World War II and Female Educational Attainment

Hollis Tardy
May 2017

ABSTRACT: This paper explores World War II's effect on female educational attainment. First, I analyze whether there is a link between World War II and female educational attainment. I then assess two possible channels through which the war could have affected a woman's likelihood of graduating from high school and from college: the marriage market and the labor market. I find that World War II is correlated with an increased probability of graduating from college for white women, but there is little to no correlation for non-white women. I also find little correlation between World War II and the probability of graduating from high school for white and nonwhite women alike. It is likely that effects of the marriage and labor markets together created a small net effect on female education.

Thanks to Professor Shester, Professor Davies, Professor Handy, Alice Cannon, and Wilson Miller for their assistance and feedback on this project.

I. Introduction

The United States is one among many countries that have experienced an exponential increase in female educational attainment during the 20th century. In 1940, 26.9% of females in the US age 18-19 were enrolled in school, where in 1990, this number jumped to 59.9%. Similarly, a mere 5.0% of females age 20-24 were enrolled in school in 1940, while 29.4% were enrolled in school in 1990 (nces.ed.gov). This substantial change happened in only 50 years, partially due to important developments during the 20th century that spurred a change in the female role in society. Legislation, such as The Nineteenth Amendment which guaranteed women the right to vote, and the Fair Labor Standards Act which mandated that women receive the same minimum wage as men, plausibly affected a woman's view of herself and the desire to pursue an education (nwhp.org).

Research has also documented the upward trend in female labor force participation through the 20th century, and it is probable that the simultaneous increases in female education and labor force participation were related (Olivetti 2013). As more women entered the labor force, returns to education increased, and as women became more highly educated, they entered labor force at higher rates.

Male educational attainment experienced an increase during this time period as well. Throughout the early 20th century and until World War II, high school graduation rates for men and women were strikingly similar. However, while men were significantly more likely than women to graduate from college during this time, males and females experienced nearly identical upward trends in the probability of graduating from college (Acemoglu and Autor 2012).

While the 20th century saw a continued upward trend in both high school and college attendance for women, the trend was not linear (Figures 1 and 2). For many of the peaks and valleys in the trends, historians and economists have provided plausible historical explanations. The probability of graduating from college dipped in the late 1920s and early 1930s, for example, likely due to the Great Depression (Figure 2).

In the middle of the 20th century, however, World War II rocked the status quo in the United States and the majority of the world. As the United States fought to defeat Hitler and the Nazis, societal trends and gender roles on the home front were forced into change due to the large number of men at war and the country effectively united behind the cause at home. Economists have documented many major effects of the War, given the nice case study that it provides. Trey (1972) discusses the wartime increase in female labor force participation that was actually not as salient as many believe. Bound and Turner (2002) analyze the G.I. Bill, which provided a college education at no cost to veterans upon their return from the war, and its role in increasing male educational attainment. Like Bound and Turner, Lazerson (1998) also notes the general growth of higher education following World War II. Surprisingly, though, while extensive literature exists on many of World War II's societal effects, economists have not yet documented the plausible changes in female educational attainment stemming from World War II. This paper seeks to analyze the War's effect on the educational trends of women in the mid-20th century and the channels through which those changes took place.

To answer this question, I create a model which regresses high school and college graduation rates on birth cohort and includes multiple state-level measurements of the number of men at war to target the channel through which female educational attainment may have changed. Results are consistent with a positive effect of the marriage market and a negative effect of the labor market on the probability of a white woman graduating from college.

Section II provides a review of existent economic literature on the effects of World War II, specifically regarding the war's effects on male education and female labor force participation. Section III describes the theory behind this paper's analysis. Section IV gives explanation of the data used in this analysis. Section V provides an empirical model and estimation strategy. Section VI delivers empirically-based results. Section VII concludes and suggests avenues for further research.

