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The Consequences of the Vietnam War on the Vietnamese Population

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by

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Professor John Wilmoth
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Abstract

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The purpose of this dissertation is to examine the demographic and socioeconomic consequences of wars, using the case of the Vietnam War and its effects on the Vietnamese population. Using mainly the 1989 and 1999 census microdata, it focuses on the effects of the last ten years of the Vietnam War (or the "American War") from 1965 to 1975, characterized by the escalation of the war with a large presence of American troops in Vietnam and extensive aerial bombings by the United States.

The dissertation consists of two descriptive chapters and two analytical chapters. In the first descriptive chapter, I summarize existing estimates of mortality in Vietnam covering the period before, during, and after the war. I find evidence of increased mortality among young men during wartime, but raised mortality among children and the general population is not observed. Next, I examine whether the Vietnamese population age and sex structure show evidence of the war's imprints. Indeed, the 1989 and 1999 Vietnamese censuses reveal that the war left a mark on the cohorts that were in their 20s and 30s during 1965-1975, by reducing their numbers relative to their surrounding cohorts and by skewing the sex ratios.

In the first analytical chapter, I examine marriage patterns in Vietnam between 1979 and 1999 using census data. Using a marriage squeeze index that applies the age-specific probability of first marriage estimated using the Coale-McNeil marriage model to the population, I show that Vietnam experienced a severe marriage squeeze in 1979 and 1989, but the squeeze had been alleviated by 1999. Furthermore, the dissertation investigates the relationship between the marriage squeeze and two war-related causes of the squeeze: excess male mortality and emigration. While the relationship between excess male mortality and the marriage squeeze was not observed, the results indicate that disproportionate male emigration is likely to be a major factor in bringing about the marriage squeeze.

Lastly, the dissertation explores the long-term effects of early-life exposure to the war, examining educational attainment, literacy, marriage, and employment outcomes of those who experienced the war as infants and *in utero*, using the difference-in-differences technique. Separate analyses were conducted for North and South Vietnam. The results reveal adverse

effects of early-life exposure to the war on marriage and employment in the north and on employment in the south. Mixed results are seen on literacy and educational outcomes.

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Chapter 1

Introduction

Wars have been a pervasive part of human society since the beginning of time. While there is no question about the human suffering and societal disruption precipitated by wars, empirical evidence of their impacts are difficult to produce, especially in developing countries. This is partly due to data limitations and partly because it is difficult to disentangle the effects of a war from other societal and economic forces taking place before, during, and after a war. This dissertation is one attempt to examine the population consequences of wars, using the case of the Vietnam War.

The demographic consequences of wars can be broadly grouped into three categories:

1. morbidity, mortality, and disability;
2. forced migration and other types of internal or international mobility; and
3. fertility, nuptiality, and household composition.

The most obvious impact of wars is on mortality. In violent conflicts, deaths are inevitable. Much of the focus in studies that examine demographic consequences of wars have centered around estimating the wartime mortality rates and the total number of deaths from various conflicts. The lack or inadequacy of vital registration systems in countries that are undergoing war complicates the measurement of mortality (Checchi and Roberts, 2008). Under these circumstances, studies have used a range of methods to estimate both adult and child mortality. These include direct measures of mortality from "body counts" (Iraq Body Count, 2010) as well as from retrospective mortality surveys that ask about deaths of household members within a specified period of time (Burnham et al., 2006; Hirschman et al., 1995; Lee et al., 2006), and indirect measures from data on deaths of siblings from household retrospective surveys to estimate adult mortality (Obermeyer et al., 2008) or on mothers' reports of children ever born and children surviving to estimate infant and child mortality (Savitz et al., 1993). Demographic reconstruction techniques have also been employed through the application of forward and backward projection using data on population structure from before and after the conflicts to estimate excess mortality (Heuveline, 1998; Neupert and Prum, 2005). In addition, some studies have used the capture-recapture method to infer the total number of deaths by matching individual records across multiple data sources and analyzing the overlap in documentation across data sources (Ball et al., 1999; Silva and Ball, 2008).

In addition to mortality, wars can also produce conditions such as poor sanitation, malnutrition, crowded living conditions, and deteriorated health infrastructure, that could lead to increased morbidity. Furthermore, diseases and injuries incurred during wartime may result in disabilities, which may be temporary or long-term.

Another consequence of wars is migration. The United Nations defines a refugee is a person who "owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of his nationality, and is unable to or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it..." (United Nations, 1951). Refugees are distinguished from internally displaced persons who are defined as "persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border" (United Nations, 1988). In addition, economic conditions precipitated by war may result in economic migration. While these definitions may offer specific legal protections, the line between the categories are often blurred.

Moreover, since wars disrupt normal functioning of societies, they often have effects on fertility and nuptiality. Marriage is likely to be reduced in the short-term, but may experience a rebound after a war (Palloni et al., 1996), as soldiers return from the warfront, and the pent up demand for marriage is met. Wars may reduce or increase fertility depending on the stage of the demographic transition that the country experiencing the war is in and degree to which people experience the intermediate factors that lead to fertility. Factors that could lead to a decrease in fertility include decreased sexual activity, decreased conception due to starvation and disease, increased spontaneous abortions, and postponement of births due to inopportune circumstances. Factors that could lead to increased fertility include rise in coercive sex, lack of access to contraceptives, and pronatalist policies (Agadjanian and Prata, 2002; Fargues, 2000; Hill et al., 2004). In addition, the mortality and migration caused by wars can have an effect on household composition, either temporarily or in the long-term (Zimmer et al., 2006).

The effects of the above demographic consequences of wars often can be seen in the age and sex structure of the population. Further, the three population consequences discussed above may occur through intermediate effects. These include psychosocial effects which impact demographic behavior such as marriage and fertility, and socioeconomic effects which can influence to morbidity, mortality, fertility, and nuptiality.

1.1 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 (Long, 1973; Woodside, 1976). 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 (Clodfelter, 1995). 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 (Hirschman et al., 1995). Mortality from the war is discussed further in the next chapter.

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 wartime, 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 (Marr and White, 1988). 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 (Luong, 2003; Marr and White, 1988; Vo Nhan Tri, 1988).

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 (Desbarats, 1987). 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 (Merli, 1997).

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 (Luong, 2003).

These challenges may have led to declining health infrastructure in the period following the war. One report cited in Banister (Banister, 1993) 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 (Banister, 1993)).

Furthermore, in the south, some one million persons may have been sent to reeducation camps or were incarcerated for political reasons (Desbarats and Jackson, 1985), 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 (Desbarats, 1987).

1.2 Organization of the Dissertation

The dissertation is organized as follows. First, in this chapter, I have presented a framework for thinking about the population consequences of wars and provided a background on the Vietnam War, which will be the focus of this dissertation. In the next chapter, I review existing estimates of war-related mortality in Vietnam and describe the mortality trends to investigate the effect of the Vietnam War on mortality. Specifically, I search for evidence of a mortality shock on the Vietnamese population that may have occurred during the war. Then, in Chapter 3, I examine the impact of the war on population age and sex structure in 1989 and 1999. Also in this chapter, I describe in detail the main datasets used in the dissertation: the Vietnam census microdata from Integrated Public Microdata Series (IPUMS) International (Minnesota Population Center, 2009). Next, I explore the consequences of the war on marriage patterns in the period following the war, by measuring the marriage squeeze in 1979, 1989, and 1999 in Chapter 4. In Chapter 5, I examine the long-term effects of the war on those who were exposed to the war as infants and *in utero*. Finally, I end the dissertation with some concluding remarks.

Chapter 2

The Effects of the War on Mortality

This chapter will examine the most direct consequence of war: mortality. Lacina and Gleditsch (Lacina and Gleditsch, 2005) classify war mortality into battle deaths and non-battle deaths. Battle deaths include deaths of soldiers and civilians killed in combat. Non-battle deaths include deaths from less directly related sources of deaths, but those which occur because of war-time conditions. These include 1) one-sided violence, which are acts of violence committed when there is no meaningful armed resistance, such as genocide and execution of prisoners, 2) deaths as a result of increase in criminal and unorganized violence; and 3) increase in non-violent mortality such as disease and starvation. I will first review the literature on Vietnamese war-related mortality from the Vietnam War, then various published trends in mortality in Vietnam to see whether a peak in mortality can be established during the war.

2.1 Vietnamese War-Related Mortality

A handful of data-based studies exist on war-related mortality from the Vietnam War. Each study defines war-mortality slightly differently and use different time periods for the war, therefore, a precise comparison is not possible. However, from these estimates, one can still gain a sense of the magnitude of mortality from the war.

Hirschman, et al. (Hirschman et al., 1995) calculated war-related mortality rates from data on deaths of parents and siblings in the 1991 Vietnam Life History Survey, a small sample survey (403 households) conducted in four select areas of Vietnam, using direct methods of estimation. War deaths were identified from the cause of death, reported by a child or sibling of the deceased, as either military casualty or civilian casualty of war. They then apply the rates to the United Nations population estimates to arrive at an estimate of approximately one million Vietnamese war deaths (791,000 to 1,141,000) between 1965 and 1975.

Using sibling histories from the 2002-2003 World Health Survey after correcting for sampling bias and censoring, Obermeyer and colleagues (Obermeyer et al., 2008) estimate violent war deaths during 1965-1974 to be approximately 1.7 million (1.02 to 2.55 million) or 170,000 deaths per year. Violent war deaths are defined as those deaths caused by injuries, that were related to the war.

Finally, the number of battle deaths in the Battle Deaths Dataset Version 3.0 (Lacina and Gleditsch, 2005) documented by the International Peace Research Institute, Oslo, show similar results as Obermeyer, et al. at about 1.4 million for period between 1965 and 1974, although their uncertainty interval is very wide (1.1 million to 4.5 million). Their definition of battle deaths include deaths of soldiers and civilians killed in combat as discussed above.

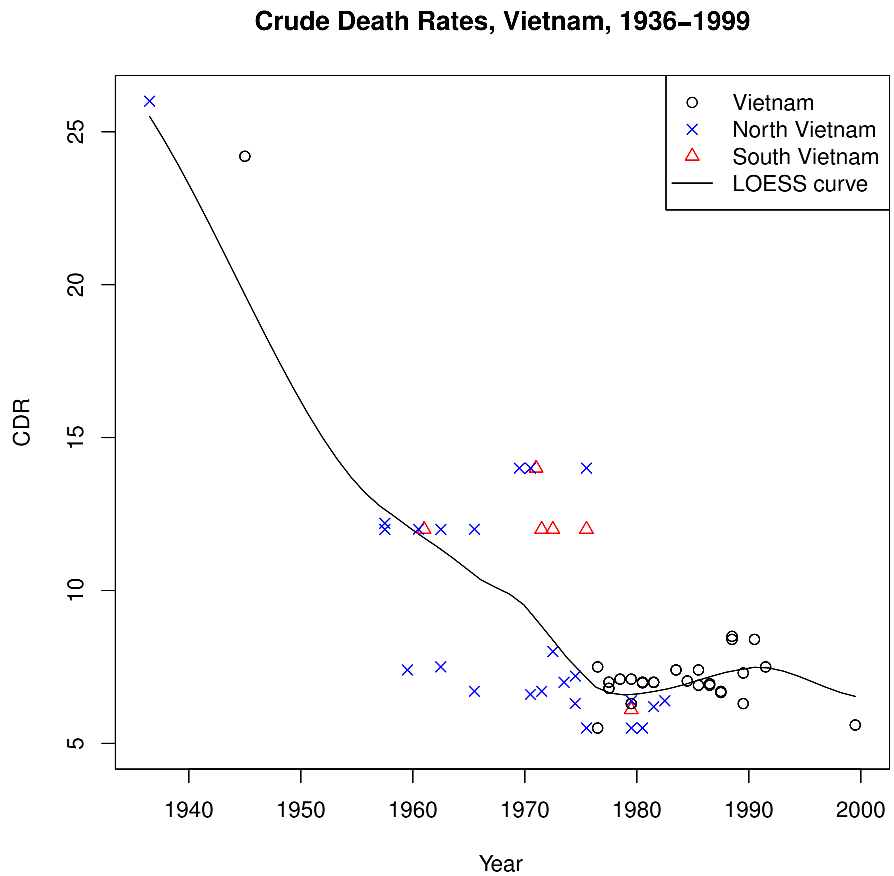
2.2 Mortality Trends in Vietnam

In order to understand the effects of the Vietnam War on populations, it is useful to examine not only the total number of battle deaths, but also the overall war mortality that include non-battle deaths. To do this, mortality trends in Vietnam from various sources over the past few decades can be observed to determine whether mortality shocks can be seen during the war period, 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. A peak in mortality in a particular year could be used to identify cohorts that might have been particularly affected by the war. In this section I will attempt to identify such a peak in mortality.

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 1936 and 1999 are shown in Figure 2.1. For Vietnam as a whole, a steady decline in crude death rates is observed throughout the war period. The pace of the decline appears to slow down after the war in the 1980s. A slight increase in the crude death rates is observed from the late 1970s to the early 1990s, but then mortality resumes its decline in the 1990s. Data from North and South Vietnam show that the majority of the data points from the north lie below the LOESS curve fitted to all of the data, while the data points from the south lie above the curve.

Age-specific death rates from 1979 to 1999 are available through the censuses of 1979, 1989, and 1999. Figure 2.2 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 (Banister, 1993) 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 (Vietnam General Population Census Central Committee, 1983). The vital registration death counts are likely to be incomplete and therefore, the mortality rates are also likely to be underestimated (Banister, 1993).

Figure 2.1: Crude death rates, Vietnam, 1936-1991.



Note: The line indicates a LOESS curve fitted on all available data.
Data sources: vital registration, census data, and as appears in Banister (Banister, 1993; Banister and United States Bureau of the Census, 1985), Jones (Jones, 1982), Monnier (Monnier, 1981), Nguyen (Nguyen Duc Nhuan, 1984), and Vietnam Government Statistical Office (Vietnam General Statistical Office, 2001)

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 (Vietnam General Statistics Office, 1991). To account for the underreporting of deaths typical in responses from household retrospective mortality questions, the Preston-Coale method (United Nations, 1983; Preston et al., 1980) was applied to correct for the problem. However, as noted by others (Hirschman et al., 1995; Merli, 1998), 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.[1] Given the trend in declining mortality seen in Figure 2.1, 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 (Vietnam General Statistical Office, 2001). 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 described earlier in this chapter (Hirschman et al., 1995). Although the sample size was small (403 households) and a sub-national sample was used, the resulting estimates were shown to be fairly consistent with the life tables from the 1979 and 1989 censuses (Hirschman et al., 1995).

In comparing the four estimates of age-specific mortality by sex over time (Figure 2.2), 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. The rise in male

[1] Briefly, Preston-Coale method of adjusting for completeness of death registration stipulates that the relative completeness of death registration can be indicated by the ratio of estimated population of age x derived from deaths over age x to the reported population of of age x, $\hat{N}(x)/N(x)$. The $\hat{N}(x)$ can be estimated by using the stable population growth rate (r) and the number of deaths at age x ($D(x)$):

$$\hat{N}(x) = \sum_{a=x}^{\omega} D(a) exp(r(a-x)).$$

Since using age-specific ratios of $\hat{N}(x)/N(x)$ is subject to bias from age misreporting or under-enumeration, the median or mean of a sequence of $\hat{N}(x)/N(x)$ or $\hat{N}(\text{x to A})/N(\text{x to A})$ (where A is the lower bound of the open ended interval) is used to denote the completeness of death registration, C. Then, the age-specific death rates can be adjusted by applying $1/C$ to the reported death rates. If mortality has been declining, then the $\hat{N}(x)/N(x)$ would show first a rising and then a falling trend and $\hat{N}(\text{x to A})/N(\text{x to A})$ would show a falling trend. Therefore, C would be smaller than we would expect under the stable population conditions. As a result, the adjusted death rates will be overestimated (United Nations, 1983). The completeness of death reporting in the 1989 census was considered 55 percent for males and 45 percent for females and thus, the death rates were approximately doubled in the adjustment (Vietnam General Statistics Office, 1991).

mortality in these age groups is consistent with the estimates of cause-specific deaths by Obermeyer, et al. (Obermeyer et al., 2008), who estimated a peak in violent war deaths in Vietnam during 1965-1974 as discussed earlier. They estimated that the total number of violent war deaths per year rose from 131,000 between 1955 and 1964 to 170,000 between 1965 and 1974, then declined to 81,000 in the postwar period between 1975 to 1984 (Obermeyer et al., 2008). While they do not report estimates broken down by age and sex, it is likely that these war-related deaths occurred among young men in military service.

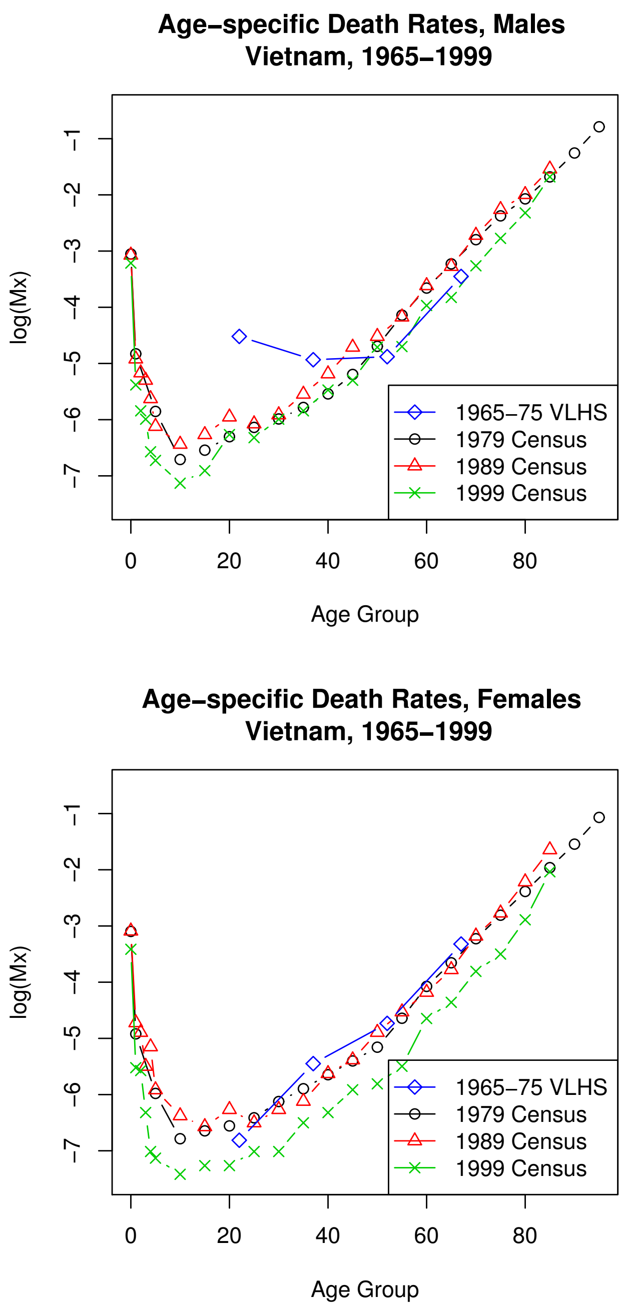
One puzzling trend is that male mortality in 1989 appears to be slightly higher than that in 1989 for some age groups. For females, however, the mortality rates are about the same in 1979 and 1989. One likely explanation for the higher male mortality in 1989 compared to 1979 is the underestimation of mortality from the 1979 census and the overestimation of the adjusted death rates from the 1989 census as discussed earlier. However, the reason for the higher 1989 death rates relative to 1979 rates for males and not for females is unclear, especially since the completeness of death data for females is lower than that for males and thus, the adjustment factor for the female is higher. Sex-selective emigration could be a factor if the male population in 1989 was under-enumerated more than the male deaths were under-registered. However, emigration would not explain the higher mortality rates in 1989 than in 1979 of the younger age groups of 10-14 and 15-19.

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 mortality peaks among children during the conflict period (Figure 2.3 and 2.4). Instead, both infant and under-five mortality trends show a gradual decline in mortality until about 1990, after which a rapid drop is observed.

2.3 Conclusion

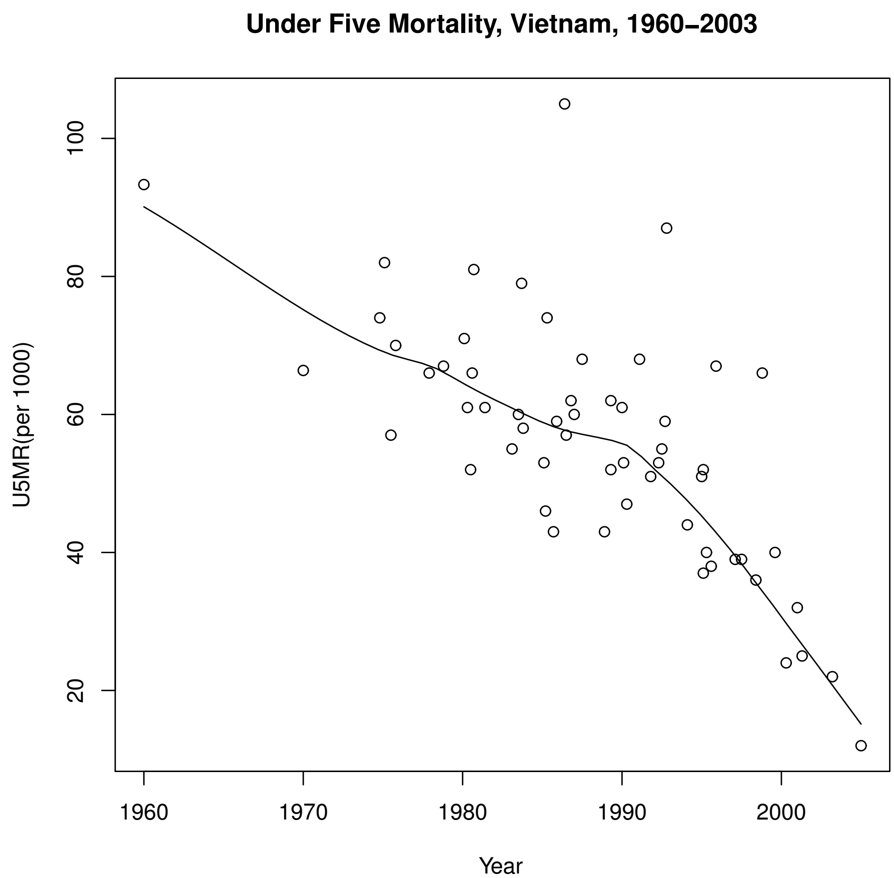
In sum, the existing data-based estimate of war-related mortality range from about one million to 1.7 million during 1965-1975 and 1965-1974. Further, there is some evidence of increased mortality among young men during the war, but no mortality peaks can be detected among young children or in the general population based on the available data.

Figure 2.2: Age-specific death rates by sex, 1965-1999, Vietnam



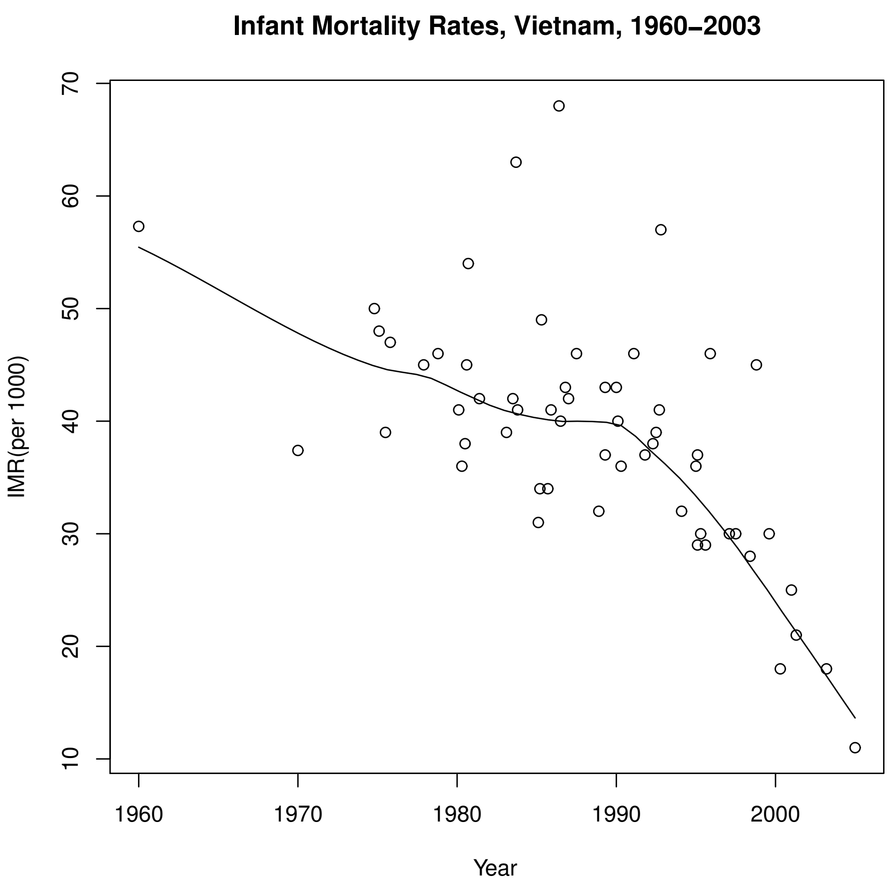
Note: The line indicates a LOESS curve fitted on all available data.
Data sources: 1979 Census (Banister, 1993), 1989 and 1999 Censuses (Vietnam General Statistical Office, 2001), Vietnam Life History Survey (Hirschman et al., 1995)

Figure 2.3: Estimates of under-five mortality rates, Vietnam, 1960-2003.



Note: The line indicates a LOESS curve fitted on all available data.
Data sources: census data, Demographic and Health Surveys, Multiple Indicator Cluster Surveys, Vietnam Intercensal Demographic Survey as appears in www.childmortality.org (Inter-agency Group for Child Mortality Estimation, 2009) and Savitz (Savitz et al., 1993)

Figure 2.4: Estimates of infant mortality rates, Vietnam, 1960-2003.



Note: The line indicates a LOESS curve fitted on all available data.
Data sources: census data, Demographic and Health Surveys, Multiple Indicator Cluster Surveys, Vietnam Intercensal Demographic Survey as appears in www.childmortality.org (Inter-agency Group for Child Mortality Estimation, 2009) and Savitz (Savitz et al., 1993)

Chapter 3

The War's Imprint on the Population Structure

This chapter examines the imprint that the Vietnam War may have left on the population age and sex structure in 1989 and 1999. As discussed earlier, the demographic consequences of wars, namely mortality, fertility, and migration, could have significant impacts on the population age and sex structure. Hence, a careful examination of the population age and sex structure in Vietnam in the decades following the war may reveal some insights about the population consequences of the war.

3.1 Data Description

The main datasets used for analysis in this chapter and the following two chapters are the 1989 and 1999 Vietnamese census microdata, available through the Integrated Public Microdata Series (IPUMS) International: Version 5.0 (Minnesota Population Center, 2009). The 1989 census was conducted on April 1, 1989 and the 1999 census was implemented on March 31, 1999. The 1989 data consist of a 5 percent sample of 2,627,000 persons while the 1999 data constitute a 3 percent sample and includes 2,368,000 persons.

3.1.1 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" in both the 1989 and 1999 censuses, but only for cohorts born in 1960 or earlier. The consistency between the number of households and household heads is also good in both censuses. 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 3.1 and 3.2).

Another point of concern is that cohort survival[1] 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 3.3). These patterns indicate the presence of sex and age-specific migration or under-enumeration.

3.2 The War's Imprint on the Population Structure in the 1989 and 1999 Census Data

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. (Hirschman et al., 1995). 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 3.1). The following discussion focuses on the 1999 population pyramid with comparisons made to the 1989 pyramid. Three large 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 second "dent" is more prominent for males. This decrease in cohort size does not appear in the 1989 population pyramid when the cohorts were around age 10. Thus, this dent is likely to be a period effect resulting from sex-selective under-enumeration of males. The dent for the age 52 to 57 cohorts are likely due to the impact of the war, since they were in their 20s and early 30s between 1965 and 1975 during the

[1] Cohort survival refers to the ratios of people enumerated in the two censuses. It is the number of people in an age group x in 1999 divided by the number of people in the age group $x-10$ in 1989. Therefore, it reflects age-specific survival form mortality, as well as "survival" from emigration and age-specific under-enumeration. In the case of large immigration, the cohort survival rate may be above unity.

period of heaviest fighting and a similar dent occurs in the 1989 pyramid for ages ten years younger. These two dents can be explored further through the inspection of the age-specific sex ratios between 1989 and 1999.

In addition to the three large indentations, there are two smaller indentations in the population pyramid that may be attributable to the war. These occur for ages 31-33 and 37 in 1999. Both of these indentations are visible in the 1989 population pyramid as well for ages 21-23 and 27, indicating a cohort effect, and for both males and females. The cohorts aged 31-33 in 1999 were born in 1966-1968 which fall during the period of heavy fighting. The smaller size of these cohorts may be due to either the reduction in fertility or increased infant and child mortality during the war. The cohort aged 37 in 1999, however, was born in 1962. This cohort may have been exposed to high rates of child mortality as the war intensified, but the available data on child mortality do not show a rise in child mortality during the war period. Also, if the small cohort size for 1962 was due to the war, then the surrounding cohorts should also show smaller cohort sizes, but the data only show an indentation for the 1962 cohort. Therefore, it is unclear whether the smaller size of this cohort is attributable to the war.

Evidence of a baby boom shortly after the end of the war is not seen. Instead, the population pyramid shows larger cohort sizes for those born around 1983-1985 (14-16 year olds) which also can be seen in the 1989 population pyramid. Larger cohort sizes are also seen for cohorts born between 1989 and 1990, which may be attributable to the implementation of economic reforms in the late 1980s.

Figure 3.2 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-enumeration 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 include 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. (Hirschman et al., 1995) in the 1979 and 1989 censuses.

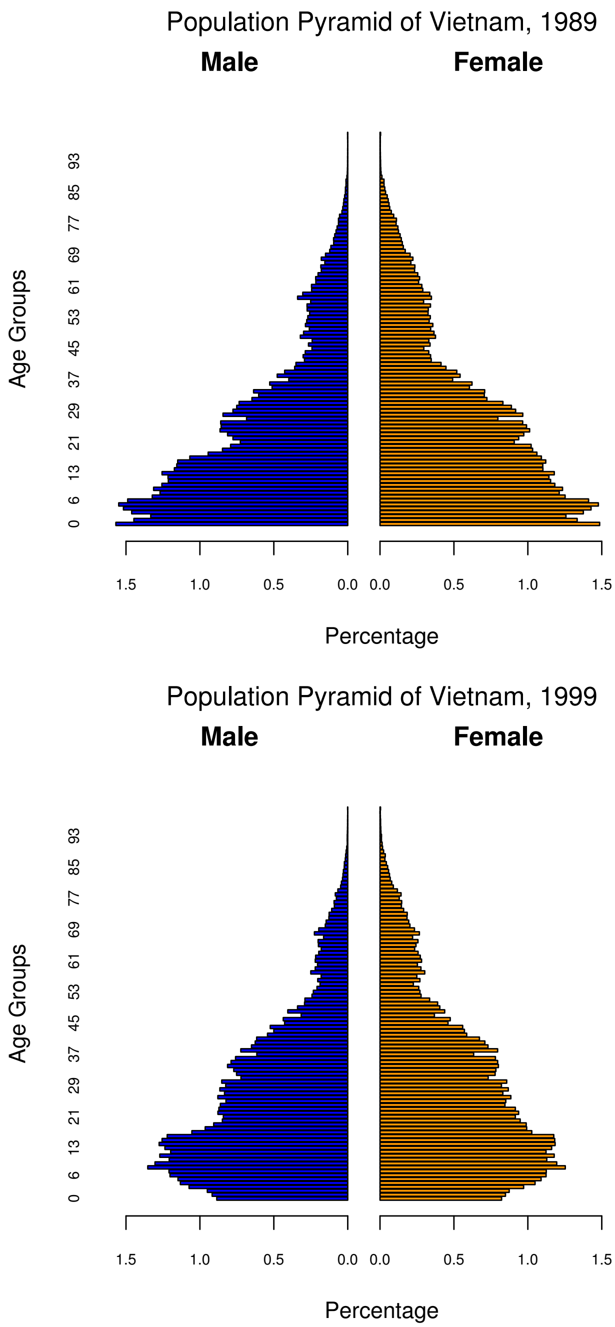
An additional drop in the sex ratios is observed in the 45-49 and 50-54 age group in 1989 and for the same cohort who are 55-59 and 60-64 in 1999. It is possible that the low sex ratios in these older age groups are attributable to excess mortality of males during the Vietnam War, since these cohorts 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 3.3). 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 (Hirschman et al., 1995).

3.3 Conclusion

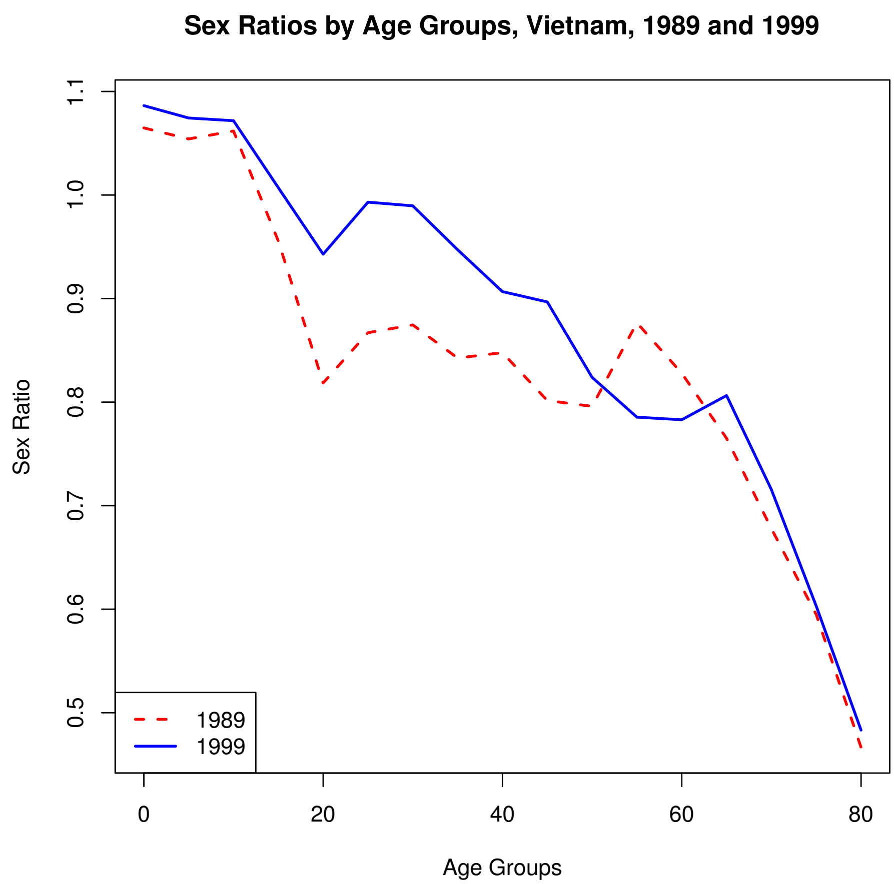
Based on the examination of the population pyramid, age-specific sex ratios, the war's impact on the population structure is seen in the age groups between 55 to 64 in 1999. While a dent in the population pyramid and a deficit in males is observed in the younger age groups, the evidence from the cohort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

Figure 3.1: Population pyramid, Vietnam, 1989 and 1999



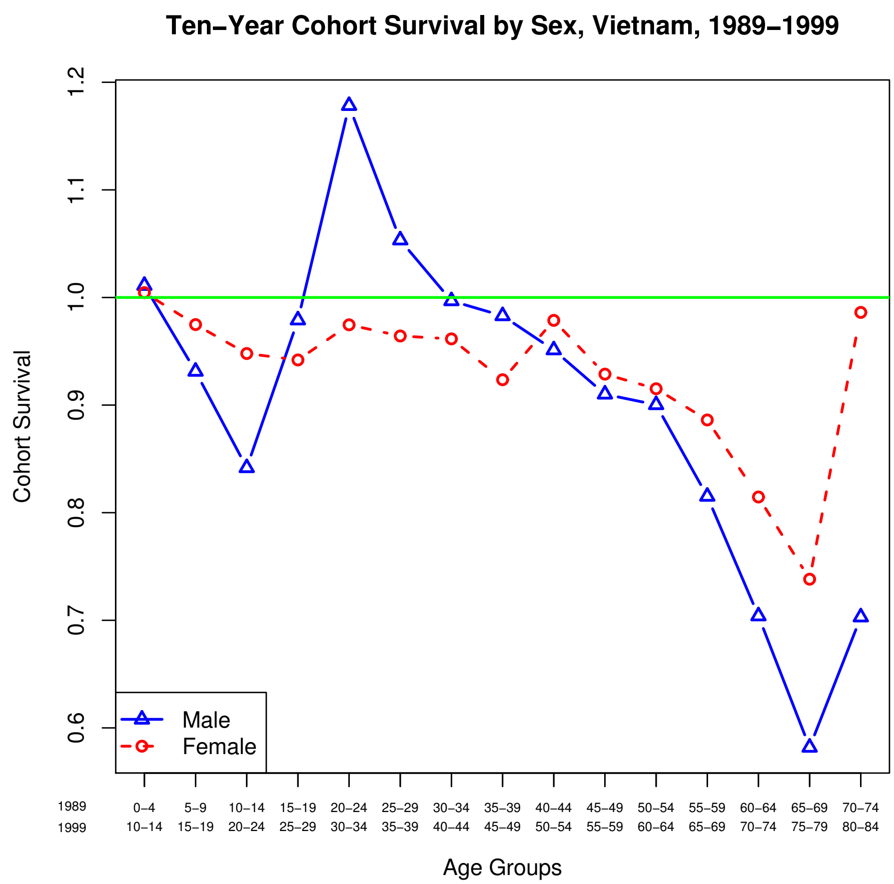
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 3.2: Sex Ratios by five-year age groups, Vietnam, 1989 and1999



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 3.3: Ten-year cohort survival rates, Vietnam, 1989-1999



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Chapter 4

Vietnamese Marriage Patterns After the War

4.1 Introduction

The Vietnam war resulted in a sex imbalance among young adults caused by excess male mortality and sex-selective emigration after the war. These imbalances are said to have had consequences for the first-marriage market due to the surplus of young women relative to young men. This chapter explores the effect of the Vietnam War on marriage patterns in Vietnam through the use of a "marriage squeeze" index.

