The Effect of the Vietnam War on Marriage Patterns in Vietnam: Measuring the Marriage Squeeze

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Abstract

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 have had consequences for the first-marriage market due to the surplus of young women relative to the young men. Using data from the censuses of Vietnam, this paper explores the effect of the Vietnam War on marriage patterns in Vietnam through the application of a marriage squeeze index. Furthermore, the paper makes use of data on the U.S. bombing of Vietnam between 1965-1975 to explore the relationship between marriage squeeze and war intensity. The results show that the density of U.S. bombing was associated with the squeeze on women in first marriage in 1989.

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 have had consequences for the first-marriage market due to the surplus of young women relative to the young men. This paper explores the effect of the Vietnam War on marriage patterns in Vietnam through the use of a marriage squeeze index.

2 Background

The pattern of marriage following a crisis has been studied by many scholars. Studies on the effects of marriage due to crises are mostly based on responses to economic crises and recessions [16, 7], 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 self-sufficient household; and 2) the increase in adult mortality [16]. The first is related to the feasibility of marriage while the latter affects the availability.

The effect of war on the availability of marriage 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[9, 12, 18]. A marriage squeeze is commonly seen in growing populations where the men tend to marry at older ages than the women[9, 18].

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 and marriage is considered important for the entire family in order to extend the male family lineage through the birth of sons [3, 2, 24]. Until recently, alternatives to marriage were almost non-existent [21]. However, there has been some recent indications that the traditional view of marriage has begun to shift and that the near universal marriage in Vietnam, as with many other countries in East and Southeast Asia, is no longer universal [10, 11].

Further, men tend to marry at later ages than women in Vietnam. The minimum

legal age at marriage in Vietnam has been 18 for women and 20 for men since 1959 in the north and 1975 in the south[15]. The 1989 Census reported the singulate mean age of first marriage (SMAFM) of men to be 24.5, while that of women to be 23.2 [23]. In 1999, the SMAFM was 25.3 for men and 22.7 for women[22]. This pattern, combined with the population growth that Vietnam had witnessed until the 1990s [1], makes it likely for a "marriage squeeze" on women to be observed in Vietnam. These conditions may be further exacerbated by the sex imbalance caused by two additional factors as described by Goodkind [9]: the excess male mortality during the Vietnam War and the disproportionately male emigration shortly after the war.

Previous literature on the marriage squeeze in Vietnam has been limited to an examination of sex ratios at marrying ages [9]. The purpose of this paper is to extend this literature through the use of a marriage squeeze index to better measure the degree of marriage squeeze across time, geographic regions, urban/rural areas, and by educational attainment. The marriage squeeze index is applied to the 1989 and 1999 censuses to see how marriage patterns may have changed between the two censuses.

3 Data and methods

3.1 Data

The 1989 and 1999 census microdata from the Integrated Public Microdata Series (IPUMS) International: Version 5.0 [14] are used for the analysis. 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 1.

Table 1: Number of ever-married persons in the 1989 and 1999 census samples, Vietnam

	1989		1999	
	Male	Female	Male	Female
Total	1896	2381	2155	2600
Rural	1168	1459	1129	1297
Urban	728	922	1026	1303
Less than primary completed	774	1363	630	1160
Primary completed	828	764	1054	1033
Secondary completed	213	210	371	343
University completed	75	41	95	53
North	926	1036	1071	1300
South	970	1345	1084	1300
Red River Delta	310	388	338	435
Northeast	427	434	469	558
Northwest	83	86	99	138
North Central	143	191	232	234
Central Coast	177	187	198	256
Central Highlands	69	131	90	114
Southeast	321	448	297	334
Mekong River Delta	366	516	432	531

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 with the marital status data. The Vietnam General Statistical Office attributes this differential in reporting across sexes mostly

to misreporting of marital status due to the stronger stigma associated with singlehood, separation or divorce for women than men and partially to the practice of polygamy existing in some regions[23, 22]. In addition, although not mentioned in the official reports, to the extent that there are more male emigrants than female emigrants, the censuses would count more married women than men since they would count the women whose husbands are abroad.

In addition, to test whether excess male mortality was associated with the marriage squeeze, data on the U.S. bombing of Vietnam is used as an indicator. The bombing data is used as a proxy for excess mortality since data on mortality by province during the war are not available. It is assumed that areas that experienced heavy bombing would also have seen heavy fighting, and therefore, male mortality would be higher in those provinces. The original database is from the Unites States National Archives, Record Group 218, "Records of the U.S. Joint Chiefs of Staff", compiled by the Defense Security Cooperation Agency from the 1965-70 Combat Activities-Air (CACTA), the 1970-1975 South East Asia (SEADAB), and the Combat 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 [13].

3.2 Methods

To measure the marriage squeeze in Vietnam, I apply a marriage squeeze index used by Tuljapurkar, et al.[19]. Essentially, the index is a weighted ratio of males to females with the weights at each age representing the probability of 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:

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

where R_f is the first marriage sex ratio. $P_i^{m,x}$ is the population size of males at age x in year i and $F_i^{m,x}$ is the frequency of first marriages among males at age x in year i. Similarly, $P_i^{f,x}$ is the population size of females at age x in year i and $F_i^{f,x}$ is the frequency of first marriages among females at age x in year i.

The frequency of first marriages is defined by the United Nations Manual X[20] 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. To estimate the frequency of first marriages by age, I apply the Coale-McNeil nuptiality model [5]. The model has been used to examine marriage patterns by educational attainment [8] and has been applied to a number of developing countries[4, 6].

The Coale-McNeil model stipulates that the pattern of first marriage for women follow a certain age progression in populations[17, 5]. According to the model, the standard 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 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 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 density of first marriage, the values of a_0, κ, and C that best fit the the census data are estimated using the criteria of minimum squared differences between the observed first differences of proportion ever-married and the predicted density of first marriage ($g(x)$) from the model. The $g(x)$ is fit to the first differences rather than fitting the $G(x)$ to the proportion ever married because the goal is to fit estimate the frequency of marriage.

The possible values of a_0 are restricted to a range where the observed proportion ever-married is approximately one percent in the data. Similarly, potential values of C are bound

between .9 and 1, reflecting the observed proportion of the population that is married by age 55.[1]

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.

To investigate the the relationship between marriage squeeze and migration, I project the 1979 population forward to see what the population would have been in 1989 if there had been no migration, then apply the Coale-McNeil density of first marriage from the 1989 to calculate the marriage squeeze index for 1989 without migration. Similarly, I project the 1989 population forward to 1999 assuming no migration, then calculate the marriage squeeze index for 1999 based on the 1999 density of first marriage.

4 Results

4.1 Descriptive Analysis

4.1.1 Age Pyramid by Marital Status

Figure 1 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,

[1]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 minimum squared differences approach is used in the analysis.

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 1 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 outnumer 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 outnumbers 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 the total population by marital status is viewed by north and south Vietnam (Figure 2 and 3), distinct differences are observed in the and sex structure and marital patterns between the north and the south 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. In addition, 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 great 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 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 is observed among women in their late 50s and 60s in the 1999 pyramid.

When comparing across rural and urban areas (Figure 4 and 5), 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 number of 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.

Figure 1: Total population by sex and marital status, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

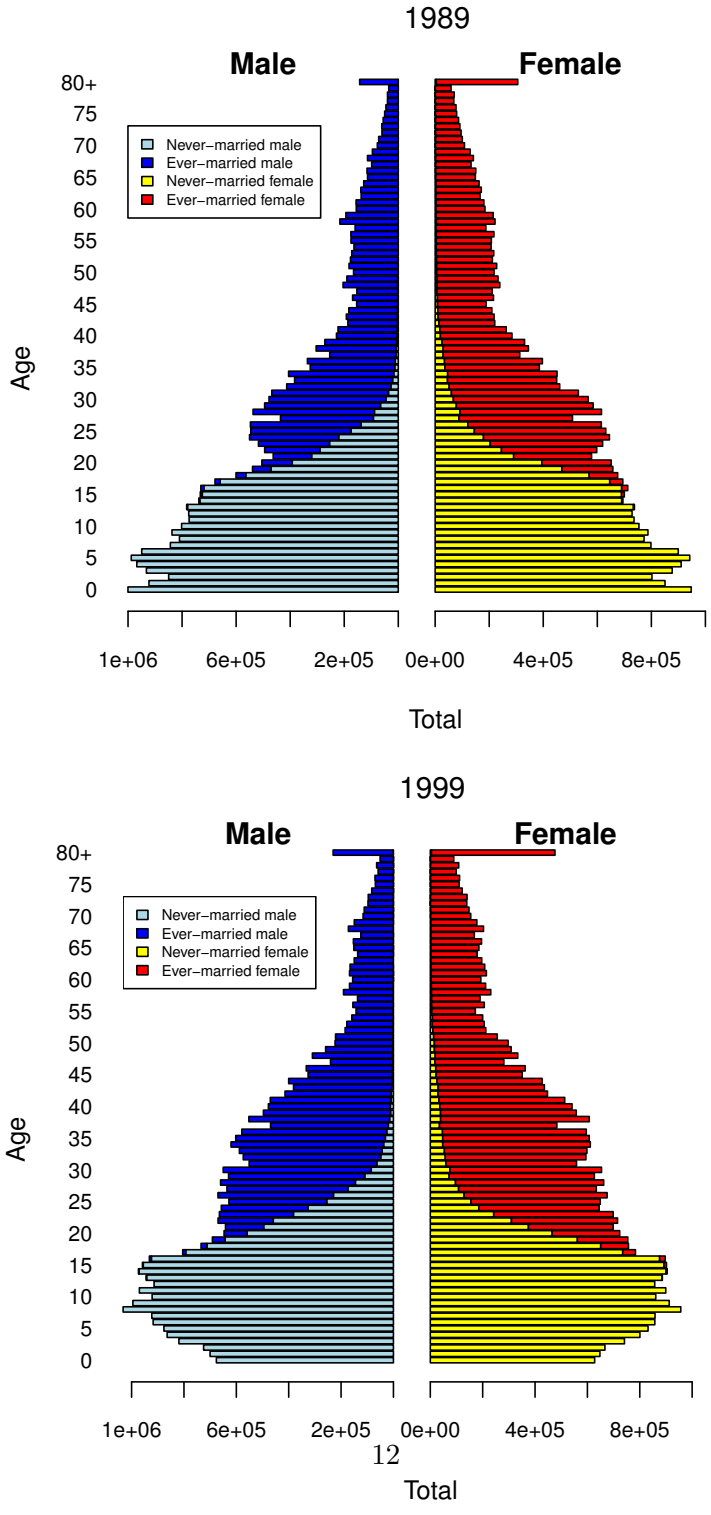
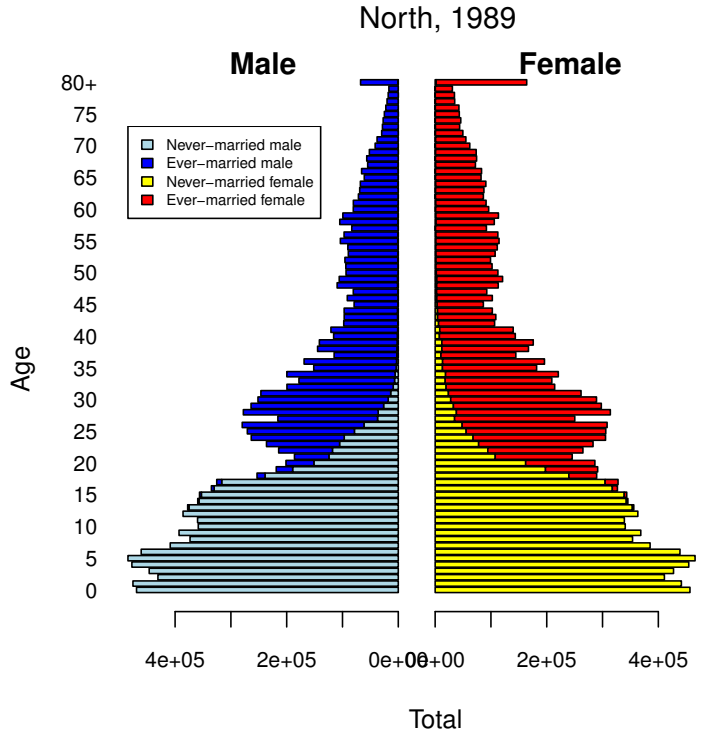


