	
		(0.0248)			(0.0377)	
War Cohort * Medium * Female		0.0030			0.0033	
		(0.0806)			(0.0165)	
War Conc. Cohort * High * Female		0.0623			0.0050	
		(0.1132)			(0.0699)	
War Conc. Cohort * Medium * Female		-0.0813 **			0.0069	
		(0.0246)			(0.0150)	
War Cohort * High * Urban			0.0459 +			-0.0140
			(0.0248)			(0.1166)
War Cohort * Medium * Urban			-0.2351 **			0.0494
			(0.0261)			(0.0355)
War Conc. Cohort * High * Urban			-0.0129			-0.0601
			(0.0342)			(0.1265)
War Conc. Cohort * Medium * Urban			-0.0741 *			0.0219
			(0.0319)			(0.0449)
War Cohort	-0.0350 **	-0.0345 **	-0.0359 **	0.0194 *	0.0223 *	0.0248 **
	(0.0121)	(0.0118)	(0.0106)	(0.0091)	(0.0111)	(0.0076)
War Conc. Cohort	-0.0113	-0.0120	-0.0117	-0.0117	-0.0099	-0.0101
	(0.0099)	(0.0099)	(0.0095)	(0.0078)	(0.0092)	(0.0068)
High	-0.1148 **	-0.0985 **	-0.1141 **	0.0319	0.0411	0.0270
	(0.0211)	(0.0145)	(0.0247)	(0.0466)	(0.0551)	(0.0330)
Medium	-0.1160 *	-0.1287 **	-0.1238 **	0.0517 **	0.0534 **	0.0583 **
	(0.0462)	(0.0298)	(0.0144)	(0.0196)	(0.0194)	(0.0174)
Female	-0.0266 **	-0.0266 *	-0.0267 **	-0.0919 **	-0.0888 **	-0.0918 **
	(0.0103)	(0.0104)	(0.0101)	(0.0081)	(0.0072)	(0.0082)
Urban	0.2579 **	0.2578 **	0.2562 **	0.1192 **	0.1192 **	0.1299 **
	(0.0555)	(0.0554)	(0.0541)	(0.0419)	(0.0419)	(0.0427)
Intercept	0.3585 **	0.3585 **	0.3589 **	0.2240 **	0.2224 **	0.2217 **
	(0.0137)	(0.0136)	(0.0133)	(0.0098)	(0.0099)	(0.0088)

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

Table 10: The effect of exposure to the war on the probability of completing upper secondary school: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
War Cohort * High	-0.0133 *	-0.0063	-0.0141 **	0.0034	-0.0241 +	0.0046
	(0.0055)	(0.0233)	(0.0025)	(0.0104)	(0.0142)	(0.0049)
War Cohort * Medium	0.0306	0.0026	0.0401 **	0.0236 *	0.0128	0.0017
	(0.0345)	(0.0229)	(0.0025)	(0.0102)	(0.0094)	(0.0047)
War Conc. Cohort * High	0.0088	0.0190	0.0006	0.0081	0.0042	0.0151 **
	(0.0305)	(0.0740)	(0.0024)	(0.0124)	(0.0182)	(0.0054)
War Conc. Cohort * Medium	-0.0100	-0.0165	-0.0077 **	0.0177 +	0.0199 *	0.0051
	(0.0101)	(0.0173)	(0.0025)	(0.0094)	(0.0089)	(0.0036)
War Cohort * High * Female		-0.0132			0.0553 **	
		(0.0359)			(0.0211)	
War Cohort * Medium * Female		0.0553 +			0.0217 *	
		(0.0303)			(0.0108)	
War Conc. Cohort * High * Female		-0.0192			0.0077	
		(0.0819)			(0.0200)	
War Conc. Cohort * Medium * Female		0.0134			-0.0044	
		(0.0507)			(0.0111)	
War Cohort * High * Urban			0.0113			-0.0077
			(0.0257)			(0.0255)
War Cohort * Medium * Urban			-0.1199 **			0.0761 *
			(0.0244)			(0.0300)
War Conc. Cohort * High * Urban			0.0813 **			-0.0334
			(0.0274)			(0.0315)
War Conc. Cohort * Medium * Urban			-0.0326			0.0441
			(0.0248)			(0.0316)
War Cohort	0.0102 +	0.0111 +	0.0097 +	-0.0128 *	-0.0057	-0.0043
	(0.0059)	(0.0062)	(0.0058)	(0.0053)	(0.0050)	(0.0040)
War Conc. Cohort	-0.0003	-0.0003	-0.0002	-0.0137 **	-0.0143 **	-0.0093 **
	(0.0059)	(0.0062)	(0.0061)	(0.0047)	(0.0044)	(0.0029)
High	-0.0541 **	-0.0597 *	-0.0513 **	0.0006	0.0110	-0.0020
	(0.0054)	(0.0236)	(0.0090)	(0.0108)	(0.0098)	(0.0082)
Medium	-0.0654 **	-0.0537 **	-0.0693 **	-0.0012	0.0015	0.0097
	(0.0189)	(0.0084)	(0.0058)	(0.0076)	(0.0065)	(0.0062)
Female	-0.0237 **	-0.0231 **	-0.0237 **	-0.0236 **	-0.0195 **	-0.0236 **
	(0.0061)	(0.0060)	(0.0060)	(0.0049)	(0.0047)	(0.0049)
Urban	0.2577 **	0.2577 **	0.2573 **	0.0508 **	0.0509 **	0.0709 **
	(0.0490)	(0.0491)	(0.0487)	(0.0162)	(0.0162)	(0.0154)
Intercept	0.1210 **	0.1207 **	0.1211 **	0.0519 **	0.0498 **	0.0477 **
	(0.0056)	(0.0057)	(0.0056)	(0.0036)	(0.0032)	(0.0032)