II. Literature Review

World War II's Effects on Female Labor Force Participation

Significant existing literature explores the effects of World War II on the societal trends of the United States, including women's participation in the labor force. Trey (1972) finds that the increased female labor force participation during the war was not lasting upon the return of soldiers to the home front. Women were a "reserve labor force" in the absence of men, a pattern which was also seen during World War I. While women were forced into this new role with a "new conception of themselves," Trey argues that societal ideology of the woman's position did not change; women were largely seen as mothers and wives instead of workers. However, Trey does note a change in the attitude about women's capability as workers stemming from World War II. Schweitzer (1980) shows similar evidence that female wages increased during World War II, but subsequently fell at the end of the war. Goldin (1991) echoes Trey (1972) and Schweitzer (1980) in finding only a modest effect of World War II on women's employment. She cites that immediately preceding the war in 1940, 15.6% of married white women were employed. At the end of the war in 1944, though, that number increased to 21.7% for women whose husband was present on the home front, and skyrocketed to 52.5% for women whose husband was at war. While it seems that women entered the labor force during the war in the absence of men, Goldin notes that they lost their jobs or left voluntarily when soldiers returned; only about 20% of the women employed in 1950 entered the labor force during the war. It is possible, though, that World War II had a long term impact on women's attitudes, if not employment levels; one potential impact of the war that Goldin specifically mentions is its effect on female educational attainment.

Additional economists consider the labor force behavior of specific groups of women during World War II. Goldin (2006) finds that the 15% increase in the female labor force participation rate from 1930-1950 stemmed largely from married women. The increase in numbers of single women in the labor force during this time was insubstantial, if present at all. Goldin also notes that part-time jobs became more popular during these decades. Goldin and Olivetti (2013) analyze the

labor supply of married women and find that married women, and specifically those in the upper half of the education distribution, experienced a substantial wartime increase in weeks worked and labor force participation. Married women without children experienced a larger but shorter-run increase, where the impact on married women with children was smaller but more persistent in the long run. Coleman and Pencavel (1993) address the relationship between female educational attainment and employment, specifically studying the employment rates and work hours of women from 1940 to 1980. They find a downward trend from 1940 to 1980 in hours worked for women with less education, but an upward trend for more educated women. Acemoglu, Daron, and Lyle (2004) examine the effect of the number of men at war on the female labor supply and wage rates. They find that the states who sent higher percentages of men to the war showed higher levels of female employment in 1950. They also find that these shifts reduced both male and female wages, ultimately resulting in greater wage inequality between high school and college educated men.

World War II's Effect on Male Educational Attainment

While World War II spurred important changes for women, men experienced lasting effects as well, specifically with regards to educational attainment. Bound and Turner (2002) discuss the G.I. Bill's effect on male education after World War II and argue that it brought about the "democratization" of American higher education by making college a viable option for a wider range of men. They find that World War II increased the average years of college completed for males by roughly 0.25 years and increased college completion rates by 5-6 percentage points. Lazerson (1998) also analyzes the effects of World War II on education, discussing a general growth of higher education in the years after World War II. He notes how higher education transitioned from being a "public good to a private benefit that confers economic rewards." Lazerson specifically argues that "higher education's postwar success was built on three already established patterns and beliefs: vocationalism, public higher education, and multiple sectors of postsecondary school." Turner and Bound (2003) examine the racial disparity in the G.I. Bill's effects on male

educational attainment and find that, while the G.I. Bill had large and substantial impacts on the educational attainment of white men and black men living outside of the South, its effect was nonexistent for Southern black men. Larsen et al. (2015) discuss whether the G.I. Bill altered the structure of marriage through assortative mating. They find that men who were eligible to receive education through the G.I. Bill married women with roughly 0.4 more years of education, compared to men who barely missed the eligibility cutoff, pointing to assortative mating as a means through which World War II changed the structure of marriage in the United States.

My paper will contribute to existing literature by specifically analyzing World War II's effect on female educational attainment. While substantial literature has discussed female labor force participation during the war and male educational attainment after the war with the creation of the G.I. Bill, a gap exists in a complete understanding of women. Given the sizable increase in female educational attainment in the last century, the societal changes that happened during the war may provide extensive insight on the source of these meaningful improvements.