The pattern of marriage following a crisis has been studied by many scholars. Studies of the effects of crises on marriage are mostly based on responses to economic crises and recessions (Galloway, 1988; Palloni et al., 1996), but to the extent that wars produce economic conditions that are similar to those seen during economic crises and recessions, findings from these studies may be analogous to the effects of war on marriage.

The general pattern of marriage following a crisis is that there is an immediate drop in the number of marriages, followed by a rebound. The potential mechanisms that result in the initial postponement are 1) the behavioral response to the less optimistic economic prospects for establishing a self-sufficient household; and 2) the increase in adult mortality among males in particular (Palloni et al., 1996). The first is related to the feasibility of marriage while the latter affects the availability of marriage partners.

The effect of war on the availability of marriage partners can be observed through the marriage squeeze phenomenon. A marriage squeeze occurs when one sex is in short supply relative to the other sex such that the more abundant sex must marry later or remain single (Goodkind, 1997; Jones and Ferguson, 2006; Schoen, 1983). A marriage squeeze is commonly seen in growing populations where men tend to marry at older ages than women (Goodkind, 1997; Schoen, 1983) or following a baby boom or bust.

Traditionally, marriage has been considered a social norm in Vietnam and both men and women are generally expected to marry. This expectation is rooted in the patrilineal tradition in Vietnam; marriage is considered important for the entire family in order to extend the male family lineage through the birth of sons (Belanger, 2004; Belanger and Hong, 2002; Williams, 2009). Until recently, alternatives to marriage were almost non-existent (Van Bich, 1999). However, there have been some recent indications that the traditional view of marriage has begun to shift and that the near universal marriage in Vietnam is a thing of the past, as in many other countries in East and Southeast Asia (Jones, 1997; Jones, 2007).

Further, men tend to marry at later ages than women in Vietnam. The minimum legal age at marriage in Vietnam has been 18 years for women and 20 years for men since 1959 in the north and since 1975 in the south (Nguyen, 1997). The 1989 census reported the singulate mean age of first marriage (SMAFM) to be 24.5 for men and 23.2 for women (Vietnam General Statistics Office, 1991). In 1999, the SMAFM was 25.3 for men and 22.7 for women (Vietnam General Statistical Office, 2001). This pattern, combined with the population growth that Vietnam had witnessed until the 1990s (Barbieri et al., 1996), makes it likely for a "marriage squeeze" on women to be observed in Vietnam up to the 1990s. These conditions may be further exacerbated by the sex imbalance caused by two additional factors as described by Goodkind (Goodkind, 1997): the excess male mortality during the war and the disproportionately male emigration shortly after the war. The excess male mortality during the Vietnam War is discussed in an earlier chapter. Merli estimates that there was heavy net outmigration of males between the ages of 14.5 and 29.5, nearly three times as much as the net outmigration of females (Merli, 1997).

Previous quantitative literature on the marriage squeeze in Vietnam has been limited to an examination of sex ratios at marrying ages (Goodkind, 1997). The purpose of this chapter is to extend this literature through the use of a marriage squeeze index to better understand the degree of marriage squeeze across time, geographic regions, urban/rural areas, and by educational attainment. Further, I investigate the two underlying causes of the marriage squeeze related to the war: excess male mortality and sex-selective emigration.

4.2 Data and Methods

4.2.1 Data

The 1989 and 1999 census microdata from the Integrated Public Use Microdata Series (IPUMS) International: Version 5.0 (Minnesota Population Center, 2009) are used for the analysis. The data are described in detail in Chapter 3. Information on marital status was collected in both the 1989 and 1999 censuses for persons aged 13 and older. All persons under the age 13 are coded as "single/never married". Persons who are married include those married by law or custom, or living with a partner of the opposite sex as husband or wife. Widowed persons are those whose spouse had died and have not remarried, divorced persons are those who have divorced by law and have not remarried, and separated persons are those who are married, but permanently not living with their spouse. The outcome of interest in the analysis is whether a person was ever-married. Those who are married, widowed, divorced, or separated at the time of the censuses are considered ever-married. The summary statistics of those ever-married are shown in Table 4.1.

Table 4.1: Estimated total number of ever-married persons, Vietnam, 1989 and 1999

	1989		1999	
	Male	Female	Male	Female
Total	12,179,388	15,325,327	16,629,934	19,768,378
Rural	9,749,390	12,269,952	12,690,812	15,014,088
Urban	2,429,998	3,055,375	3,939,122	4,754,289
North	6,285,805	7,777,103	8,260,758	9,753,578
South	5,893,583	7,548,224	8,369,175	10,014,800
Red River Delta	2,811,753	3,588,321	3,497,648	4,202,230
Northeast	1,821,775	2,200,359	2,465,691	2,845,260
Northwest	222,119	245,947	485,474	539,263
North Central	1,672,423	2,061,767	2,128,692	2,552,910
Central Coast	998,590	1,312,193	1,326,123	1,647,417
Central Highlands	339,422	403,980	607,569	696,433
Southeast	1,734,403	2,242,964	2,625,310	3,154,660
Mekong River Delta	2,578,902	3,269,796	3,493,427	4,130,204
Less than primary completed	5,273,119	9,235,706	5,615,882	9,450,153
Primary completed	5,308,668	4,828,941	8,270,325	8,091,772
Secondary completed	1,178,940	990,681	2,196,356	1,958,867
University completed	383,509	213,097	518,719	237,399

Note: The totals are weighted sums using person level weights.
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

With regard to the quality of the marital status data, the total number of women who are married is greater than the total number of men in both the 1989 and 1999 samples, indicating that there may be some quality issues. The Vietnam General Statistical Office attributes this differential in reporting across sexes largely to misreporting of marital status due to the stronger stigma associated with singlehood, separation or divorce for women than men, and to a smaller extent to the practice of polygamy existing in some regions (Vietnam General Statistical Office, 2001; Vietnam General Statistics Office, 1991). In addition, to the extent that there are more male emigrants than female emigrants, the censuses would count more married women than men since the women whose husbands are abroad would be enumerated, while their husbands would not be in the country to be counted.

In addition to the 1989 and 1999 census microdata, aggregate data on population by sex and age in five-year age groups by province from the 1979 census (Vietnam General Population Census Central Committee, 1983) are used to estimate the degree of the marriage squeeze in 1979. The 1979 census was the first population census to be carried out after reunification of Vietnam. The census did not collect information about marital status.

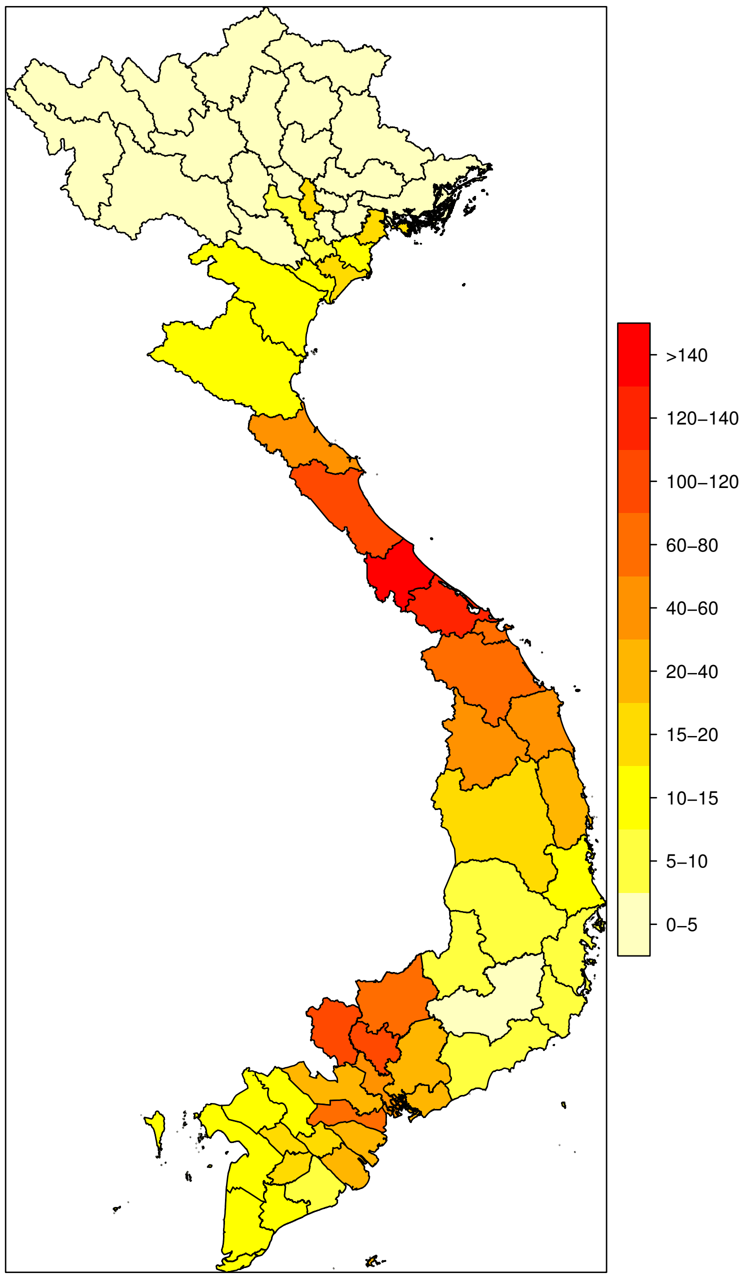
Further, to test whether excess male mortality is associated with the marriage squeeze, data on total number of bombs dropped by the United States on Vietnam by the United States Air Force and Navy from 1965 to 1975 are used as an indicator of war activity at the province level, which then serves as a measure of excess male mortality since data on mortality by province during the war are not available. The original bombing 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 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 of the data is provided by Miguel and Roland (Miguel and Roland, 2009). Figure 4.1 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 there was a 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 in this chapter, I assume that the two were highly correlated.

4.2.2 Methods

To measure the marriage squeeze in Vietnam, I apply a modified version of the marriage squeeze index used by Tuljapurkar, et al. (Tuljapurkar et al., 1995) and Akers (Akers, 1967). Essentially, the index is a weighted ratio of males to females with the weights at each age representing the underlying probability of first marriage at that age. Hence, the index represents the expected number of males entering first marriages over the expected number of females entering first marriages. It can be written as follows:

[1] The district level data are aggregated to the province level and bomb density is calculated by dividing the total number of bombs dropped on a province by the total area of the province in square kilometers.

Figure 4.1: Total number of bombs dropped per square kilometer by province, Vietnam, 1965-1975



Data sources: 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia(SEADAB), and Combat Naval Gunfire (CONGA) databases

$$R_f = \frac{\sum P_i^{m,x} * F_i^{m,x}}{\sum P_i^{f,x} * F_i^{f,x}}$$

where R_f is the marriage squeeze index, $P_i^{m,x}$ is the population size of males at age x in year i, and $F_i^{m,x}$ is the probability of first marriages among males at age x in year i. Further, $P_i^{f,x}$ is the population size of females at age x in year i and $F_i^{f,x}$ is the probability of first marriages among females at age x in year i.

The underlying probability of first marriages can be estimated through frequency of first marriage, defined by the United Nations Manual X (United Nations, 1983) as the number of first marriages between age x and $x+n$ divided by the number of persons in that age interval. However, since the censuses only collect data on current marital status, it is difficult to calculate the number of first marriages. Therefore, to estimate the probability of first marriages by age, I apply the Coale-McNeil nuptiality model (Coale and McNeil, 1972). The model has been used to examine marriage patterns by educational attainment (Goldstein and Kenney, 2001) and has been applied to a number of developing countries (Chowdhury, 1983; Coale, 1989).

The Coale-McNeil model stipulates that the pattern of first marriage for women follow a certain age progression in populations(Coale and McNeil, 1972; Preston et al., 2001). According to the model, the standard probability density of first marriage can be described as:

$$g_S(x) = 0.1946e^{-0.174(x-6.06)-e^{-0.288(x-6.06)}}.$$

The standard probability density can be used to calculate the standard cumulative probability of marriage G^S. The proportion ever-married at age a is derived from the standard cumulative probability in the following relational form:

$$G(a) = C * G^S(\frac{a-a_0}{\kappa})$$

where $G(a)$ is the proportion ever-married at age a, G^s is the proportion ever-married in the standard population, a_0 is the age at which nuptiality begins in the population or where the proportion ever-married is approximately one percent. κ represents the spread of the distribution or the number of years of the population's nuptiality schedule which is equivalent to one year of the standard nuptiality schedule. C is a scale factor which represents the proportion of the population that eventually marries. Since

$$G_S(x) = \int_0^x g_S(y)dy,$$

the probability density $g(a)$ has the form:

$$g(a) = (0.1946C/\kappa)e^{(-0.174/\kappa)(a-a_0-6.06\kappa)-e^{(-0.288/\kappa)(a-a_0-6.06\kappa)}}.$$

In order to best estimate the age distribution of first marriage, the values of a_0, κ, and C that best fit the the census data are estimated using nonlinear least-squares. The model is fit between the ages of 0 to 45 to better estimate probability of first marriage when most first marriages occur. The value of C is bounded between .7 and 1, reflecting the observed proportion of the population that is married by age 55, and κ between .5 and 1.5.[2]

For 1979, since marital status data are not available from the 1979 census, the marriage squeeze index is calculated by applying the density of first marriage calculated from the Coale-McNeil model using 1989 data to the 1979 age and sex distribution.

Furthermore, I explore whether the marriage squeeze is associated with either the excess male mortality during the Vietnam War or male emigration from particular regions in Vietnam using ordinary least squares with the marriage squeeze index as the dependent variable and the number of bombs dropped per square kilometer on the log scale as the independent variable for each census year. The p-values for the coefficients are obtained from permutation tests using the `lmp()` command in the `lmPerm` package in R programming language (R Development Core Team, 2010). Ten thousand samples were drawn using the observed data to obtain the p-value.

As an initial investigation of the the relationship between marriage squeeze and migration, I project the 1979 population forward to 1989 to see what the population would have been in 1989 if there had been no migration or mortality between the two time periods (Projection A). Then, I apply the Coale-McNeil probability density of first marriage from the 1989 census data to the projected 1989 population to calculate the marriage squeeze index for 1989 without migration or mortality. Since the war had ended by 1979, assuming there were no excess male mortality in the marrying age groups, then the difference between the projected marriage squeeze index and the observed marriage squeeze index would more likely be due to migration rather than excess male mortality. Similarly, I project the 1989 population forward to 1999 assuming no migration or mortality, then calculate the marriage squeeze index for 1999 based on the 1999 density of first marriage. In reality, however, even when there are no wars, male mortality tends to be slightly higher than female mortality. Therefore, to test the sensitivity of the presence of a slight excess male mortality, a second projection is conducted where 95 percent of males survive, while 100 percent of females survive (Projection B). The Coale-McNeil probability densities of first marriage from 1989 and 1999 are applied to the respective projected populations as in Projection A and the resulting marriage squeeze index values are analyzed.

[2]The United Nations' Manual X shows a different way of estimating the three parameters. C is set equal to $1 - U(\omega)$, where $U(\omega)$ is the proportion who never marry and ω is generally set to the age group 50-54. The estimate for κ can be derived from the singulate mean age of first marriage (SMAFM) where κ=(SMAFM-a_0)/11.37. However, in the case of Vietnam, this method did not yield a set of parameters that fit the data well. This may be because the assumption of a closed population made in calculating the SMAFM is violated. Therefore, the nonlinear least-squares approach describe here is used for the analysis.

4.3 Results

4.3.1 Descriptive Results

Age Pyramid by Marital Status

Figure 4.2 shows the population pyramids by marital status in Vietnam for 1989 and 1999. The top panel shows the total population of Vietnam by age, sex, and ever-married status for 1989. The 1989 pyramid shows that overall, there are more men than women between the ages of 0 and 17, but for ages above 17, the women outnumber the men. Further, examining the marital status of the population, for ages above 18, the number of never-married women is greater than the number of never-married men. Between the ages 21 and 28, the number of never-married men far exceeds the number of women in the same age group. At ages older than 28, the number of never-married women exceeds the number of never-married men. The number of married women is greater than the number of married men at every age, but this may be due to the data quality issue discussed earlier particularly in the older age groups.

The bottom panel of Figure 4.2 shows the 1999 population pyramid by marital status. The 1999 pyramid displays a markedly different population age structure than the 1989 pyramid. First, the 1999 pyramid shows that Vietnam had entered a demographic transition in the 1990s and the base of the pyramid has shrunk. Similar to the 1989 pyramid, there are more men than women below age 18 and the women outnumber the men between the ages of 18 and 24. However, unlike in the 1989 pyramid, between age 25 and 38 the number of men and women are about the same. For ages above 38, there are more women than men. With regard to marital status, the 1999 pyramid shows a greater number of never-married men than never-married women for ages 32 or younger. In particular between the ages of 18 and 32, the never-married men considerably outnumber the never-married women. This probably is a reflection of the younger ages at marriage for women as compared to the men. For ages above 32, the number of never-married women exceeds the number of never-married men. At every age, except 33 through 37, the number of married women exceeds the number of married men at every age.

When comparing across rural and urban areas (Figure 4.5 and 4.6), while the urban areas in 1989 show signs of declining fertility about five years prior to the census, the rural areas show no such indications. By 1999, both rural and urban areas display shrinking of the base of the population pyramid. Further, while both rural and urban areas show indentations to the pyramids around age 20 in 1989, in 1999, the indentation appears very slightly in urban areas and only among males.

Not surprisingly, the urban areas show later ages of marriage in both 1989 and 1999 compared to the rural parts. Furthermore, later age at marriage is seen for the 1999 urban population as compared to the 1989 population. The patterns of sex imbalances are such that the population of unmarried men is greater than the population of unmarried women up to about age 31 in 1989 and 36 in the urban areas, and 27 in 1989 and 31 in 1999 in rural areas. The married women tend to outnumber the married men in both rural and urban areas in both time periods with a few exceptions. The one notable exception is in the rural areas in 1999, where the number of married men exceeds the number of married women between the ages of 31 and 38.

When the total population by marital status is viewed by North and South Vietnam (Figure 4.3 and 4.4), distinct differences are observed in the sex structure and marital patterns between the two regions in both 1989 and 1999. The 1989 pyramid in the north shows a pronounced indentation around age 20, which is less apparent in the population pyramid for the south. Overall, there are more boys than girls under the age of 18, but more women than men at ages 18 and above, with the exception of the south in 1999 where the number of men and women are about equal between ages of 24 and 38.

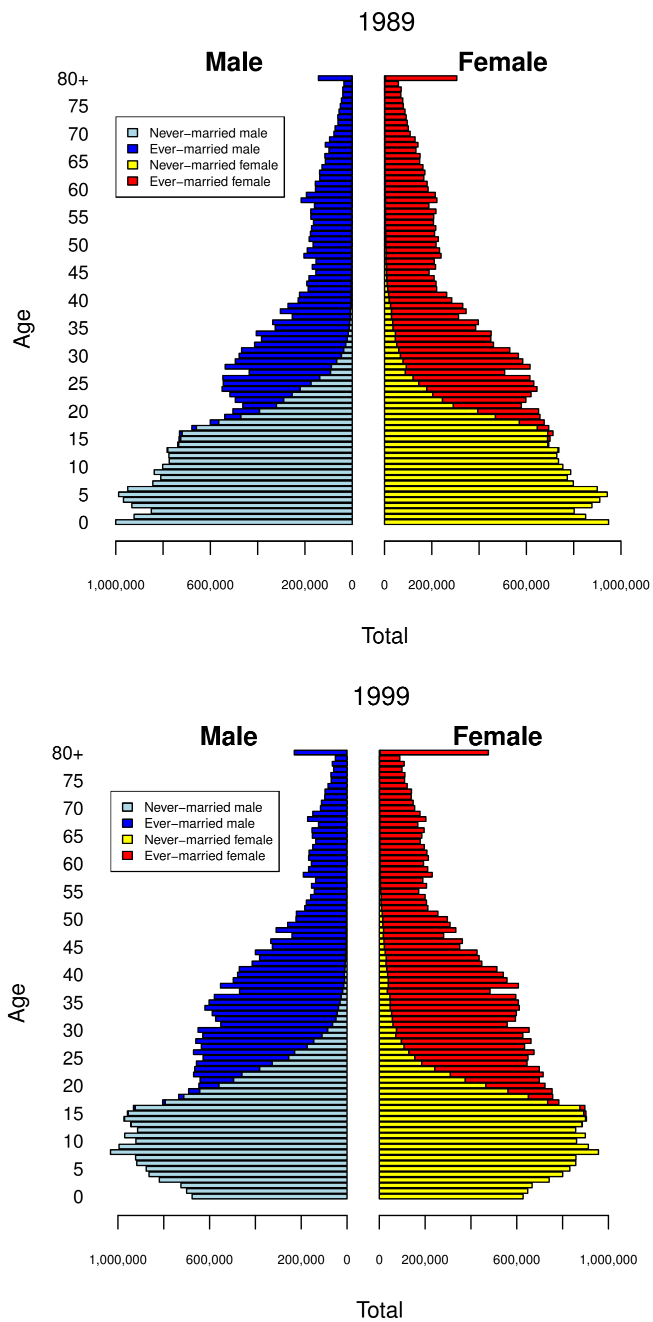
In the north in 1989, the men outnumber the women around the ages of 19 to 26, then again between 35 and 42. The former deficit of men is apparent for the same age groups in 1999, but the latter is seen among cohorts approximately ten years older. The overall deficit of men above age 18 relative to the women in 1989 is much greater in the south than in the north. Additionally, in the south, the women far outnumber the men between ages 40 and 60 in 1989 and 50 and 70 in 1999.

By marital status, the number of unmarried men exceeds the number of unmarried women at ages below 28 (except at ages 20 and 21, which is likely due to underenumeration of men due to military service). As in the 1989 pyramid for the total population, the ages between 21 and 28 shows a much greater number of unmarried men relative to unmarried women. At ages above 28, unmarried women outnumber the unmarried men. The number of married women is greater than the number of married men at all ages (above age 13), but the difference is particularly large between the ages 16 and 28. Again, this is likely a reflection of younger ages at marriage for women relative to the men.

A similar pattern is observed in the south in 1989, but the excess of unmarried men between the ages of 21 and 28 is not as severe as that seen in the north. Furthermore, in addition to the pattern of sex imbalance among the ever-married population between the ages of 16 and 28, the population pyramid in the south shows an excess of married women between the ages of 45 to 58.

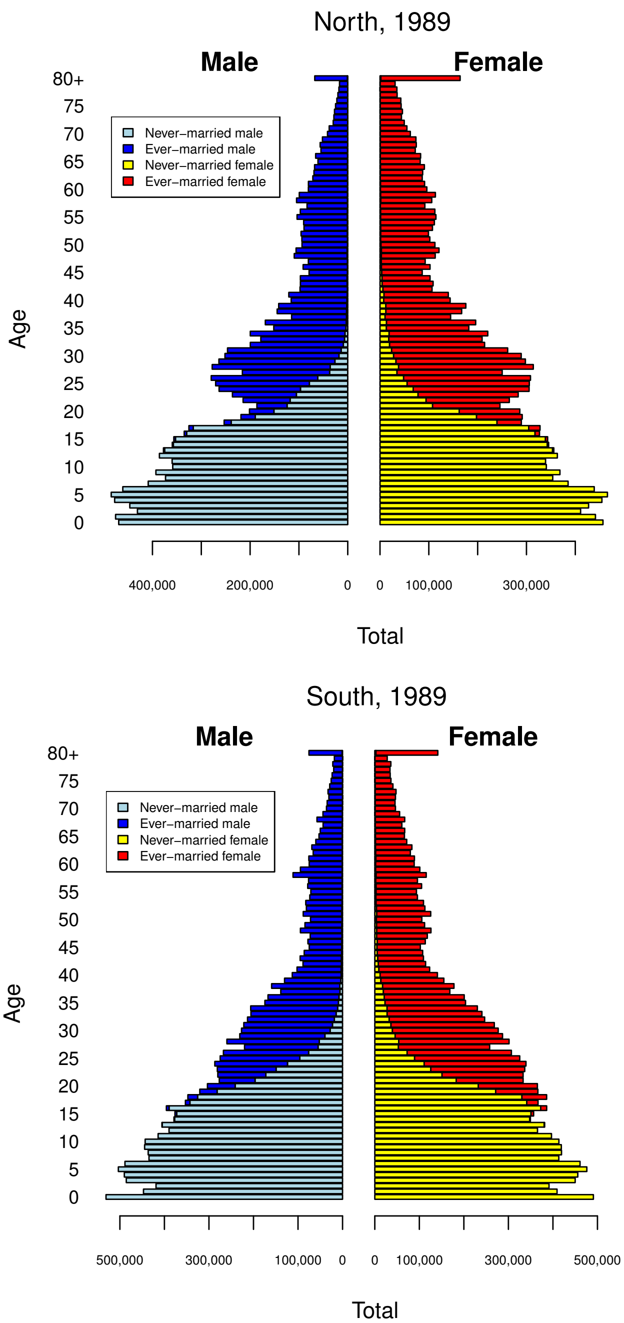
In 1999, both the north and the south show evidence of decline in fertility in the 1990s. However, in the north, there is a wide indentation for both sexes in the pyramid approximately between the ages of 20 and 35. The indentation is more severe for men than for women. The pattern of never-married and ever-married population in the north in 1999 is similar to that in 1989, except that in 1999, the relative excess of unmarried men is much greater than in 1989 and that there are more unmarried women above the age of 40 in 1999 than in 1989. The pattern in the south in 1999 is also similar to 1989, but unmarried men outnumber the unmarried women until age 32 and the relative difference between unmarried men and unmarried women is much greater than was seen in 1989 and in the north in 1999. The excess of married women in their late 40s and 50s seen in the 1989 pyramid in the south

Figure 4.2: Total population by sex and marital status, Vietnam, 1989 and 1999



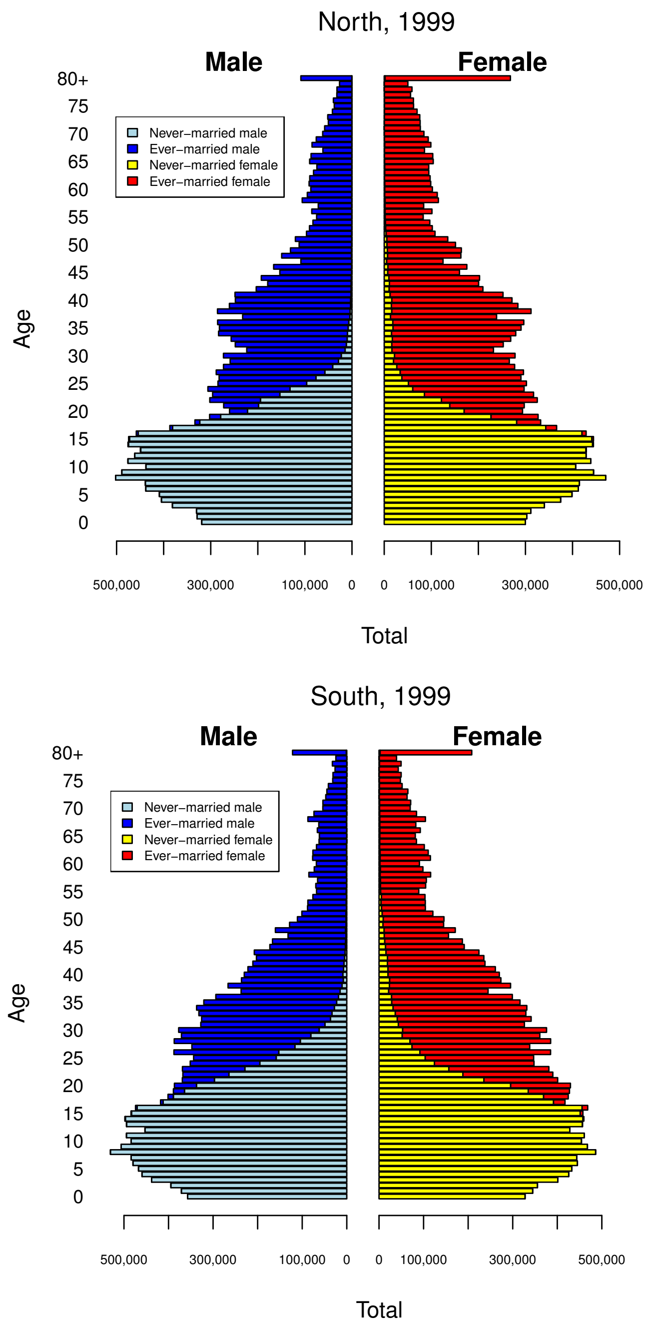
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 4.3: Total population by sex and marital status, North and South Vietnam, 1989



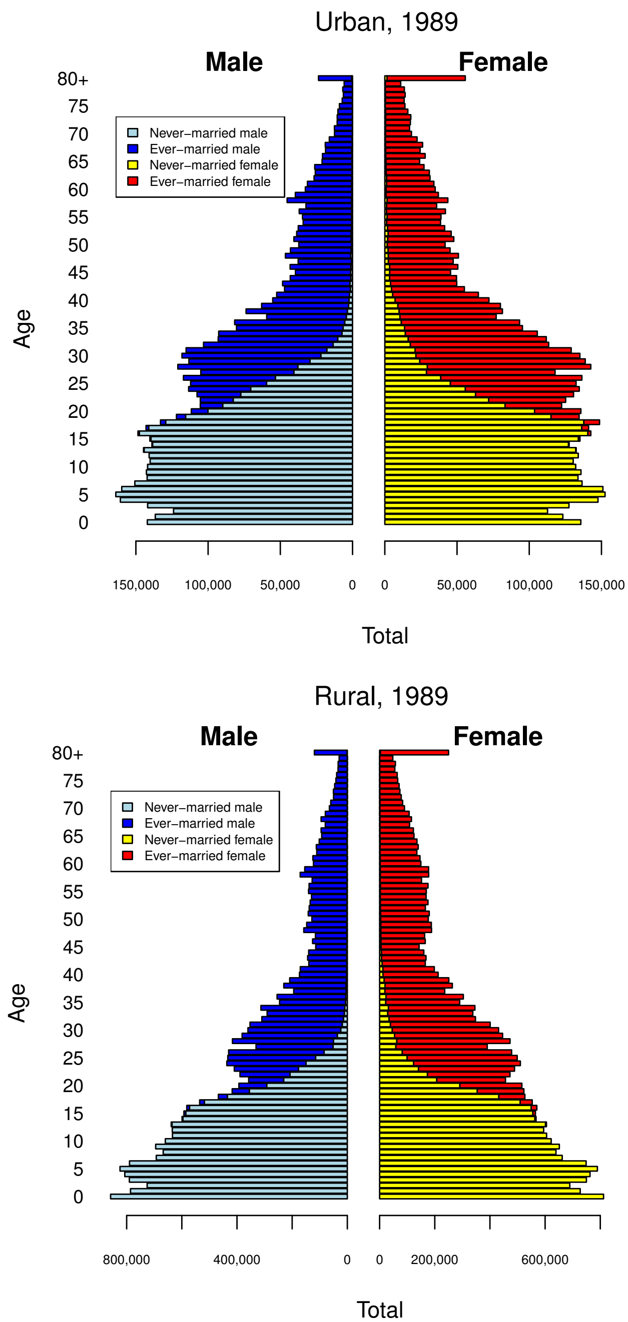
Data source: 1989 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

Figure 4.4: Total population by sex and marital status, North and South Vietnam, 1999



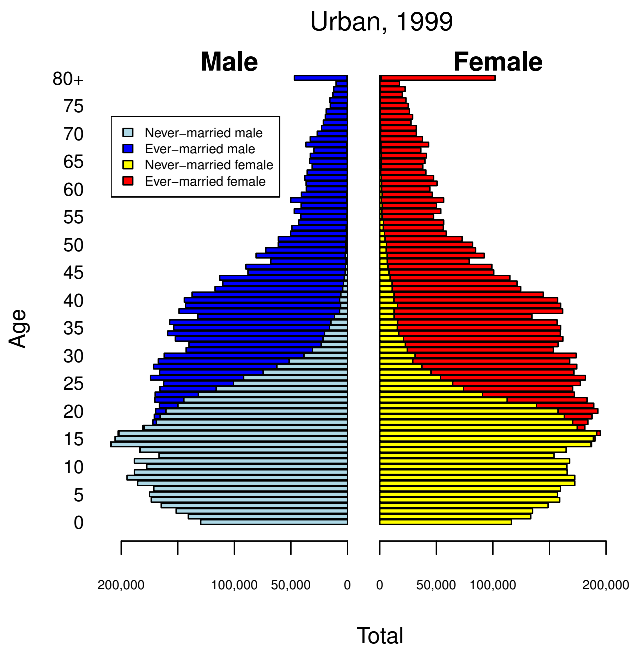
Data source: 1999 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

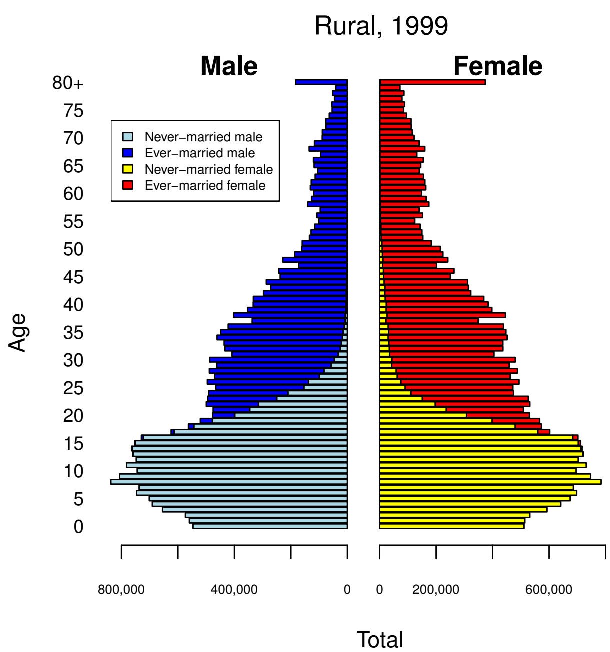
Figure 4.5: Total population by sex and marital status, urban and rural Vietnam, 1989



Data source: 1989 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

Figure 4.6: Total population by sex and marital status, urban and rural Vietnam, 1999





Data source: 1999 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

is observed among women in their late 50s and 60s in the 1999 pyramid.

Proportion Ever-Married

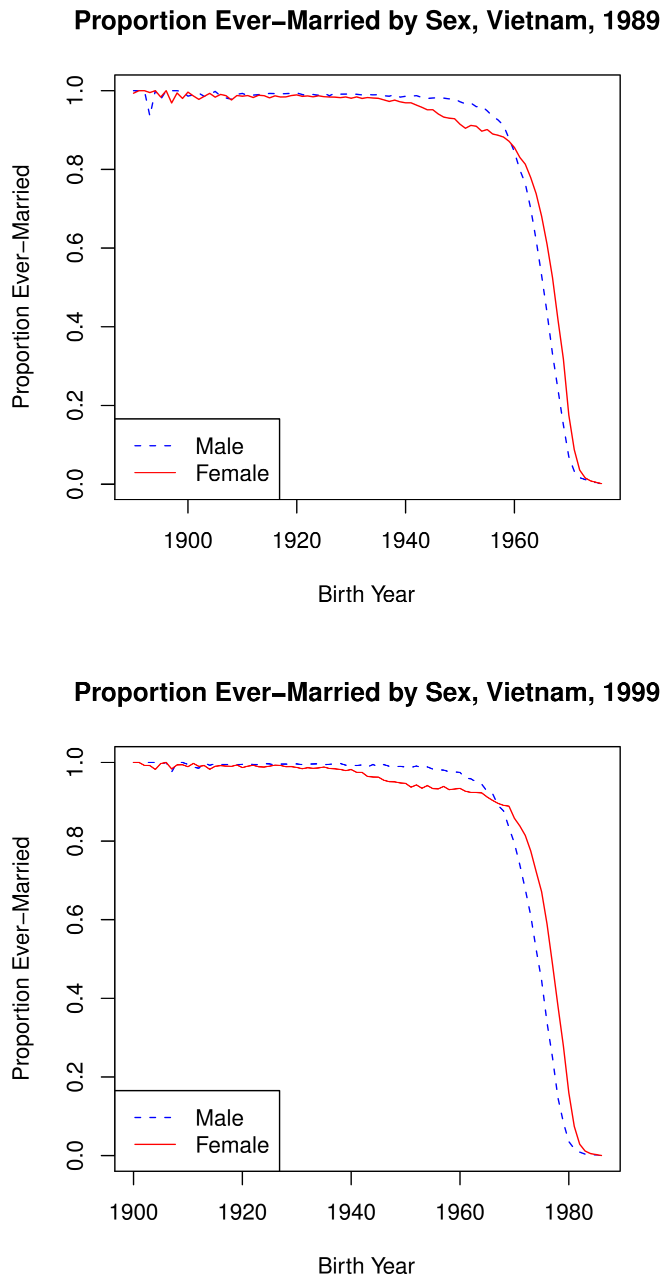
Figures 4.7 through 4.11 show the proportion ever-married by birth year and sex. Figure 4.7 shows the proportion of men and women who were ever-married by their birth year in 1989 and 1999. In 1989, women born after 1960 show a higher proportion ever-married than men of the same birth cohorts indicating that women tend to enter into marriage at an earlier age than men. Similarly, in 1999, women born after 1967 display a higher proportion ever-married than men of the same cohorts. If women were "squeezed" out of marriage due to excess male mortality during the war, then we would expect to see a drop in proportion ever-married for women born between approximately 1935 to 1957 since these cohorts would have been between the ages of 18 and 30 during the heavy periods of fighting between 1965-1975. Indeed, the top panel in Figure 4.7 shows that proportions ever-married in 1989 for female cohorts born around 1935 up to 1959, who entered marrying age during or shortly after the war, are lower compared to their male counterparts. The bottom panel shows the same plot in 1999. As in 1989, proportions married are lower for women as compared to the men starting around the 1935 birth cohort. However, contrary to the expectation that the proportion ever-married would come back to levels similar to the men's for cohorts born in the 1960s, the proportion remains low for cohorts of women up to the 1967 cohort.