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

Table 11: The effect of exposure to the war on the probability of being literate: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
War Cohort * High	0.0020	0.0051	0.0031	0.0028	0.0117	0.0042
	(0.0066)	(0.0095)	(0.0020)	(0.0108)	(0.0217)	(0.0059)
War Cohort * Medium	-0.0049	-0.0154 **	-0.0034	-0.0006	-0.0056	-0.0008
	(0.0089)	(0.0038)	(0.0021)	(0.0065)	(0.0090)	(0.0050)
War Conc. Cohort * High	0.0032	0.0141	0.0037 +	0.0048	0.0023	0.0063
	(0.0043)	(0.0191)	(0.0022)	(0.0082)	(0.0087)	(0.0077)
War Conc. Cohort * Medium	-0.0156 *	0.0049	-0.0167 **	0.0062	0.0034	0.0118 +
	(0.0071)	(0.0053)	(0.0023)	(0.0060)	(0.0084)	(0.0063)
War Cohort * High * Female		-0.0057			-0.0181	
		(0.0071)			(0.0272)	
War Cohort * Medium * Female		0.0210			0.0099	
		(0.0190)			(0.0118)	
War Conc. Cohort * High * Female		-0.0206			0.0048	
		(0.0289)			(0.0194)	
War Conc. Cohort * Medium * Female		-0.0375			0.0055	
		(0.0243)			(0.0107)	
War Cohort * High * Urban			-0.0103			-0.0056
			(0.0078)			(0.0388)
War Cohort * Medium * Urban			-0.0179 *			0.0001
			(0.0079)			(0.0163)
War Conc. Cohort * High * Urban			-0.0060			-0.0077
			(0.0071)			(0.0362)
War Conc. Cohort * Medium * Urban			0.0139 *			-0.0193
			(0.0068)			(0.0180)
War Cohort	-0.0041	-0.0038	-0.0042	0.0055	0.0070	0.0054
	(0.0037)	(0.0039)	(0.0038)	(0.0059)	(0.0074)	(0.0058)
War Conc. Cohort	0.0031	0.0021	0.0032	0.0032	0.0047	0.0010
	(0.0033)	(0.0035)	(0.0033)	(0.0060)	(0.0074)	(0.0064)
High	-0.0186 **	-0.0231 *	-0.0191 **	0.0098	0.0076	0.0088
	(0.0058)	(0.0112)	(0.0030)	(0.0185)	(0.0178)	(0.0179)
Medium	0.0109 **	0.0084 **	0.0108 **	0.0356 **	0.0381 **	0.0338 **
	(0.0032)	(0.0029)	(0.0037)	(0.0107)	(0.0119)	(0.0107)
Female	0.0144 **	0.0140 **	0.0144 **	0.0179 **	0.0198 *	0.0180 **
	(0.0029)	(0.0030)	(0.0029)	(0.0062)	(0.0082)	(0.0062)
Urban	0.0161 **	0.0160 **	0.0160 **	0.0346 *	0.0346 *	0.0308 +
	(0.0051)	(0.0051)	(0.0051)	(0.0159)	(0.0159)	(0.0173)
Intercept	0.9723 **	0.9725 **	0.9723 **	0.9140 **	0.9130 **	0.9148 **
	(0.0019)	(0.0019)	(0.0019)	(0.0089)	(0.0095)	(0.0091)