III. Theory

Marriage Market

There are several potential mechanisms through which World War II could have affected women's educational attainment. On one hand, it is possible that the substantial number of men at war could have increased female educational attainment through the marriage market. If women were less likely to marry young since the men they would have "matched" with were at war, they may have continued their schooling, in which case we would expect female educational attainment to have increased during this period. Further, economists have documented the increased male educational attainment after World War II due to the G.I. Bill, which provided free education to war veterans upon their return to the states (Bound and Turner 2002); it is possible that this increase in male educational attainment led men to marry later, thus postponing marriage for females and theoretically allowing them to attend school for a longer time before marriage. Finally, it is possible that assortative mating increased female educational

attainment during this time. With more men attending college due to the G.I. Bill, women may have desired to "match" with those men, leading them to attend college as well and further their own educational attainment with marriage motives (Larsen et al. 2015).

Labor Market

It is also possible that the number of soldiers absent from society during the war may have decreased women's educational attainment through the labor market. With an increased number of jobs available, women may have entered the labor force in higher numbers during the war given the additional employment opportunities, postponing or ending their education in favor of employment. Economic literature has already documented that married women in particular entered the labor force in increased numbers during the war in an effort to support their families (Goldin 2006). Increased wartime employment opportunities through war contracts may also have affected the educational attainment of women during World War II. During the War, FDR asked companies to contribute to the war by changing their production habits to more closely align with the United States' wartime needs. Thus, approximately 24 million Americans, including 8 million women, entered into defense jobs during the war (PBS). With more jobs created to accommodate these employment changes, women may likely have chosen to enter the labor force instead of pursuing additional education. This paper will give insight into whether these potential mechanisms played a role in the change in female educational attainment during World War II.

IV. Data

To assess the effect of World War II on women's educational attainment, I use individual level data from the 5% sample of the 1960 US Census available from the Integrated Public Use Microdata Series (IPUMS). I limit my sample to variables for educational attainment, birth year, sex, race, veteran status, and state. Specifically, my analysis will focus on women born 1913-1936, or who turned 18 years old from 1931-1954. Because of that, I chose to use data from 1960 to ensure

that most women in my analysis would have completed their entire education by the time the census was taken. Given the existent racial disparity in educational attainment, I provide separate summary statistics for white and non-white women in my sample who turned 18 before, during, and after World War II. I also display the probability of a woman graduating from college in Figures 2 and 3.

Highest Educational Attainment by Race for Women Who Turned 18 Before, During, and After World War II

Turned 18 from…	1931-1940		1941-1945		1946-1954	
	White	Non-White	White	Non-White	White	Non-White
Less Than 9th Grade	23.91%	54.14%	16.13%	39.68%	12.48%	29.93%
Some High School	22.00%	22.46%	22.60%	28.03%	21.77%	31.56%
High School Grad	37.41%	15.60%	43.81%	22.33%	45.73%	26.71%
Some College	10.19%	4.17%	10.54%	5.80%	11.86%	7.04%
College Grad	6.49%	3.64%	6.93%	4.15%	8.16%	4.76%

The number of veterans who were at war is another factor that likely contributed to the educational attainment of women during World War II. Figure 4 displays state level differences in the percentage of men who fought in World War II. Because of the variation that existed, I account for the number of men at war throughout my analysis. The table below provides the same information seen in Figure 4, but in a different form. I limit these percentages to men of age 18-44 at the start of the war in 1941 since combat fighting in World War II was limited to that age range (Acemoglu, Daron, and Lyle 2004).

Percent of Men 18-44 Years Old in 1941 Who Fought in World War II

State	Percentage	State	Percentage
Alabama	33.6%	Montana	45.5%
Arizona	45.0%	Nebraska	36.1%
Arkansas	35.8%	Nevada	44.2%
California	47.3%	New Hampshire	42.7%
Colorado	42.7%	New Jersey	44.8%
Connecticut	44.5%	New Mexico	41.4%
Delaware	40.9%	New York	43.9%
District of Columbia	47.1%	North Carolina	32.9%
Florida	39.9%	North Dakota	38.2%
Georgia	32.9%	Ohio	41.7%
Idaho	42.8%	Oklahoma	40.3%
Illinois	39.9%	Oregon	44.5%
Indiana	36.9%	Pennsylvania	41.5%
Iowa	35.3%	Rhode Island	46.2%
Kansas	38.3%	South Carolina	32.7%
Kentucky	34.5%	South Dakota	37.9%
Louisiana	35.4%	Tennessee	35.2%
Maine	39.6%	Texas	38.3%
Maryland	38.2%	Utah	39.3%
Massachusetts	45.6%	Vermont	35.6%
Michigan	39.6%	Virginia	34.6%
Minnesota	38.1%	Washington	42.4%
Mississippi	32.1%	West Virginia	39.7%
Missouri	36.8%	Wisconsin	35.3%
		Wyoming	45.1%