Similar patterns exist in both rural and urban areas (Figure 4.8). However, women in urban areas in 1989 show lower proportion ever married for all birth cohorts, but especially for younger women born in the 1960s. In North and South Vietnam (Figure 4.9), again, the trends are similar where women born between 1935 to 1959 show lower proportion ever married than men in 1989 in both the north and the south. The pattern persists in 1999, but the lower proportions remain for later cohorts of women. In both 1989 and 1999, women in the south tend to have lower proportion ever-married than women in the north.

When viewed regionally (Figure 4.10), similar patterns are seen in almost all regions. The Red River Delta, Central Coast, Southeast, and the Mekong River Delta regions show markedly lower proportion ever-married for women in the cohorts mentioned earlier in 1989. The Central Highlands show only slightly lower proportion ever-married for women and only for those born in the late 1940s to the late 1950s in 1989. Some regional variation also exists in 1999. The Red River Delta, Central Coast, Southeast, the Mekong River Delta, and to a lesser extent, the North Central region, show the pattern of continued lower proportion ever-married for the younger cohorts in 1999. The cohorts born in the 1960s do not show such pattern in other regions. In both 1989 and 1999, women in the Southeast tend to marry at later ages than women in other regions and have the lowest proportion ever married at almost all birth cohorts after 1935. On the other hand, the women in the Central Highlands, Northwest, and the Northeast, tend to marry at younger ages and have the highest proportions ever-married for most cohorts after 1935.

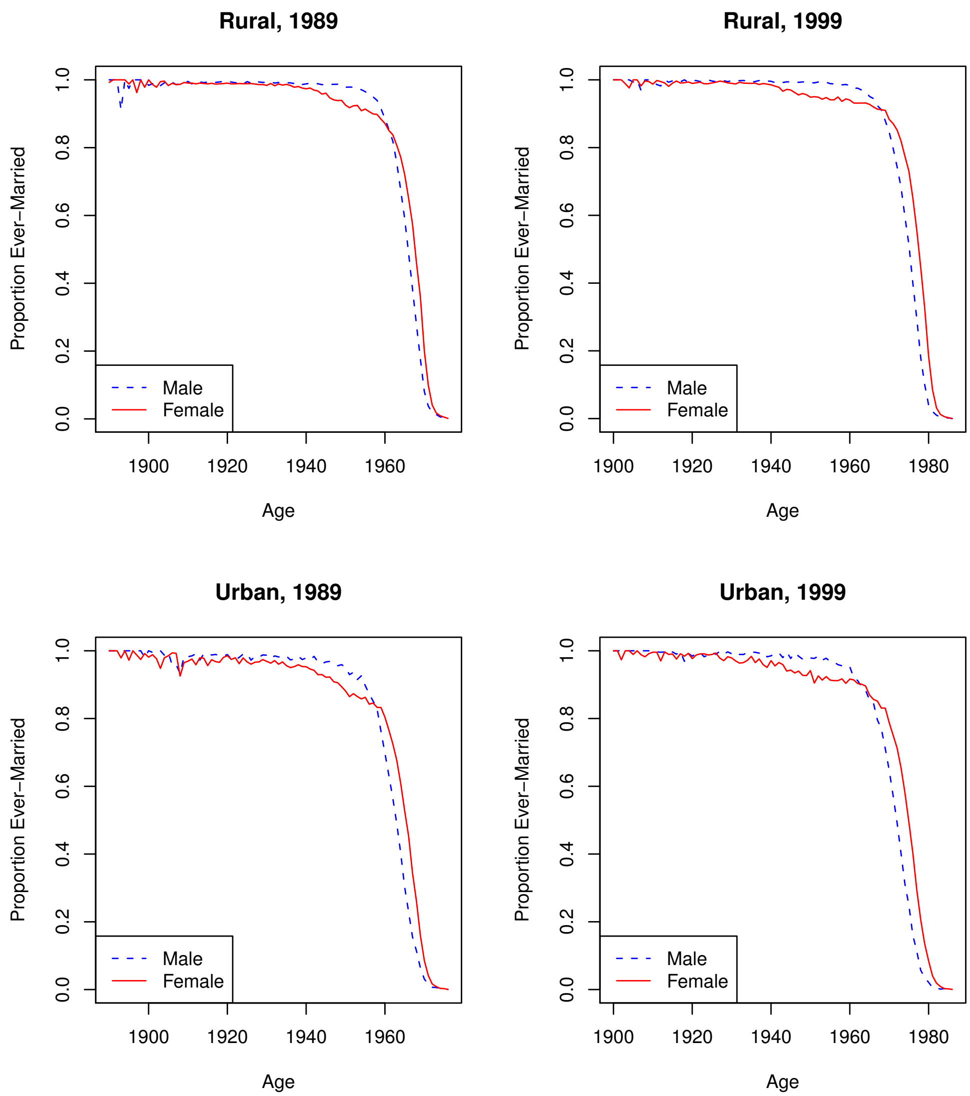
Finally, the patterns also persist by educational level (Figure 4.11), although women

Figure 4.7: Proportion ever-married by birth year and sex, Vietnam, 1989 and 1999



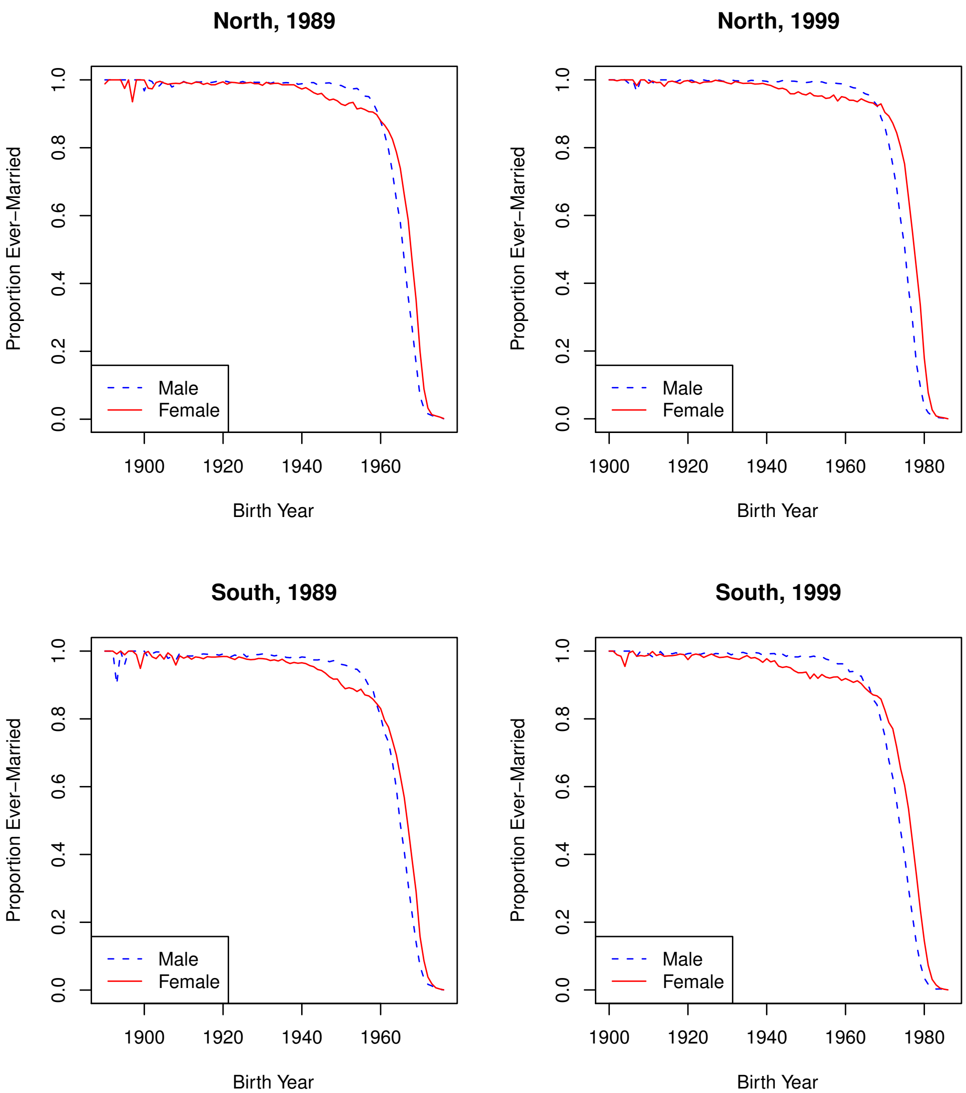
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 4.8: Proportion ever-married by birth year, sex and urban/rural residence, Vietnam, 1989 and 1999



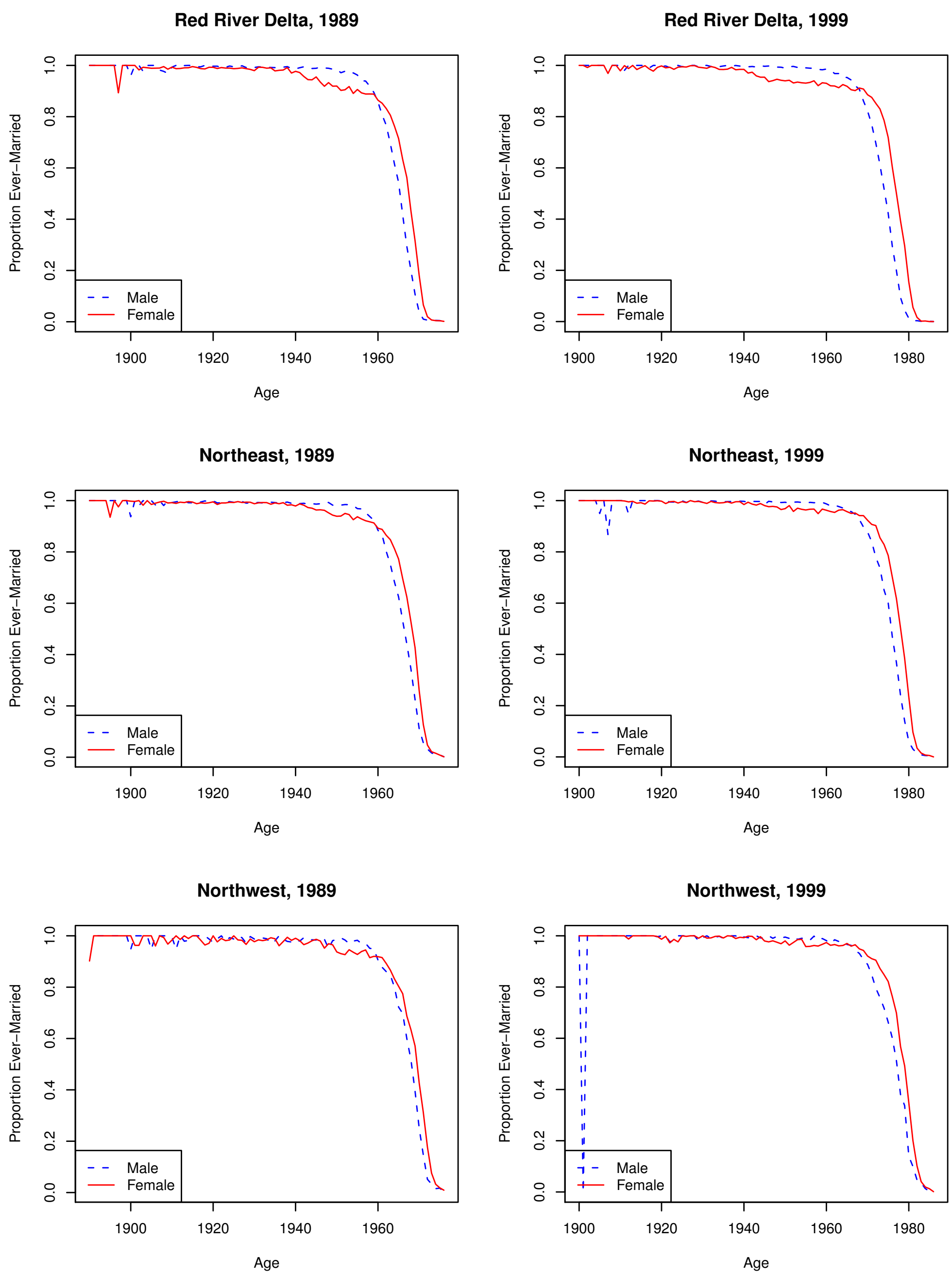
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

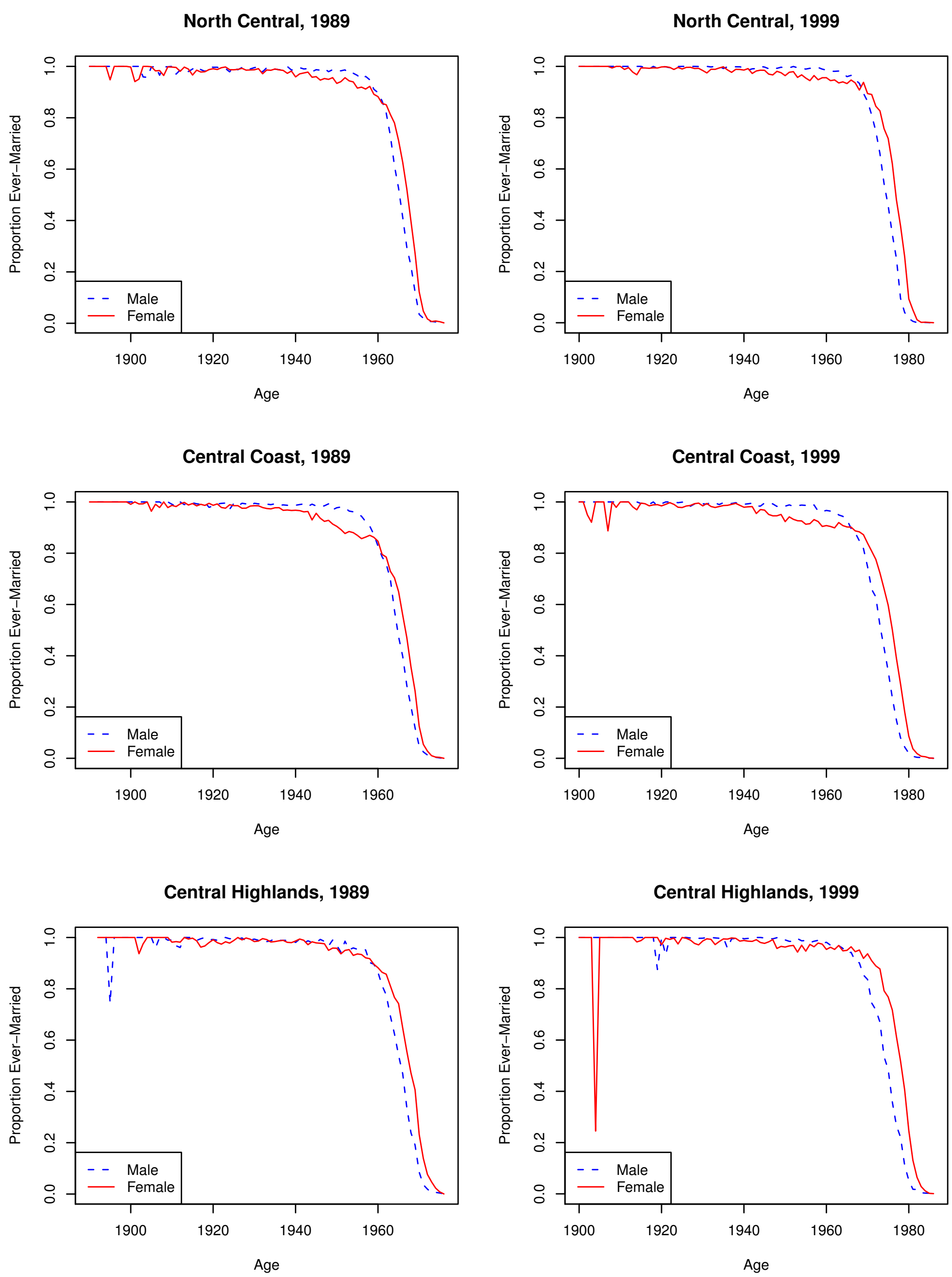
Figure 4.9: Proportion ever-married by birth year and sex, North and South Vietnam, 1989 and 1999

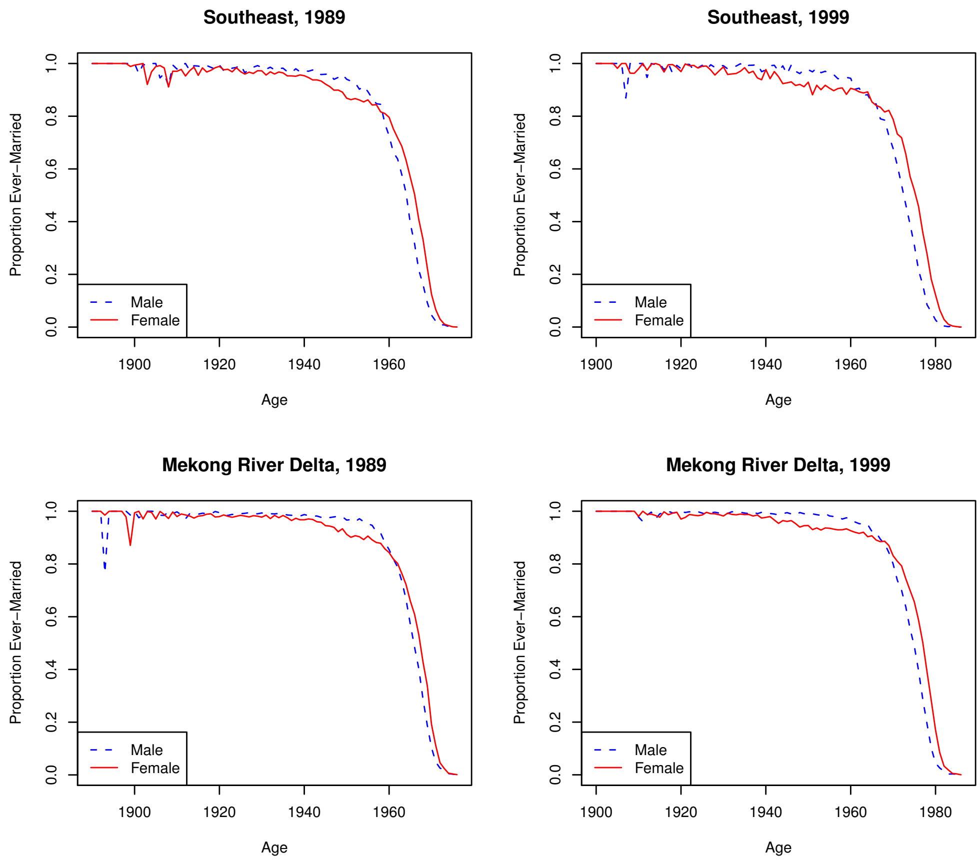


Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 4.10: Proportion ever-married by birth year, sex and region, Vietnam, 1989 and 1999




North Central, 1989
North Central, 1999
Central Coast, 1989
Central Coast, 1999
Central Highlands, 1989
Central Highlands, 1999
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
Age
1900
1920
1940
1960
1980
Male
Female



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

born in the 1960s, who completed secondary school or university have higher proportion ever-married in 1999 than the cohort of women born in the 1950s in 1989. As expected, both men and women who have completed university and secondary schools tend to marry at later ages than those with primary or less than primary education.

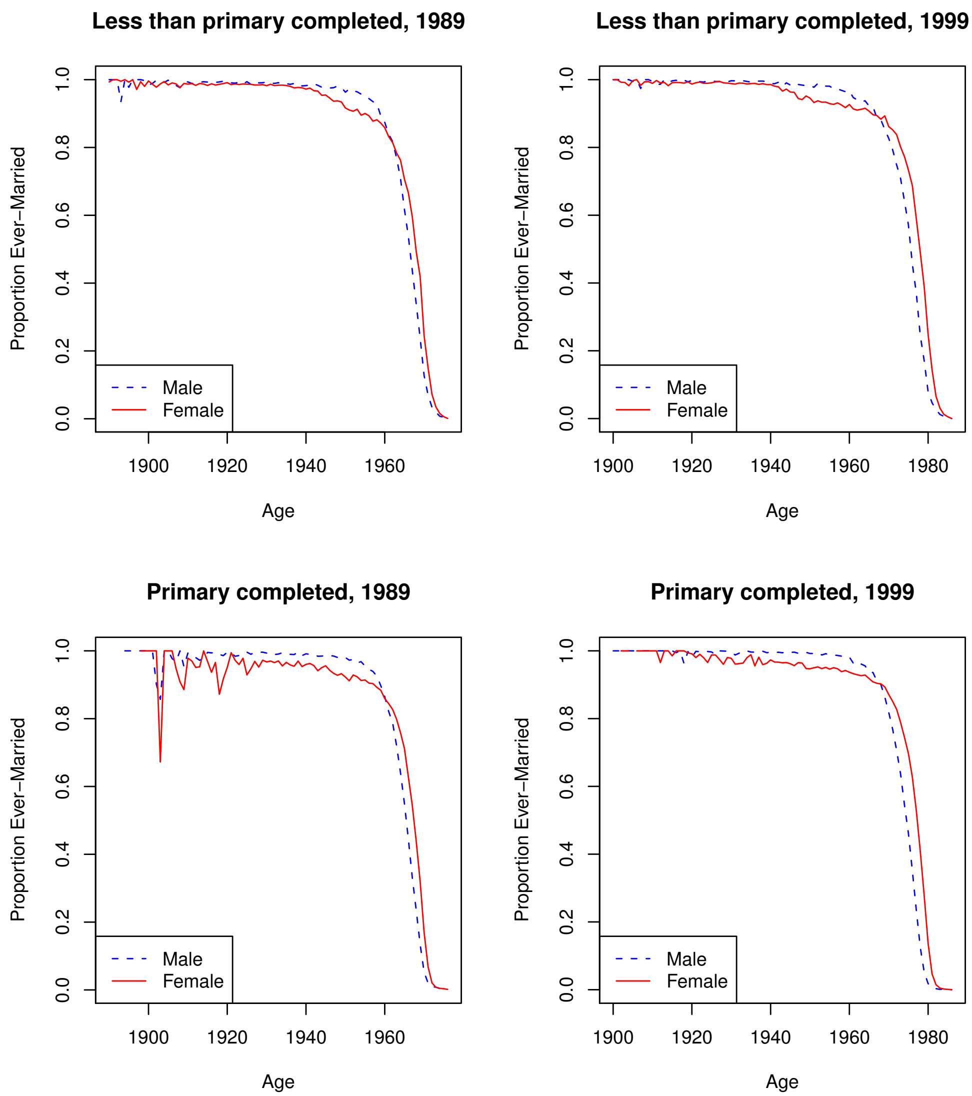
4.3.2 Singulate Mean Age at First Marriage

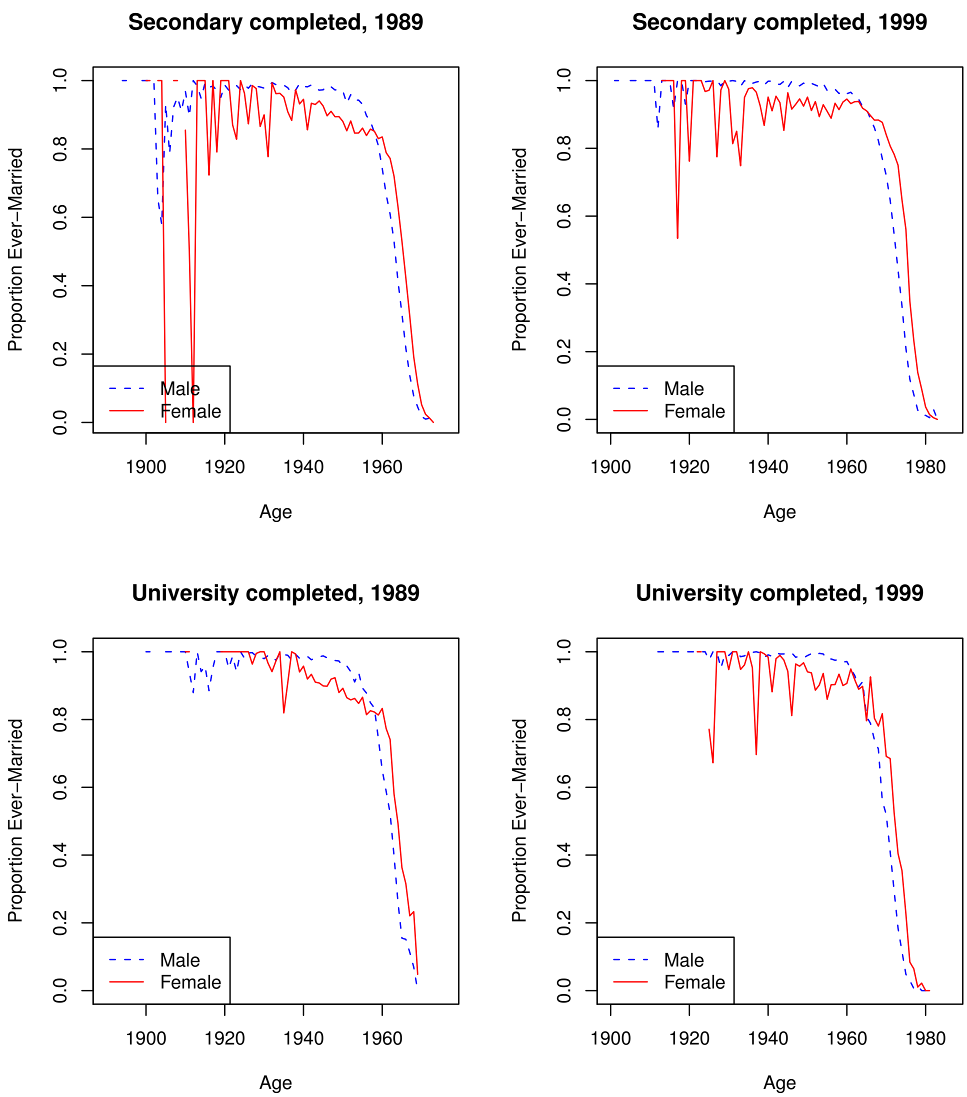
Table 4.2 shows the singulate mean age at first marriage (SMAFM) for men and women in 1989 and 1999. In both 1989 and 1999, men have higher SMAFM than the women, indicating that men tend to marry at older ages than women. Further, men's SMAFM rose between 1989 and 1999 in all areas and across educational levels. For women, this trend is also generally true, with a few exceptions. For women in the Northwest and Central Highlands, their SMAFM declined. Further, the SMAFM of women with secondary school and university education declined between 1989 and 1999.

Table 4.2: Singulate mean age of first marriage, Vietnam, 1989 and 1999

	Male 1989	Male 1999	Female 1989	Female 1999
Total	24.3079	25.4414	23.6577	24.2208
Rural	23.5755	24.5949	23.0989	23.4677
Urban	26.6524	27.9104	25.2355	26.5249
North	23.7406	24.4276	22.9732	23.2625
South	24.7712	26.1877	24.2423	25.1097
Red River Delta	24.2406	25.2826	23.6056	24.2085
Northeast	23.1106	23.8571	22.3228	22.3554
Northwest	21.5326	22.8309	20.8276	20.5354
North Central	23.9127	24.7132	23.0698	23.2180
Central Coast	24.6101	26.3969	24.7576	25.1213
Central Highlands	24.0495	24.8536	22.4545	21.2711
Southeast	26.1168	26.9798	25.4567	26.6216
Mekong River Delta	23.8723	25.1826	23.5298	24.4282
Less than primary completed	23.3836	24.6407	23.0408	23.5164
Primary completed	24.0452	25.1821	22.8536	23.1209
Secondary completed	26.1386	27.0344	24.3434	23.5612
University completed	27.0912	29.2261	27.1397	26.0644

Figure 4.11: Proportion ever-married by sex and educational attainment, Vietnam, 1989 and 1999





Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

4.3.3 Age Distribution of First Marriage

Figures 4.12 through 4.16 show the results of fitting the Coale-McNeil model to the first differences of proportions ever-married. The lines indicate the model estimates which approximate the probability density of age at first marriage. The parameters used to fit the model are shown in Tables A.1 and A.2 in the Appendix.

As can be seen in Figure 4.12 the density ($g(x)$) calculated from the Coale-McNeil model fits the first differences of proportion ever-married fairly well for both males and females in 1989 and 1999. The density curve for men peaks around age 21 in 1989 and 22 in 1999, while for women, the peak occurs at age 19 in both 1989 and 1999, reflecting the older ages at marriage for men compared to the women. For women, the curve is more concentrated at the peak age, whereas the men's curve shows a wider span of ages at which they enter into marriage. Furthermore, for men, there is a slight shift in ages at which people are likely to first marry between 1989 and 1999, from 21 to 22. A similar shift is not observed among women. For women, the concentration around the peak age at marriage is slightly relaxed between 1989 and 1999, such that the curve at the peak is lower in 1999 than in 1989, but the probability of first marriage is greater for those in their early 20s to the late 30s in 1999 than in 1989.

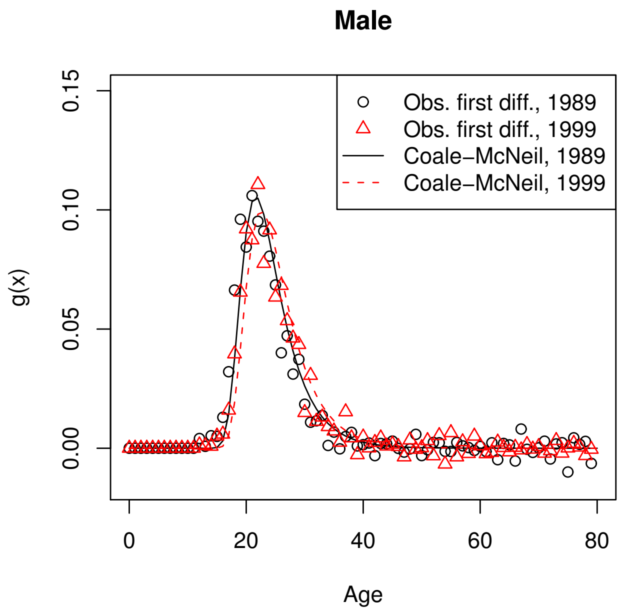
Comparing across rural and urban areas, in rural areas, the peak age at which first marriages occur is around 20 for rural men in 1989, and 21 in 1999. For women, the peak is around age 19 in both 1989 and 1999. For urban males, the peak is seen around age 23 in 1989 and 24 in 1999. For both rural and urban men, the density curve has shifted slightly to the older ages. For urban women, the peak is around age 20 in 1989 and 21 in 1999. While hardly any change is seen in the density between 1989 and 1999 for rural women, the urban women's curve has shifted slightly to the older ages and less concentrated at the peak age.

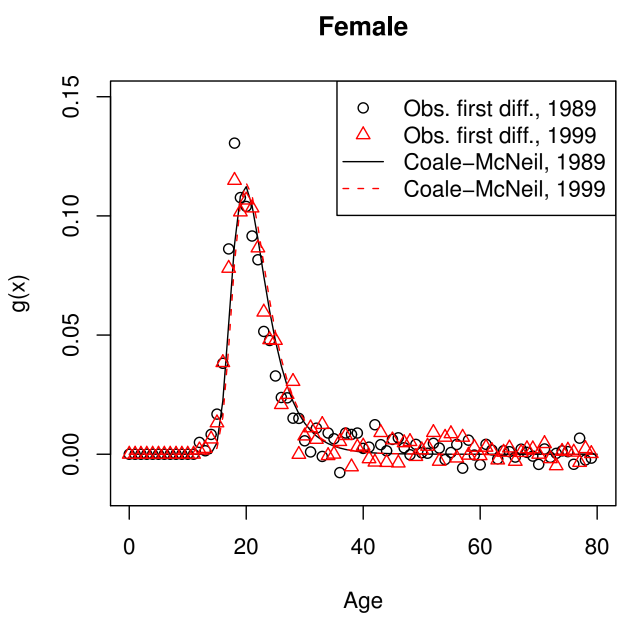
When patterns across North and South Vietnam are observed, the trends are similar to those described thus far. In the north, the density for men peaks around age 20 in 1989 and 21 in 1999, and an overall shift in the curve is observed between 1989 and 1999. For women, the peak occurs around age 19 in 1989 and 1999, and the curves are much more concentrated around the peak than the men's. No shift in the density is observed for women. Further, the densities for both men and women in the south tend to be more dispersed than those in the north and the probability at the peak age is lower in the south for both sexes.

Patterns across regions are remarkably similar as well. The Southeast region shows the lowest probability of first marriage at the peak age and the curve is less concentrated around the peak age than in other regions. Further, the peak age occurs later in the Southeast than in other areas (for men, 22 in 1989 and 23 in 1999; for women, 20 in both 1989 and 1999).