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

Table 12: The effect of exposure to the war on the probability of having married: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North						South					
Covariates	(1)		(2)		(3)		(1)		(2)		(3)	
War Cohort * High	-0.0259		-0.0351		-0.0386	**	0.0084		-0.0139		0.0084	
	(0.0632)		(0.0613)		(0.0052)		(0.0168)		(0.0161)		(0.0179)	
War Cohort * Medium	0.0466	**	0.0201		0.0461	**	-0.0125		-0.0373	*	-0.0029	
	(0.0062)		(0.0188)		(0.0050)		(0.0136)		(0.0187)		(0.0121)	
War Conc. Cohort * High	-0.0149		-0.0479	**	-0.0183	**	-0.0098		-0.0255		-0.0116	
	(0.0183)		(0.0087)		(0.0049)		(0.0332)		(0.0339)		(0.0291)	
War Conc. Cohort * Medium	-0.0142		-0.0070		-0.0160	**	-0.0155		0.0029		0.0072	
	(0.0112)		(0.0248)		(0.0050)		(0.0121)		(0.0177)		(0.0099)	
War Cohort * High * Female			0.0177						0.0442			
			(0.0196)						(0.0301)			
War Cohort * Medium * Female			0.0526						0.0501	*		
			(0.0331)						(0.0247)			
War Conc. Cohort * High * Female			0.0622	+					0.0303			
			(0.0358)						(0.0253)			
War Conc. Cohort * Medium * Female			-0.0122						-0.0363			
			(0.0654)						(0.0292)			
War Cohort * High * Urban					0.1284	**					0.0017	
					(0.0280)						(0.0371)	
War Cohort * Medium * Urban					0.0027						-0.0331	
					(0.0290)						(0.0286)	
War Conc. Cohort * High * Urban					0.0368						0.0061	
					(0.0278)						(0.0355)	
War Conc. Cohort * Medium * Urban					0.0216						-0.0766	*
					(0.0288)						(0.0348)	
War Cohort	0.2137	**	0.2150	**	0.2141	**	0.1875	**	0.2004	**	0.1836	**
	(0.0097)		(0.0102)		(0.0093)		(0.0127)		(0.0142)		(0.0108)	
War Conc. Cohort	0.1368	**	0.1375	**	0.1370	**	0.1298	**	0.1230	**	0.1213	**
	(0.0089)		(0.0090)		(0.0087)		(0.0112)		(0.0124)		(0.0093)	
High	-0.0652	**	-0.0515	**	-0.0603	**	-0.1151	+	-0.1028	+	-0.1147	*
	(0.0188)		(0.0148)		(0.0221)		(0.0594)		(0.0599)		(0.0566)	
Medium	-0.1097	**	-0.1026	**	-0.1089	**	-0.0631	*	-0.0613	*	-0.0736	**
	(0.0199)		(0.0308)		(0.0214)		(0.0248)		(0.0249)		(0.0241)	
Female	0.2915	**	0.2927	**	0.2915	**	0.2260	**	0.2295	**	0.2261	**
	(0.0100)		(0.0106)		(0.0100)		(0.0193)		(0.0219)		(0.0193)	
Urban	-0.2889	**	-0.2888	**	-0.2879	**	-0.1206	**	-0.1204	**	-0.1401	**
	(0.0450)		(0.0450)		(0.0451)		(0.0327)		(0.0327)		(0.0331)	
Intercept	0.3800	**	0.3793	**	0.3798	**	0.3682	**	0.3663	**	0.3723	**
	(0.0139)		(0.0138)		(0.0138)		(0.0152)		(0.0158)		(0.0143)	

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

Table 13: The effect of exposure to the war on the probability of being employed: Interactions between birth cohort and war intensity areas. Vietnam Census 1999.