Interestingly, the percentages I find range from 32%-48%. The magnitude of those percentages reinforces the importance of including men at war in my analysis and of including state-level variation. To add some perspective, in a pool of 300,000 men, a difference of 15% is 45,000 men, which seems significant. The large amount of men at war echoes the plausibility of both the marriage market and labor market theories for why World War II may have affected female educational attainment.

It is likely that the numbers reported in this table are an underestimation of the actual number of soldiers who were absent from the home front during World War II. Many American soldiers died during the war, and others likely died between

the end of the war and the time at which the 1960 Census was taken. While the percentage of war deaths was not consistent across all states, these statistics provide a rough, yet likely underestimated, picture of the demographic change that occurred during World War II due to the sizable percentages of men at war.

I also use data from The United States, 1790-2002 (Haines), that provides information on war contract spending by state during World War II. During World War II, President Franklin D. Roosevelt created the War Production Board, which supervised production of goods on the home front necessary to the war efforts (PBS). Because the United States produced many warplanes and warships, these war contracts created employment opportunities in states that received large contracts. The Haines dataset provides numbers of total war contract spending by state, which will be used as a proxy for employment opportunities during World War II that also varied by state. Figure 5 displays state-level variation in government funded war contracts per capita.

V. Empirical Model and Estimation Strategy

To analyze the effect of World War II on female educational attainment, I employ a linear probability model. My regression estimating this effect is as follows:

$$Educational\ Attainment_{ibcsr} = \beta_1 \%Veteran_{young,sb} + \beta_2 \%Veteran_{0-6,sb} + \beta_3 \%Veteran_{7-19,sb} + \beta_4 \%Veterans_{20+,sb} + \sum_c (\gamma_{1c} \%Veteran_{young,sb} + \gamma_{2c} \%Veteran_{0-6,sb} + \gamma_{3c} \%Veteran_{7-19,sb} + \gamma_{4c} \%Veteran_{20+,sb}) + \beta_5 War\ Contracts + \delta_s + \theta_{br} + \varepsilon$$

My dependent variable in this regression is a measure of educational attainment for individual *i* in birth cohort *b*, state *s*, region *r*, and year group *c*. I will run this regression twice, once with high school graduate and once with college graduate as indicator variables for the measure of educational attainment. Measuring both high school and college is necessary because it is very possible that women during World War II decided to drop out of high school to enter the

workforce, or to complete their high school education and then enter the workforce instead of attending college. It is also possible that women completed high school and college in higher rates during World War II, postponing marriage in the absence of so many men. Thus, separately measuring the effect of birth cohort on high school and college graduation rates is a necessary step in my analysis.

My regression focuses on the number of men at war through the "%Veteran" variables. I include four measurements in my regression, each with a different purpose. $\%Veteran_{0\text{-}6,\,sb}$ is a measurement of the number of men at war that focuses on the marriage market channel through which female educational attainment may have changed. It is a state-level measurement of the percentage of men who fought in World War II who were 0-6 years older than each birth cohort of women in my sample. In the 1940's, the median age gap in a marriage was roughly three years (Census.gov), and I allow for an additional three years on either side of that expected age gap. For example, since a woman born in 1925 would be "expected" to marry a man born in 1922, $\%Veteran_{0\text{-}6,\,sb}$ would include men born 1919-1925 for the cohort of women born in 1925.