Figure 2: Total population by sex and marital status, North and South Vietnam, 1989 *(Data source: 1989 Vietnam Census, IPUMS International [14])*



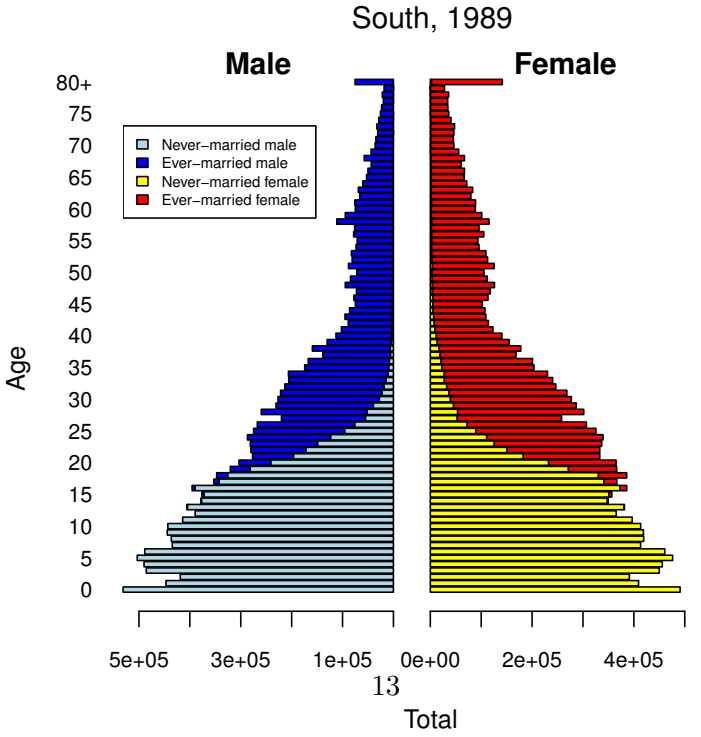
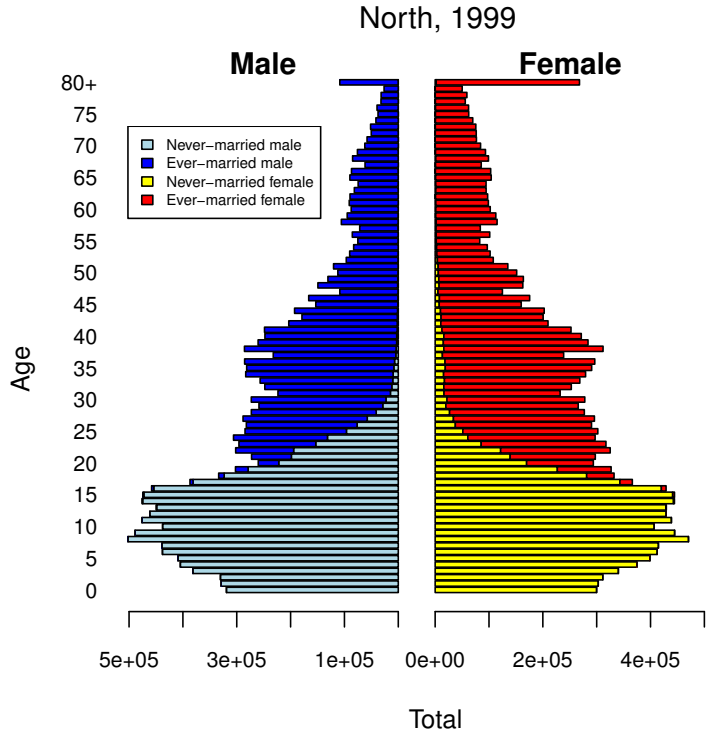


Figure 3: Total population by sex and marital status, North and South Vietnam, 1999 *(Data source: 1999 Vietnam Census, IPUMS International [14])*



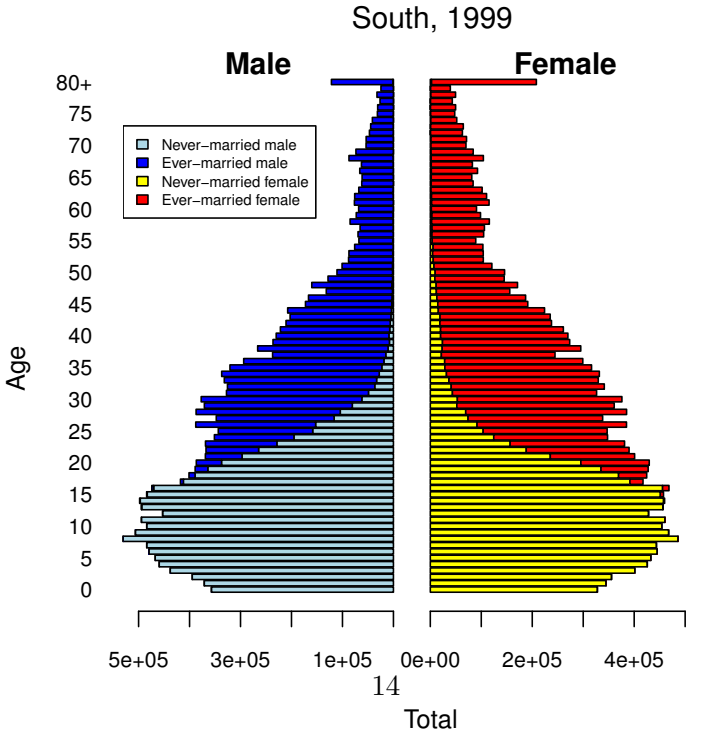
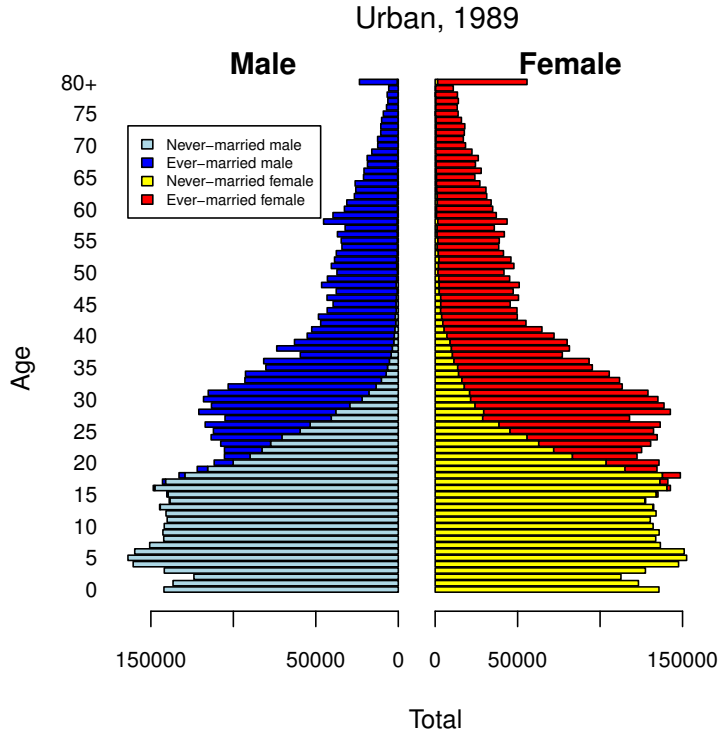


Figure 4: Total population by sex and marital status, urban and rural Vietnam, 1989 *(Data source: 1989 Vietnam Census, IPUMS International [14])*



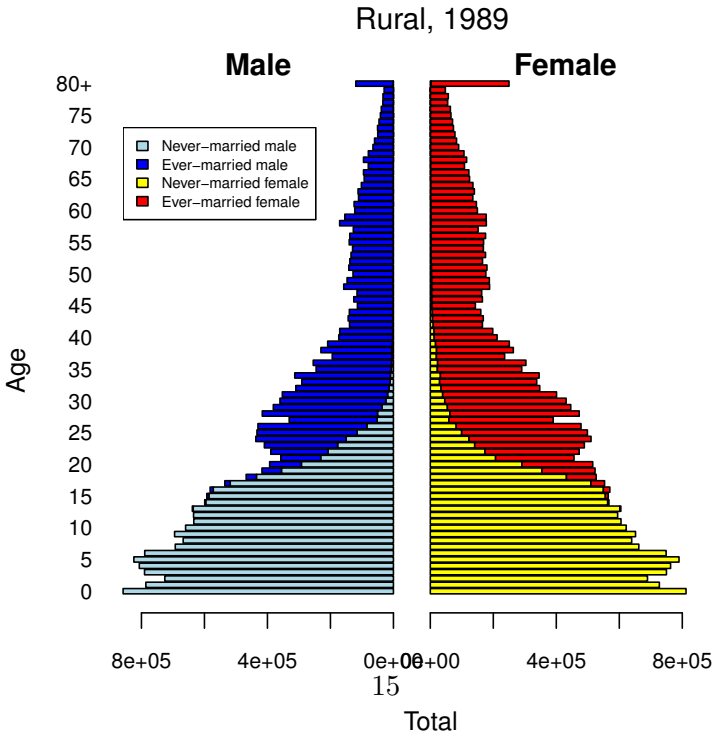
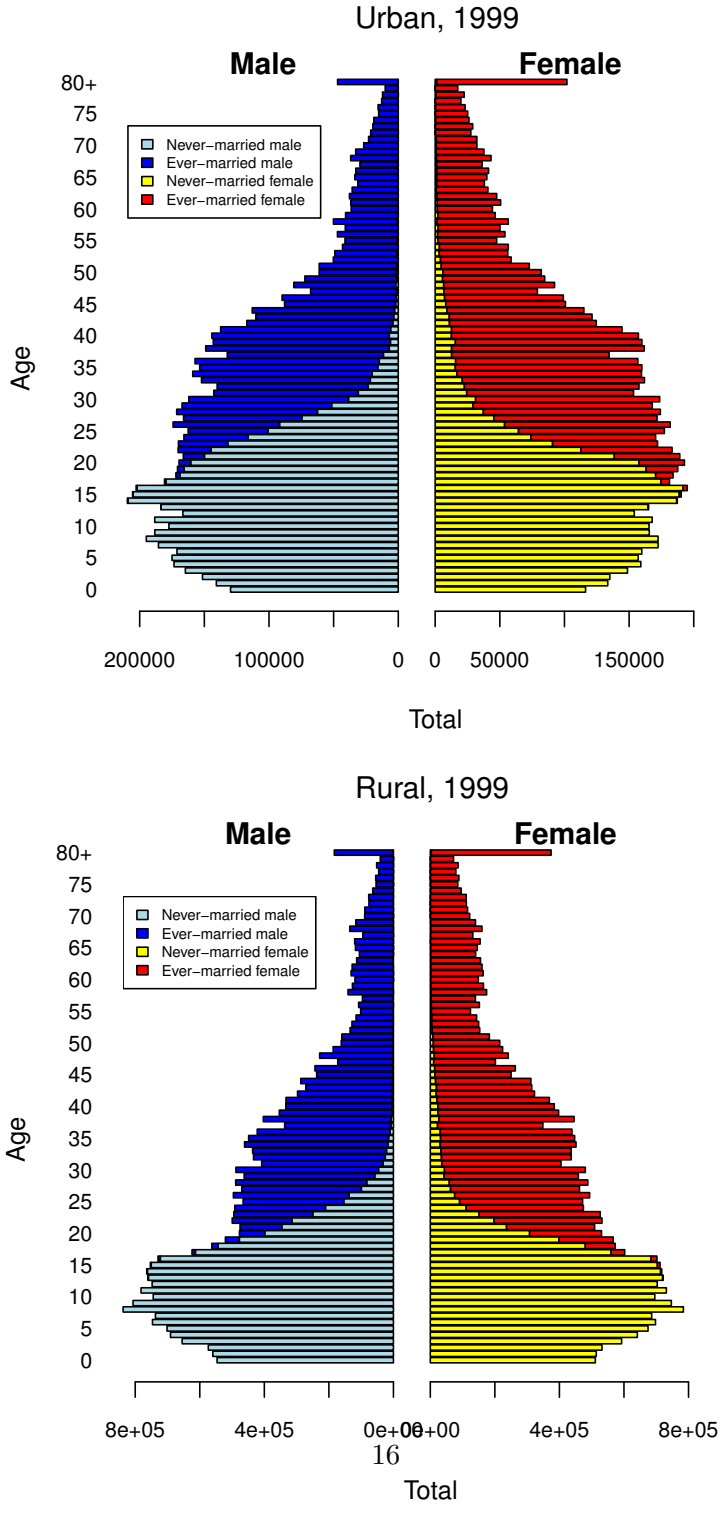