	North						South					
Covariates	(1)		(2)		(3)		(1)		(2)		(3)	
War Cohort * High	-0.0064	+	-0.0235	*	-0.0055	**	-0.0095		-0.0183		-0.0158	+
	(0.0038)		(0.0093)		(0.0015)		(0.0184)		(0.0201)		(0.0088)	
War Cohort * Medium	-0.0048		-0.0137		-0.0074	**	-0.0098		-0.0045		-0.0118	*
	(0.0081)		(0.0172)		(0.0015)		(0.0091)		(0.0088)		(0.0053)	
War Conc. Cohort * High	-0.0084		-0.0125		-0.0098	**	-0.0146		-0.0144	+	-0.0179	
	(0.0060)		(0.0156)		(0.0016)		(0.0147)		(0.0078)		(0.0144)	
War Conc. Cohort * Medium	-0.0227	**	-0.0442	**	-0.0203	**	-0.0000		0.0106		-0.0109	+
	(0.0079)		(0.0132)		(0.0016)		(0.0060)		(0.0076)		(0.0062)	
War Cohort * High * Female			0.0321	*					0.0192			
			(0.0128)						(0.0159)			
War Cohort * Medium * Female			0.0176						-0.0115			
			(0.0195)						(0.0109)			
War Conc. Cohort * High * Female			0.0076						-0.0012			
			(0.0388)						(0.0231)			
War Conc. Cohort * Medium * Female			0.0410	**					-0.0233	+		
			(0.0092)						(0.0123)			
War Cohort * High * Urban					-0.0104						0.0293	
					(0.0222)						(0.0491)	
War Cohort * Medium * Urban					0.0350						0.0097	
					(0.0226)						(0.0234)	
War Conc. Cohort * High * Urban					0.0140						0.0188	
					(0.0208)						(0.0574)	
War Conc. Cohort * Medium * Urban					-0.0312						0.0407	+
					(0.0203)						(0.0210)	
War Cohort	0.0072	*	0.0081	*	0.0073	*	0.0138	**	0.0121	*	0.0153	**
	(0.0034)		(0.0036)		(0.0035)		(0.0053)		(0.0055)		(0.0040)	
War Conc. Cohort	0.0116	**	0.0125	**	0.0115	**	0.0053		0.0006		0.0098	*
	(0.0042)		(0.0043)		(0.0042)		(0.0045)		(0.0057)		(0.0048)	
High	-0.0152	**	-0.0083		-0.0150	**	-0.0199		-0.0170		-0.0167	
	(0.0048)		(0.0125)		(0.0052)		(0.0170)		(0.0159)		(0.0121)	
Medium	0.0112	+	0.0208	**	0.0113	+	-0.0099		-0.0152		-0.0057	
	(0.0066)		(0.0080)		(0.0062)		(0.0113)		(0.0106)		(0.0106)	
Female	0.0228	**	0.0239	**	0.0228	**	-0.0470	**	-0.0519	**	-0.0471	**
	(0.0041)		(0.0042)		(0.0041)		(0.0083)		(0.0097)		(0.0083)	
Urban	-0.1939	**	-0.1939	**	-0.1938	**	-0.0737	**	-0.0737	**	-0.0634	**
	(0.0273)		(0.0273)		(0.0277)		(0.0200)		(0.0200)		(0.0246)	
Intercept	0.9490	**	0.9484	**	0.9490	**	0.9613	**	0.9635	**	0.9593	**
	(0.0036)		(0.0036)		(0.0035)		(0.0057)		(0.0056)		(0.0051)	

** indicates p-value<.01, * p-value<.05 ; + p-value<.10

6 Discussion

This chapter attempts to investigate whether long-term effects of early-life exposure to war can be observed on later life socioeconomic outcomes of Vietnamese children born or conceived during the Vietnam War. Untangling the long-term effects of the war from other factors that could be influencing the socioeconomic outcomes has proven to be challenging. However, the results of the analysis are fairly consistent with the expected conditions that produce the difference-in-differences shown in Table 5. Marriage and employment most consistently show some adverse effects of war exposure in the north. In addition, some evidence is seen of unfavorable effects on employment in the south. For literacy and educational attainment, although the results are fairly consistent with our expectations (i.e., they fall under one of the conditions outlined in Table 5), the possible effects of war exposure are more difficult to extricate because in most cases, the war-exposed cohorts show better outcomes than the postwar cohort and therefore the interpretation of the difference-in-differences estimates is less straightforward. Further, despite the fact that difference-n-differences estimates are in agreement with our expected results for the effect of war exposure, it is still unclear whether these effects are observed because of 1) early life exposure to war time conditions *in utero* and/or as infants; 2) being school aged in the 1980s and the early 1990s when Vietnam was undergoing economic hardship, then reform; or 3) coming of age during a period of expanding economic opportunities in the mid to late 1990s.