By educational attainment, as would be expected, those with higher levels of education have higher peak age of first marriage density. For those with less than primary school completed, the peak age is 20 for men in 1989 and 21 in 1999, and 18 for women in both years. Among those with primary school completed, the peak age is 21 for men in 1989 and 22 in 1999, and 19 for women in both years. The peak age is 23 in 1989 for men with

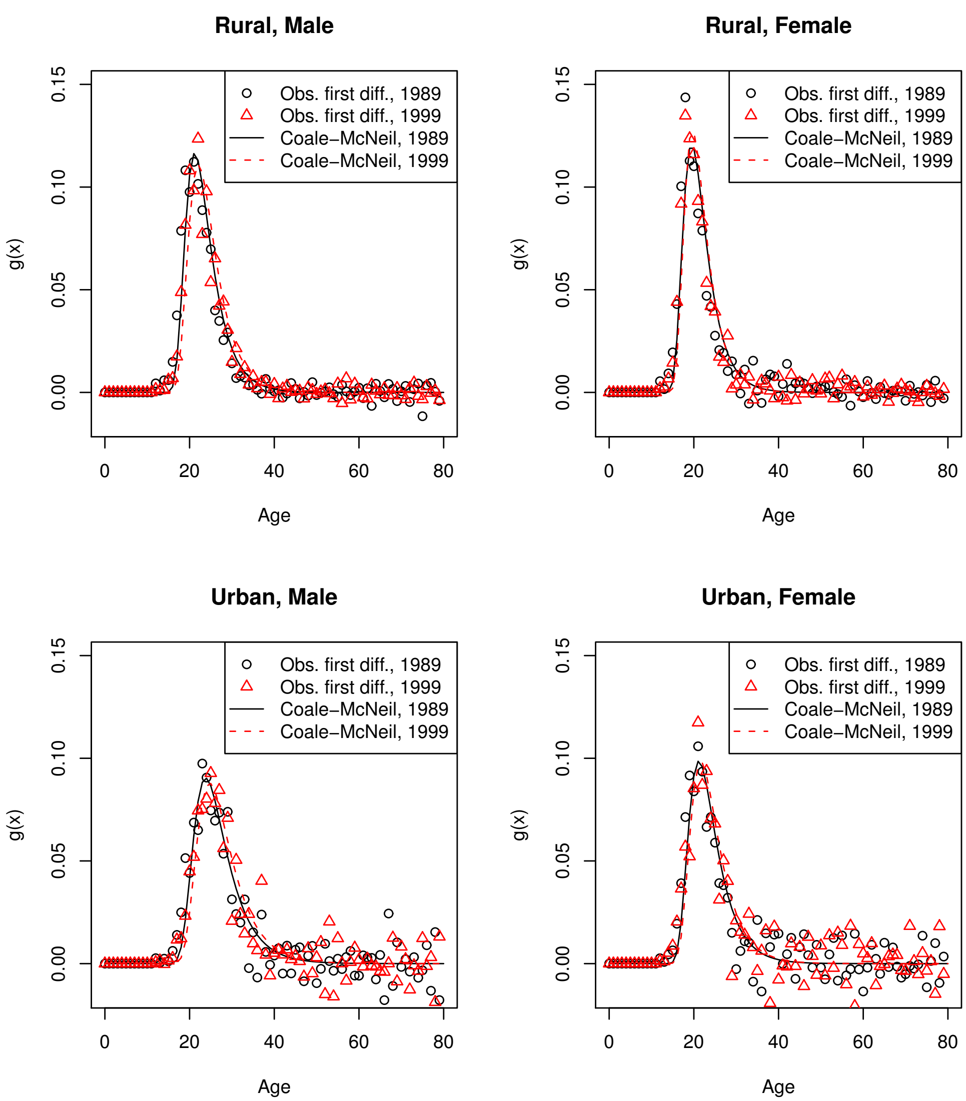
Figure 4.12: Probability density of age at first marriage by sex, Vietnam, 1989 and 1999





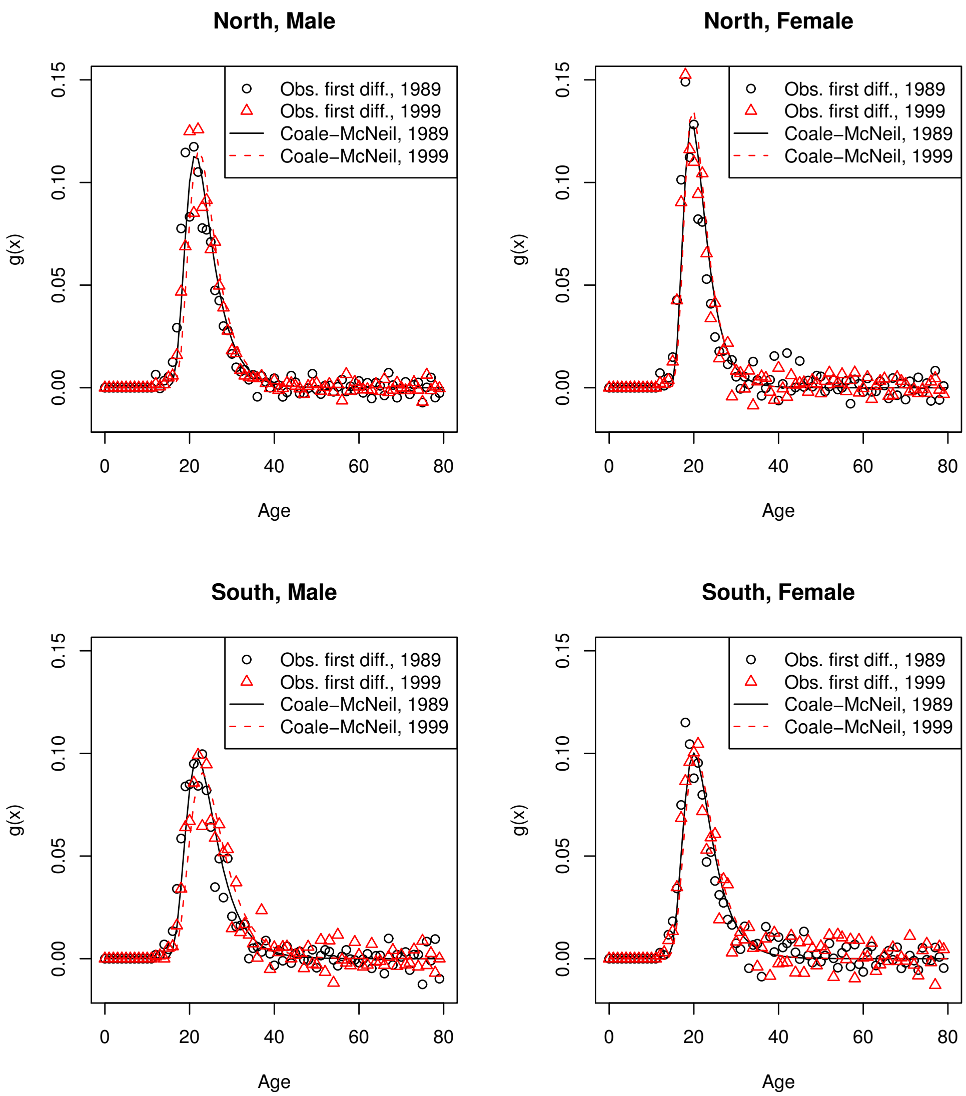
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 4.13: Probability density of age at first marriage by sex and urban/rural, Vietnam, 1989 and 1999



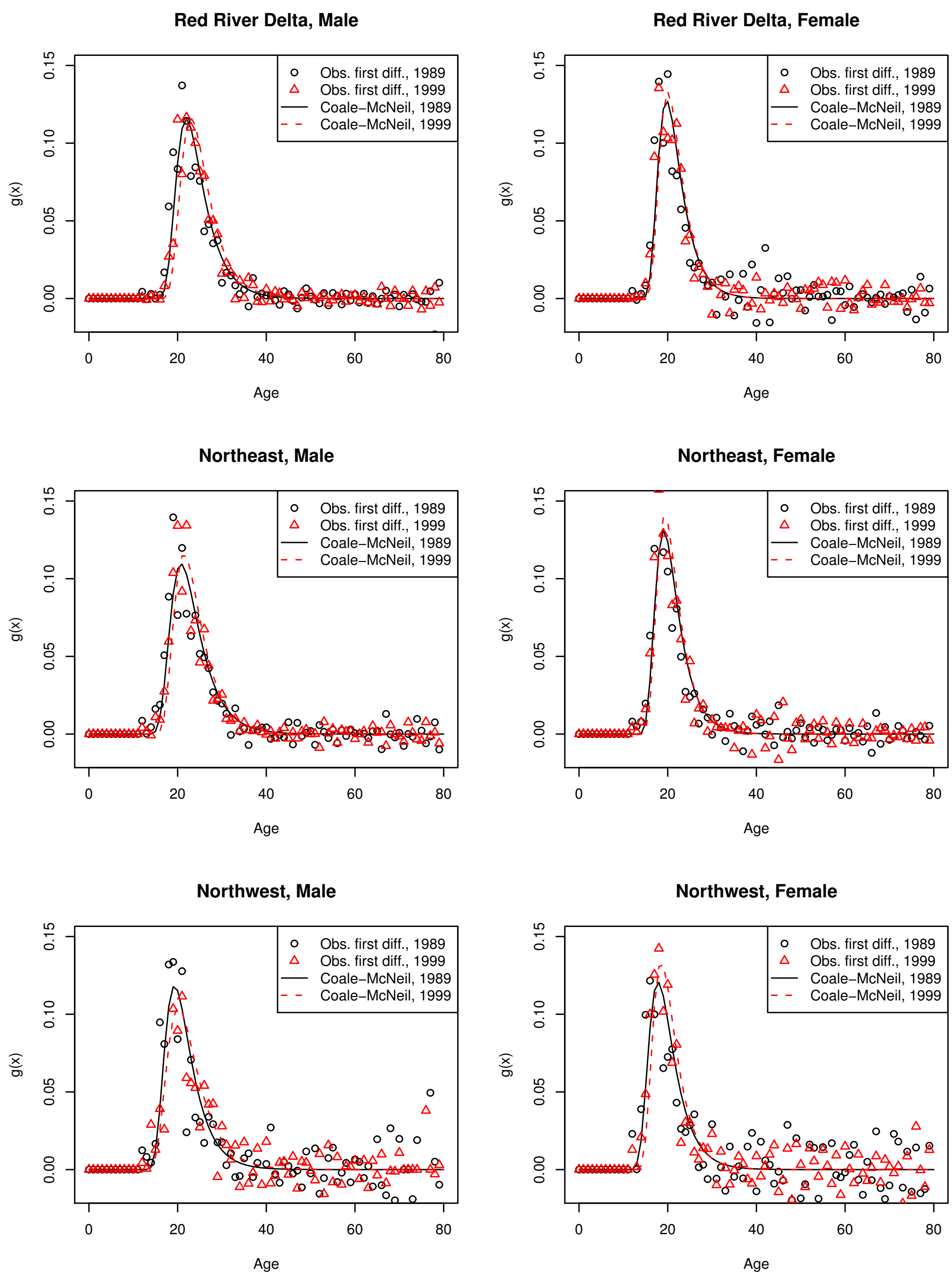
Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Figure 4.14: Probability density of age at first marriage by sex, North and South Vietnam, 1989 and 1999

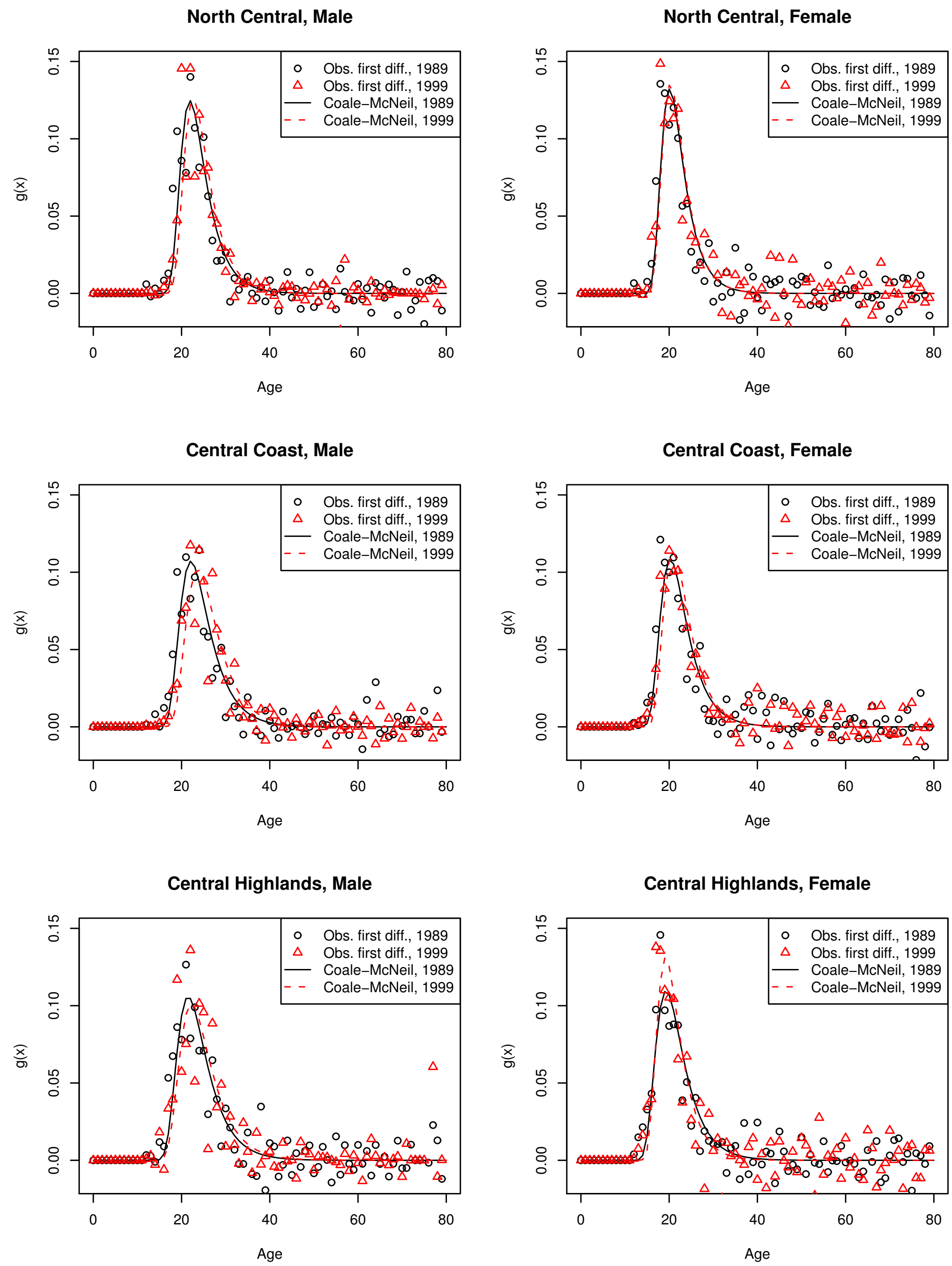


Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

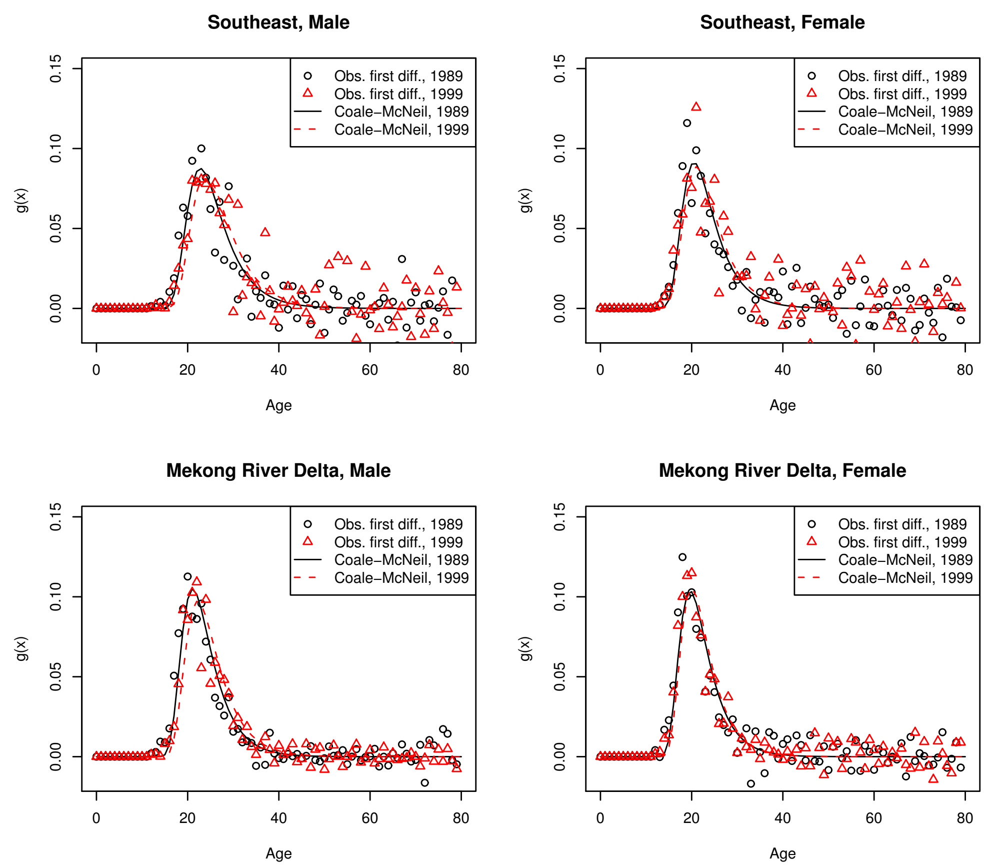
Figure 4.15: Probability density of age at first marriage by sex and region, Vietnam, 1989 and 1999



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

secondary school education and 24 in 1999; for women the peak age is 21 in both 1989 and 1999. University educated men and women have even higher peak ages at 25 for men in 1989 and 26 for men in 1999, while women's peak ages are around 23 and 24 in both 1989 and 1999.

4.3.4 Marriage Squeeze Index

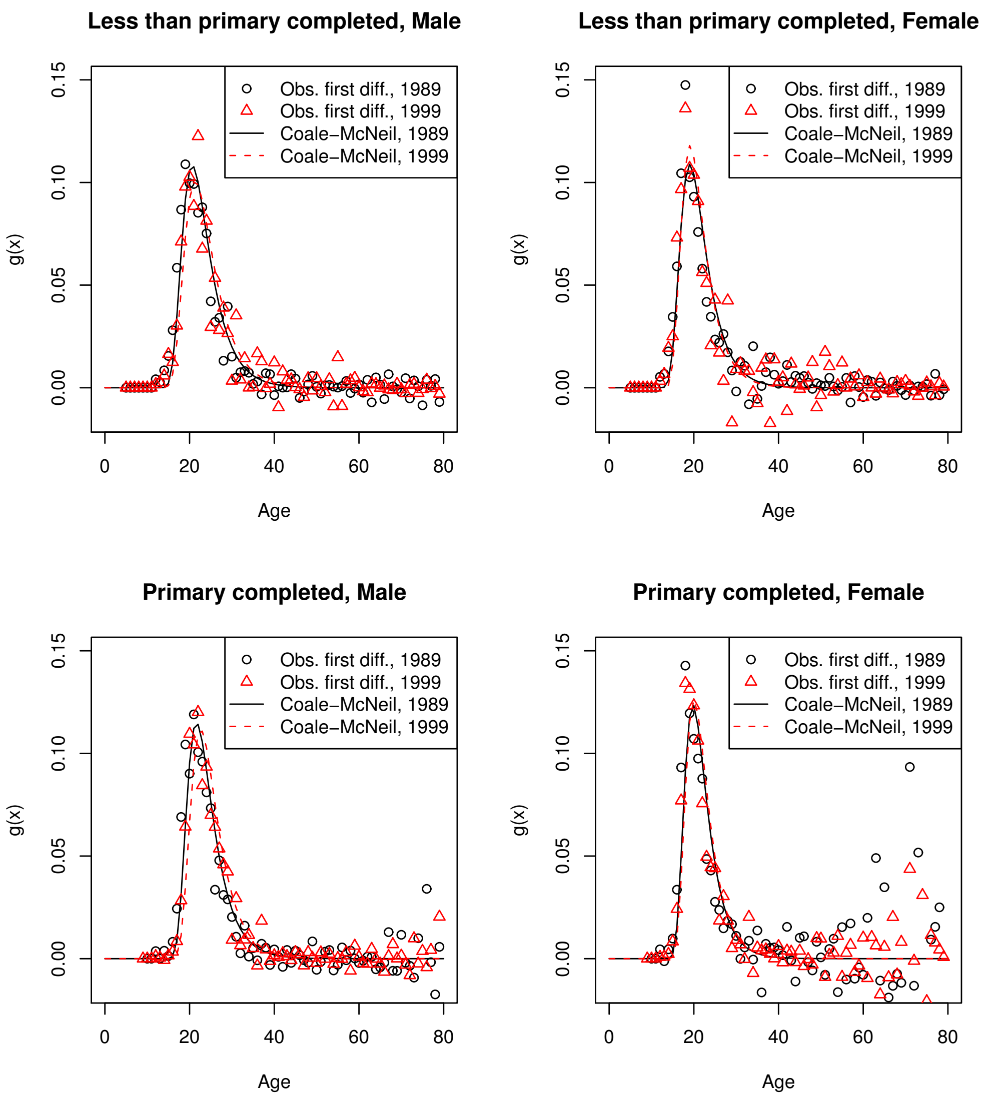
Table 4.3 shows the marriage squeeze index values for 1979 by regions, and for 1989 and 1999 by rural/urban areas, North and South Vietnam, regions and by educational levels. The marriage squeeze index value for the total population in 1979 is 0.866, indicating that for every 100 women seeking marriage, only about 87 men are available to marry. This overabundance of women in the first marriage market suggests the presence of a "squeeze" on women seeking a first marriage partner. For 1989, the index value is about the same as in 1979 at 0.862. By 1999, however, the index value has risen to 0.929, indicating that the marriage squeeze has eased relative to the 1979 and 1989 levels, although women still outnumber the men in the marriage market. The results also show that the squeeze on women in 1989 and 1999 is more severe in rural areas than in urban areas, although in both areas, the degree of the squeeze has lessened between 1989 and 1999.

Further, the marriage squeeze index values in the north and the south show that the squeeze is slightly worse for women in the south than in the north in both 1989 and 1999. The squeeze in both areas has improved between 1989 and 1999, however, it improved more in the north than the south with northern values reaching almost one in 1999.

Across regions, the marriage squeeze index values show varied trends between 1979 and 1989, with some regions experiencing a worsening of a squeeze while other regions see an easing of the squeeze. The Red River Delta, North Central and the Central Coast regions all experienced a decline in the value of the marriage squeeze index between 1979 and 1989, suggesting a greater squeeze on women in 1989 than in 1979. On the other hand, the Northeast, Northwest, Southeast, and the Mekong River Delta regions saw an increase in the marriage squeeze index values between 1979 and 1989, indicating the easing of the squeeze on women. The Central Highlands stayed about the same at around 0.90. Between 1989 and 1999, all regions experienced lessening of the squeeze on women between 1989 and 1999. The greatest change is observed in the Central Coast, where the marriage index value rose from 0.872 in 1989 to 1.016 in 1999.

By educational level, the squeeze on women is greater for those with less education. At all levels below the university, the index values rose between 1989 and 1999, indicating the reduction of the squeeze on women. For those who completed secondary school, while women are squeezed in 1989, men are squeezed in 1999. For the university completed population, the squeeze is on men rather than on women, but the index values show a decrease between 1989 and 1999, suggesting that the squeeze on men eased during this time period. However, these calculations assumes homogamy across educational levels. In reality, more educated men may marry less educated women.

Figure 4.16: Density of first marriage by sex and educational attainment, Vietnam, 1989 and 1999



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

Table 4.3: Marriage squeeze index, Vietnam, 1979, 1989 and 1999

	1979	1989	1999
Total	0.8659	0.8620	0.9692
Rural		0.8517	0.9641
Urban		0.8971	0.9753
North		0.8636	0.9575
South		0.8606	0.9798
Red River Delta	0.9130	0.8742	0.9809
Northeast	0.8704	0.8886	0.9611
Northwest	0.7692	0.9222	0.9476
North Central	1.0036	0.8217	0.9429
Central Coast	0.9210	0.8715	1.0163
Central Highlands	0.9037	0.9099	1.0062
Southeast	0.8022	0.8863	0.9961
Mekong River Delta	0.7536	0.8338	0.9456
Less than primary completed		0.7505	0.9262
Primary completed		0.9170	0.9447
Secondary completed		0.9113	1.1817
University completed		1.5383	1.3690

Figures 4.17 through 4.19 show the marriage squeeze index by province in 1979, 1989, and 1999. Figure 4.17 shows the marriage squeeze to be severe in 1979 in much of the north and the south, showing levels below 0.9 in most provinces. In three of the provinces, the marriage squeeze index values were below 0.7 (Son La, Tien Giang, Vung Tau - Con Dao). In the central region of the country, and in a couple of provinces in the northeast, the squeeze is on the men. The highest marriage squeeze index is seen in Quang Ninh in the northeast. Hai Phong, also in the north east and Binh Tri Thien (shown in the map as three provinces of Quang Tri, Quang Binh, and Thua Thien - Hue) in the center similarly displayed index values greater than 1.05.

Figure 4.18 shows an improvement in the marriage squeeze on women in most provinces in 1989 compared to 1979, but the squeeze is still fairly tight with 16 out of 44 provinces showing marriage squeeze index values less than 0.85. Interestingly, the three provinces that formally made up Binh Tri Thien province show a marriage squeeze in the opposite direction as in 1979. In 1989, the squeeze is on women, with index values ranging from 0.769 to 0.851. Further, only one province shows an index value greater than one. Quang Ninh province, which also shows a high index value in 1979, has a value of 1.105, although it has declined substantially from the 1979 value of 1.459.

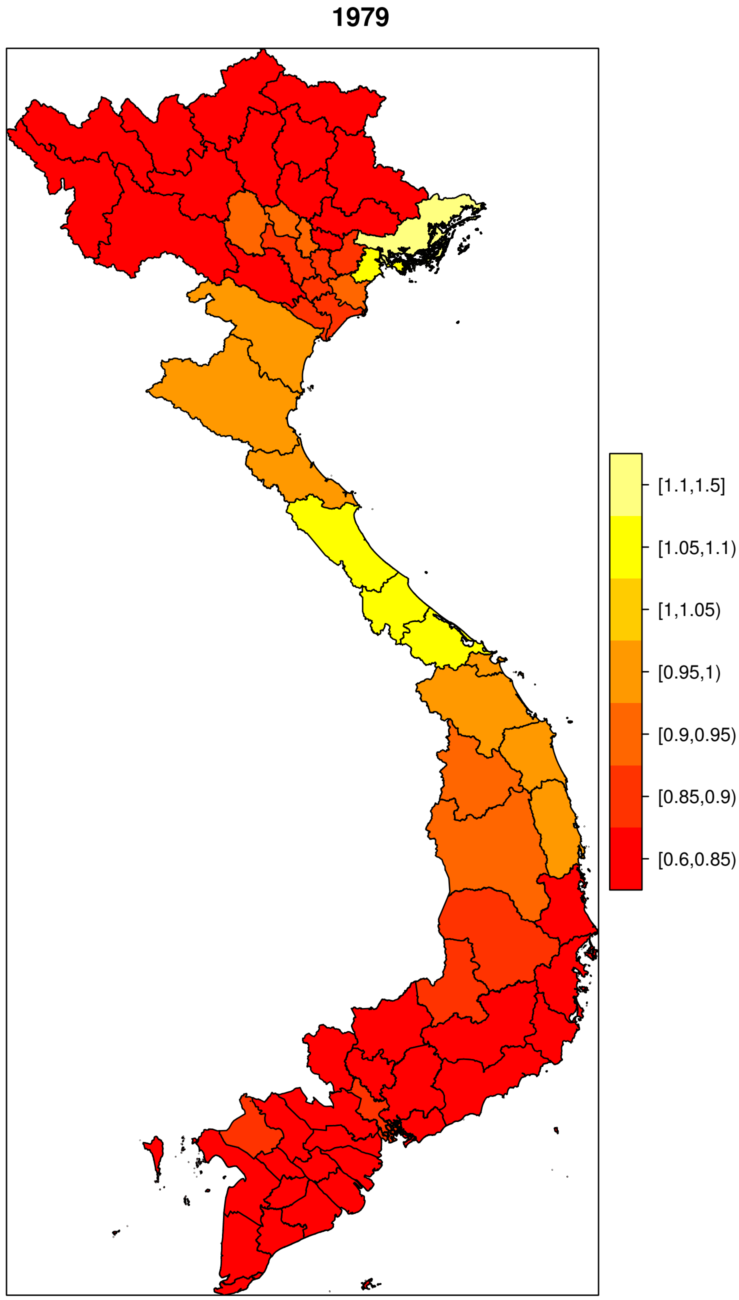
By 1999, the marriage squeeze index values for most provinces have risen to levels closer to one (Figure 4.19). The lowest value is found in Ca Mau with 0.860 and the highest in Quang Ngai with 0.113. Only seven out of 61 provinces show index values less than 0.9 and 18 provinces have index values between 0.98 and 1.02.

The trends for the province-level marriage indexes are summarized in Figure 4.20. As seen in the figure, the mean R_f for the provinces shifts from the lowest R_f in 1979 to the highest in 1999. Similarly, the variance around the mean decreases considerably between 1979 and 1999.

4.3.5 Association between Marriage Squeeze and Bombing Density

Figure 4.21 shows the relationship between the marriage squeeze index (R_f) and the log of the density of bombs per province across years. The solid line indicates the fitted regression line. The dotted line represents the level where the $R_f = 1$ where there is one man for every woman in the marriage market. In 1979, the relationship appears positive, where the number of bombs dropped per square kilometer is positively associated with the marriage squeeze index. However, as seen in Table 4.4, this association is not statistically significant. There is a negative relationship between the marriage squeeze index and bomb density in 1989, indicating that provinces with higher bombing activity also experienced a tighter marriage squeeze on women. The negative association is statistically significant at the .05 level (see Table 4.4). There is no evidence of a relationship between bombing and marriage squeeze in 1999. The overall levels of the marriage squeeze index are lower in 1979

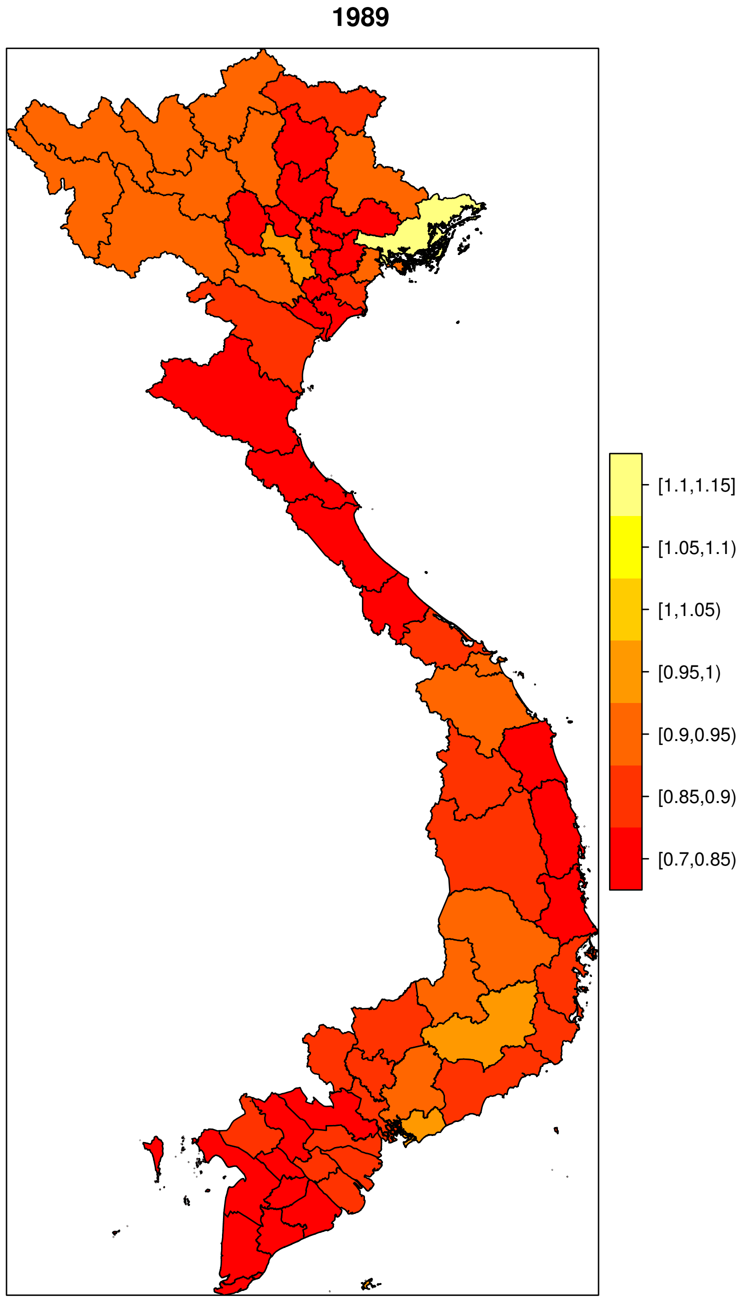
Figure 4.17: Marriage squeeze index by province, Vietnam, 1979



Note: The provinces are mapped using 1999 provinces and therefore approximate. For provinces that were split between 1979 and 1999, the provinces that formed the original province were assigned the value of the original province.

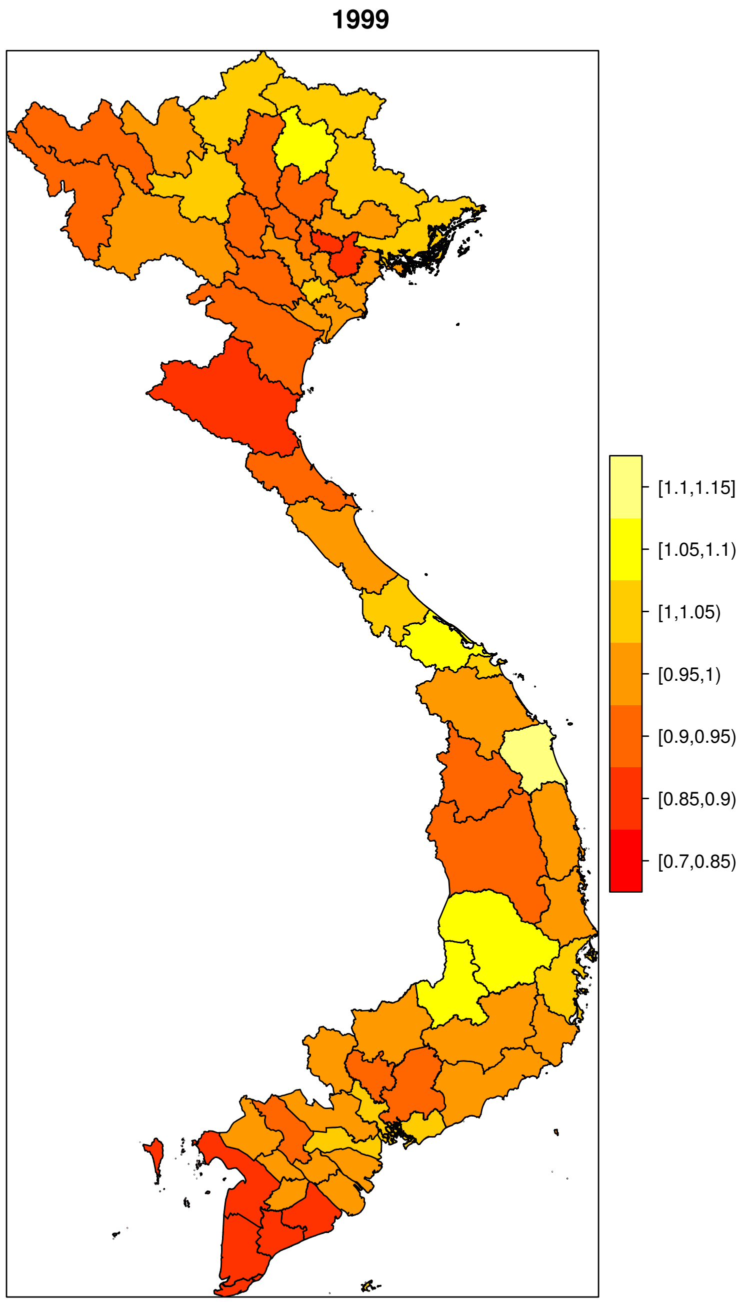
Data sources: 1979 Vietnam census (Vietnam General Population Census Central Committee, 1983), 1989 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

Figure 4.18: Marriage squeeze index by province, Vietnam, 1989



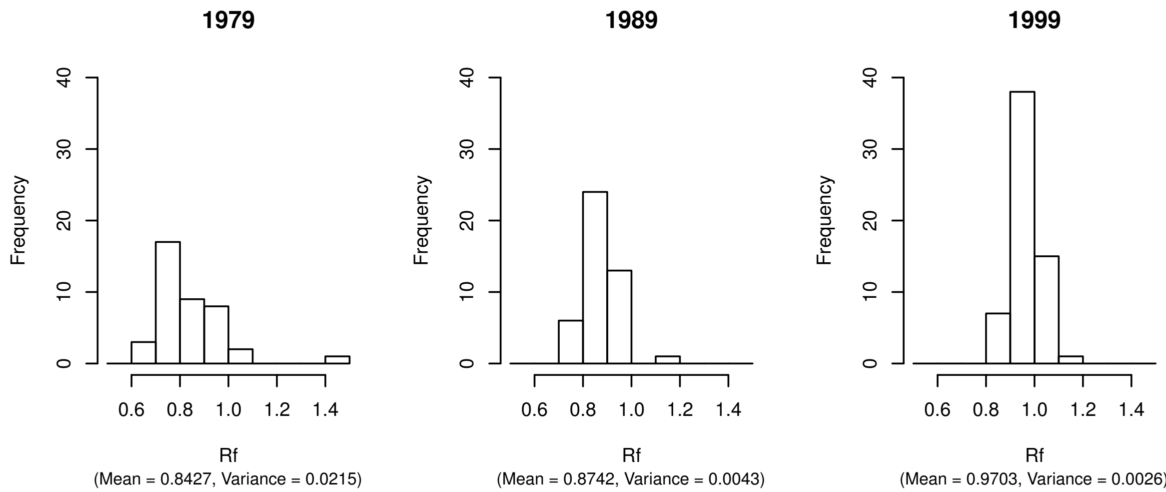
Note: The provinces are mapped using 1999 provinces and therefore approximate. For provinces that were split between 1989 and 1999, the provinces that formed the original province were assigned the value of the original province.
Data sources: 1989 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

Figure 4.19: Marriage squeeze index by province, Vietnam, 1999



Data source: 1999 Vietnam census, IPUMS International (Minnesota Population Center, 2009)

Figure 4.20: Distribution of the province-level marriage squeeze index



Data sources: 1979 Vietnam census (Vietnam General Population Census Central Committee, 1983), 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009)

than in 1989 or in 1999 and the regression line moves closer to the level where $R_f = 1$ from 1979 to 1999. Similarly, the R_f values are more widely distributed around the regression line in 1979 than in 1989 or 1999, and the spread decreases from 1979 to 1999.

The results for 1979 are not consistent with the idea that excess male mortality may have affected the marriage market. If most people who are in the marriage market for the first time are between the ages of 15 to 39, then in 1979, this group would have been born between 1940 and 1964, which means that they would have entered the marriage market around 1955 to 1979. This time range encompasses the period of heavy fighting during the war between 1965 and 1975. In 1979, this cohort would still be in the marriage market, and therefore, if bombing density were a good indicator for excess male mortality, then we would expect to see a negative relationship between bombing density and the marriage squeeze index.

The results for 1989 is more consistent with the expectation that excess male mortality would be associated with a marriage squeeze on women. In 1989, the cohorts born between 1950 to 1974 would be in the first marriage market. In 1989, the older cohorts in this age group, those born around 1950-1957, would have entered the marriage market between 1965-1975 when the heaviest bombing occurred. The lack of availability of potential male first-marriage partners due to excess male mortality from war activity may explain the drop in the marriage squeeze index for these provinces. However, if this were the case, then we should see a stronger relationship between the marriage squeeze index and bomb density in 1979 than in 1989, since more of those who would be directly affected by the war-related excess male mortality would be in the marriage market. Given the lack of such results from

1979, it is difficult to conclude that bombing during the war affected the availability of male partners in 1989. Furthermore, for the younger cohorts in the marriage market in 1989, excess male mortality is not likely to explain the marriage squeeze. The reason we see the negative relationship between marriage squeeze and bomb density may be that provinces that experienced heavy bombing also experienced large out-migration shortly following the war. The possible relationship between migration and marriage squeeze is explored briefly in the next section.

Finally, as expected, the 1999 marriage squeeze index values by province show no relationship with bombing density. We would expect to see no result in 1999 because by 1999, those who would be affected by the marriage squeeze from the war would be above the typical marrying age.

Table 4.4: Marriage squeeze index and bombing density, 1979-1999

(a) 1979

	Estimate	Std. Error	p-value
(Intercept)	0.8108	0.0377	0.0000
log(bombs per sq. km)	0.0142	0.0133	0.2867

(b) 1989

	Estimate	Std. Error	p-value
(Intercept)	0.8987	0.0162	0.0000
log(bombs per sq. km)	-0.0102	0.0054	0.0495

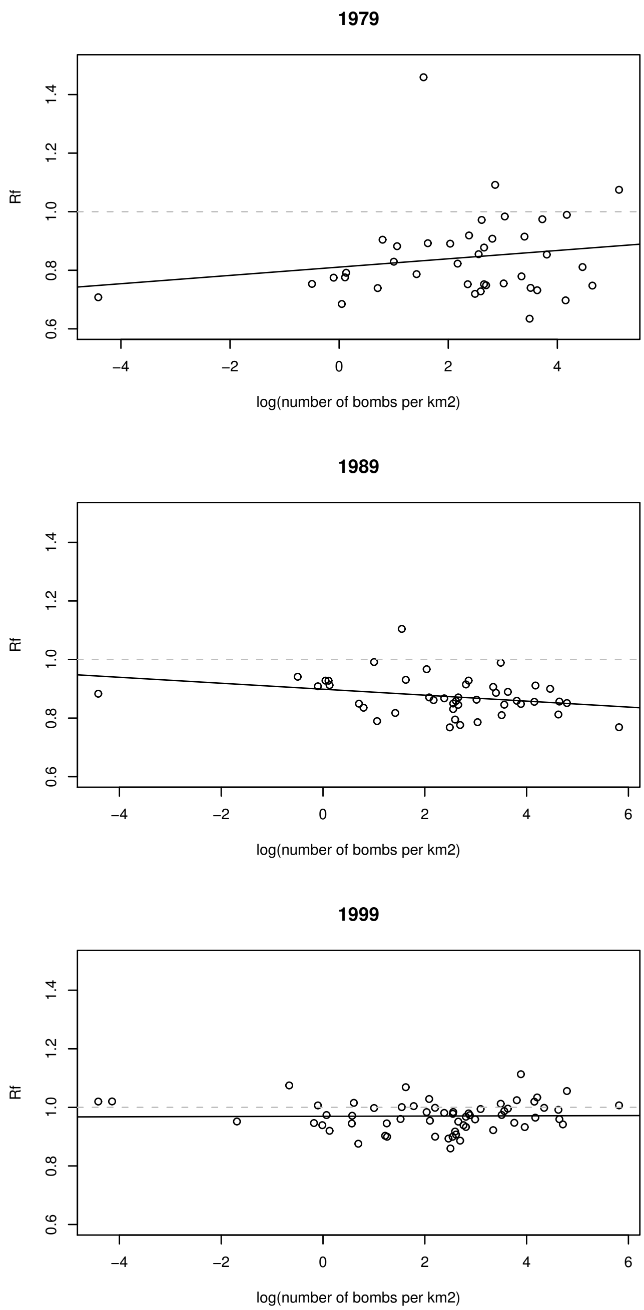
(c) 1999

	Estimate	Std. Error	p-value
(Intercept)	0.9694	0.0099	0.0000
log(bombs per sq. km)	0.0004	0.0034	0.9024

4.3.6 Association between Marriage Squeeze and Migration

Table 4.5 shows the values of the marriage squeeze index using observed and projected populations. Comparing the 1989 marriage squeeze index values using the 1989 population to those calculated using the projected 1979 populations with no migration and no mortality (Projection A) reveals that in the absence of migration or mortality between 1979 and 1989, the marriage squeeze index values are greater than one in all regions, except the Central Highlands which shows a marriage squeeze index value of 0.97. Since Vietnam is no longer at war between 1979 and 1989, excess male mortality is expected to be low in this time period. Therefore, most of the difference between the marriage squeeze index values using

Figure 4.21: Bombing density during the Vietnam War and marriage squeeze index of provinces, Vietnam, 1989



Data sources: 1989 and 1999 Vietnam censuses, IPUMS International (Minnesota Population Center, 2009), 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia(SEADAB), and Combat Naval Gunfire (CONGA) databases the projected and observed population are likely to be attributable to migration. Since the 1989 projected marriage index values for the regions are greater than one, they tell us that without migration (or mortality), there would be no marriage squeeze on women except in the Central Highlands. Instead, there would be a slight marriage squeeze on men in the Red River Delta, North Central, Central Coast, North East, and the Mekong River Delta regions.