Figure 5: Total population by sex and marital status, urban and rural Vietnam, 1999 *(Data source: 1999 Vietnam Census, IPUMS International [14])*

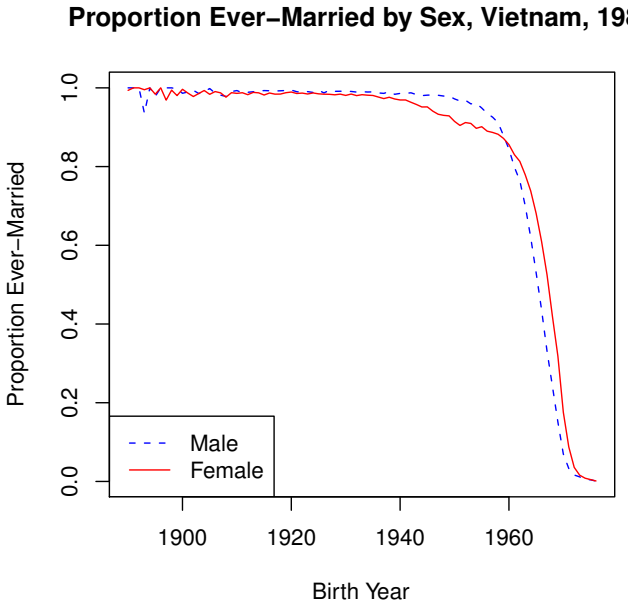


4.1.2 Proportion Ever-Married

Figures 6 through **??** show the proportion ever-married by birth year and sex. Figure 6 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 6 shows that proportions ever-married in 1989 for female cohorts born around 1935 up to 1959, who entered marrying age during the war or shortly after, 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 ever-married remains low for cohorts of women up to the 1967 cohort.

Similar patterns exist in both rural and urban areas (Figure 7). 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 8), 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.

Figure 6: Proportion ever-married by birth year and sex, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*



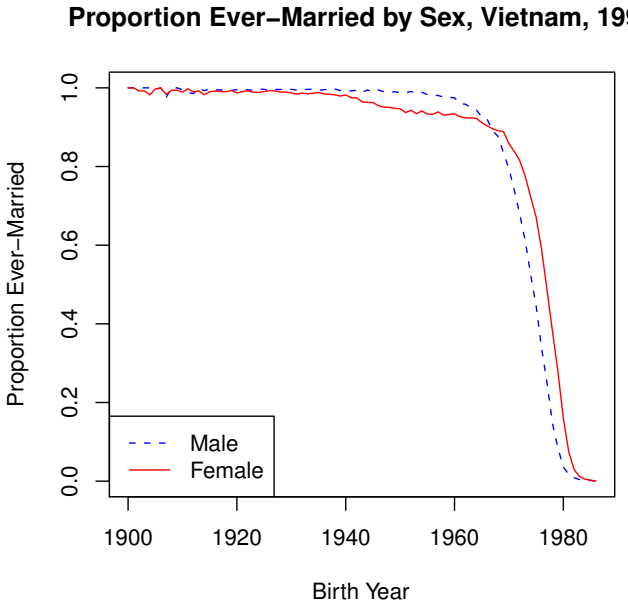


Figure 7: Proportion ever-married by birth year, sex and urban/rural residence, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

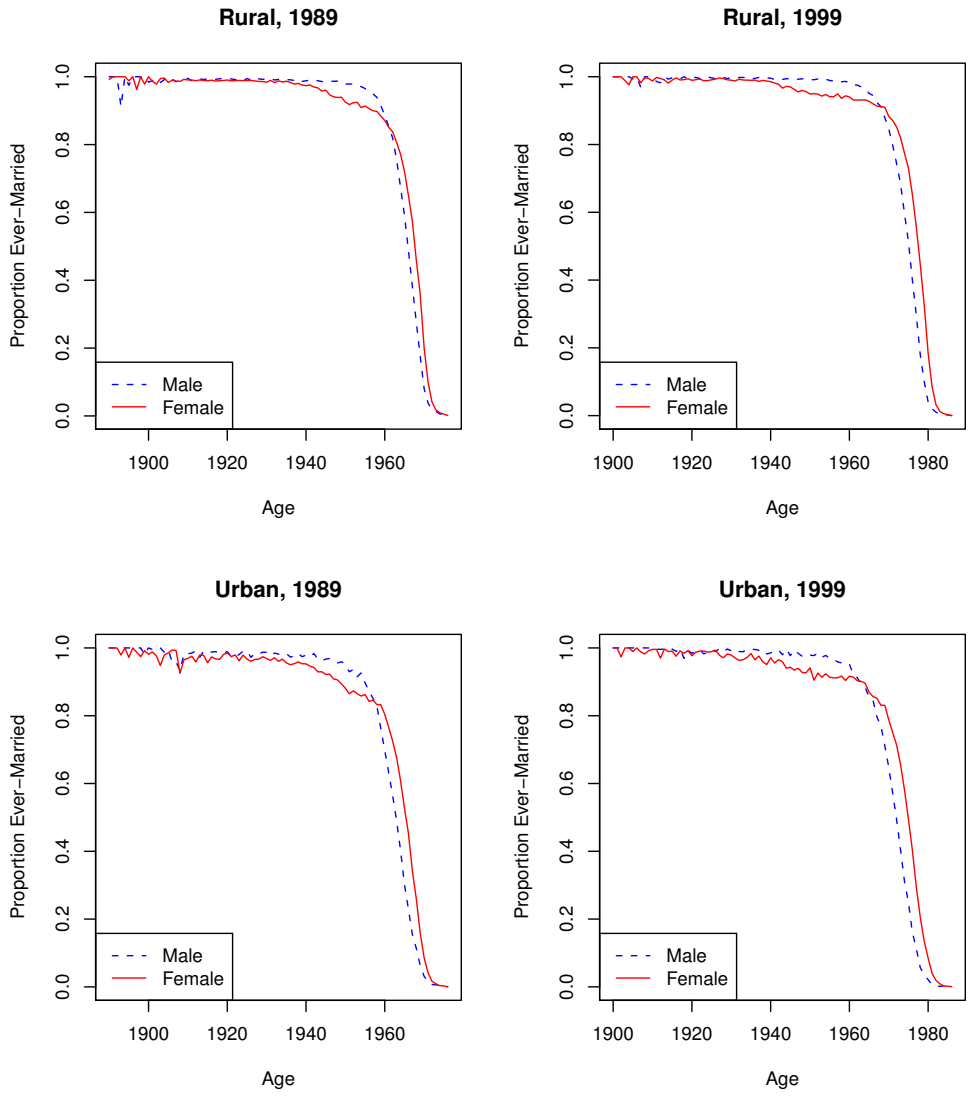
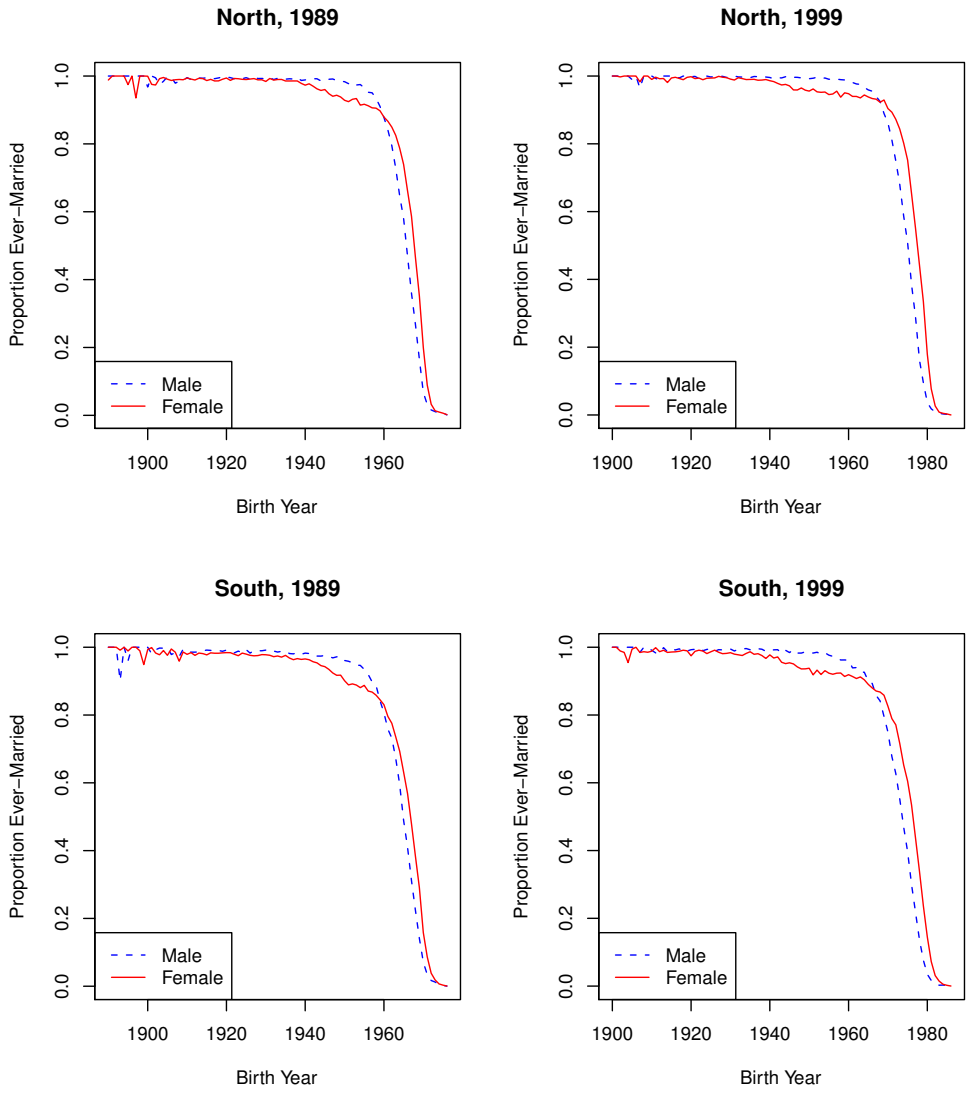