Furthermore, in the south, most of the results showed no effects of exposure to the war. This is surprising since one would expect more war impact in the south especially towards the end of the war as the North Vietnamese troops moved further south. However, the null result is consistent with findings from a previous study on the long-term effects of bombing on poverty rates, consumption levels, infrastructure, literacy, or population density [38]. One reason for not observing adverse outcomes in difference-in-differences estimates is that conditions in the south may not have changed very fast after the war or even worsened. As discussed earlier, the postwar period was characterized by economic hardships stemming from the cessation of foreign aid, the U.S. trade embargo, destroyed industrial and agricultural production centers, poor harvests, etc. In addition, the country experienced massive dislocation of the population, wars with Cambodia and China, and the general deterioration of the health care system. To the extent that the postwar conditions may have been worse in the south than in the north, it may be more difficult to see any effects of war exposure in the south.

With regard to the differential impacts of exposure to the war on women, this study shows some indication that women may be affected differently than men, but the results are mixed. Women show higher levels of primary school completion and literacy than men, but lower levels of lower secondary school completion and upper secondary school completion in both the north and the south. In addition, being female and war exposed further lowers the probability of lower secondary school completion in the north, but for upper secondary school completion, the effects are opposite in both the north and the south. Therefore, no generalizations can be made about the differential effects of war exposure on women's educational attainment. However, it is clear that gender has some role to play in the effect of war exposure on socioeconomic outcomes.

For marital outcomes, the added effect of being female is likely to be due to earlier age of marriage for women rather than a war effect. Similarly, it is difficult to make any conclusions about the the differential effects on employment between men and women, because of the varied patterns in labor force participation between the sexes. For example, men who are not employed may continue to look for work, especially if they are the primary wage earners for the family, and therefore, remain unemployed but in the labor force, while women in the same situation may leave the labor force, especially if married and are the secondary wage earners or have young children. Since the variable for employment used in the analysis only reflects those who are in the labor market, this may bias the results.

Finally, higher rates of educational attainment and literacy and lower rates of marriage and employment are consistently associated with urban residence. These results are in agreement with the ideas that urban areas would have better access to education, those with more education tend to marry later, and urban areas may attract more people who are looking for work and thus have lower employment rates. However, there are no consistent trends regarding differential impact of the war on urban residents.

There are many challenges to studying the long-term effects of war. These include difficulties in identifying war impacts, lack of data before, during, and soon after the war, quality of the data, and population movements around the time of the war and confounding economic and policy changes after the war. This study is not immune to these challenges and faces several weaknesses. First, war impacts were identified on a provincial level based on the number of bombs dropped per province. However, there may have been considerable heterogeneity of war impacts within provinces. It was not possible to conduct the analysis at a smaller geographic level because the province was the smallest unit available in the census data. Further, bombing alone may not reflect the true impact of the destruction caused by the war. In addition, because of the absence of birth place data in the 1989 and 1999 censuses, the geographic controls used in the analysis are not optimal despite attempts to mitigate the effects of migration. As mentioned earlier in the chapter, a massive population redistribution program was implemented in Vietnam after the war. This creates a challenge for using place of residence as a proxy for birth place. Even if place of birth data were available, it would be difficult to track whether people had lived in one place all of their lives or had moved to another location temporarily and therefore were exposed to different conditions in childhood, before returning to their province of birth. Moreover, the process of reconstruction takes time and in the case of Vietnam, the country faced many economic and political hardships in the period following the war. Therefore, conditions for the postwar cohort might not have changed enough to show much difference between them and the war-exposed cohorts. Finally, the censuses captured the cohorts of interest in early adulthood. While examining this age group is interesting because they are at a critical period of transition into adulthood, the cohorts may still undergo further changes in their socioeconomic outcomes. There may also be tremendous heterogeneity in the stages of life at which they find themselves. Some may still be students or living with their parents, while others may have established their own household or have children of their own. A study from the 2009 round of census when the cohorts are in their middle ages may produce more concrete results.

7 Conclusion

The results from this analysis do not present a clear picture of the effect of early life exposure to war on later life socioeconomic outcomes, but rather, point to the complexity of the social and economic dynamics during the war and postwar reconstruction periods. Despite the weaknesses in the analysis, this study has shown that the north and the south show very different trends in socioeconomic outcomes and that within each region, some possible adverse effects of war exposure were observed. However, these effects should be approached with caution given the limitation of the study.

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