Furthermore, if I project the 1979 population forward to 1989 assuming no migration, but assuming that 95 percent of males and 100 percent of females survive (Projection B), the marriage squeeze is much weaker in most regions. In particular, in the Red River Delta and in the North Central region, the squeeze on women would be nearly eliminated with index values of 1.02 and 0.99, indicating that the low marriage squeeze index values estimated from the 1989 census data are mostly due to excess male migration rather than mortality. Similarly, in the Northeast, Central Coast, and Mekong River Delta regions, the index values approach one, where there is one man for every woman in the marriage market. Under this scenario, a slight squeeze on women remain in the Central Highlands, and in the Northwest and Southeast regions, but the squeeze is much less severe than is seen with the observed 1989 population.

When the 1989 population is projected forward to 1999 with no migration and no mortality (Projection A), the marriage squeeze index is close to one in all regions with two exceptions. In the Central Highlands, the observed marriage squeeze index is approximately one, but the projected index is 0.98. In the Mekong Delta, the observed value is 0.95 and the projected value is 0.98.

Projecting the 1989 population forward to 1999 assuming that 95 percent of males and 100 percent of females survive between 1989 and 1999 (Projection B), the results show that in most regions, the observed marriage squeeze index values and the projected values are similar to each other. This indicates that the difference seen between the observed marriage squeeze index values and the values under Projection A are probably due to base level excess male mortality rather than migration. Exceptions are found in the North Central, Central Highlands, and the Mekong River Delta regions. In the North Central region, the observed marriage squeeze index value (0.94) is lower than that under Projection B (0.98), indicating that excess male migration is a likely factor behind the marriage squeeze in this region. On the other hand, in the Central Highlands and the Mekong River Delta regions, the observed index values are higher than those under Projection B, which suggests either that the assumption of excess male mortality used for Projection B is overestimated or that there may be excess female emigration in these regions that compensates for the excess male mortality.

Table 4.5: Marriage squeeze index, observed and projected population, Vietnam, 1989 and 1999

	1989	1989 proj.(A)	1989 proj.(B)	1999	1999 proj.(A)	1999 proj.(B)
Total	0.8620	1.0345	0.9828	0.9692	1.0124	0.9618
Red River Delta	0.8742	1.0754	1.0216	0.9809	1.0293	0.9778
Northeast	0.8886	1.0296	0.9782	0.9611	1.0085	0.9581
Northwest	0.9222	1.0012	0.9511	0.9476	1.0006	0.9505
North Central	0.8217	1.0489	0.9964	0.9429	1.0288	0.9774
Central Coast	0.8715	1.0353	0.9836	1.0163	1.0582	1.0053
Central Highlands	0.9099	0.9692	0.9207	1.0062	0.9844	0.9352
Southeast	0.8863	1.0089	0.9585	0.9961	1.0502	0.9977
Mekong River Delta	0.8338	1.0292	0.9777	0.9456	0.9788	0.9299

Note: The 1979 population is projected to 1989 and the 1989 population is projected to 1999. Projection A assumes no migration and no mortality and Projection B assumes no migration and that only 95 percent of males survive, while 100 percent of females survive.

4.4 Discussion

The results of this analysis show that the marriage squeeze in Vietnam was severe in 1979 and 1989. Interestingly, the national marriage squeeze in 1989 is slightly tighter than in 1979, but this may be because there was greater geographic variability in the squeeze in 1979 than in 1989. Further, the different trends in the marriage squeeze between 1979 to 1989 by geography may be because some provinces were migrant-sending provinces while others were migrant-receiving provinces. By 1999, the squeeze on women had lessened considerably. It is important to note that the marriage squeeze index used here is a period measure that weights the age distribution of the male and female population by the age-specific probability density of first marriage. Since the age schedule of marriage peaks among those in their 20s, the marriage squeeze index mostly reflects the first marriage experiences of people in those age groups for the given reference year. The 1979 marriage squeeze index is focused on those who are in their 20s in 1979, who would have been born in the 1950s, the 1989 index centers on those born in the 1960s, and the 1999 index focuses on those born in the 1970s. The marriage squeeze index, therefore, reflects the marriage condition of the period, rather than cohort experiences. Hence, the cohorts who entered the marriage market during the war may still be squeezed in 1999, for example, but their experiences are not weighted heavily in the calculation of the index.

Given the weakening of the marriage squeeze in 1999, it is interesting to observe that the proportion ever-married remains low for the generation of women who are in the marriage market in 1999, who would not have been affected by excess male mortality or emigration. This finding is consistent with qualitative accounts of the change in desirability of marriage that is driving the low proportion ever-married rather than the availability of men in the marriage market (Belanger, 2004; Belanger and Hong, 2002).

Since men tend to marry at older ages than women in Vietnam, as the SMAFM estimates show (Table 4.2), and since the population of Vietnam was growing between 1979 and 1989 (Barbieri et al., 1996), a marriage squeeze likely would be observed in the absence of the excess male mortality from the war or sex-selective emigration during this period. Therefore, further investigation was conducted to investigate the relationship between excess male mortality and emigration. The results do not confirm the relationship between marriage squeeze and excess male mortality with the density of U.S. bombing of Vietnam as an indicator. However, the density of bombing may not be a good indicator for excess male mortality for a couple of reasons. First, death by bombing is not sex selective. When a bomb drops, all those in the area have an equal chance of dying regardless of sex. Second, areas that were heavily bombed may not be associated with where active combat occurred or where the soldiers would have lived if they had not been deployed.

Excess male emigration after the war appears to be a stronger force behind the marriage squeeze. The cursory analysis conducted here indicates that without migration, the sex ratios among those entering first marriage would have been more balanced. Given the scale of internal and international migration that occurred following the war discussed in an earlier chapter(Desbarats, 1987; Merli, 1997), this result is not surprising. A more careful analysis, using better methods of population projection, as well as a better estimation of the density of first marriage in 1979, is needed to further this study. In addition, more analysis can be done by taking advantage of the migration related variables in the IPUMS datasets.

4.5 Conclusion

The aim of this chapter was to investigate the marriage squeeze in Vietnam following the Vietnam War to better understand the degree of the the squeeze across time, space, and educational status, as well as to explore the underlying causes of the sex imbalances that create a marriage squeeze. The results clearly show the easing of the marriage squeeze in Vietnam between 1979/1989 and 1999. Although the analysis is not able to show conclusive evidence regarding the relationship between excess male mortality and marriage squeeze, it gives some indication that sex-selective migration may have greatly contributed to the marriage squeeze in Vietnam in 1989. In addition to expanding our understanding about the marriage squeeze that occurred in the period following the Vietnam War, this analysis lays the groundwork for studying future trends in the marriage market in Vietnam. As seen in an earlier chapter, the younger generation in Vietnam shows a high sex ratio. As these cohorts age, the squeeze on marriage may shift from women to men. Furthermore, this analysis provides quantitative evidence that supports the idea that the imbalances in marriage-age sex ratios are not the only reason that women are remaining single in Vietnam.

Chapter 5

Long-Term Effects of Early-Life War Exposure

5.1 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 (Case et al., 2002; Crimmins and Finch, 2006; Elo and Preston, 1992; Fogel, 1997). Other studies also have examined the relationship between early life conditions and demographic and socioeconomic outcomes such as fertility, marital status, education, and employment (Almond et al., 2008; Chen and Zhou, 2007; Currie et al., 2008; Lumey and Stein, 1997).

One way to study this phenomenon is through the use of sudden changes in conditions as a natural experiment, contrasting the outcomes of adjacent cohorts to study the the effects of early life conditions on later life outcomes. To this end, numerous studies have examined exposures to famines, particularly famine that started and ended abruptly. 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 (Almond et al., 2008; Cai and Feng, 2005; Chen and Zhou, 2007; Elias et al., 2005b; Elias et al., 2005a; Neelsen and Stratmann, 2010; Painter et al., 2005; Stein et al., 2006), other studies have found mixed or no long-term effects of exposure to famine (Kannisto et al., 1997; Lumey and Van Poppel, 1994; Lumey and Stein, 2009; Song, 2009; Stanner et al., 1997). 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 (Almond et al., 2008; Almond et al., 2007; Almond and Mazumder, 2008; Mamelund, 2003).

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 wartime 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 to 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 (Barker, 2001). To the extent that poor health affects economic outcomes rather than vice versa (Smith, 2004), this hypothesis could be extended to socioeconomic outcomes in adult life.

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 (Vaupel et al., 1979). Given the empirical evidence supporting higher neonatal and infant mortality among babies conceived in adverse conditions (Lumey and Van Poppel, 1994; Razzaque et al., 1990), 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 (Horiuchi, 1983) 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 (Caselli et al., 1987; Okubo and Kenkyujo., 1981). 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 (Wilmoth et al., 1990).

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 (Miguel and Roland, 2009). However, Akresh and de Walque (Akresh and Walque, 2008) 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 (Shemyakina, 2006) 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.

5.2 Data and Methods

5.2.1 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 dataset is described in detail in the previous chapter.

In addition to the bombing data, this study uses the 1999 Vietnamese census microdata, available through the Integrated Public Microdata Series (IPUMS) International: Version

5.0 (Minnesota Population Center, 2009). The quality of the 1999 census data is discussed in detail in Chapter 3. Briefly, data quality issues of concern here are the deficit of 20-24 year old men in the 1999 census and the irregular pattern of cohort survival for males in the 20-24 and 30-34 age groups. 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 5.1 presents the summary statistics of the key variables used in the analysis.

Table 5.1: Summary Statistics

Variable	N	Proportions	S.D.
Primary School Completed	70,675	0.8695	0.3369
Lower Secondary School School Completed	70,675	0.3658	0.4817
Upper Secondary School Completed	70,675	0.1466	0.3537
Literate	72,233	0.9667	0.1795
Married	72,173	0.4965	0.5000
Employed	63,225	0.9195	0.2720
War Cohort	72,244	0.3222	0.4673
War Conceived Cohort	72,244	0.3338	0.4716
Post War Cohort	72,244	0.3440	0.4751
Low War Intensity Area	72,244	0.6806	0.4663
Medium War Intensity Area	72,244	0.2286	0.4199
High War Intensity Area	72,244	0.0909	0.2874
Female	72,244	0.5227	0.4995
Urban	72,244	0.5102	0.4999

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 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 by 1999, 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. [1]

5.2.2 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 5.2 shows the cohorts, their birth months and years, and their ages at the time of the 1999 census. The war-conceived cohort consists of those who were 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 5.2: 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

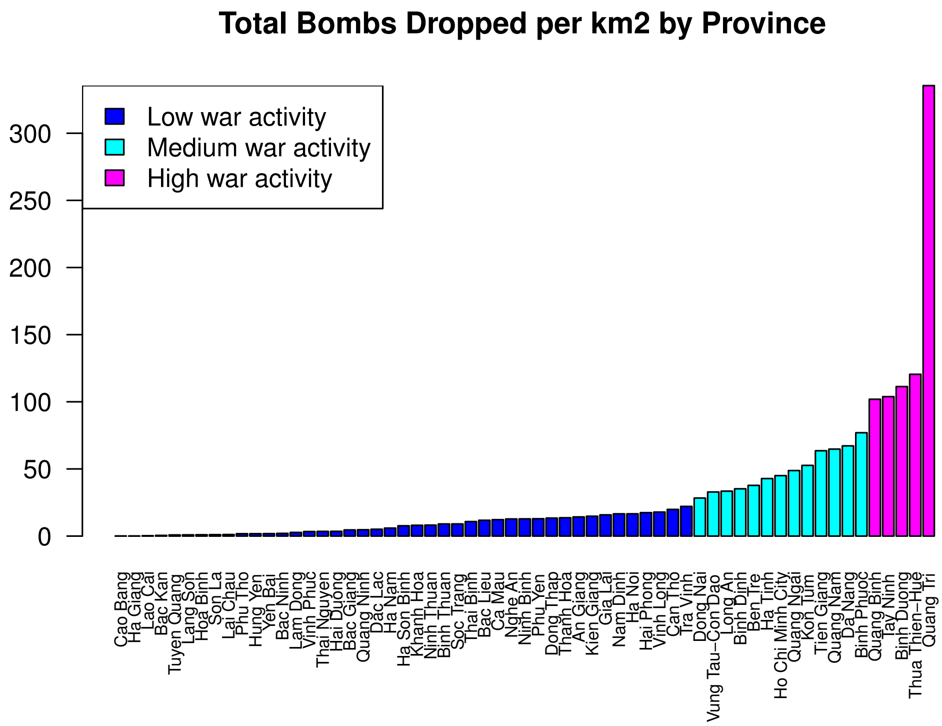
[1] Also examined are school attendance from the 1989 census and employment disability from the 1999 census. However, the results from school attendance are excluded because the age effect in school attendance was a major factor in the differences between cohorts. The 1989 census captured the cohorts 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.

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. The cut-off points for the categories were chosen based on natural breaks in the data. Figure 5.1 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. Of these, approximately 92% lived in the same commune five years earlier. Further, when the correlation between the province of birth and province of residence is checked using the 1998 Vietnam Living Standards Survey data, approximately 90% of the population in the cohorts of interest lived in the same province where they were born.

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 as defined earlier. Then, the difference-in-differences is calculated by taking the difference between the two differences. In the example shown in Table 5.3, the difference between proportions ever-married in high war intensity areas between the war-conceived cohort (treatment) and the postwar cohort (control) is first calculated (0.4595-0.3717=0.0878). The same is done for low war intensity areas (0.5608-0.4570=0.1038), 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 (0.0878-0.1038 = -0.0160). As illustrated in Figure 5.2, the difference-in-differences of -0.0160 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 probability of marriage of individuals exposed to the war are 0.0160 percentage points lower than it would have been if the difference between the war and postwar cohorts had been the same as that in the low war intensity areas. In other words, in absence of exposure to the war, the proportion married in the war-conceived cohort would have been 0.4755 or 0.0160 higher than the observed proportion of 0.4595.

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

Figure 5.1: War activity classification and total U.S. ordnance dropped per square kilometer by province, Vietnam, 1965-1975.

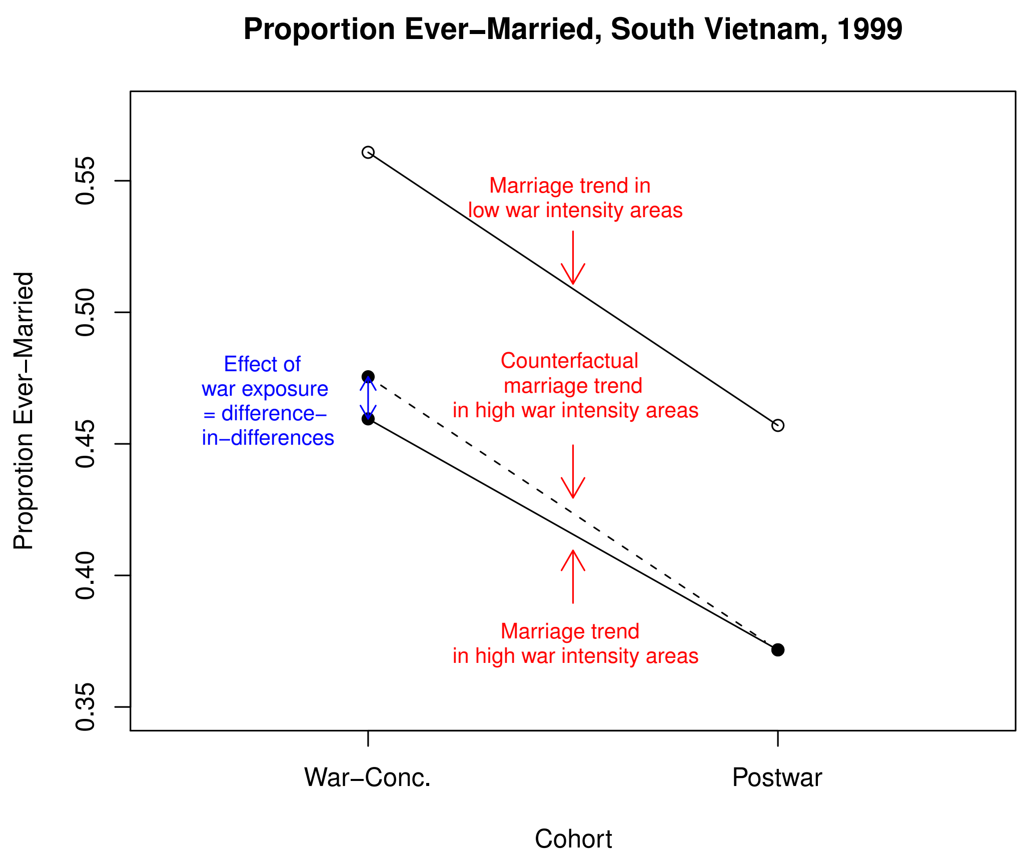


Data sources: 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia(SEADAB), and Combat Naval Gunfire (CONGA) databases

Table 5.3: Example of difference-in-differences calculation: Proportion ever-married, South Vietnam

	War-conceived cohort	Postwar cohort	Difference
High war intensity	0.4595	0.3717	0.0878
Low war intensity	0.5608	0.4570	0.1038
Difference	-0.1013	-0.0853	-0.0160

Figure 5.2: Illustrated example of difference-in-differences in proportion ever-married comparing the war-conceived and postwar cohorts in high and low war intensity areas, South Vietnam.



sex and urban residence. The long-term effects of the war on the outcomes are estimated by applying the following model:

$$E[Y_{ijc} \mid A_j, C_c, F_i, U_i] = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i \qquad (5.1)$$

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 standard errors are calculated using the Huber-White method, clustered at the province level. The `robcov` command clustered at the province level in the R programming language was used to calculate the robust standard errors (R Development Core Team, 2010).

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 5.4.

While the difference-in-differences approach allows us to identify the effects of war exposure regardless of the overall trends in the outcome variables, the degree to which we can attribute a causal effect of war exposure on the outcomes depends on whether the observed trends match the expected conditions underlying the difference-in-differences estimates. For example, 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. While the effects observed when trends in educational attainment do not follow this pattern still identify the difference-in-differences, we can more reasonably attribute the effects to war exposure rather than to other confounding events (such as migration) when the trends are observed as expected. Similar arguments can be made for literacy. Therefore, as shown in Table 5.5, the possible conditions from Table 5.4 and the expected outcome of the difference-in-differences for educational attainment and literacy are 1A (-), 1B(+), 1C(0), 3(0), 5(-), 6(+), 7(+), and 8(+). While all of the conditions mentioned in Table 5.5 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. 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.

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 5.5 displays the possible trends that can be expected from the difference-in-differences for marriage and employment. Of the expected conditions mentioned in Table 5.5, 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 interact 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}).

$$E[Y_{ijc} \mid A_j, C_c, F_i, U_i] = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i + \boldsymbol{\beta_{11jc}}(\mathbf{A_j} * \mathbf{C_c} * \mathbf{F_i}) \tag{5.2}$$

$$E[Y_{ijc} \mid A_j, C_c, F_i, U_i] = \beta_0 + \beta_{1j}A_j + \beta_{2c}C_c + \boldsymbol{\beta_{3jc}}(\mathbf{A_j} * \mathbf{C_c}) + \beta_4 F_i + \beta_5 U_i + \boldsymbol{\beta_{11jc}}(\mathbf{A_j} * \mathbf{C_c} * \mathbf{U_i}) \tag{5.3}$$

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 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.[2]

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

Table 5.4: 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 5.5: 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 5.4. *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.

5.3 Results

5.3.1 Descriptive Results

General trends

Figures 5.3 and 5.4 show the trends in the outcome variables by war intensity and North and South Vietnam. These trends are by birth year, and therefore, are not representative of the cohorts of interest which span across birth years. However, it is useful to observe the general trends in the outcome variables before proceeding with an examination of the cohort specific trends. The figures reveal a few interesting trends. First, the patterns of education in North and South Vietnam are very different (Figure 5.3). 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.

Unadjusted proportions and difference-in-differences

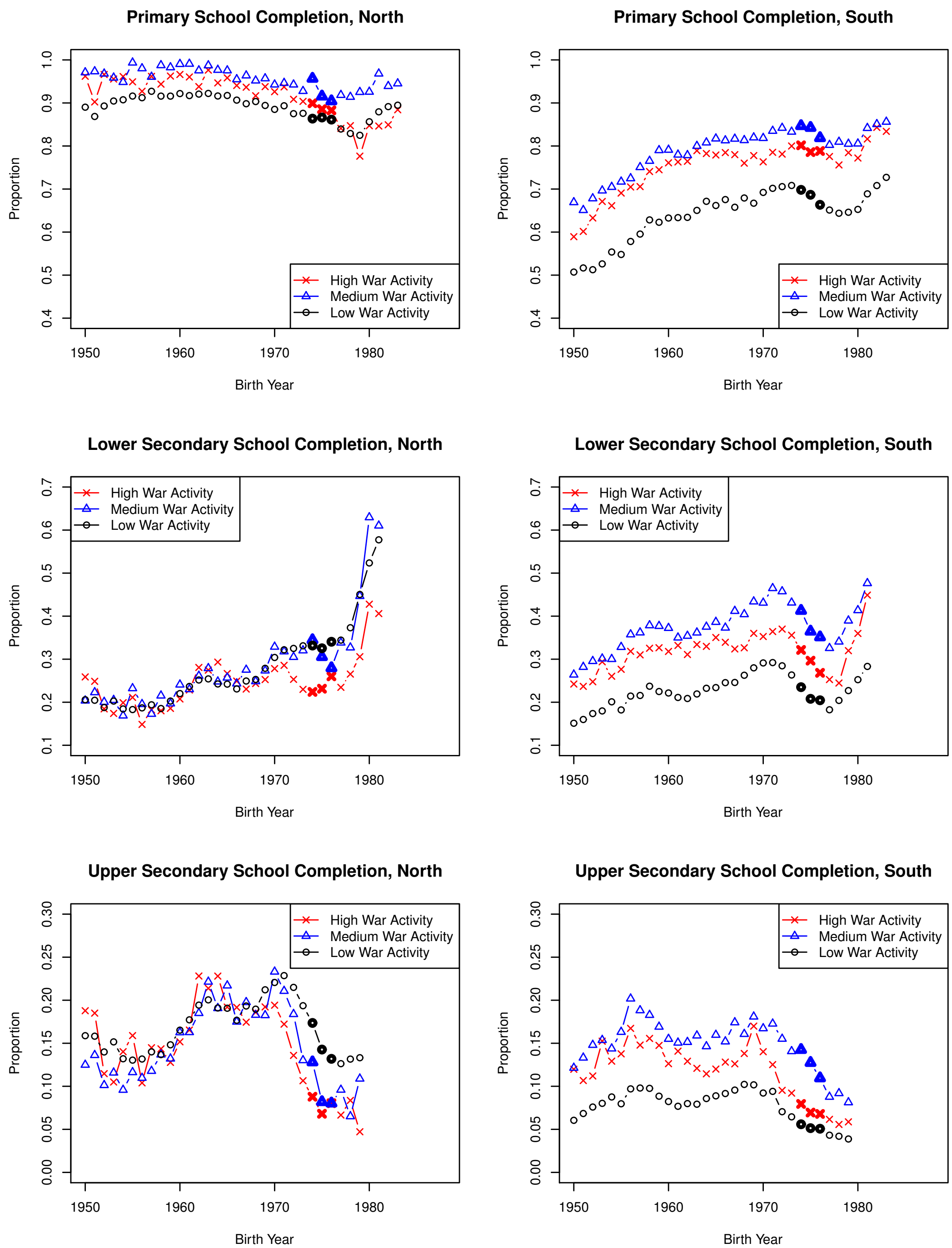
Tables 5.6 and 5.7 summarize the basic unadjusted proportions of the outcome variables and the difference-in-differences in North and South Vietnam for the cohorts of interest.

North Examining educational attainment in the north (Table 5.6, 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.

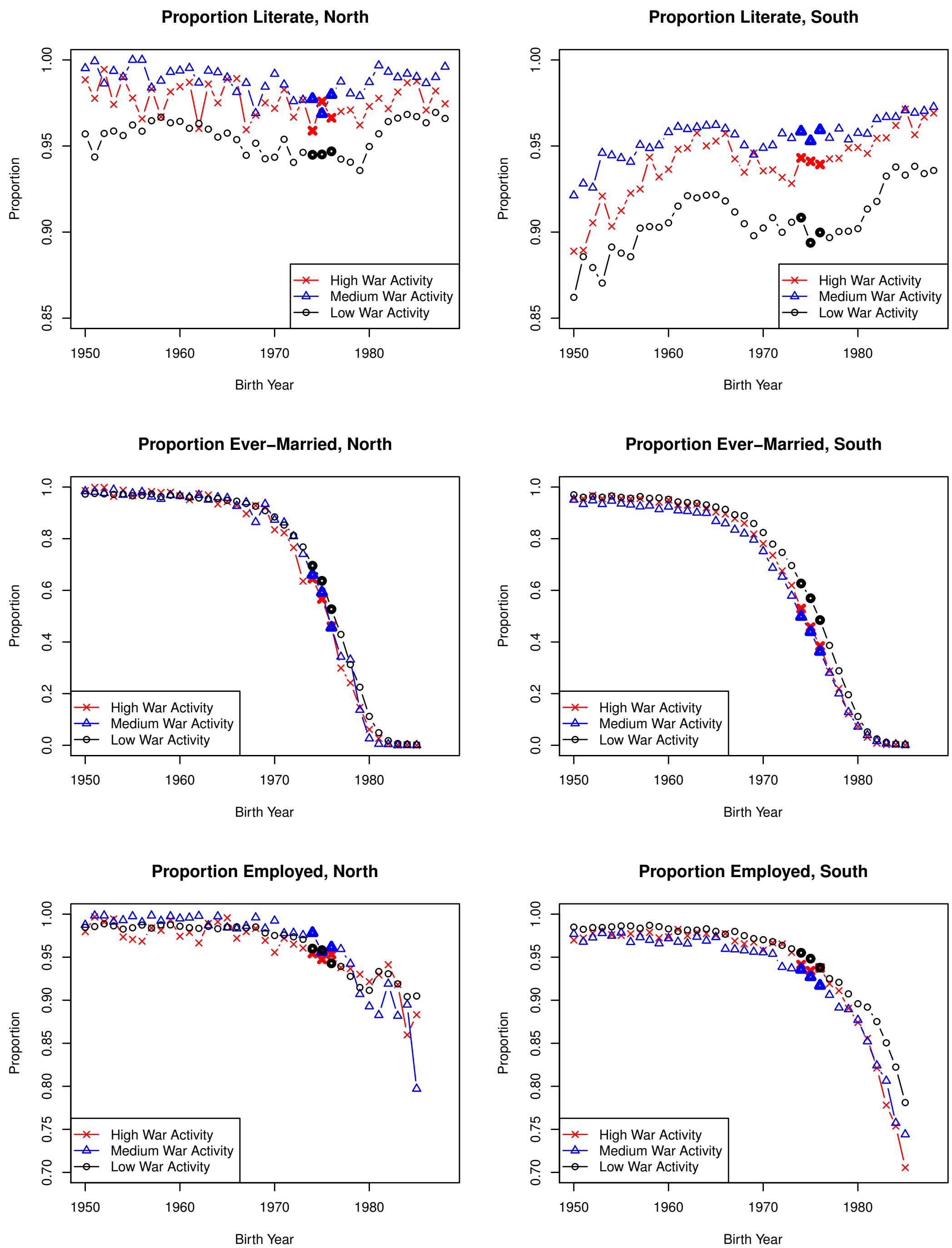
Analyzing the difference-in-differences for these three educational outcomes presents a challenge because the educational attainment of the postwar cohort is not consistent with our expectation that educational attainment improves with each birth cohort. The lower educational attainment of the postwar 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 5.4 and the list of expected conditions for each outcome of interest shown in Table 5.5. 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 5.4, 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 5.5. 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,

Figure 5.3: Trends in educational outcomes by birth year and war intensity, Vietnam, 1999.



Note: 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 cohort 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 5.4: Trends in literacy, marriage, and employment outcomes by birth year and war intensity, Vietnam, 1999



Note: 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 cohort 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.

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 5.4. 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 5.5, and therefore, we should not rule out the possibility that the war adversely affected 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 5.4 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 5.5.

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 5.6, 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 5.6, e), similar to what was observed in Figure 5.4, 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 5.6, 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 5.4 and as explained in Table 5.5.

South The patterns in the south (Table 5.7) are very different from those seen in the north. Educational attainment in the south (Table 5.7, 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 5.5. 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 5.5. 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 5.7, 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 5.6: 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 5.7: 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	

5.3.2 Regression Results

Tables 5.8 through 5.13 show the results from fitting the three regression models described above for each of the outcome variables.[3] 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-differences 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.

Primary School Completion

Table 5.8 presents results from the regression that examines the effect of war exposure on primary school completion.

North

Base Model (Model 1) In the north, the main effects are significantly negative for high and medium war intensity areas, which suggests that these areas have lower primary school completion rates than for low war intensity areas (see Table 5.8, 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 lower for those exposed to war *in utero* in high war intensity areas, in addition to the negative main effects for high war intensity areas (Table 5.8, North, Column 1).[4] 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 5.4, Condition 4). As discussed

[3] 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.

[4] 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.

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 5.5). Therefore, it is unclear whether this negative difference-in-differences can be interpreted as a negative effect of war exposure.

Model with Female Interaction Terms (Model 2) When the heterogenous effects of war exposure on women are examined by interacting the two-way interaction terms with the female variable, the main effects and the difference-in-differences estimates do not change very much (Table 5.8, 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 with Urban Interaction Terms (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. 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 5.8, 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 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 those 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 5.4. 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 5.4 for this outcome. Hence, these 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 5.5, and therefore, 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 5.8, 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

Base Model (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 5.8, 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 with Female Interaction Terms (Model 2) Including the three-way interaction terms with being female in the south, 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 5.8, South, Column 2).

Model with Urban Interaction Terms (Model 3) Similarly, the addition of the three-way interaction terms with the urban variable 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 5.8, South, Column 3).

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 5.9.

North

Base Model (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 with Female Interaction Terms (Model 2) When the three-way interaction terms with the female variable are included in the model, 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 5.9, 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 5.4, 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 5.5. 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 with Urban Interaction Terms (Model 3) In addition, the inclusion of the three-way interaction terms with the urban variable 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 5.9, 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 5.9, 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

Base Model (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 5.9, 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 with Female Interaction Terms (Model 2) Further, when the three-way interaction terms with the female variable is added, the main effects and the two-way interaction terms remain similar to those in Model 1 with one exception (Table 5.9, 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 with Urban Interaction Terms (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 5.9, 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 Condition 6 in Table 5.4 where lower secondary school completion declined in areas heavily affected by war but improved in less affected areas, which is consistent with the expected outcomes presented in Table 5.5. 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.

Upper Secondary School Completion

The effects of exposure to war on upper secondary school completion are presented in Table 5.10.

North

Base Model (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 5.10, 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 5.10, 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 5.4, 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 with Female Interaction Terms (Model 2) When the the female variable is interacted with the difference-in-differences, the main effects and the two-way interaction terms remain similar to those found in Model 1 (Table 5.10, 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 with Urban Interaction Terms (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 5.10, North, Column 3). The difference-in-differences estimate for the war cohort in medium war intensity areas is positive and should be interpreted under Condition 2A in Table 5.4, 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 term between war-conceived cohort and medium war intensity is negative but the magnitude of the estimate is small at -0.0077. Condition 5 in Table 5.4 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. This result is consistent with our expectations.

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 5.10, 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

Base Model (Model 1) Observing the Model 1 main effects on upper secondary completion in the south (Table 5.10, 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 5.4, Condition 6 applies to this case which is consistent with the expected difference-in-differences outcome outlined in Table 5.5. 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 with Female Interaction Terms (Model 2) When the difference-in-differences are interacted with the female variable in the south, 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 5.10, South, Column 2).

Furthermore, adding 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 5.4, which is one of the expected outcomes in Table 5.5. 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 5.4, 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 5.10, 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 with Urban Interaction Terms (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 5.10, South, Column 3). Examining the main effects, the main war cohort effect is less negative compared to Model 1 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 5.4, 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 5.5.

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.

Literacy

The results for literacy as an outcome are presented in Table 5.11.

North

Base Model (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 5.11, 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 5.4, 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 with Female Interaction Terms (Model 2) When the difference-in-differences estimates are interacted with the female variable, 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 5.11, 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 5.4 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 with Urban Interaction Terms (Model 3) The addition of the three-way interaction terms with urban does not vary the main effects or the two-way interaction terms much, with one exception (Table 5.11, 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 5.4 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

Base Model (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 5.11, 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 with Female Interaction Terms (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 5.11, 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 with Urban Interaction Terms (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 5.11, 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 5.4 which is consistent with our expectations. No added effects of urban residence on the difference-in-differences estimates are seen.

Marriage

Table 5.12 displays the regression results of the effect of war exposure on the proportions ever-married.

North

Base Model (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 5.12, 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 5.4, 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 adverse events delay marriages. Other coefficients to the interaction terms are negative but not statistically significant.

Model with Female Interaction Terms (Model 2) Introducing the three-way interaction terms with the female variable to the model does not seem to affect the main effects, but has changed the difference-in-differences estimates (Table 5.12, 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 5.4, Condition 2B), suggesting adverse effects of war exposure on marriage outcomes.

The added effects of being female are mostly positive. 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 with Urban Interaction Terms (Model 3) When the three-way interaction terms with the urban variable are added, again, the main effects remain unaltered, but all four difference-in-differences become statistically significant (Table 5.12, 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 5.12, 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 Condition 2B in Table 5.4, 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

Base Model (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 5.12, 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 with Female Interaction Terms (Model 2) In Model 2, the main effects are not much different from those seen in Model 1 (Table 5.12, 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 5.4, 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 with Urban Interaction Terms (Model 3) When the added effects of urban residence is observed, the main effects and the two-way interaction terms are mostly similar to those seen in Model 1 (Table 5.12, South, Column 3). The main effect for medium war intensity areas show about one percentage point lower 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.

Employment

The effects of exposure to war on employment are presented in Table 5.13.

North

Base Model (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 5.13, 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 5.4, Condition 4). This is consistent with our expectations as explained in Table 5.5. 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 5.4, 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 with Female Interaction Terms (Model 2) When the female variable is interacted with the difference-in-differences, the main effects in the north are mostly similar to Model 1, except for the coefficients on high and medium war intensity areas (Table 5.13, North, Column 2). The negative relationship between high war intensity and employment is less negative compared to Model 1 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 5.4, 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 with Urban Interaction Terms (Model 3) With the addition of the three-way interaction terms with the urban variable in the model with employment as an outcome, the main effects remain about the same (Table 5.13, 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 5.4. 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. In contrast, 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 discussed under Model 1. All four difference-in-differences estimates show expected results as explained in Table 5.5.

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

Base Model (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 5.13, 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 with Female Interaction Terms (Model 2) The main effects do not show much difference with the addition of the three-way interaction terms with the female variable (Table 5.13, 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 5.4).

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 with Urban Interaction Terms (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 5.13, 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 5.4, which is in agreement with our expectations as shown in Table 5.5. 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 5.4, 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 5.8: The effect of exposure to the war on the probability of completing primary school: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
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)

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

Table 5.9: The effect of exposure to the war on the probability of completing lower secondary school: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
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)

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

Table 5.10: The effect of exposure to the war on the probability of completing upper secondary school: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North						South					
Covariates	(1)		(2)		(3)		(1)		(2)		(3)	
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)	
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)	
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)	

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

Table 5.11: The effect of exposure to the war on the probability of being literate: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
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)

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

Table 5.12: The effect of exposure to the war on the probability of having married: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North						South					
Covariates	(1)		(2)		(3)		(1)		(2)		(3)	
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)	
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)	
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)	

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

Table 5.13: The effect of exposure to the war on the probability of being employed: Interactions between birth cohort and war intensity areas, Vietnam, 1999.

	North			South		
Covariates	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
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)

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

5.4 Discussion

This chapter investigates 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. Despite these challenges, the results obtained in this analysis are fairly consistent with what we would expect to find in long-term effects of being exposed to the war at an early age. Marriage and employment for young adults most consistently show some adverse effects of having been exposed to the war in the north. In addition, some evidence is seen of unfavorable effects on employment in the south. For literacy and educational attainment, the results are less clear. Although the results are fairly consistent with our expectations (i.e., they fall under one of the conditions outlined in Table 5.5), 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-in-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. If the latter two were correlated with war intensity, then the resulting estimates would be distorted.