Figure 8: Proportion ever-married by birth year and sex, North and South Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*



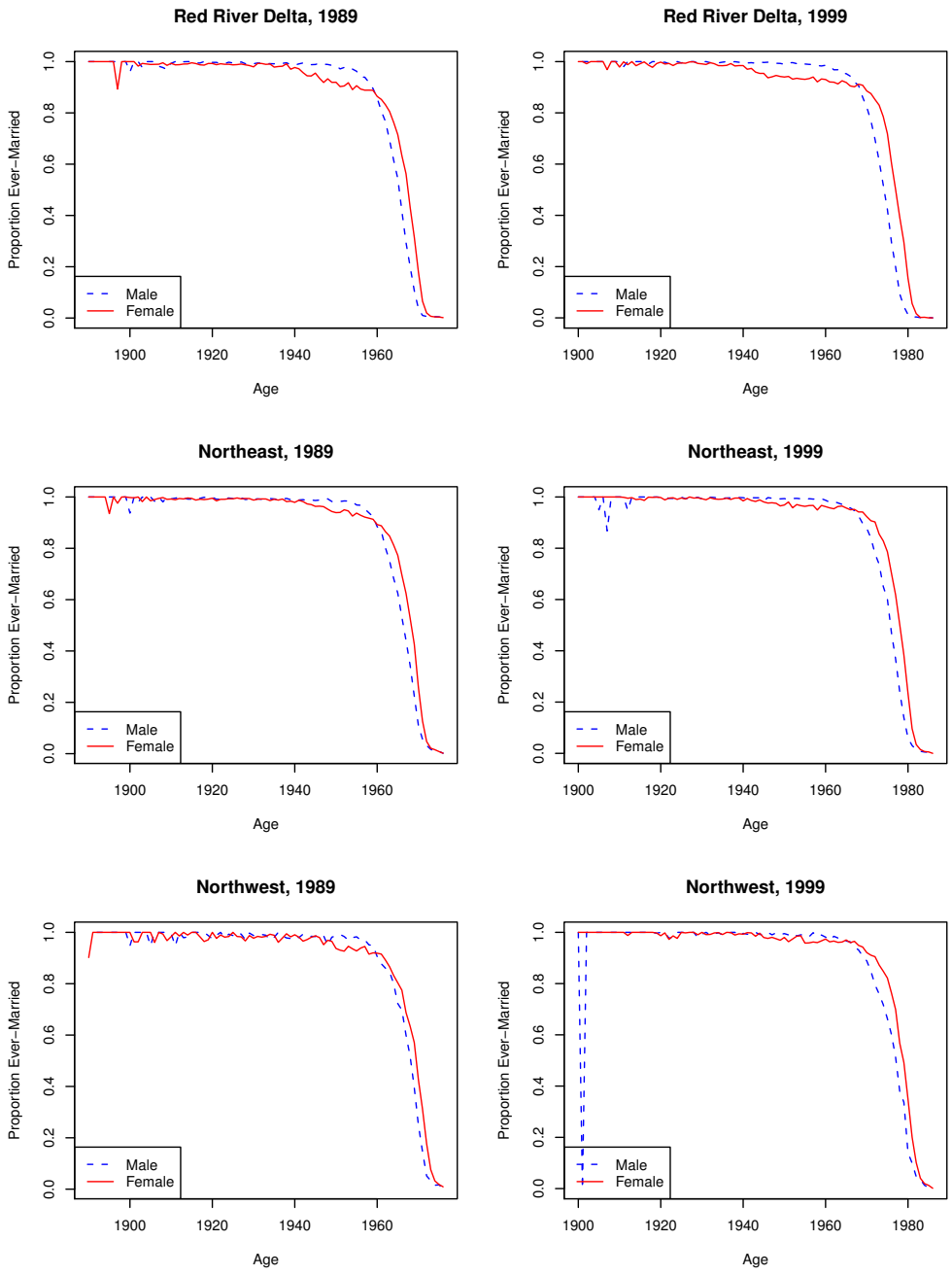
When viewed regionally (Figure 9), again similar patterns are seen in almost all regions. The Red River Delta, Central Coast, Southeast, and the Mekong River Delta regions show markedly lower proportion ever-married for women in the cohorts mentioned earlier in 1989. The Central Highlands show only slightly 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.

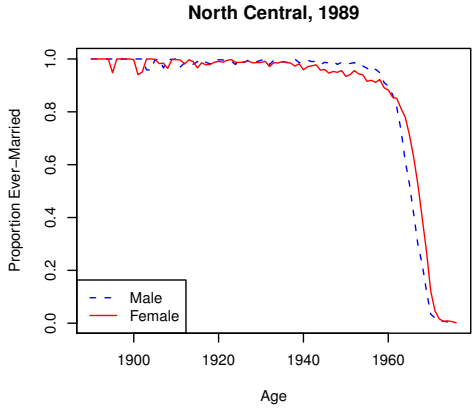
Finally, the patterns also persist by educational level (Figure **??**), although women born in the 1960s, who completed secondary school or university have higher proportion ever-married in 1999 than the cohort of women born in the 1950s in 1989. As expected, both men and women who have completed university and secondary schools tend to marry at later ages than those with primary or less than primary education.

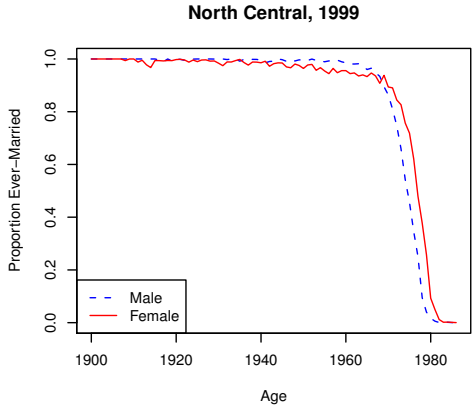
4.2 Singulate Mean Age at First Marriage

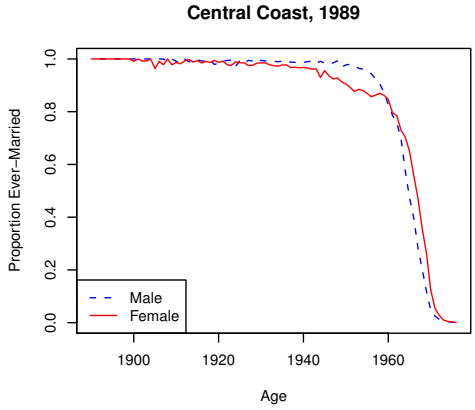
Table 2 shows the singulate mean age at first marriage for men and women in 1989 and 1999. In both 1989 and 1999, men have higher SMAFM than the women, indicating that men tend to marry at older ages than women. Further, men's SMFAM rose between 1989 and 1999 in all areas and across educational levels. For women, this trend is also generally true, with a few exceptions. For women with secondary school and university education,

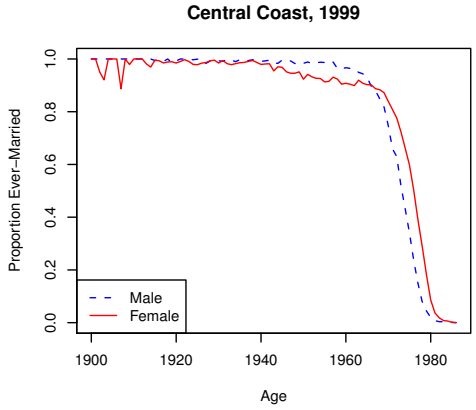
Figure 9: Proportion ever-married by birth year, sex and region, Vietnam, 1989 and 1999
(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])

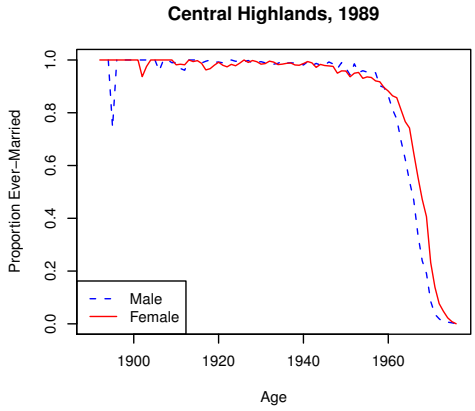


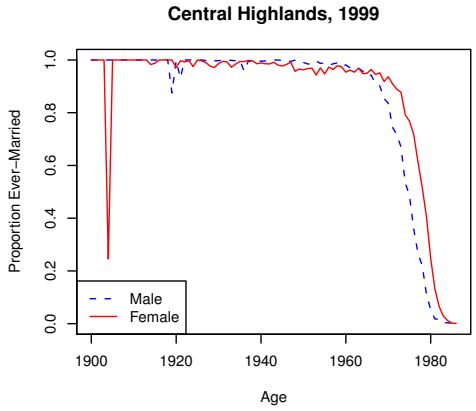

North Central, 1989
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
Age
Male
Female


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


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


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


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


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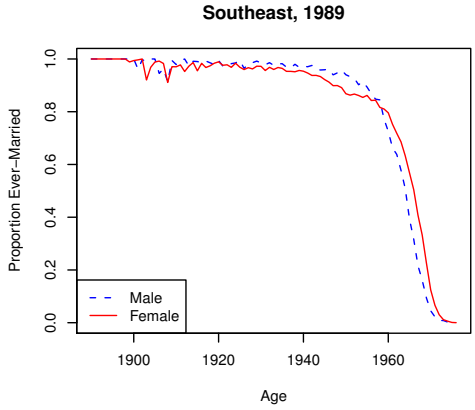
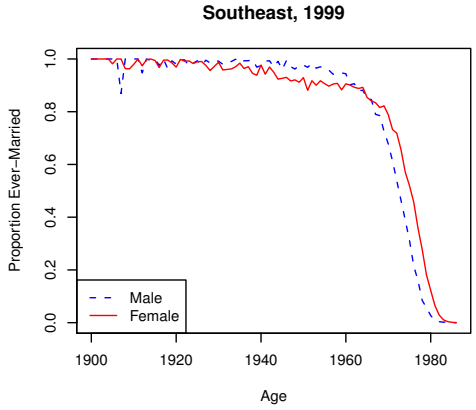
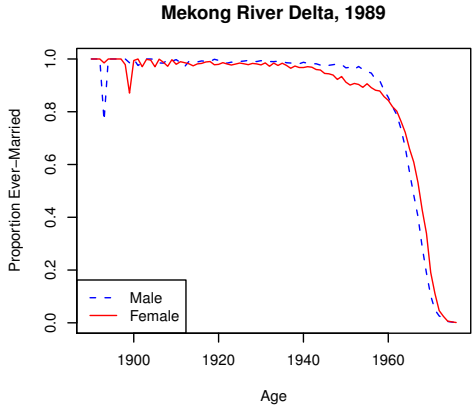
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
1980
Age
Male
Female


Southeast, 1989
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
Age
Male
Female


Southeast, 1999
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
1980
Age
Male
Female