Furthermore, in the south, very few effects of exposure to the war were found. 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 (Miguel and Roland, 2009). 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, the postwar cohort would not act as a good "control" cohort for the war-exposed cohorts and 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. The sample included in the analysis range in age from 22 to 24. In this age range, more women have begun to marry than men since the age in which marriage begins for women is lower than for men. Hence, comparing men and women in the same age range many not produce informative results. It may be more prudent to examine the proportional differences in marriage outcomes between men and women rather than the difference-in-difference-in-differences.

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 force, 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. Although the 1998 Vietnam Living Standards data showed that most people live in the same province in which they were born, there may have been some within-province urban-rural migration that was not observed in the data. 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. Conditions for all three cohorts were subject to many changing influences of which the war was just one and the 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 in their early 20s. 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.

5.5 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.

Chapter 6

Concluding Remarks

This dissertation examined the consequences of the Vietnam War on the Vietnamese population. In the introductory chapter, I explained the demographic consequences of wars and described the series of wars leading up to the Vietnam War, the war itself, and the complex set of political and economic circumstances that followed the war. Next, I reviewed existing estimates of war-related mortality in Vietnam, as well as overall mortality trends from the period before the war until decades after the war. This examination revealed some evidence of increased mortality among young men in wartime, but no peaks were observed in mortality trends for children or in the general population. In the third chapter, I investigated the war's imprint on population age and sex structure in the 1989 and 1999 Vietnam censuses and found that the war impacted the cohorts that were in their 20s and 30s during 1965-1975 by reducing their numbers relative to their surrounding cohorts and by skewing their sex ratio towards women.

The fourth chapter explored the marriage patterns in Vietnam in the postwar period, in particular, the marriage squeeze on women that followed the war. The results showed that Vietnam experienced a severe marriage squeeze in 1979 and 1989, but it had eased by 1999. On average, marriage squeeze at the province level displayed gradual improvement between 1979 and 1999. The relationship between marriage squeeze and excess male mortality was not observed, but this may be due to the use of the bombing data as a proxy for male mortality. Migration was likely a major factor in creating a marriage squeeze.

In the fifth chapter, the long-term socioeconomic effects of early-life exposure to the war were investigated. Despite the challenges faced in extricating the long-term effects of the war from other factors, the results showed adverse effects of early-life exposure to the war on marriage and employment in the north and employment in the south. The effects on literacy and educational attainment were mixed. One clear result from this analysis was that the north and the south showed very different socioeconomic effects.

Future research needs on marriage patterns in postwar Vietnam include developing a better indicator of excess male mortality at the province level and its relationship to the marriage squeeze, and further investigation of the relationship between migration and marriage squeeze in the postwar period. On long-term effects of the Vietnam War, additional research is needed that examines cohorts that were exposed to the war at different ages to determine whether timing of exposure to the war matters.

Appendix A

Coale-McNeil Model Parameters

Table A.1: Parameters used to fit the Coale-McNeil marriage model to the male Vietnamese population, 1989 and 1999.

	1989			1999		
	a_0	C	κ	a_0	C	κ
Male	15.879	0.990	0.736	16.492	0.995	0.782
Rural, Male	16.571	0.996	0.703	16.571	0.996	0.703
Urban, Male	17.793	0.993	0.886	17.793	0.993	0.886
North, Male	16.012	0.997	0.689	16.873	1.000	0.678
South, Male	15.656	0.985	0.792	16.314	0.992	0.859
Red River Delta, Male	16.673	0.995	0.675	17.747	0.998	0.671
Northeast, Male	15.186	0.998	0.714	16.189	0.997	0.673
Northwest, Male	14.187	0.986	0.654	14.292	0.996	0.748
North Central, Male	16.984	0.996	0.626	17.763	1.000	0.625
Central Coast, Male	16.391	0.997	0.730	17.640	0.998	0.770
Central Highlands, Male	15.738	0.993	0.736	16.145	1.000	0.776
Southeast, Male	15.961	0.974	0.872	16.746	0.981	0.920
Mekong River Delta, Male	15.336	0.988	0.738	15.933	0.992	0.800
Less than primary completed, Male	15.388	0.975	0.760	15.388	0.975	0.760
Primary completed, Male	17.154	0.993	0.698	17.154	0.993	0.698
Secondary completed, Male	19.344	0.987	0.679	19.344	0.987	0.679
University completed, Male	21.429	1.000	0.720	21.429	1.000	0.720

Table A.2: Parameters used to fit the Coale-McNeil marriage model to the female Vietnamese population, 1989 and 1999.

	1989			1999		
	a_0	C	κ	a_0	C	κ
Female	14.716	0.928	0.646	15.014	0.935	0.645
Rural, Female	15.156	0.940	0.576	15.156	0.940	0.576
Urban, Female	15.892	0.923	0.738	15.892	0.923	0.738
North, Female	15.068	0.937	0.568	15.417	0.949	0.547
South, Female	14.382	0.920	0.721	14.715	0.927	0.729
Red River Delta, Female	15.289	0.921	0.567	15.689	0.931	0.549
Northeast, Female	14.653	0.949	0.568	15.154	0.964	0.536
Northwest, Female	12.964	0.955	0.620	14.101	0.969	0.568
North Central, Female	15.717	0.948	0.562	15.951	0.954	0.553
Central Coast, Female	15.068	0.916	0.662	15.882	0.924	0.641
Central Highlands, Female	13.898	0.964	0.690	14.660	0.966	0.578
Southeast, Female	14.464	0.902	0.775	14.711	0.914	0.809
Mekong River Delta, Female	14.150	0.930	0.702	14.565	0.930	0.693
Less than primary completed, Female	14.290	0.923	0.613	14.290	0.923	0.613
Primary completed, Female	15.468	0.938	0.583	15.468	0.938	0.583
Secondary completed, Female	18.060	0.925	0.508	18.060	0.925	0.508
University completed, Female	19.929	0.915	0.585	19.929	0.915	0.585

Appendix B

Illustrated Trends in Socioeconomic Outcomes

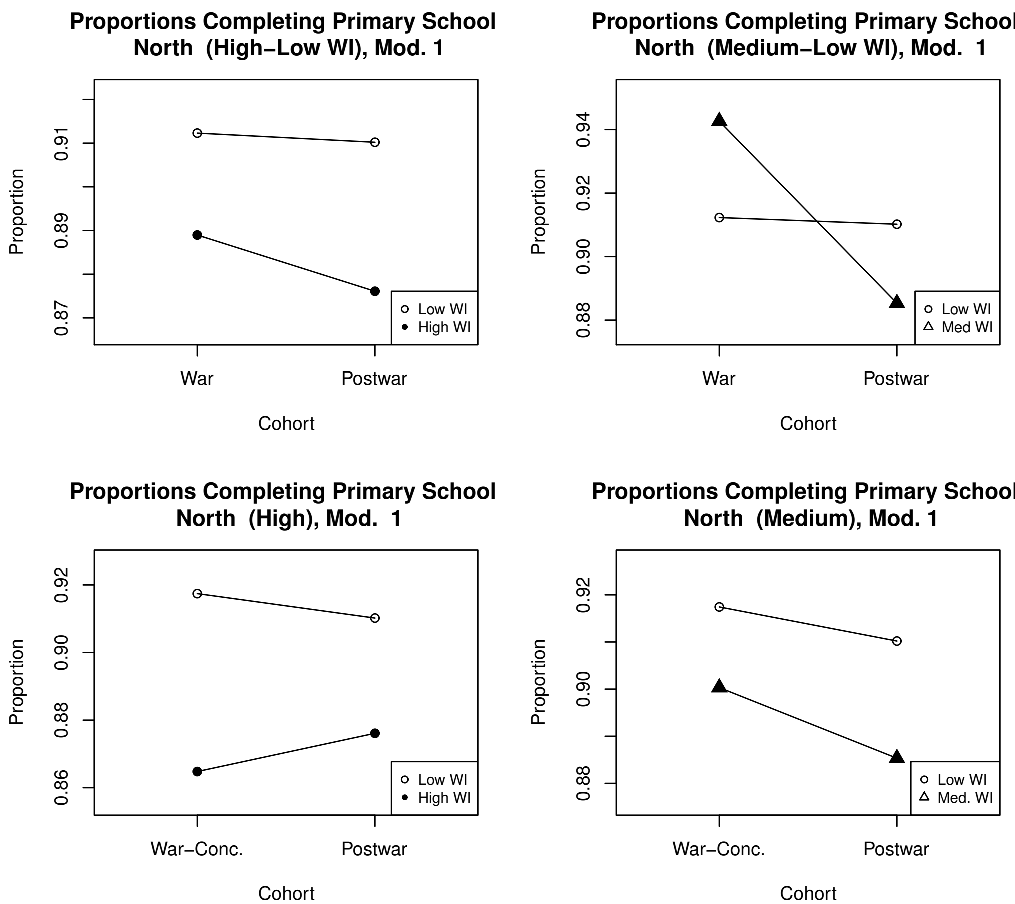


Figure B.1: Primary school completion by cohort and war intensity areas, Model 1, North Vietnam

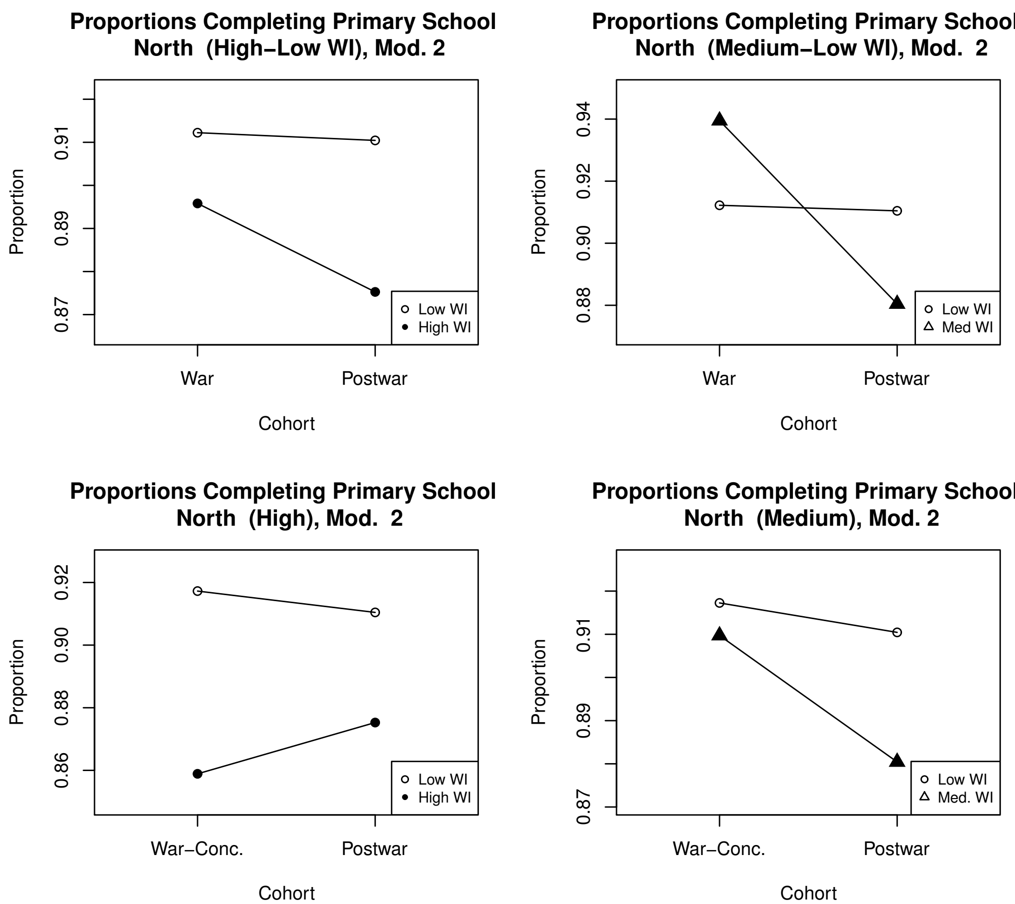


Figure B.2: Primary school completion by cohort and war intensity areas, Model 2, North Vietnam

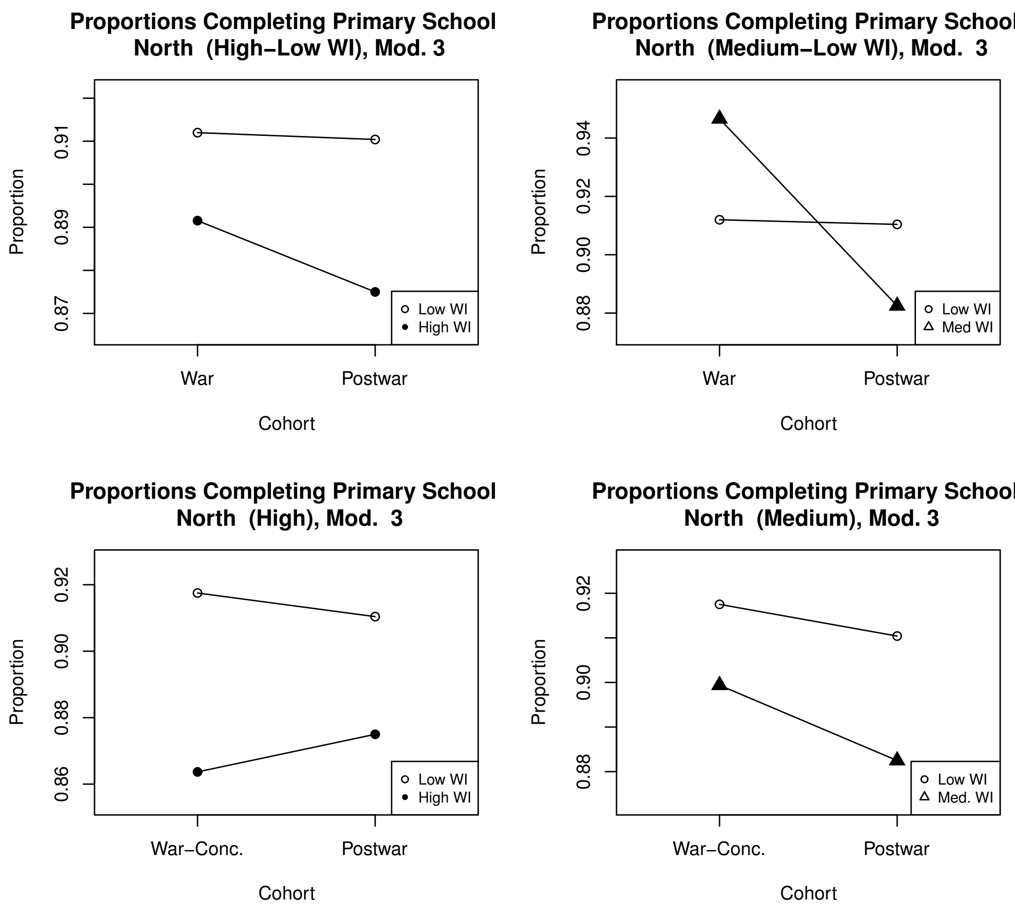


Figure B.3: Primary school completion by cohort and war intensity areas, Model 3, North Vietnam

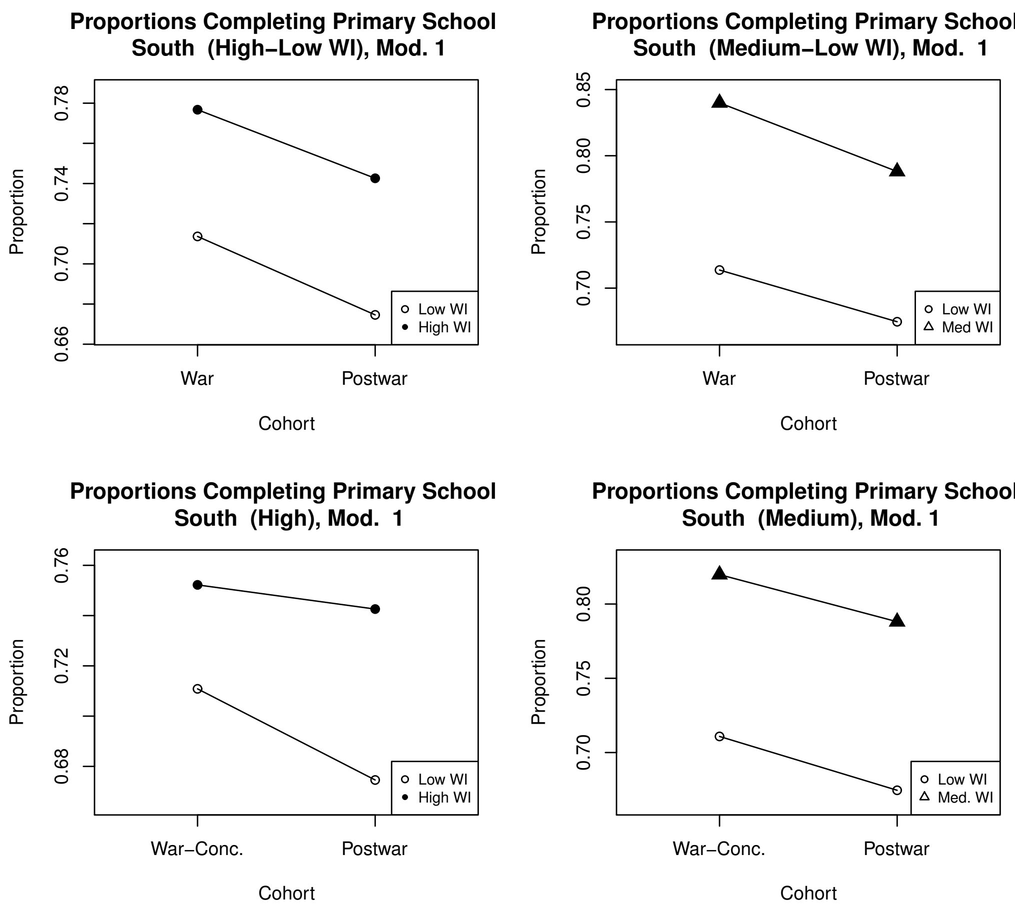


Figure B.4: Primary school completion by cohort and war intensity areas, Model 1, South Vietnam

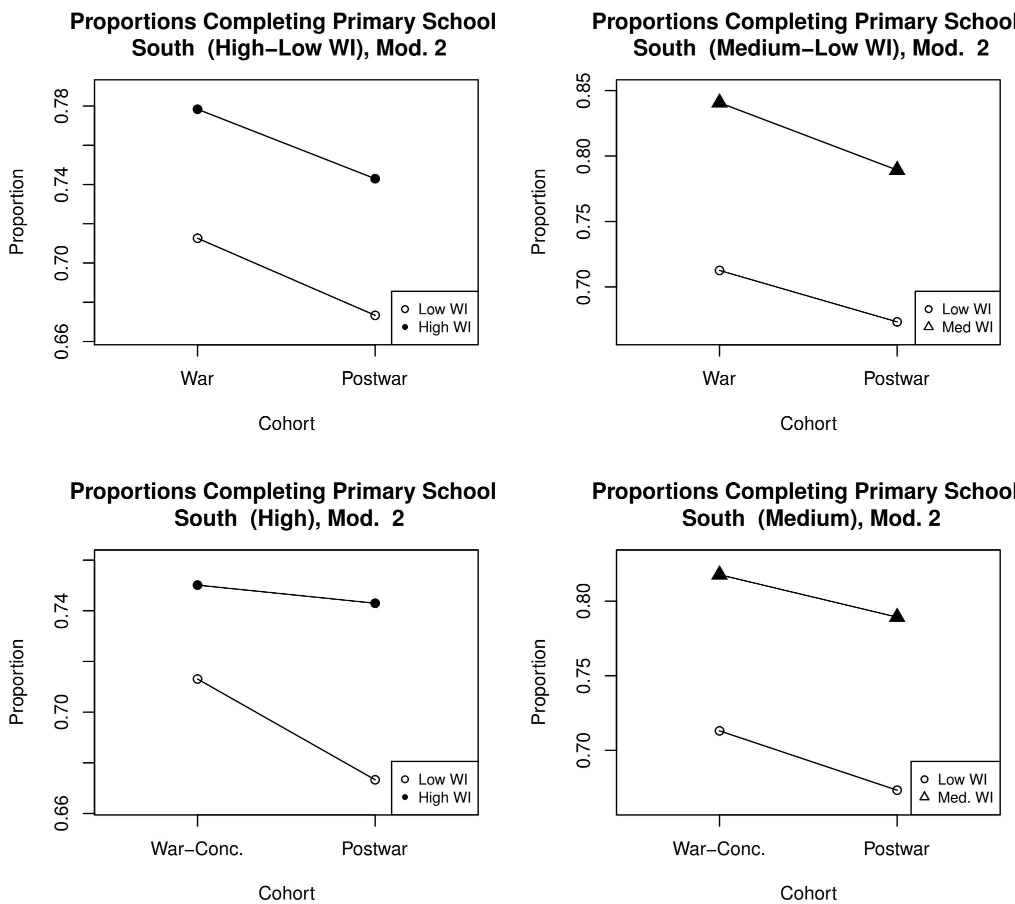


Figure B.5: Primary school completion by cohort and war intensity areas, Model 2, South Vietnam

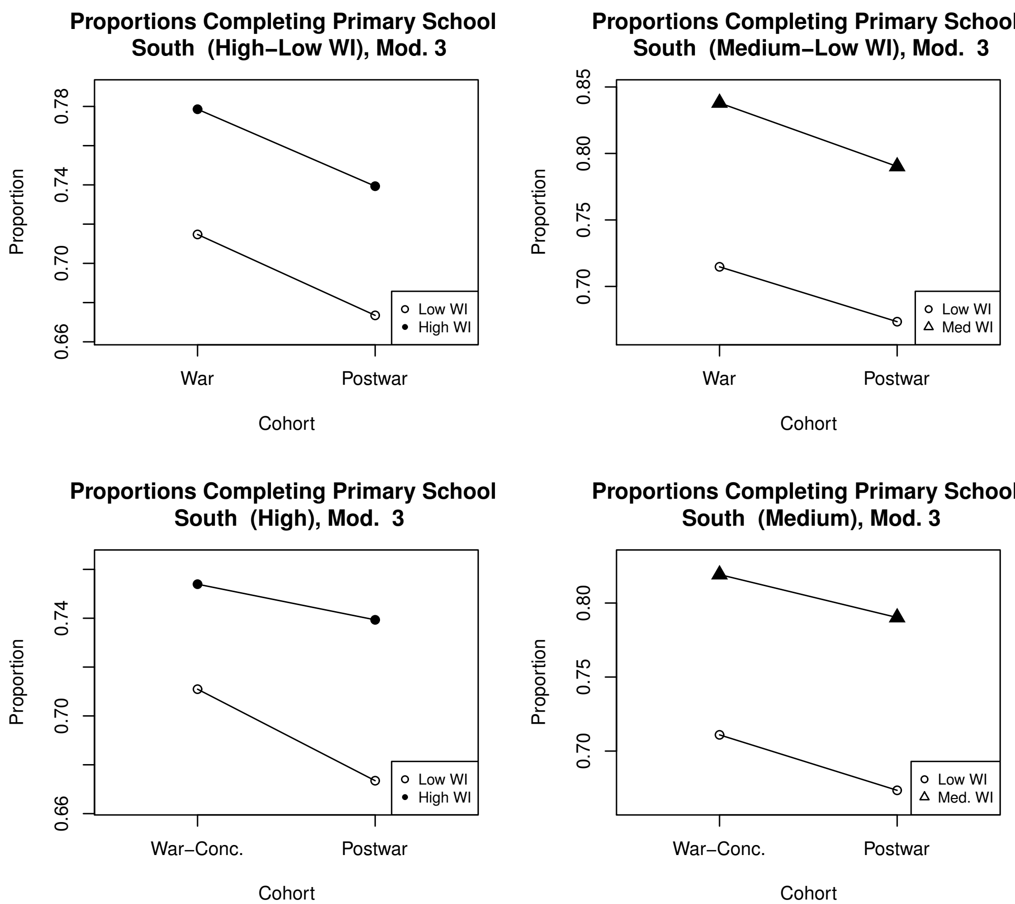


Figure B.6: Primary school completion by cohort and war intensity areas, Model 3, South Vietnam

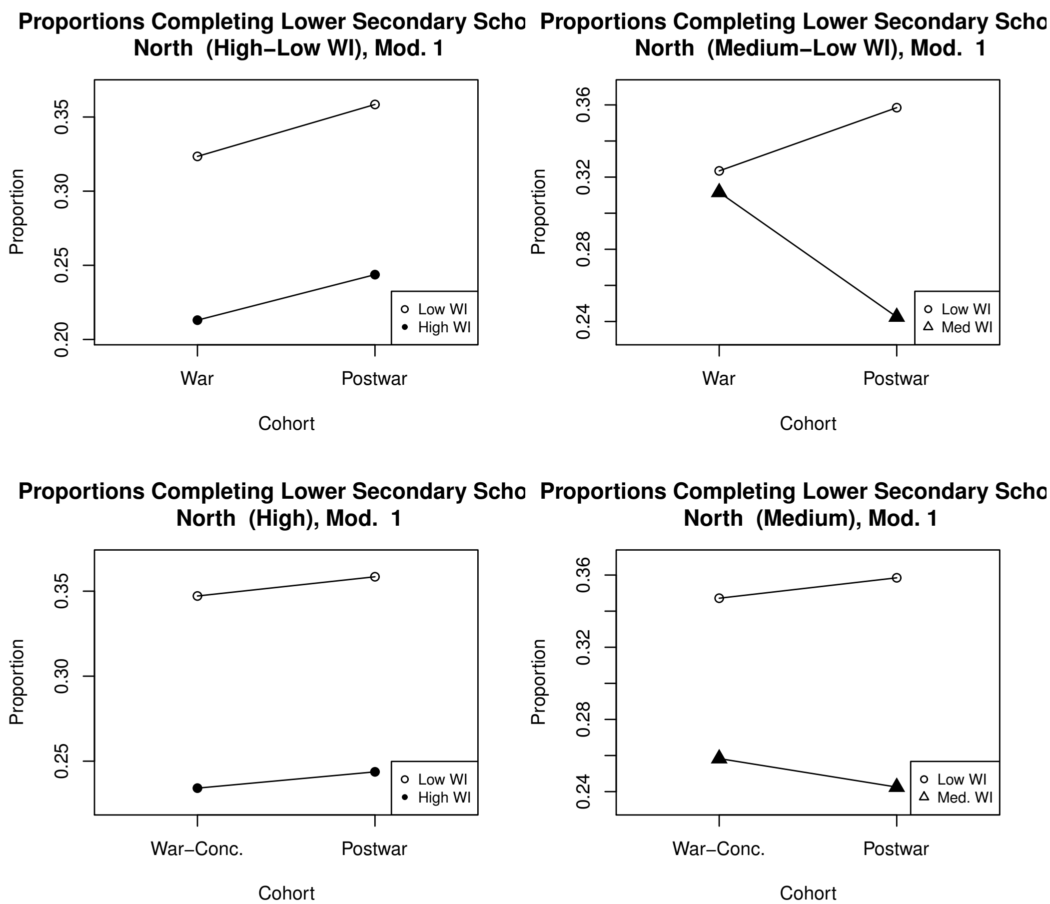


Figure B.7: Lower secondary school completion by cohort and war intensity areas, Model 1, North Vietnam

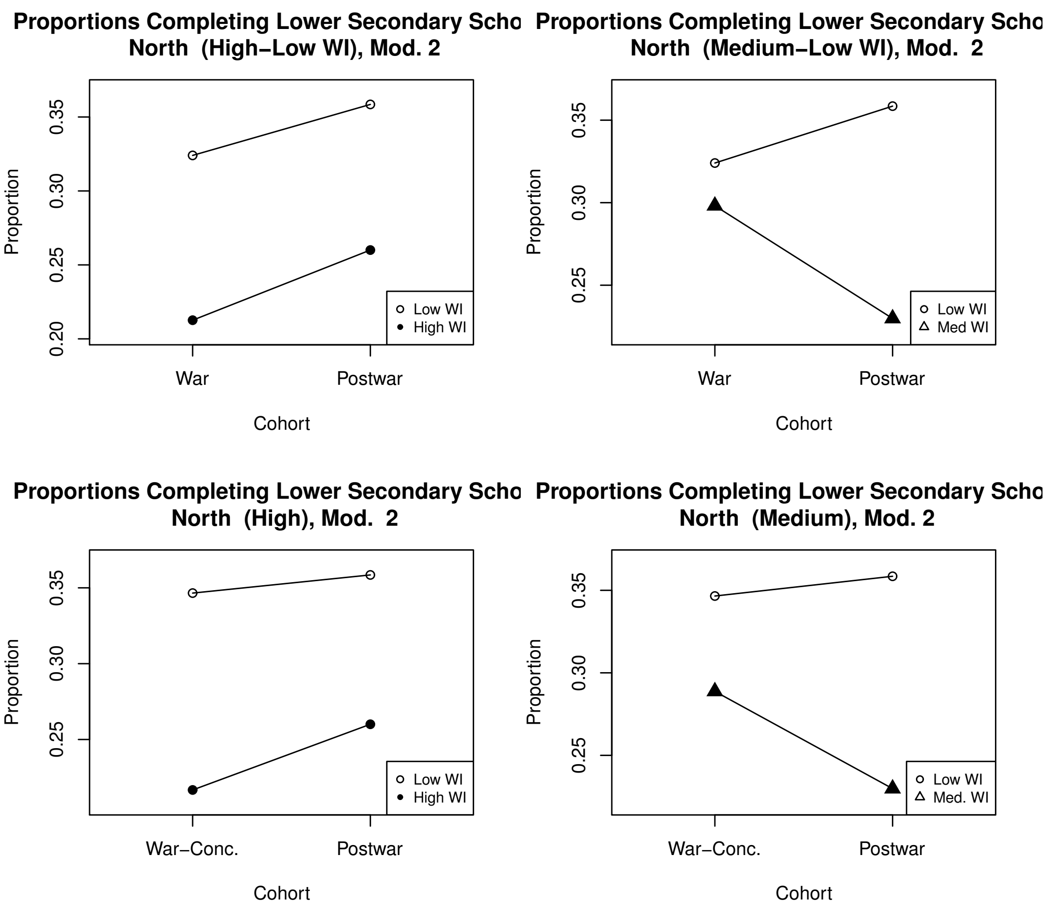


Figure B.8: Lower secondary school completion by cohort and war intensity areas, Model 2, North Vietnam

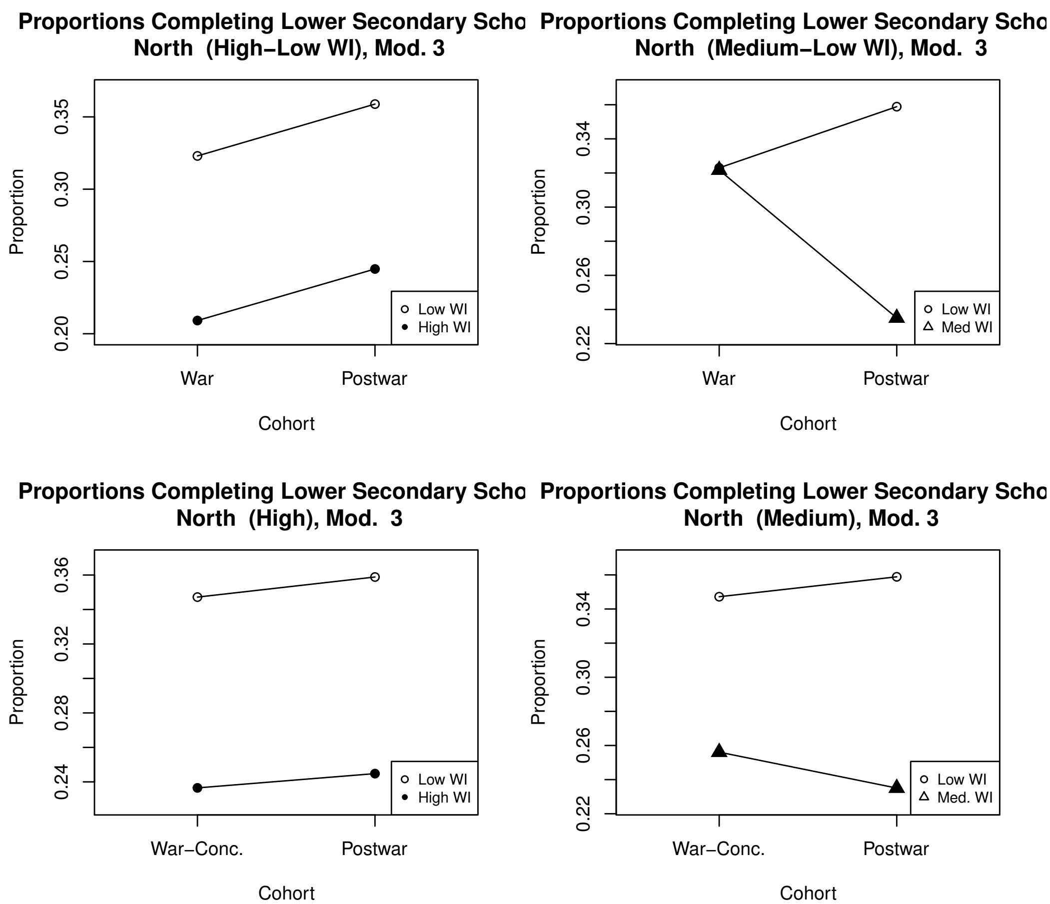


Figure B.9: Lower secondary school completion by cohort and war intensity areas, Model 3, North Vietnam

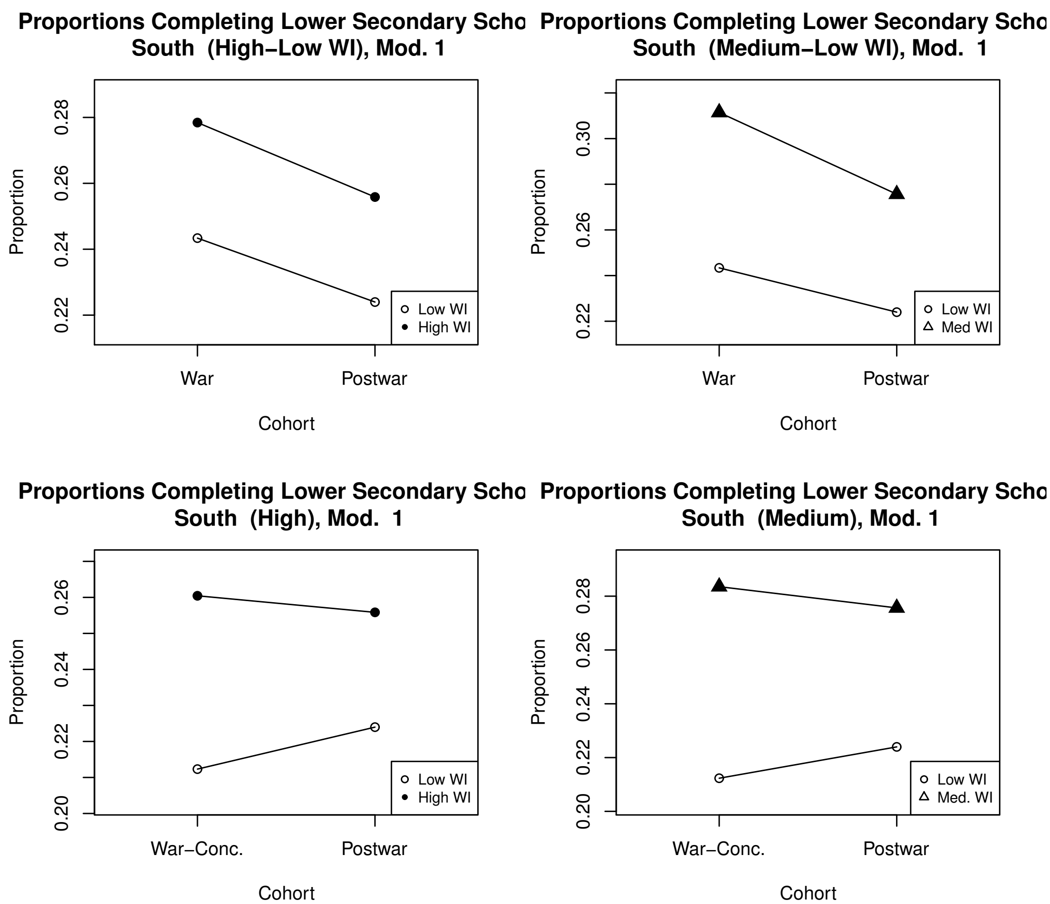


Figure B.10: Lower secondary school completion by cohort and war intensity areas, Model 1, South Vietnam

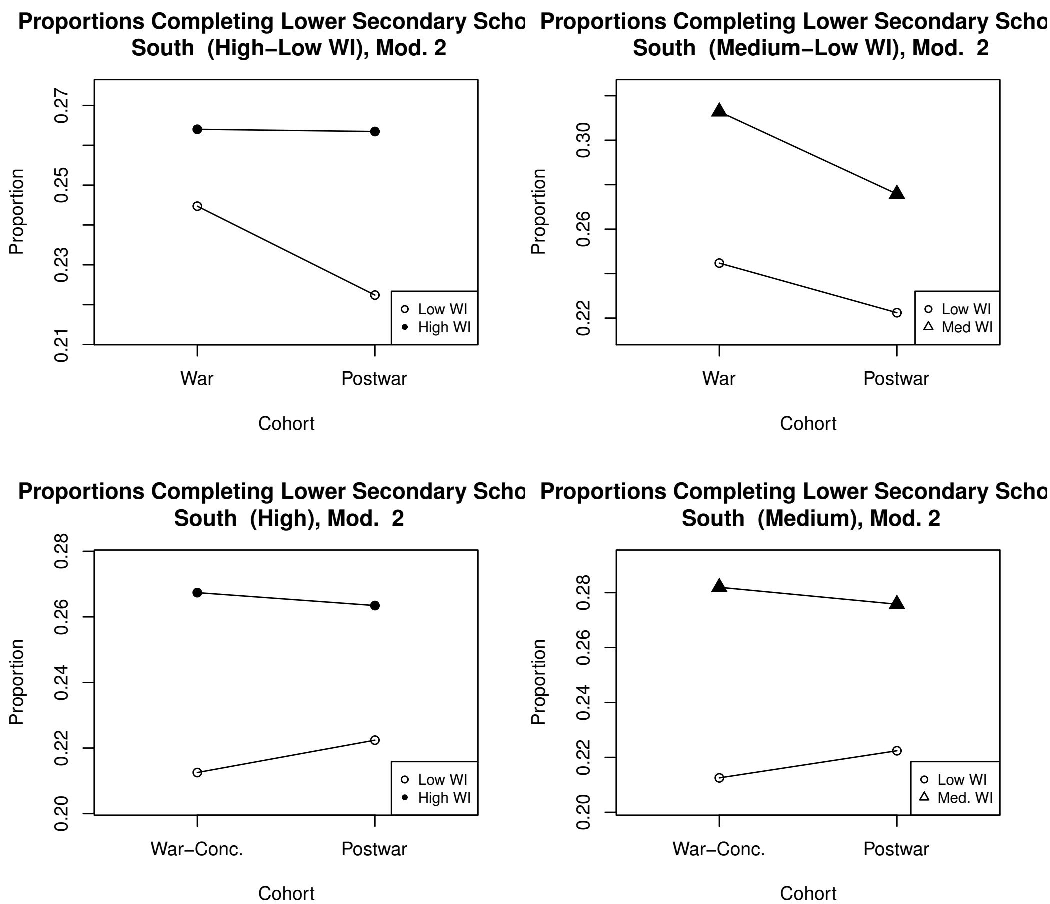


Figure B.11: Lower secondary school completion by cohort and war intensity areas, Model 2, South Vietnam