Mekong River Delta, 1989
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
Age
Male
Female

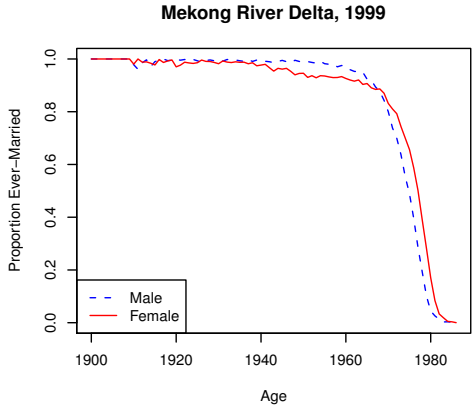
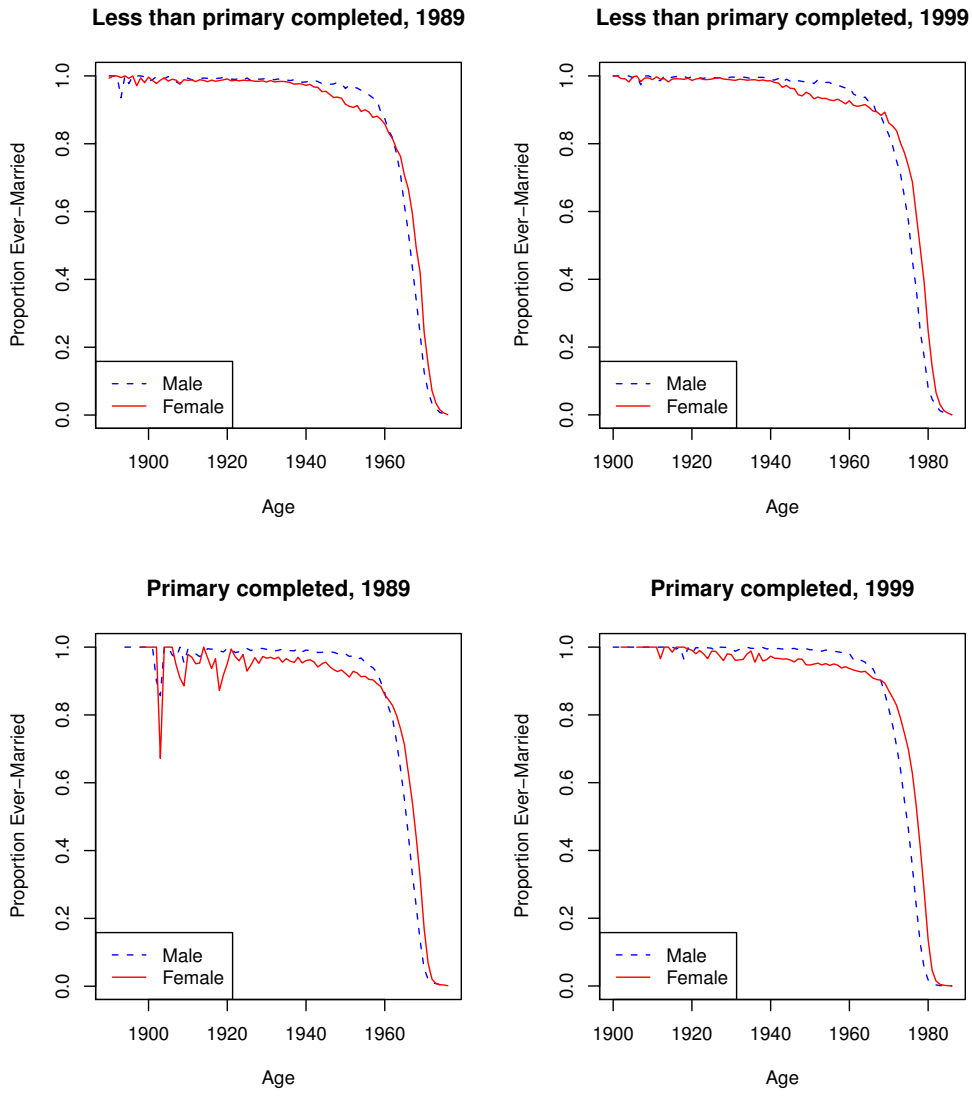
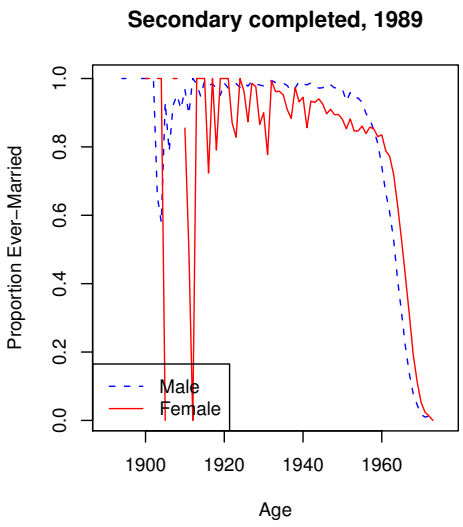
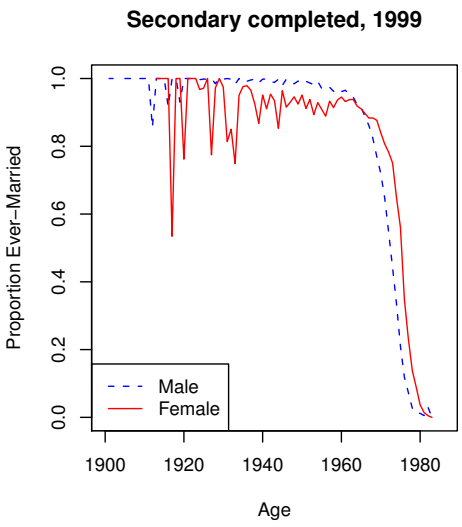
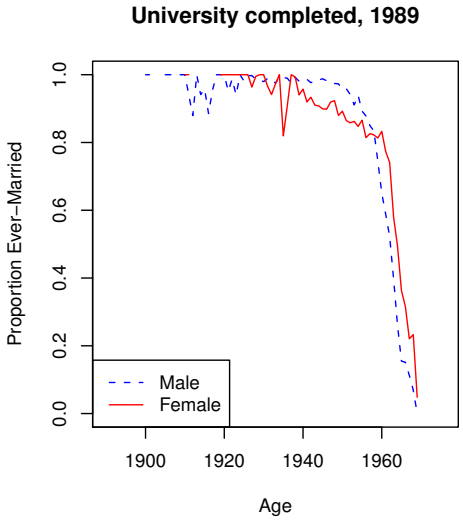

Mekong River Delta, 1999
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
1980
Age
Male
Female

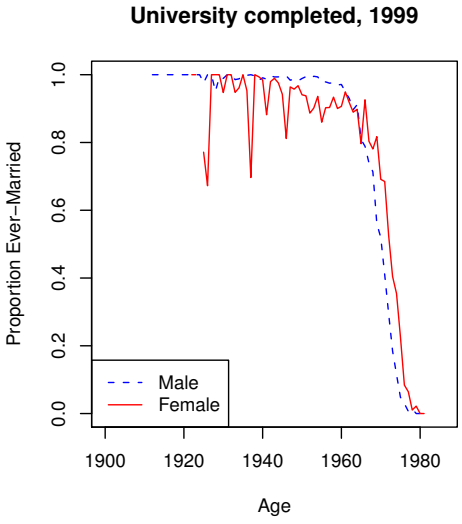
Figure 10: Proportion ever-married by sex and educational attainment, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*




Secondary completed, 1989
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
Age
Male
Female


Secondary completed, 1999
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
1980
Age
Male
Female


University completed, 1989
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
Age
Male
Female


University completed, 1999
Proportion Ever−Married
0.0
0.2
0.4
0.6
0.8
1.0
1900
1920
1940
1960
1980
Age
Male
Female

the SMAFM declined between 1989 and 1999. In addition, in the Northwest and Central Highlands, women's SMAFM also declined.

Table 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
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
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

4.3 Density of First Marriage

Figures 11 through 15 show the results of fitting the Coale-McNeil model to the first differences of proportion ever-married. The lines indicate the model estimates which approximate the density of first marriage.

As can be seen in Figure 11 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, while 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 occurs 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. Further, the densitys 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 in 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 11: Density of first marriage by sex, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

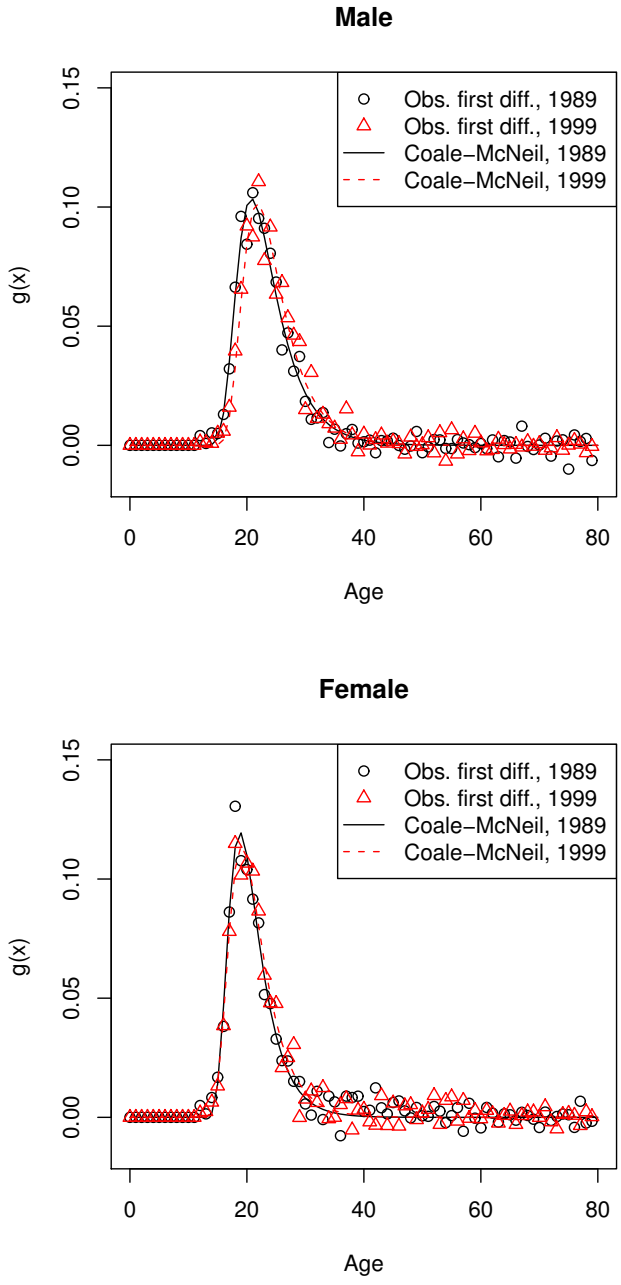


Figure 12: Density of first marriage by sex and urban/rural, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