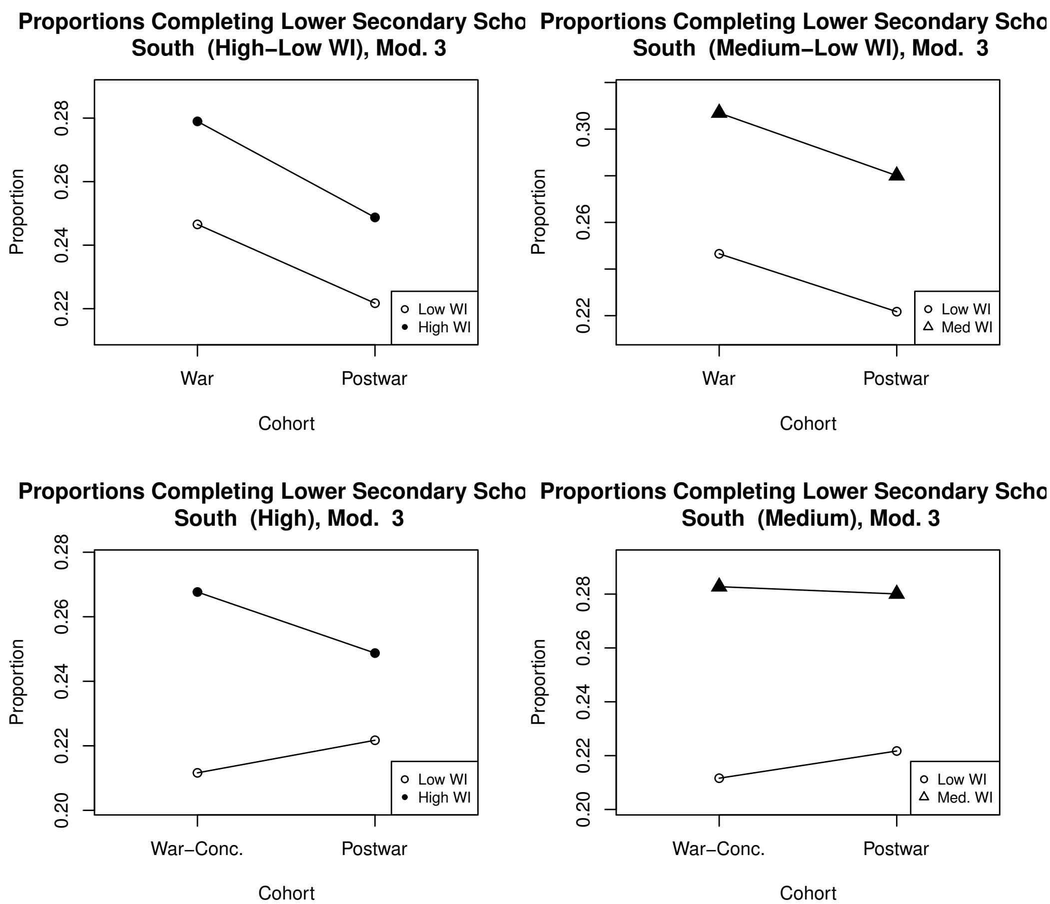


Figure B.12: Lower secondary school completion by cohort and war intensity areas, Model 3, South Vietnam

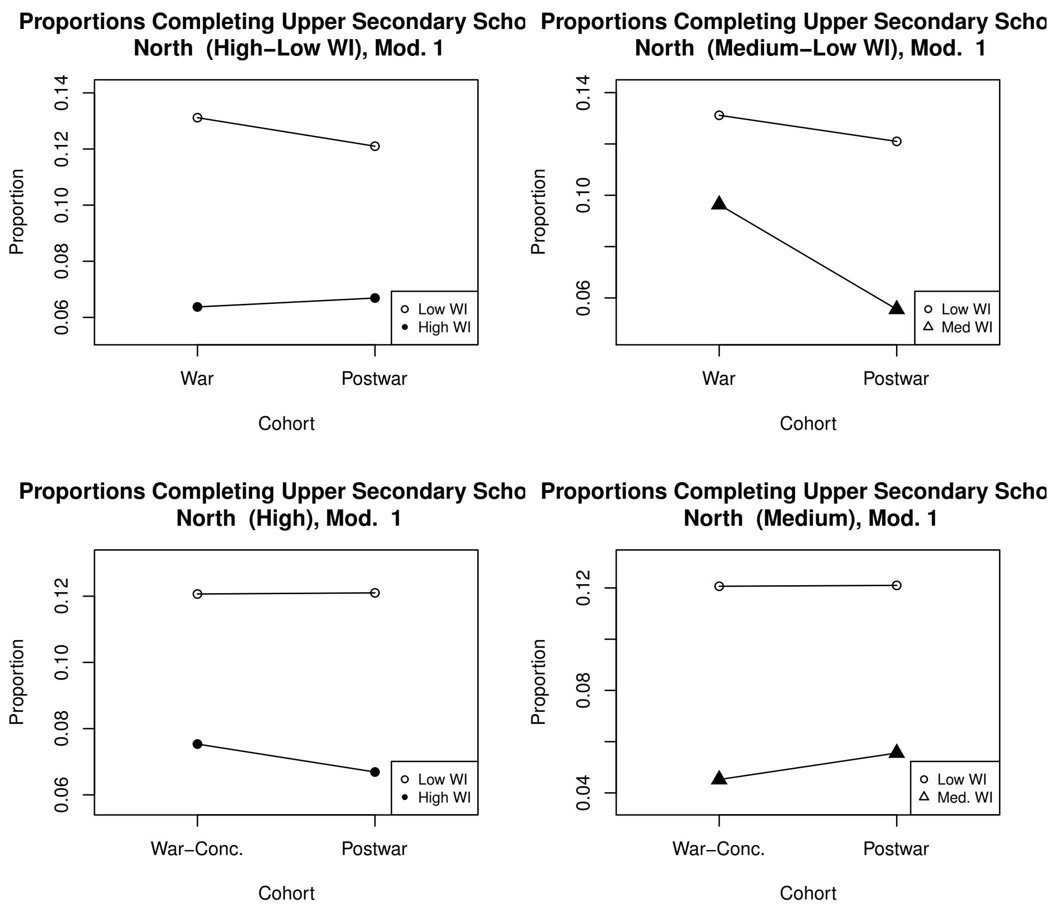


Figure B.13: Upper secondary school completion by cohort and war intensity areas, Model 1, North Vietnam

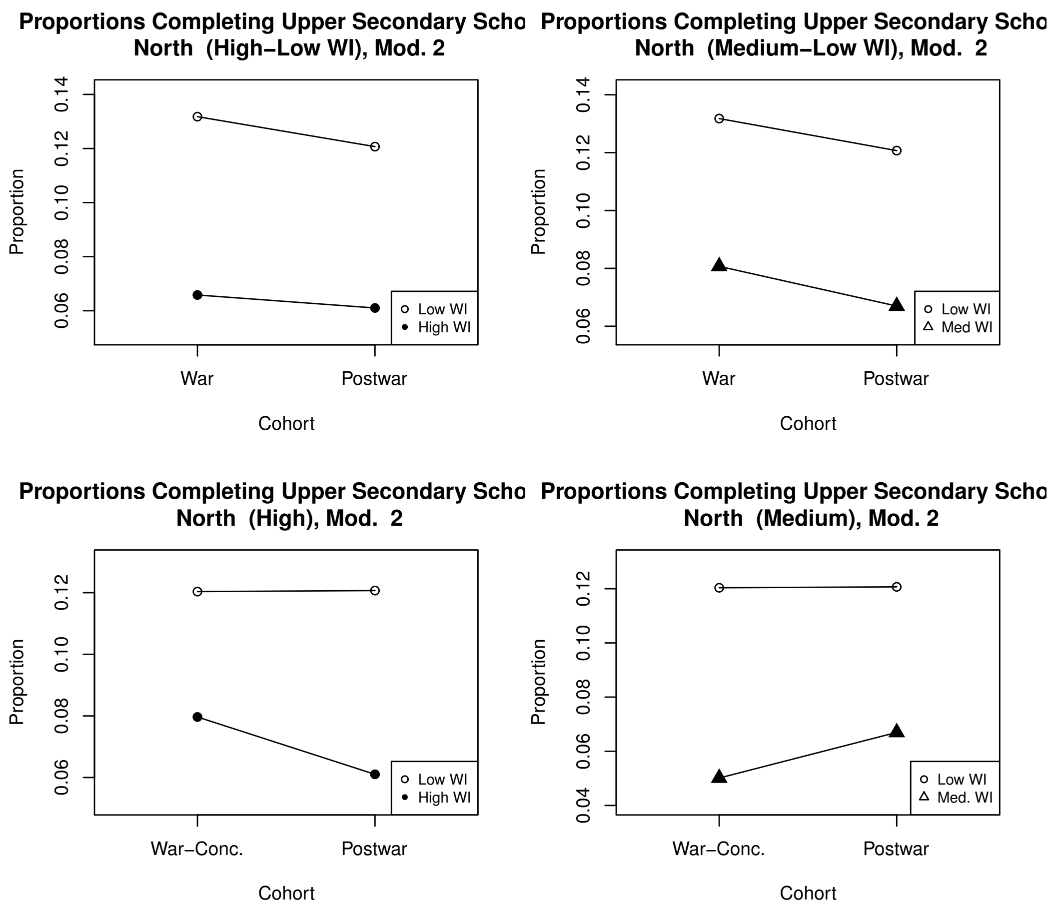


Figure B.14: Upper secondary school completion by cohort and war intensity areas, Model 2, North Vietnam

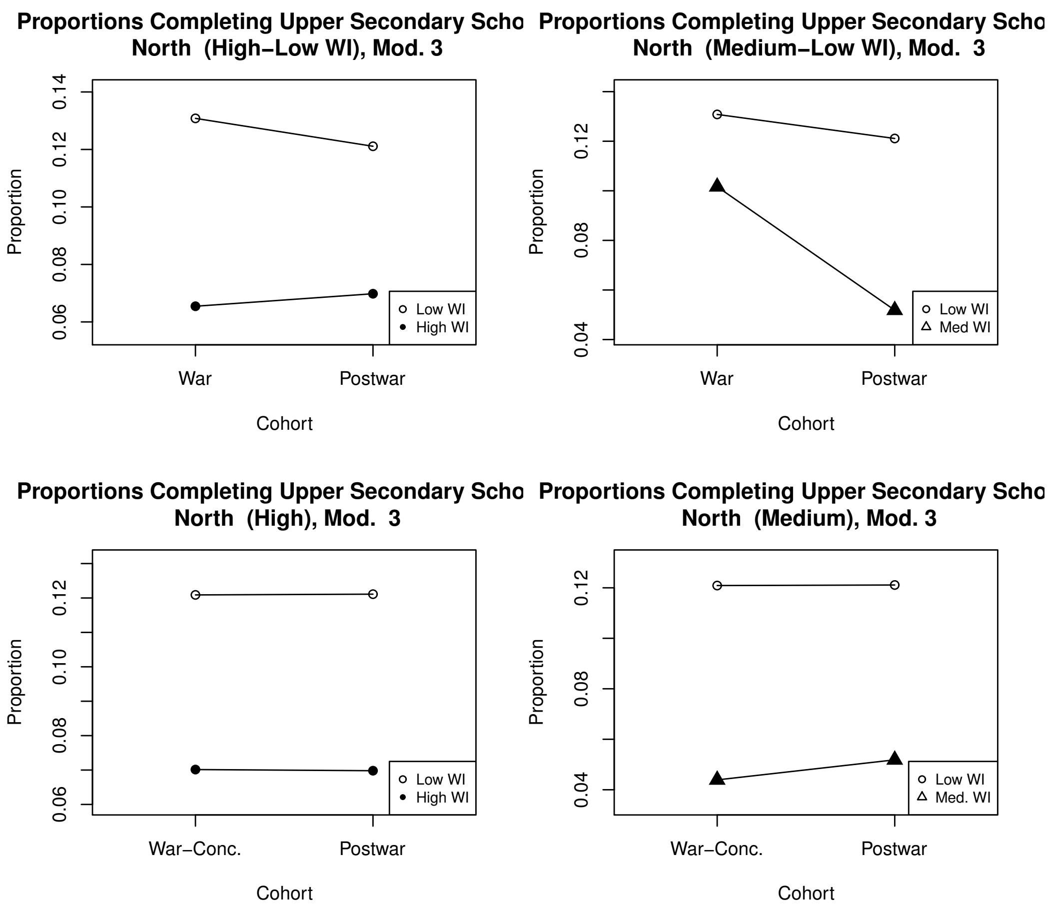


Figure B.15: Upper secondary school completion by cohort and war intensity areas, Model 3, North Vietnam

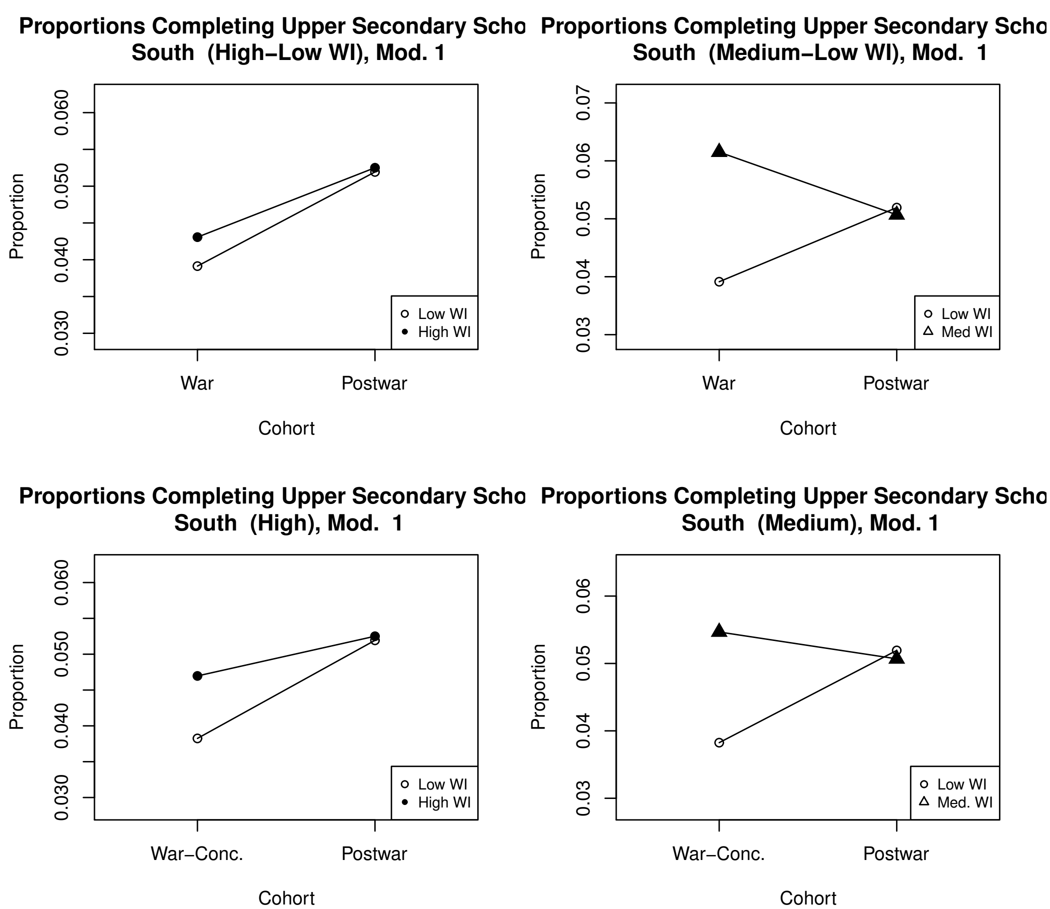


Figure B.16: Upper secondary school completion by cohort and war intensity areas, Model 1, South Vietnam

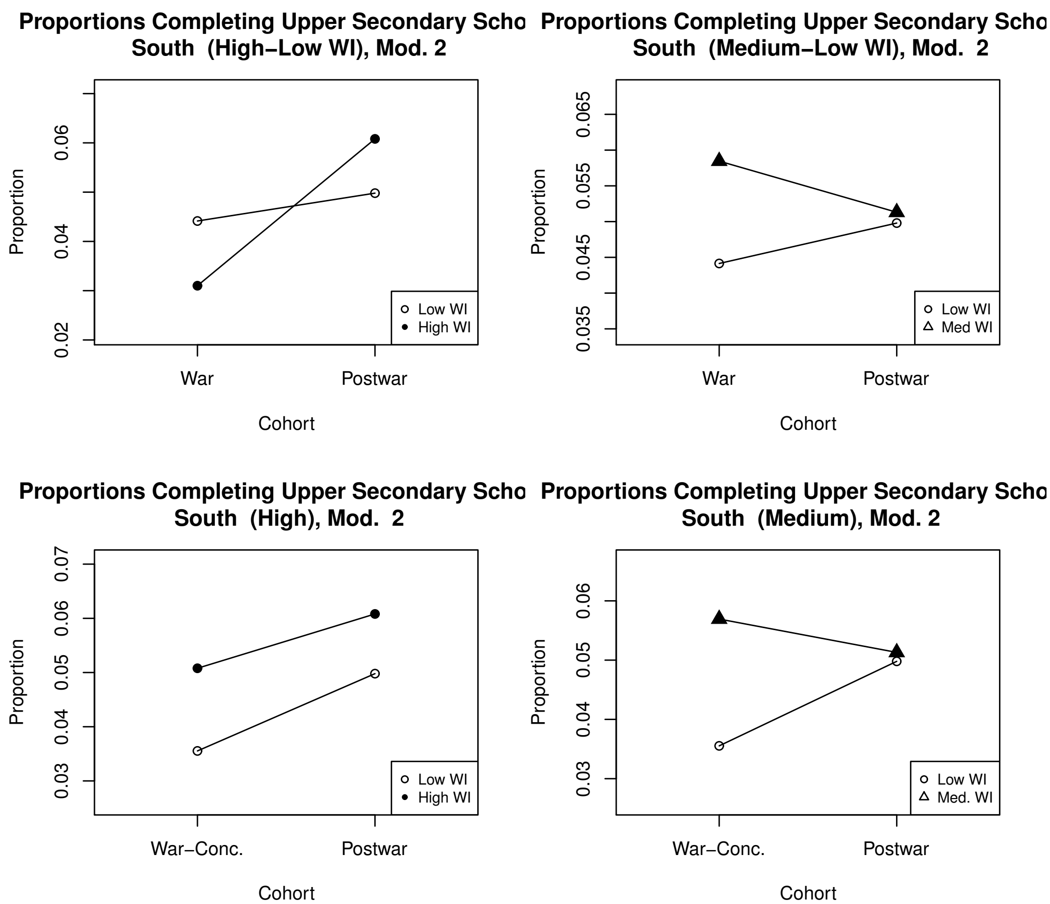


Figure B.17: Upper secondary school completion by cohort and war intensity areas, Model 2, South Vietnam

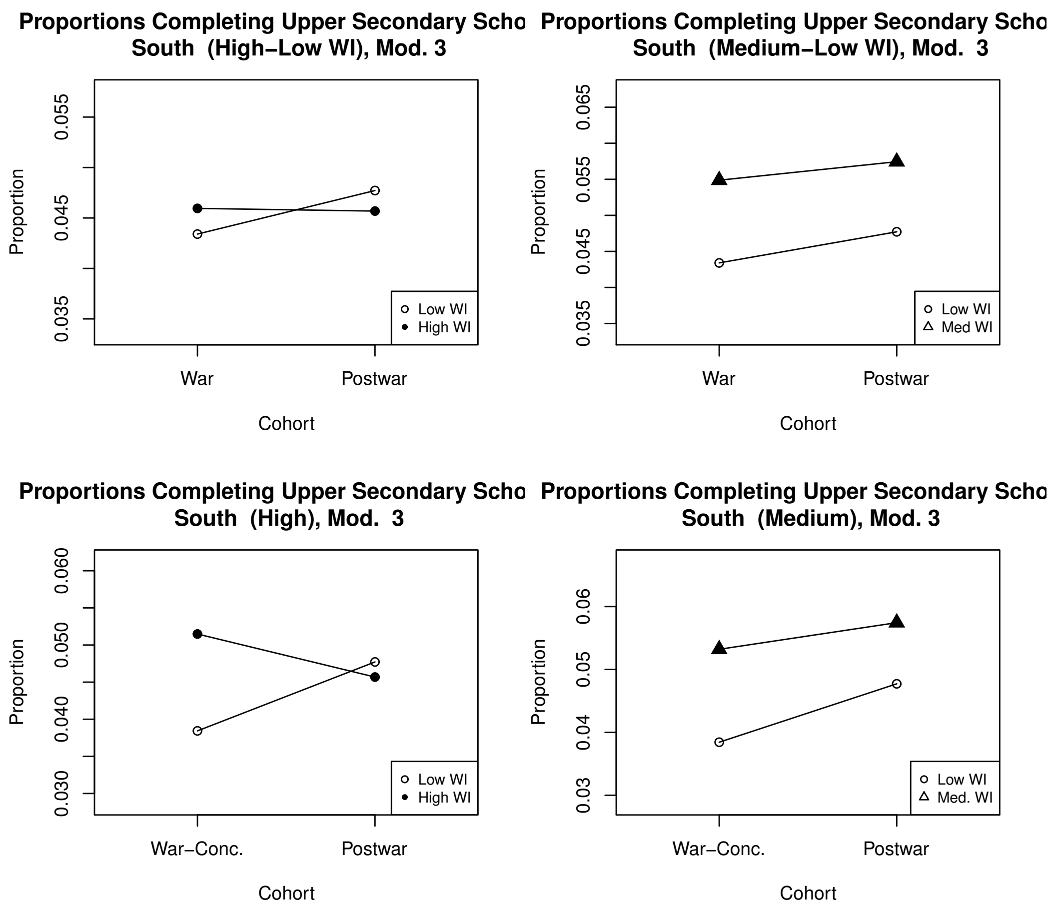


Figure B.18: Upper secondary school completion by cohort and war intensity areas, Model 3, South Vietnam

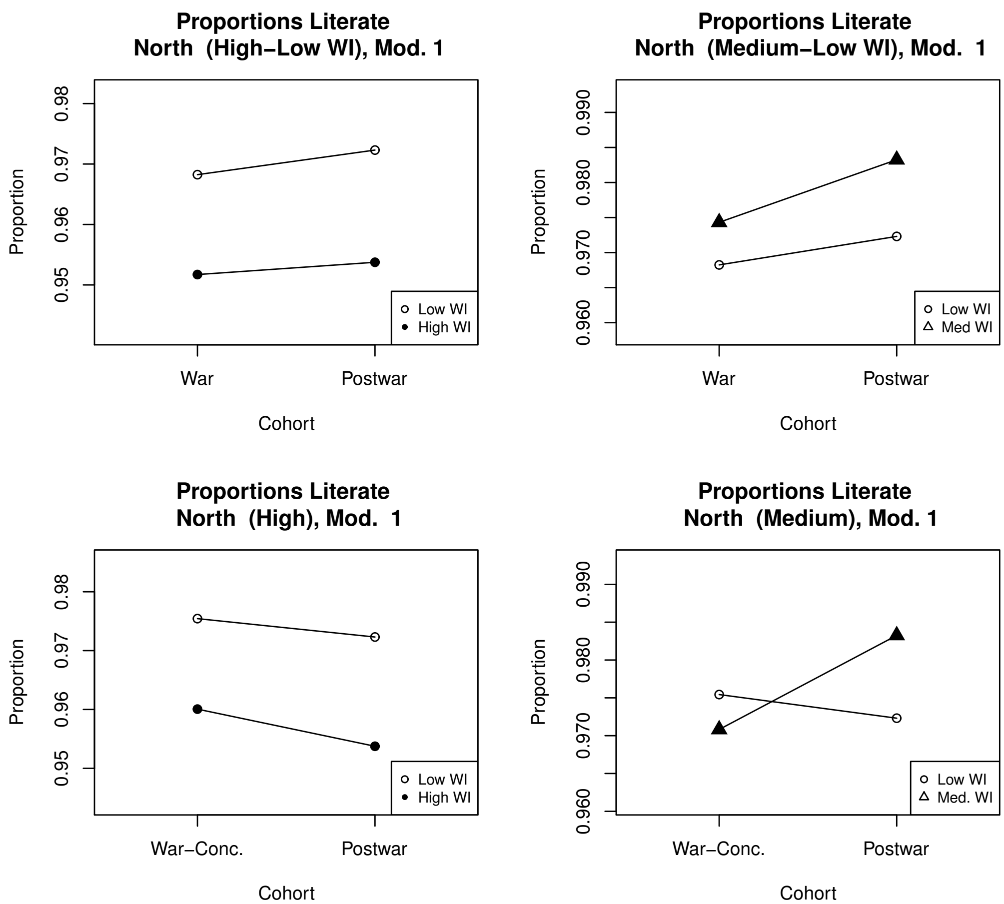


Figure B.19: Proportion literate by cohort and war intensity areas, Model 1, North Vietnam

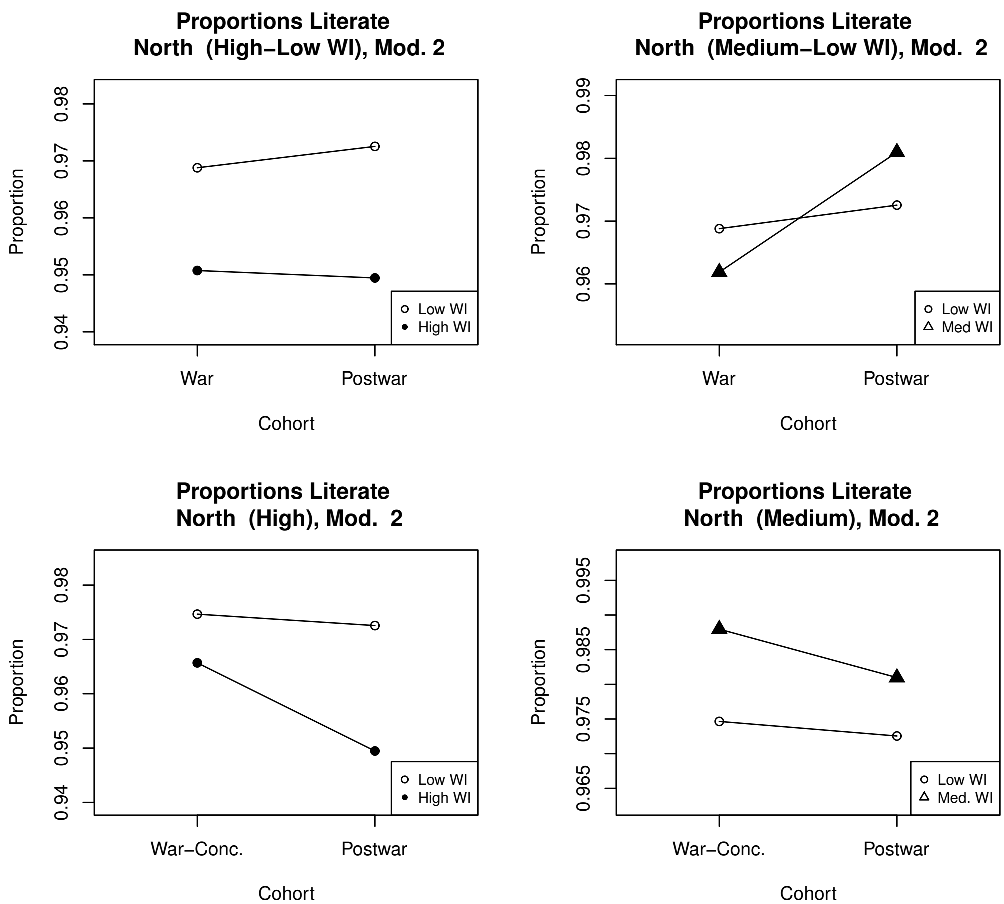


Figure B.20: Proportion literate by cohort and war intensity areas, Model 2, North Vietnam

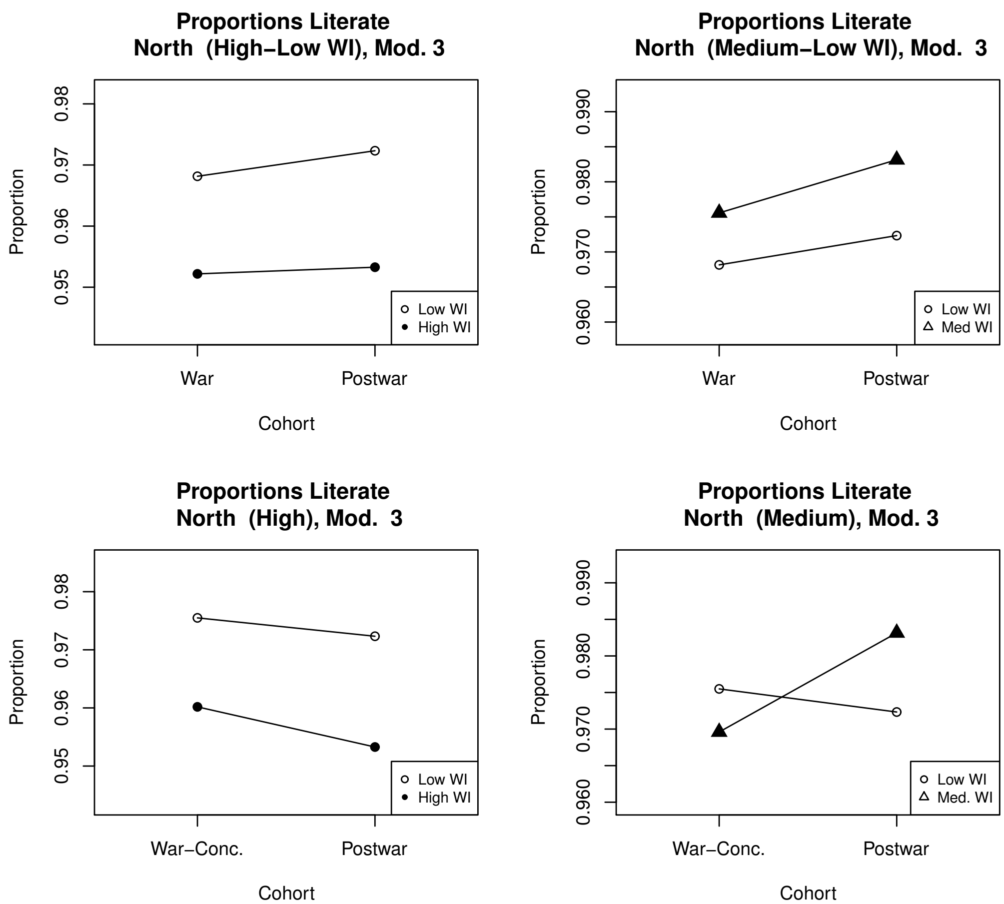


Figure B.21: Proportion literate by cohort and war intensity areas, Model 3, North Vietnam

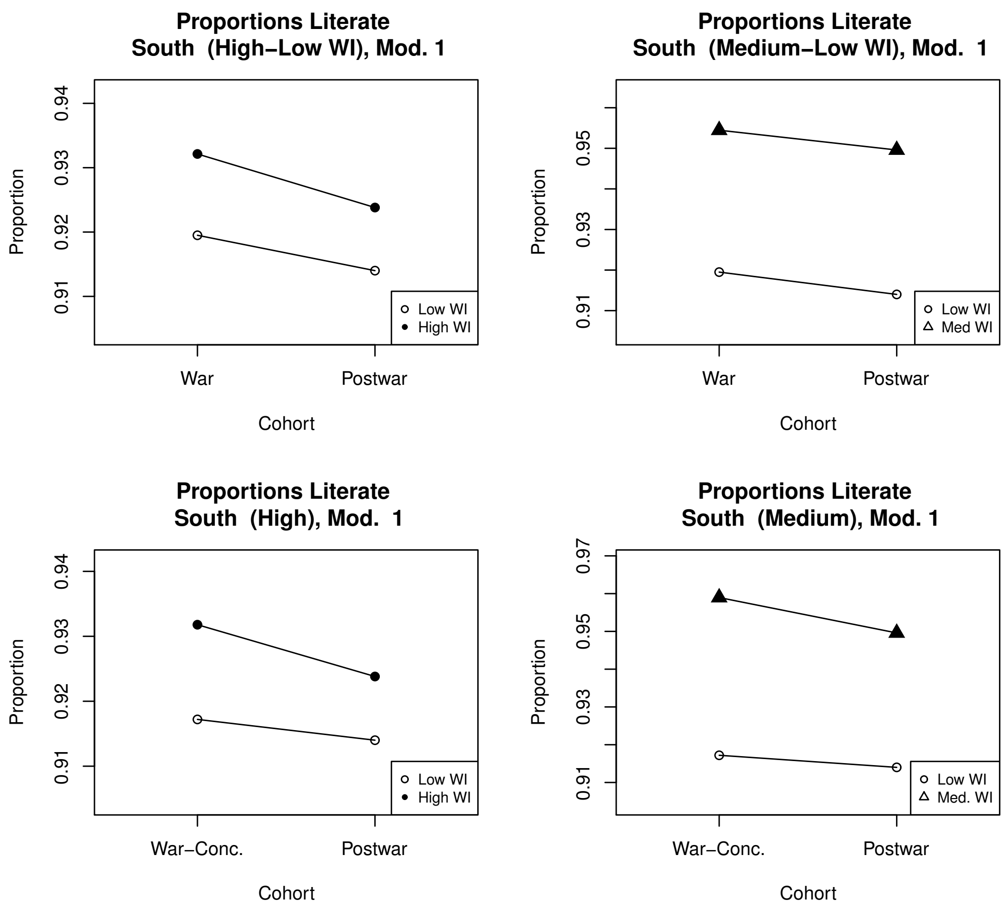


Figure B.22: Proportion literate by cohort and war intensity areas, Model 1, South Vietnam

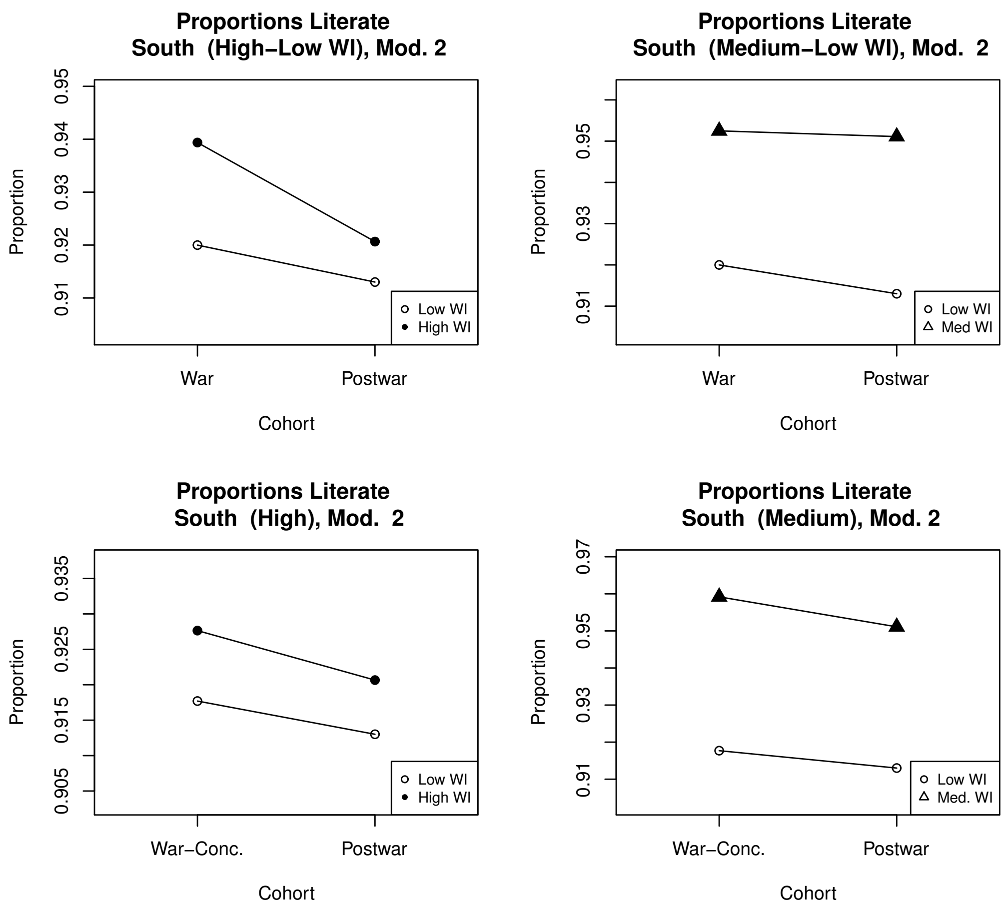


Figure B.23: Proportion literate by cohort and war intensity areas, Model 2, South Vietnam

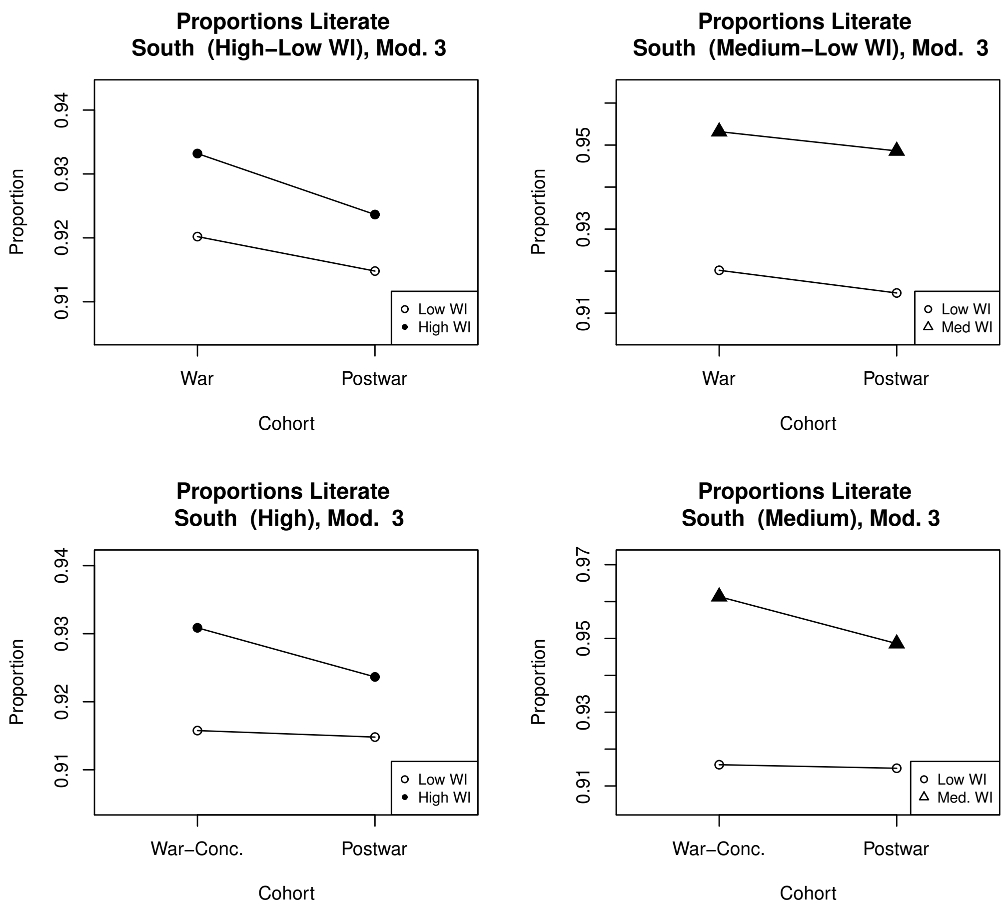


Figure B.24: Proportion literate by cohort and war intensity areas, Model 3, South Vietnam

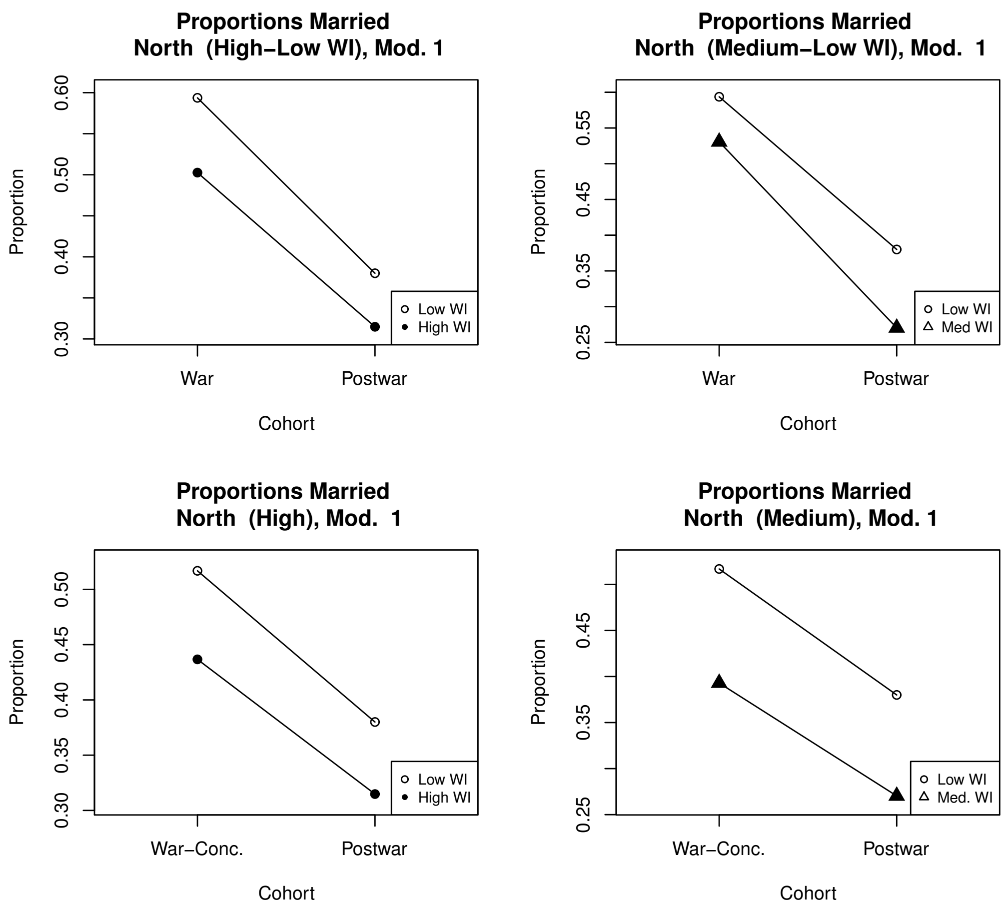


Figure B.25: Proportion ever-married by cohort and war intensity areas, Model 1, North Vietnam

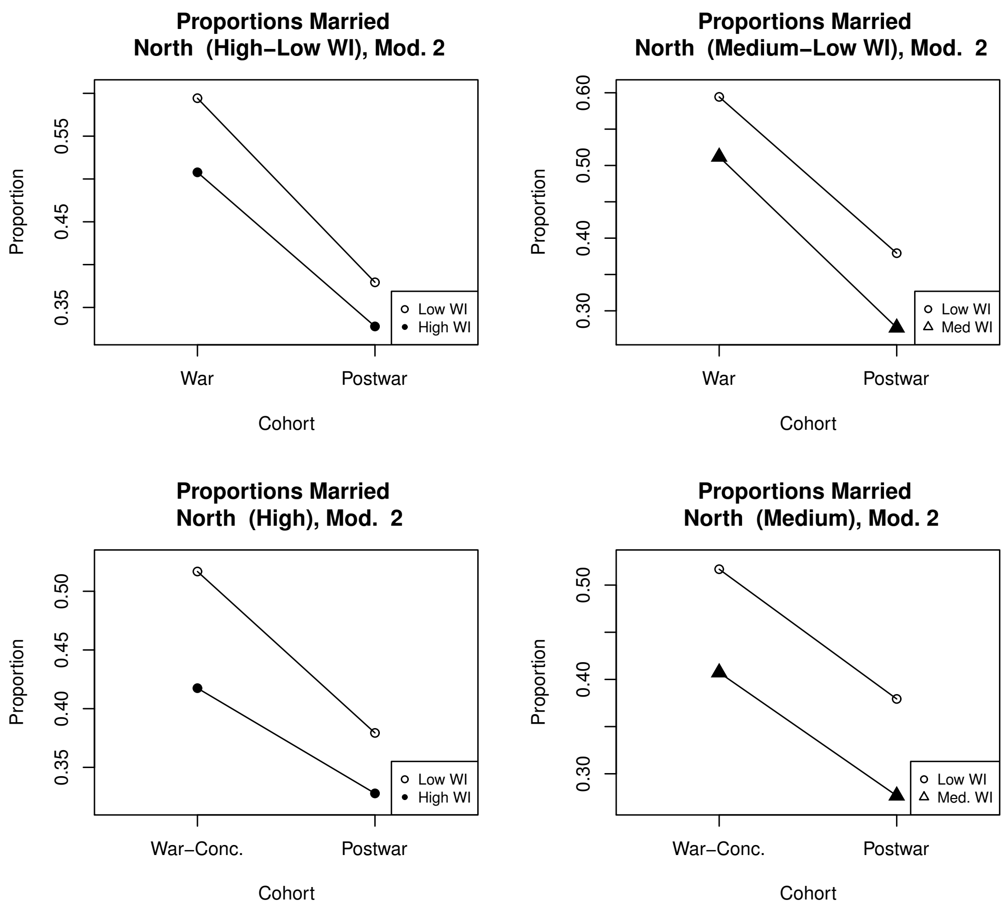


Figure B.26: Proportion ever-married by cohort and war intensity areas, Model 2, North Vietnam

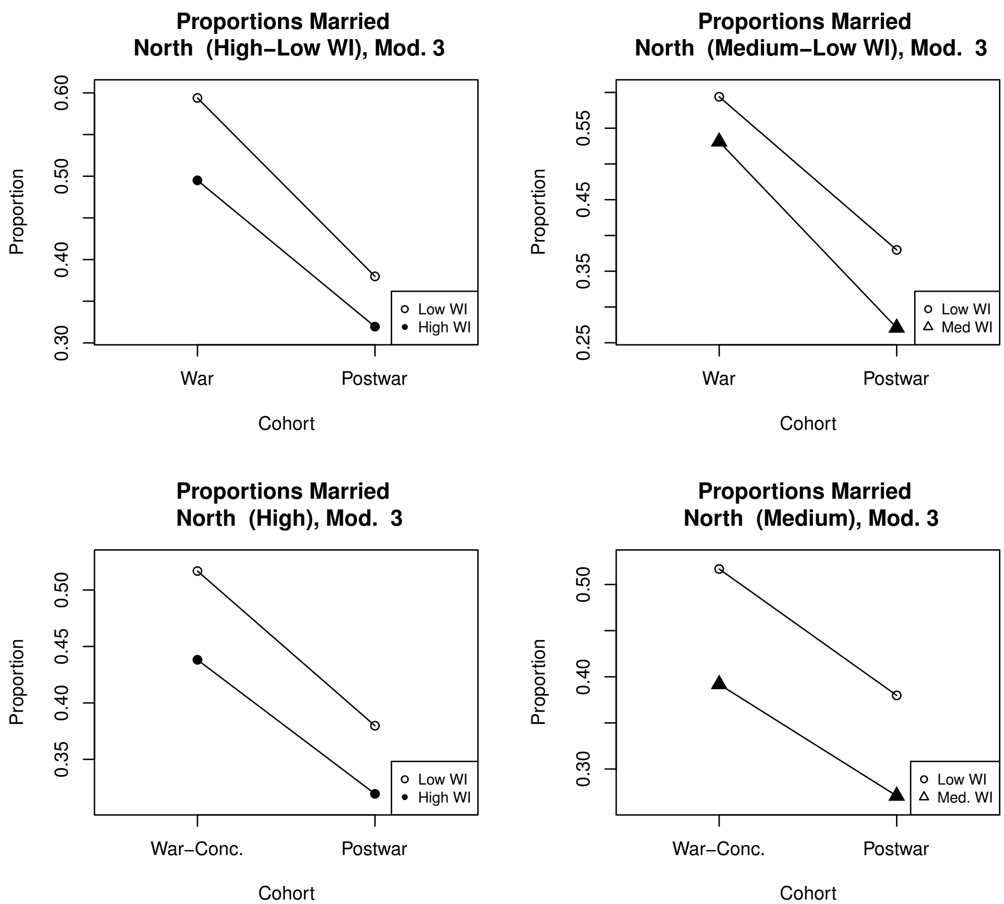


Figure B.27: Proportion ever-married by cohort and war intensity areas, Model 3, North Vietnam

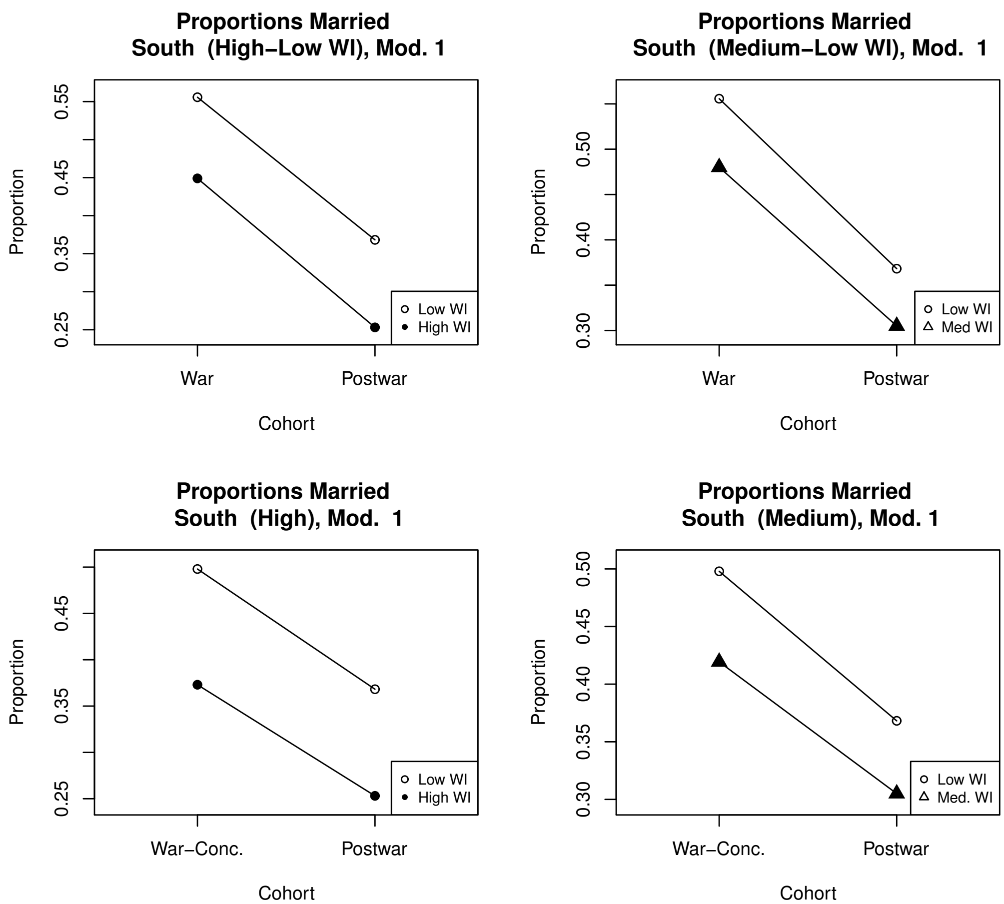


Figure B.28: Proportion ever-married by cohort and war intensity areas, Model 1, South Vietnam

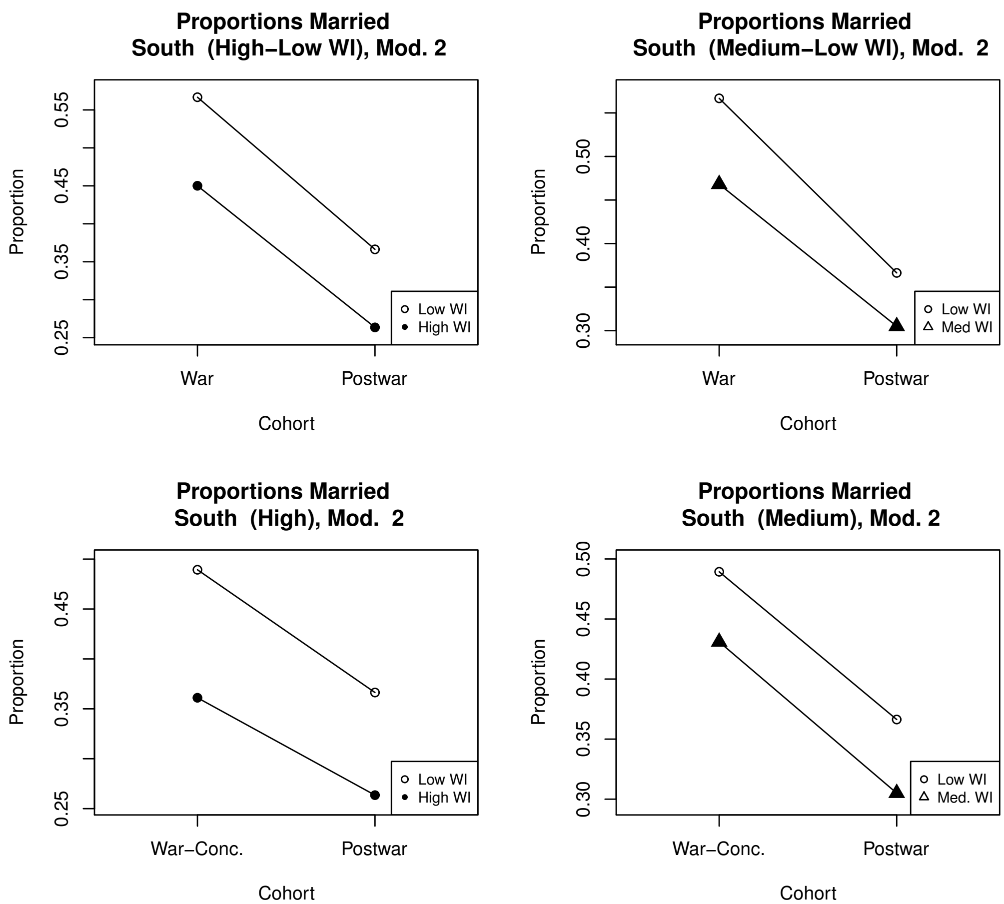


Figure B.29: Proportion ever-married by cohort and war intensity areas, Model 2, South Vietnam

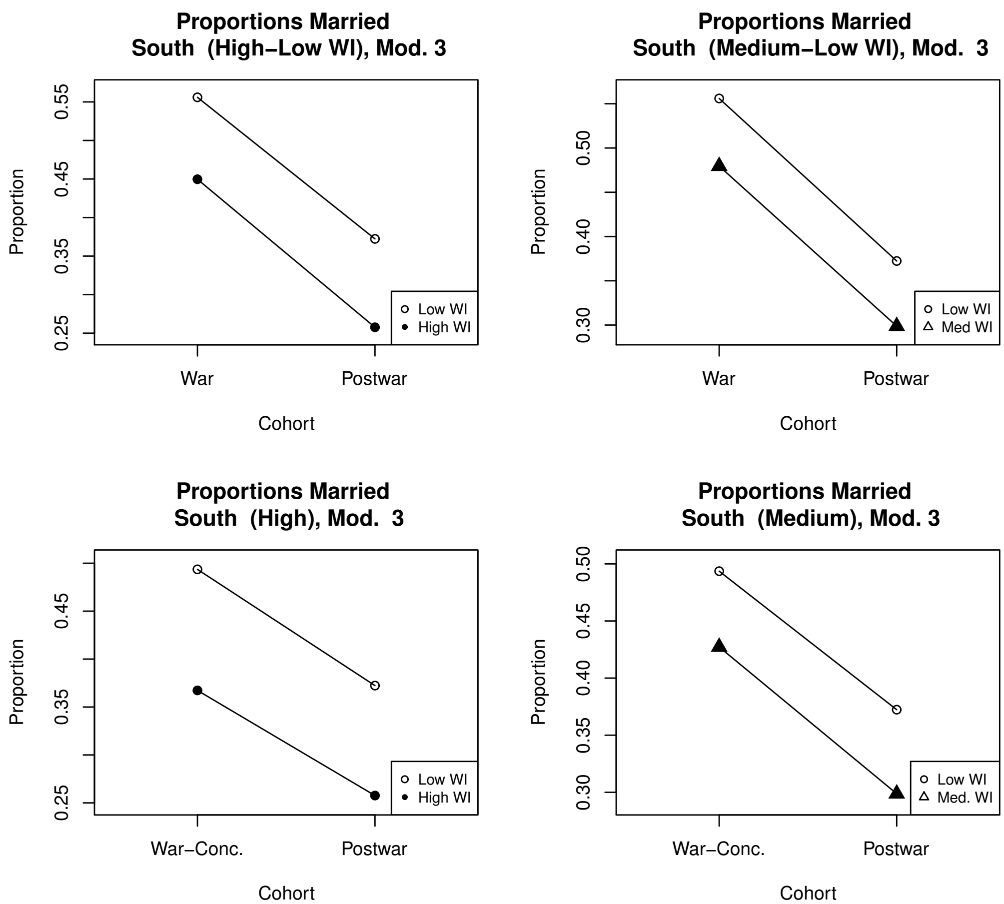


Figure B.30: Proportion ever-married by cohort and war intensity areas, Model 3, South Vietnam

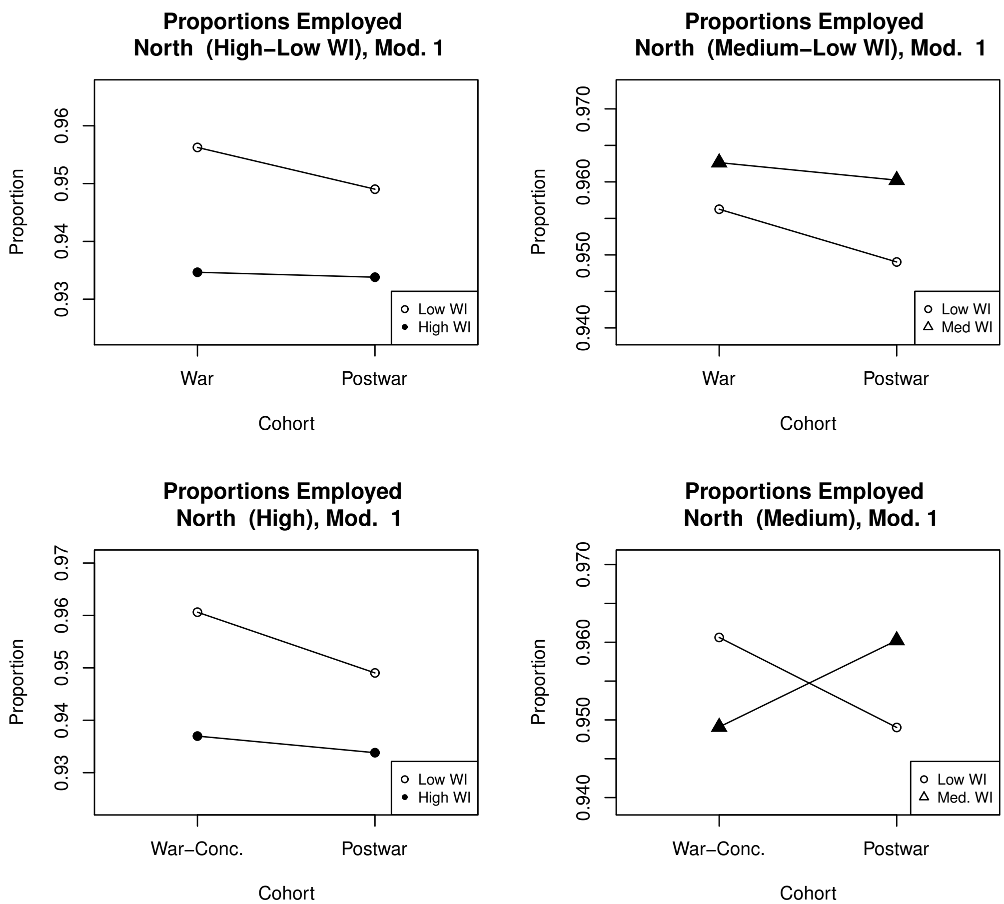


Figure B.31: Proportion employed by cohort and war intensity areas, Model 1, North Vietnam

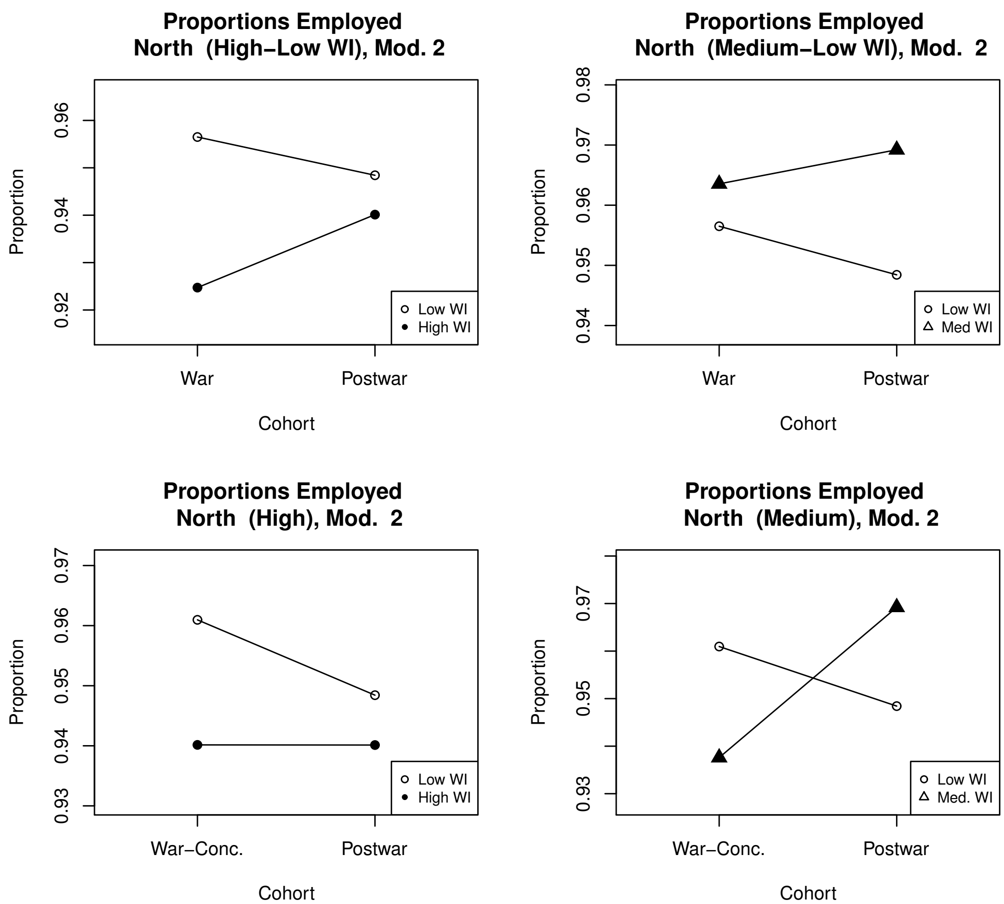


Figure B.32: Proportion employed by cohort and war intensity areas, Model 2, North Vietnam

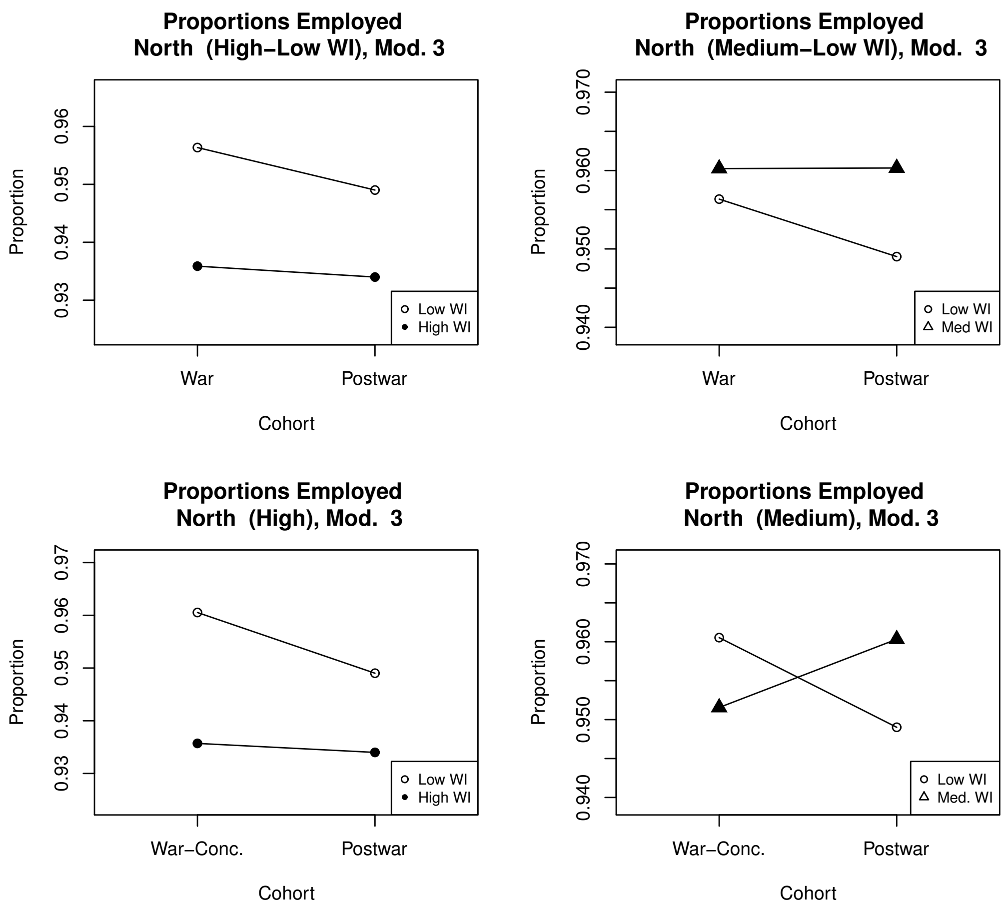


Figure B.33: Proportion employed by cohort and war intensity areas, Model 3, North Vietnam

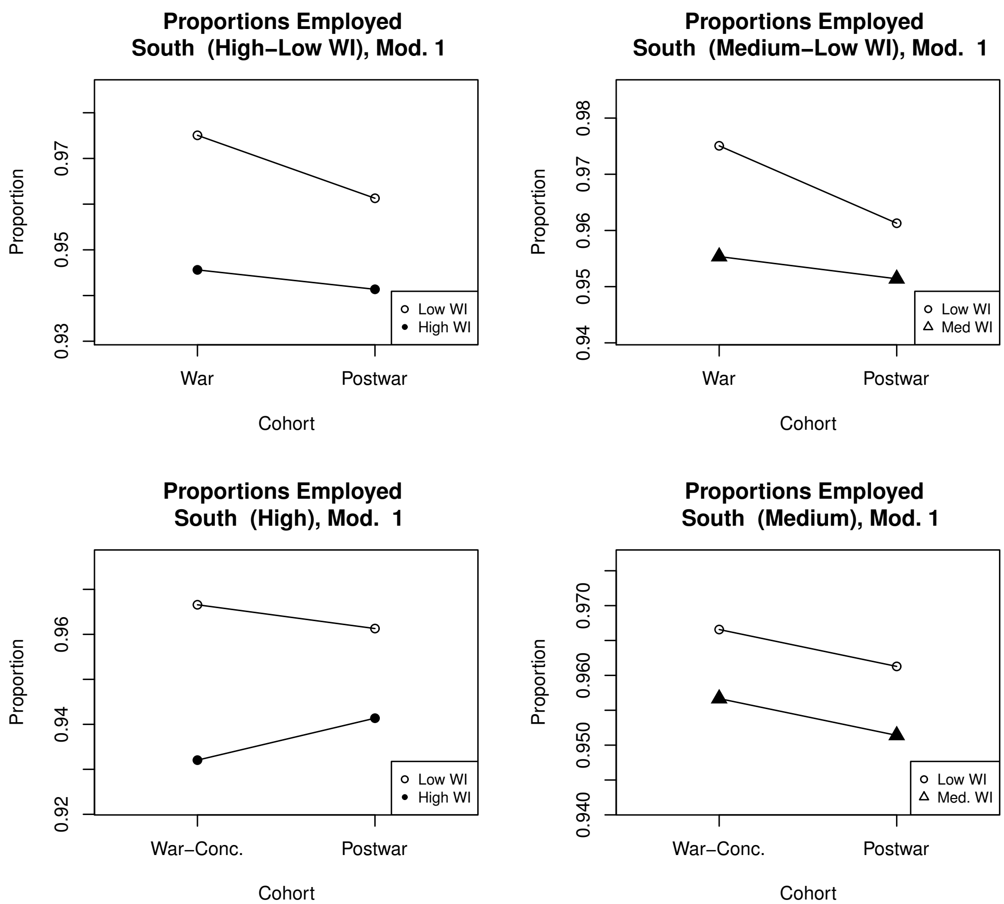


Figure B.34: Proportion employed by cohort and war intensity areas, Model 1, South Vietnam

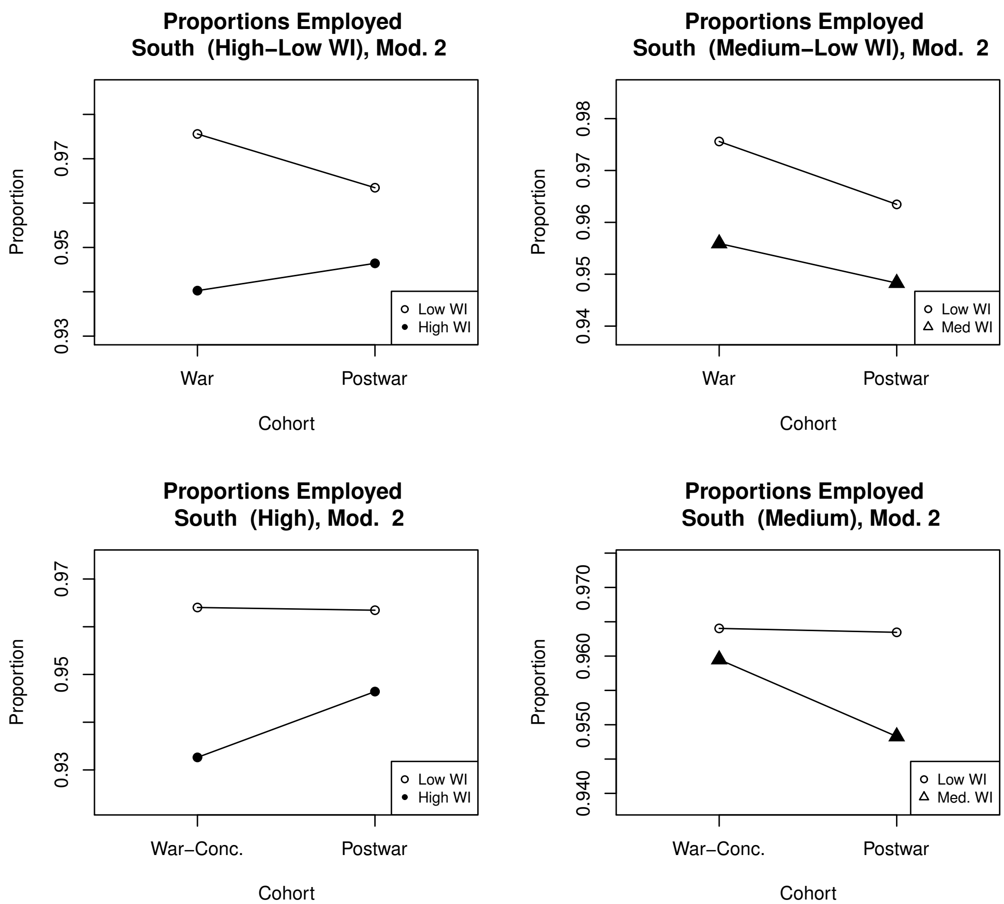


Figure B.35: Proportion employed by cohort and war intensity areas, Model 2, South Vietnam

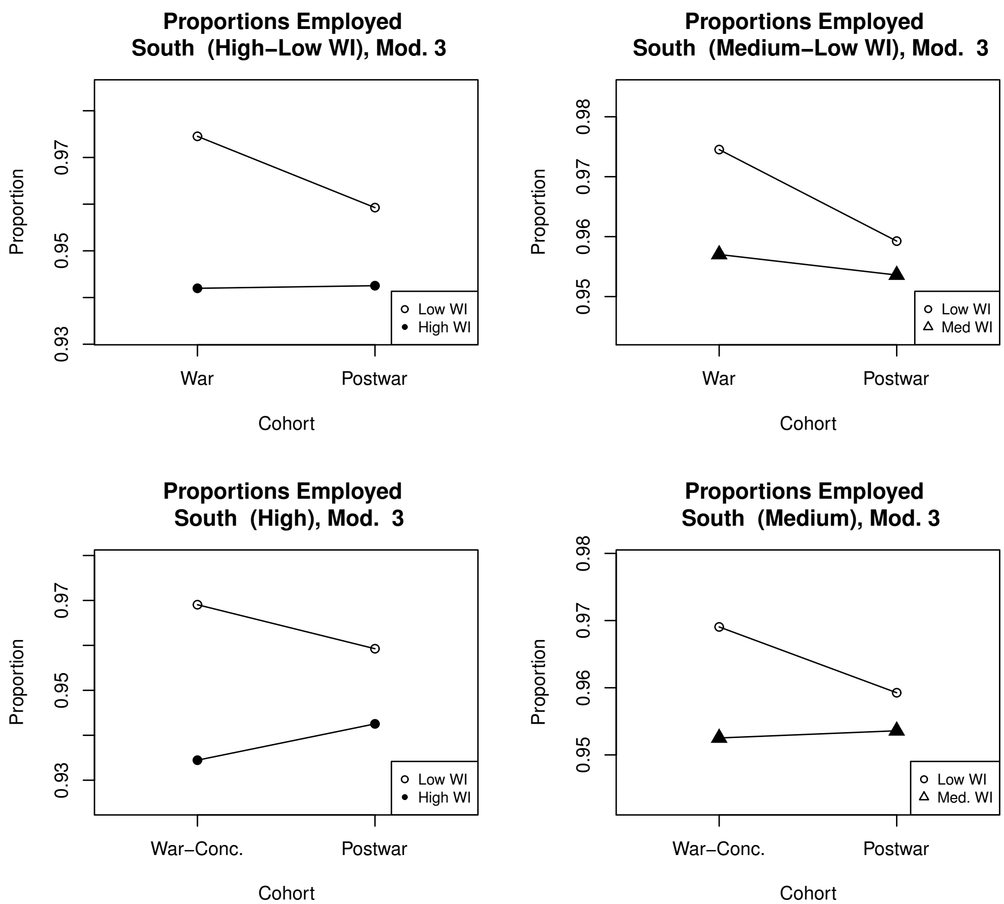


Figure B.36: Proportion employed by cohort and war intensity areas, Model 3, South Vietnam

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