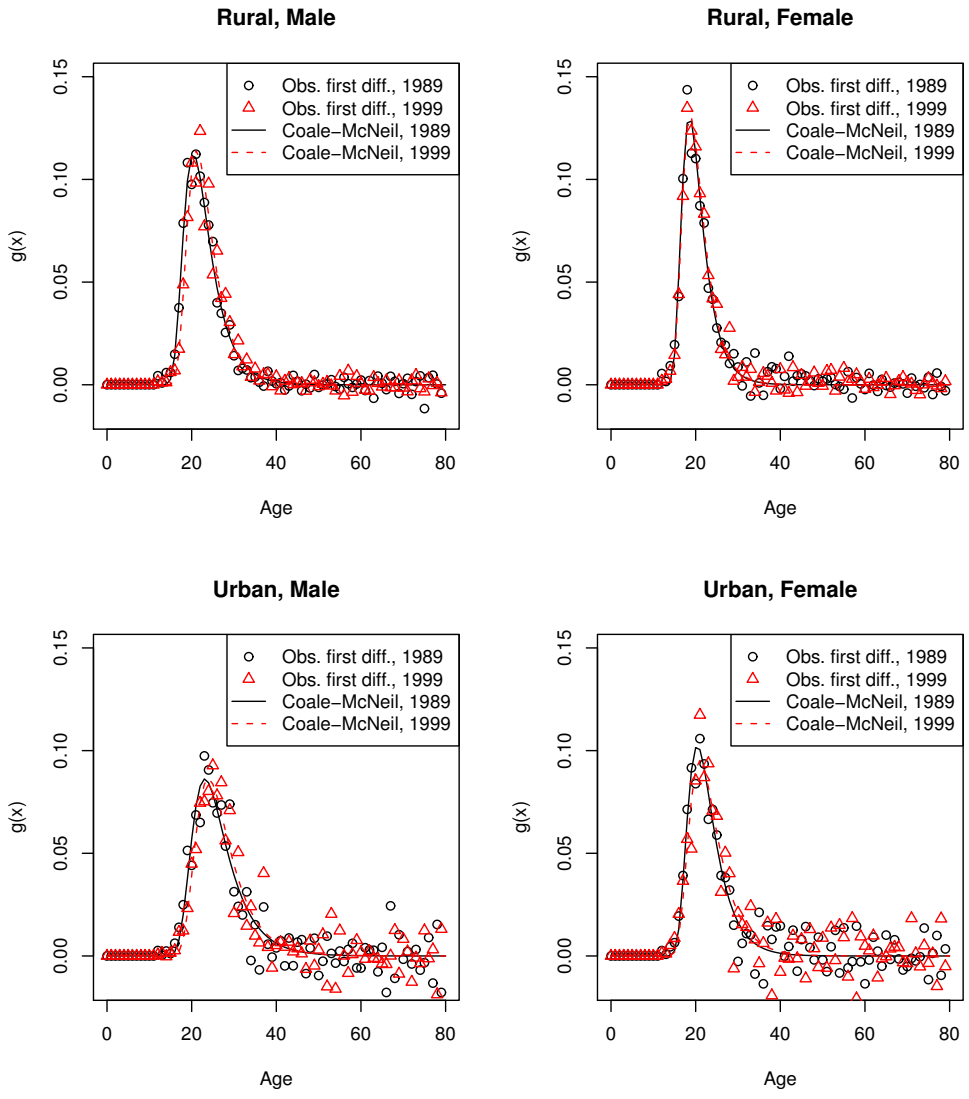


Figure 13: Density of first marriage by sex, North and South Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

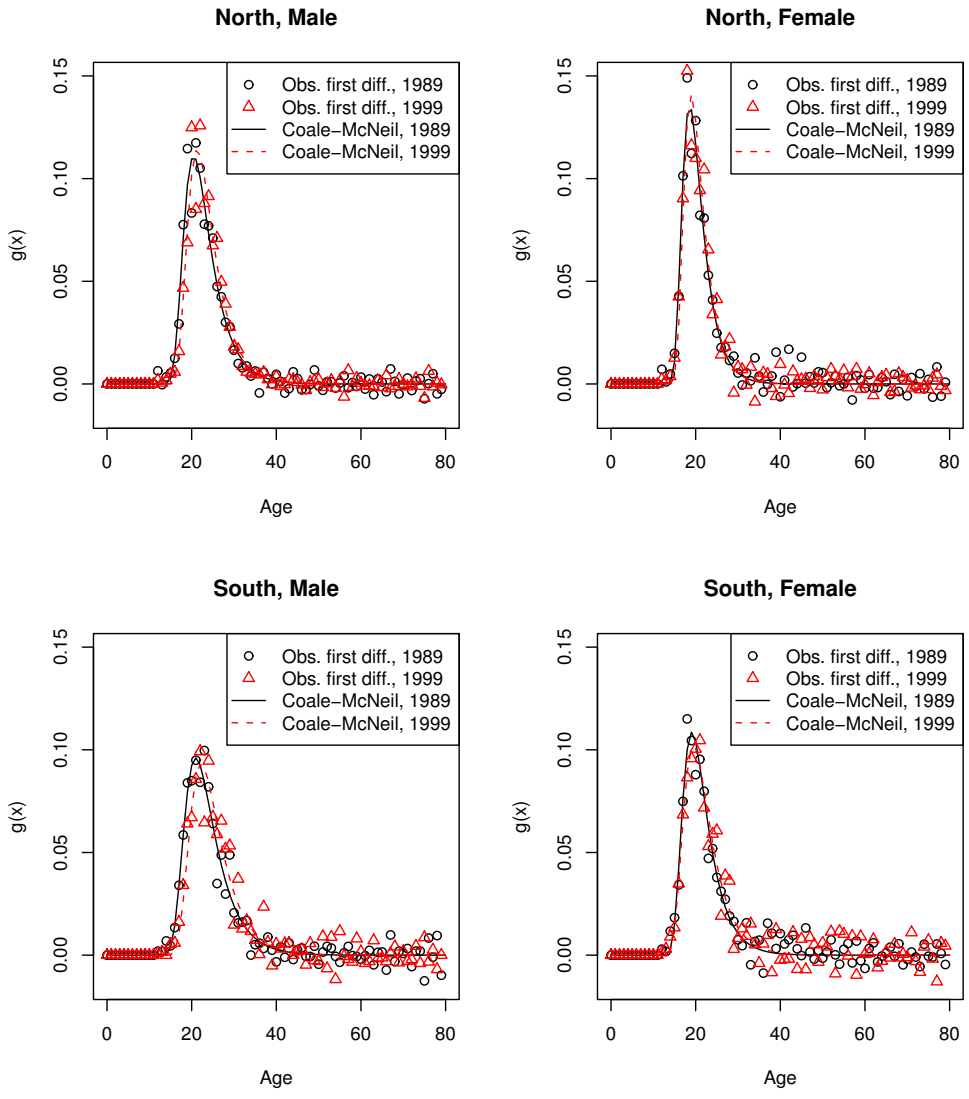
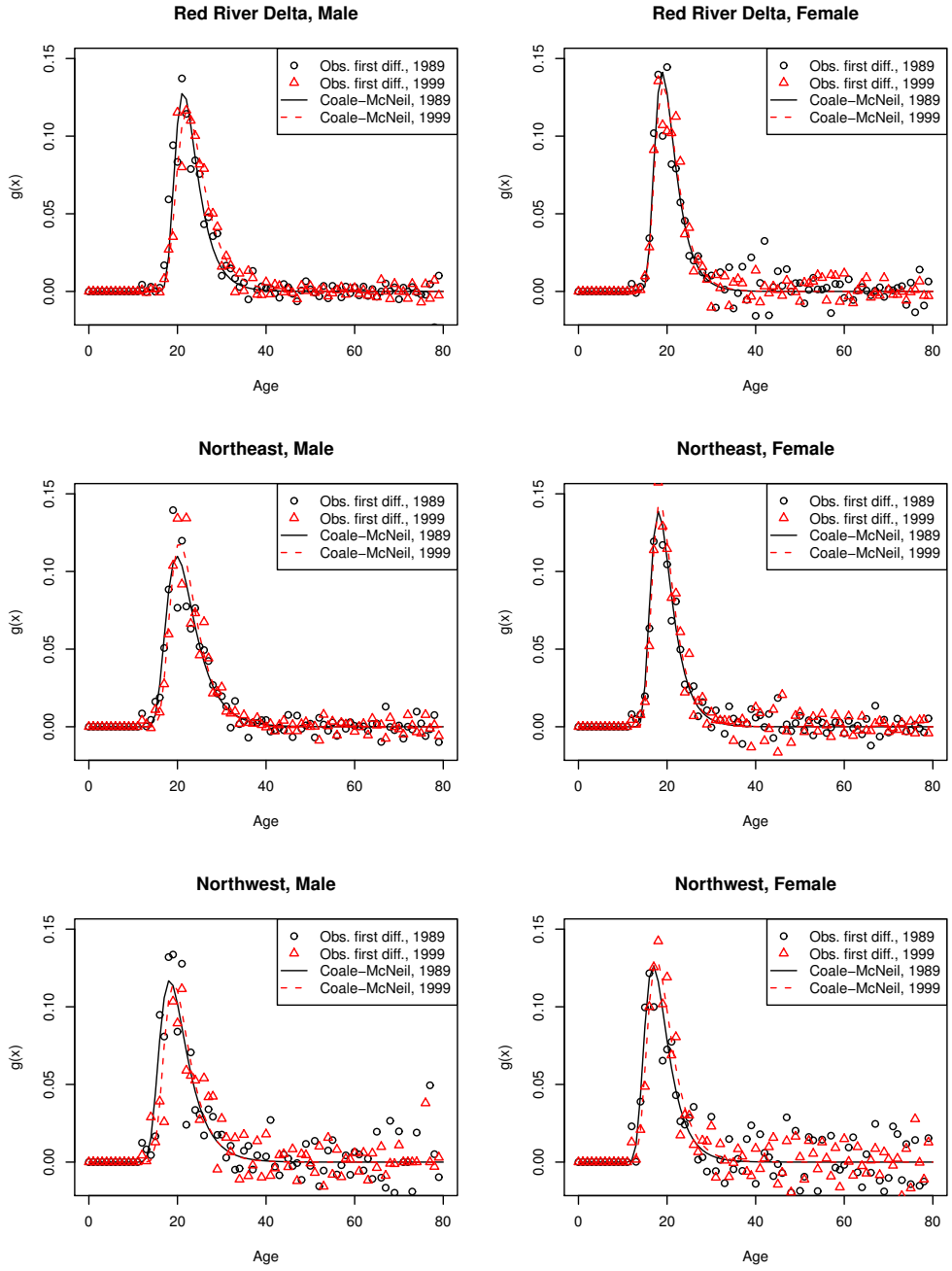
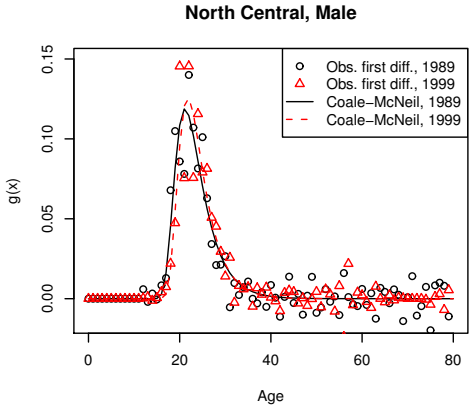
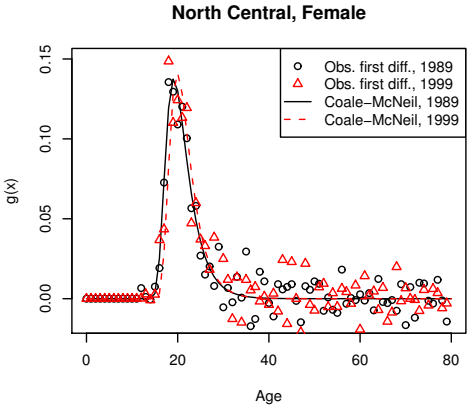
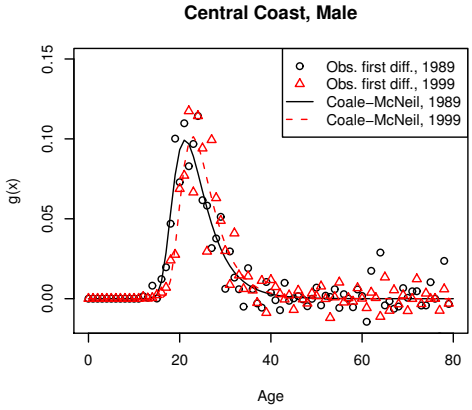


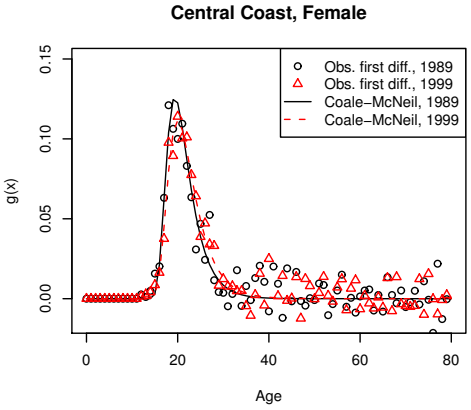
Figure 14: Density of first marriage by sex and region, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

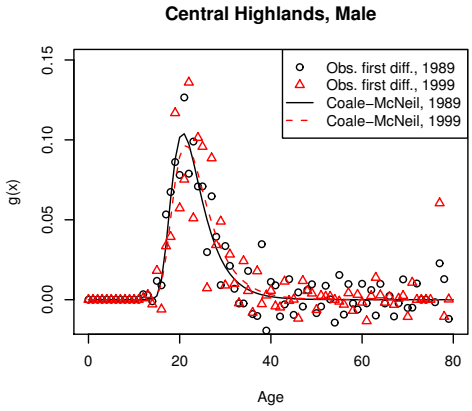


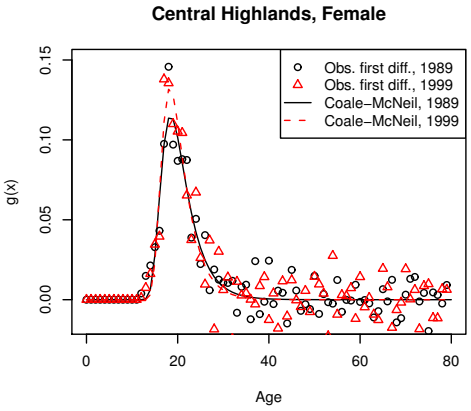

North Central, Male
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age

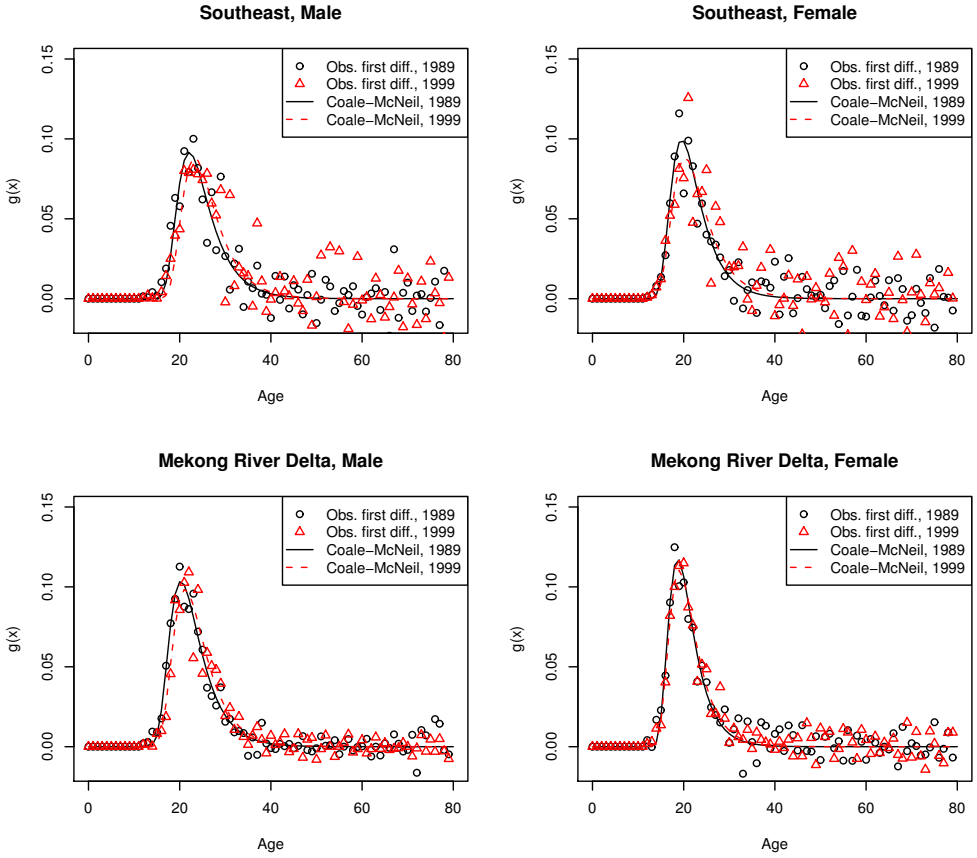

North Central, Female
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age


Central Coast, Male
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age


Central Coast, Female
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age


Central Highlands, Male
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age


Central Highlands, Female
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age


Southeast, Male
Southeast, Female
Mekong River Delta, Male
Mekong River Delta, Female
Obs. first diff., 1989
Obs. first diff., 1999
Coale–McNeil, 1989
Coale–McNeil, 1999
g(x)
Age
0.00
0.05
0.10
0.15
0
20
40
60
80

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.

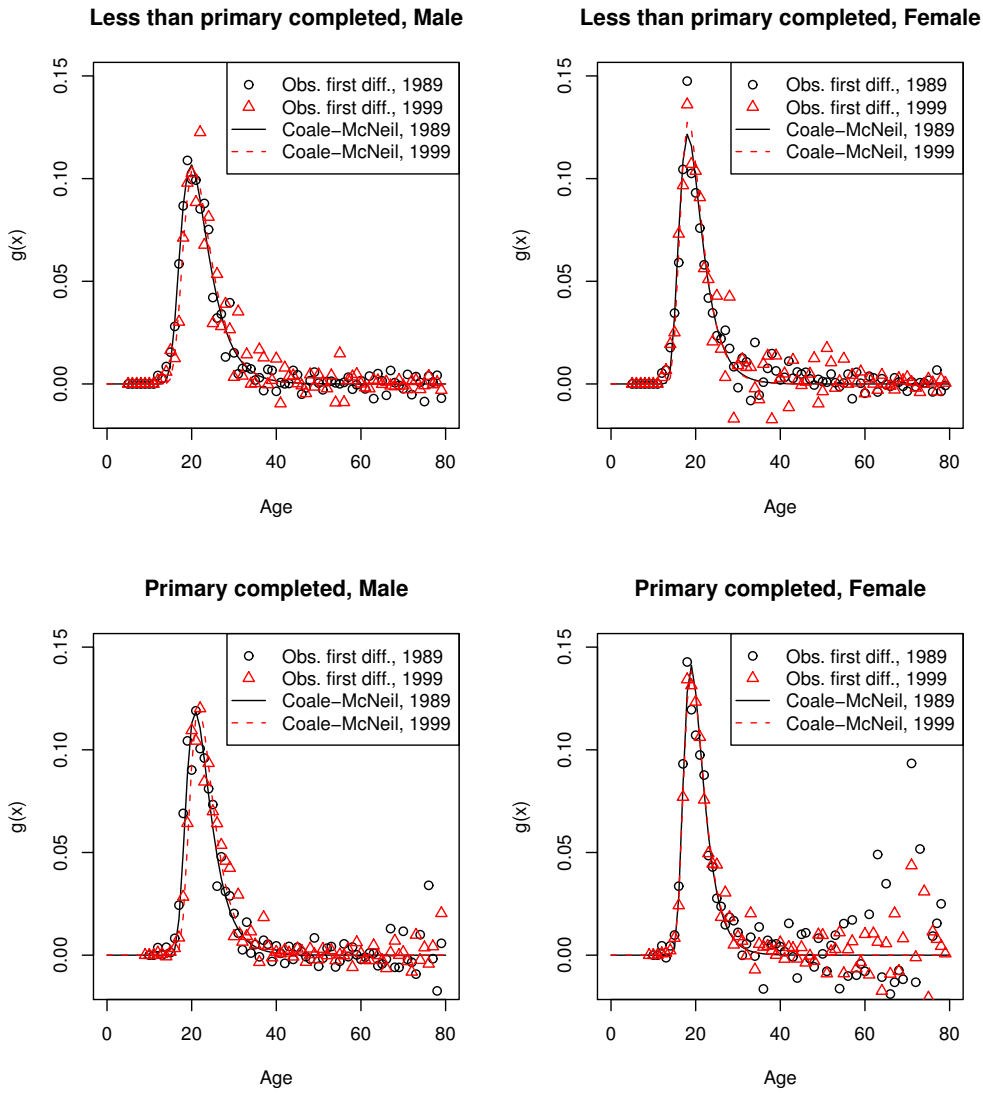
4.4 Marriage Squeeze Index

Table 3 shows the marriage squeeze index calculated from the population age distribution and the density of first marriage by rural/urban areas, educational level, north and south Vietnam and by regions. The marriage squeeze index for the total population in 1989 was .887, indicating an overabundance of women in the first marriage market and a presence of a "squeeze" on women seeking a first marriage partner. By 1999, however, the index has risen to .929, suggesting that the marriage squeeze has eased relative to 1989, although women in the marriage market still outnumber the men. Furthermore, the results show that the marriage squeeze on women was more severe in rural areas than in urban areas, although in both areas, the degree of the squeeze lessened between 1989 and 1999.

By educational level, the squeeze on women is greater for women with less education. In all areas, the index rose between 1989 and 1999, indicating the reduction of the marriage 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 the men rather than on the women. However, these calculations assumes homogamy across educational levels. In reality, more educated men may marry less educated women.

The marriage squeeze index shows that the squeeze to be slightly worse for women in the south than in the north in both 1989 and 1999. The squeeze in both areas have improved between 1989 and 1999, however, reaching almost one in the north in 1999. Across regions, the overall trend is that of greater squeeze on women in 1989 and less of

Figure 15: Density of first marriage by sex and educational attainment, Vietnam, 1989 and 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*



a squeeze on women in 1999, with a few exceptions. In the Northwest, the trend is the opposite. The marriage squeeze index shows about equal number of men and women in the first marriage market in 1989 (.991), but a squeeze on women in 1999 (.847). Further, in the Central Highlands, a slight squeeze on women is seen in 1989 (.948) and a slight squeeze on men is observed in 1999 (1.03). The region that experienced the largest change between 1989 and 1999 was the Red River Delta. The Red River Delta has the lowest index in 1989 (.785), indicating that the squeeze on marriage for women was the most severe in the region. However, by 1999, the index for the Red River Delta has recovered to .977.

Table 3: Marriage squeeze index, Vietnam, 1989 and 1999

	1989	1999
Total	0.8871	0.9290
Rural	0.8786	0.9323
Urban	0.9075	0.9764
Less than primary completed	0.7919	0.9225
Primary completed	0.8763	0.8675
Secondary completed	0.9060	1.1669
University completed	1.2034	1.4191
North	0.8868	0.9869
South	0.8781	0.9488
Red River Delta	0.7850	0.9774
Northeast	0.8989	0.9417
Northwest	0.9907	0.8472
North Central	0.8251	0.9787
Central Coast	0.8914	0.9973
Central Highlands	0.9478	1.0326
Southeast	0.8341	0.9363
Mekong River Delta	0.8604	0.9562

Figures 16 and 17 show the marriage squeeze index by province in 1989 and 1999. Figure16 shows the presence of a marriage squeeze on women in most provinces, with one exception. By 1999, the marriage squeeze index for each of the provinces has risen to a level closer to one and some provinces show an index of greater than one (Figure 17).

4.5 Relationship between the Marriage Squeeze Index and Bombing

Figure 18 shows that there is a negative relationship between the marriage squeeze index (R_f) and the number of bombs dropped per square kilometer at the province level in 1989. This suggests that provinces with higher bombing activity also experienced a tighter marriage squeeze on women. There is no evidence of a relationship between bombing and marriage squeeze in 1999. Tables 4 and 5 show the results of the regression that quantifies the relationship. The negative relationship between the marriage squeeze index and bombing density is statistically significant at the five percent level.

This result is consistent with the idea that excess male mortality may have affected the marriage market in 1989. If we consider those to be in the marriage market to be between the ages of 18 to 39, then in 1989, it would mean that this group would have been born between 1950 to 1971. 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 the bombings may explain the drop in the marriage squeeze index for these provinces. We would expect to see no result in 1999, because by 1999, those who would be affected by the marriage squeeze from the war to be above the typical marrying age.

For the younger cohorts, however, excess male mortality is not likely to explain the squeeze on the marriage market. It may be that provinces that experienced heavy bombing

Figure 16: Marriage squeeze index by province, Vietnam, 1989 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*

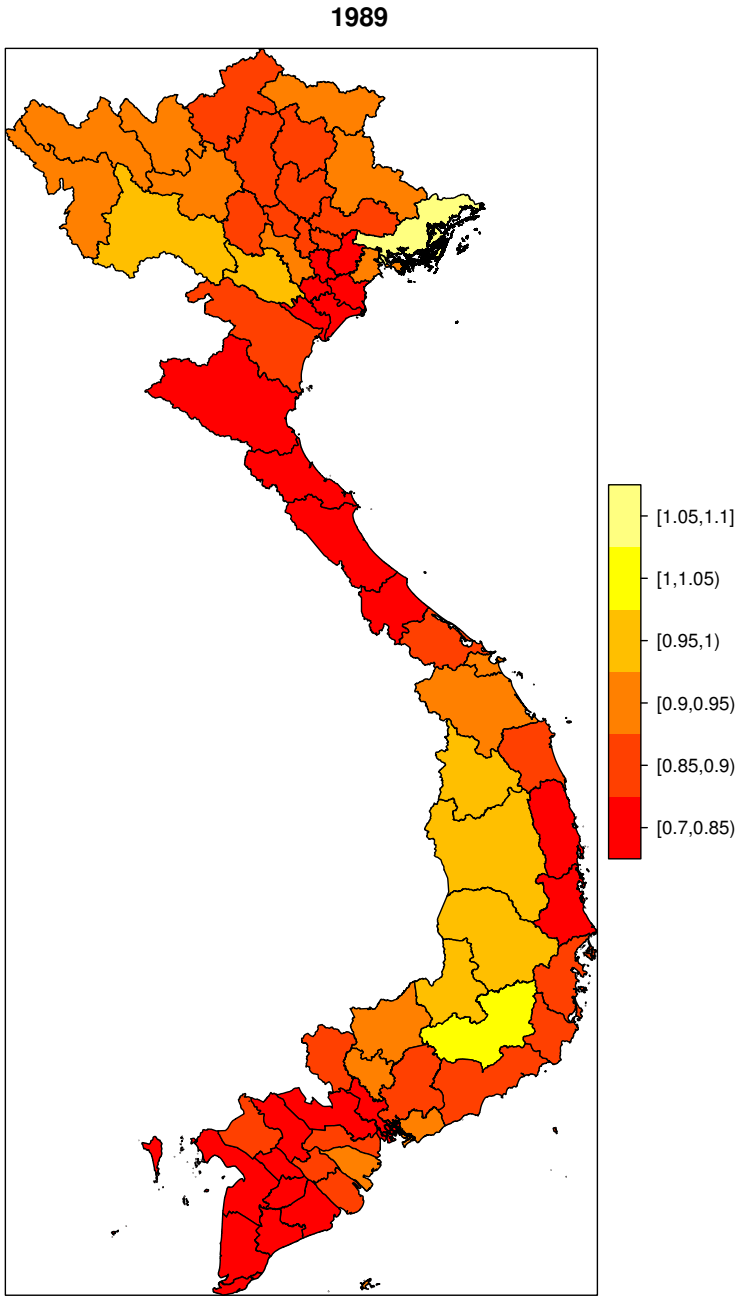
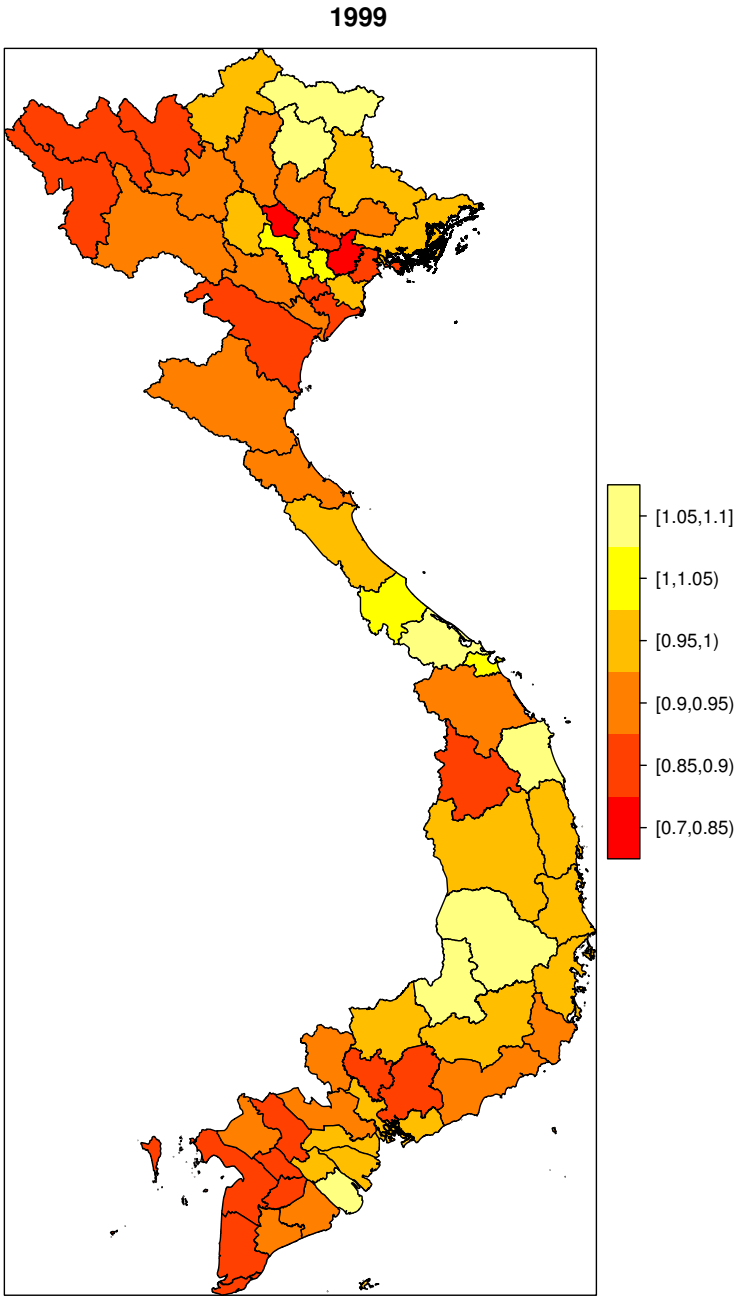


Figure 17: Marriage squeeze index by province, Vietnam, 1999 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*



also experienced heavy out-migration shortly following the war. The relationship between migration and marriage squeeze is explored further in the next section.

Table 4: Relationship between the Marriage Squeeze Index and bombing density during the Vietnam War, 1989.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.9036	0.0160	56.64	0.0000
log(bomb.per.km2)	-0.0110	0.0053	-2.07	0.0450

Table 5: Relationship between the Marriage Squeeze Index and bombing density during the Vietnam War, 1999.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.9462	0.0129	73.28	0.0000
log(bomb.per.km2)	-0.0002	0.0044	-0.05	0.9566

4.6 Relationship between the Marriage Squeeze Index and Migration

Forthcoming

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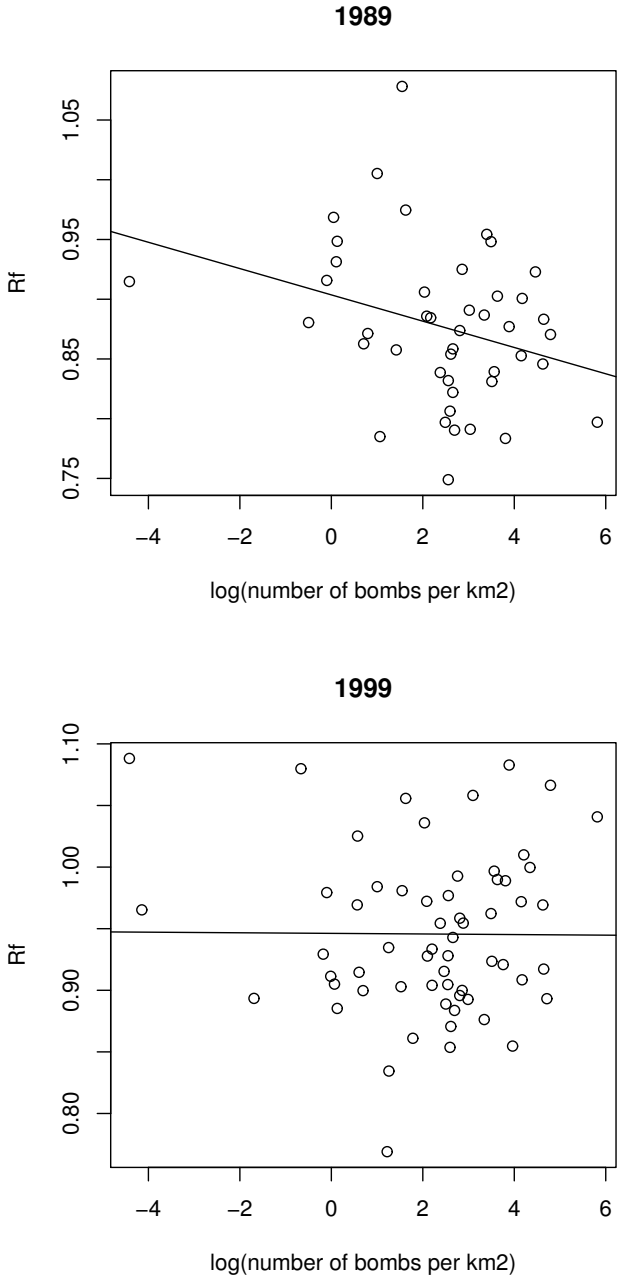
Figure 18: Bombing density during the Vietnam War and marriage squeeze index of provinces, Vietnam, 1989 *(Data source: 1989 and 1999 Vietnam Census, IPUMS International [14])*



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