$\%Veteran_{7\text{-}19,\,sb}$ is a similar state-level measurement that targets the labor market by including men who were 7-19 years older than each birth cohort of women in my sample. Men of this age range probably would not have "matched" with their respective birth cohorts of women in the marriage market, but would likely have created openings in the labor market for those women to fill. Further, limiting this measurement to men 7-19 years older than each birth cohort of women ensures that it does not pick up any generational effect of the war, since these men would not be the fathers of their respective birth cohorts of women. For a woman born in 1925, $\%Veteran_{7\text{-}19,\,sb}$ would include men born 1906-1918.

$\%Veteran_{younger,\,sb}$ is again a state-level measurement of veterans that includes men who fought in World War II but were younger than their respective birth cohorts of women. Because these men presumably would not have been in either the marriage market or labor market, I include this measurement to keep them in my sample without skewing results. For the 1925 birth cohort of women, this measurement would include men born after 1925.

Finally, %Veteran$_{20+,\,sb}$ is the state-level measurement of veterans including men who were 20 or more years older than each birth cohort of women. This measurement will pick up any generational effect of educational attainment since these men could have been the fathers of their respective birth cohorts of women. For the 1925 birth cohort of women, this measurement would include men born in 1905 or earlier.

I separate my sample of women into four year groups (1913-1918, 1919-1924, 1925-1929, and 1930-1936) to more closely measure the differential effects of the four %Veterans variables on each group. "c" is an indicator for the use of these groups. Since World War II spanned 1941-1945, I am most interested in the groups of women born 1919-1924 and 1925-1929. I separate these groups in 1925 since Figures 2 and 3 suggest a significant increase in the probability of graduating from college for women born 1925-1929. Within the summation, I interact each year group with each of the four measurements of %Veteran (interactions marked by γ) for a total of 12 interaction terms (1913-1918 is the omitted reference category throughout my regressions). These interaction terms allow me to see the differential effect of each measurement of %Veterans on each year group of women and will hopefully indicate for which year groups the marriage market and labor market channels prove true.

I include state fixed effects (δ_s) in my regression to absorb any state-level variation in college quality, availability, or societal norms with regards to education. It is possible, for example, that the quality of education in the Deep South was lower than that of the Northeast, and the educational attainment of women changed in response. Given the heterogeneity of the United States, it is unreasonable to assume that females in all states would experience the same effects, so including state fixed effects is necessary.

I also include region-by-year fixed effects (θ) to absorb any regional variation in the quality and availability of education for each birth cohort of women. As with state fixed effects, it is possible that the availability of education varied by year within regions of the United States. Absorbing this variation allows for a more accurate picture of the effect of men at war on female educational attainment.

I also control for war contracts as a proxy for additional wartime employment opportunities in each state. War contracts is measured on a per capita basis, and is then divided by 100 to provide a more interpretable coefficient. The inclusion of this variable controls for additional labor market opportunities during World War II for women in my sample, outside of the additional openings that were created by the men who were absent from the home front during the war. I also include the interactions of war contracts with each year bin of women to account for the differential effect of war contract spending on each group of women.

It is possible that multiple of the variables previously described would have differential effects by race; we may see, for example, different effects of war contracts on educational attainment for whites and nonwhites, or that the percentage of men at war had a different effect on whites and nonwhites. It is necessary to analyze these groups separately to understand the full effect of World War II on patterns of female educational attainment. I will run the regression described above by race, analyzing the effect of World War II on female educational attainment separately for white and nonwhite women.

VI. Results

Predicted Effects

The table below displays predicted signs on the %Veterans coefficients in my regression analysis, in line with the marriage market and labor market channels through which World War II may have affected female educational attainment. The omitted cohort group in all tables is women born 1913-1918. Men born after 1930 or before 1898 likely would not have fought in World War II, resulting in coefficients that are meaningless for those categories. Also, women born 1913-1918 would have completed their education by the time of World War II, so we would expect zero effect of the war on those birth cohorts. Similarly, we would not expect men younger than a given birth cohort of women to affect their educational attainment through the marriage or labor markets, again resulting in zeros for those predicted categories. Predicted positive and negative signs on %Veterans 0-6 and

7-19 Years Older fall in line with expected effects of the marriage market and labor market channels on female educational attainment.

Predicted Signs on %Veterans Coefficients

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	0	0	0	N/A
0-6 Years Older	0	+	+	
7-19 Years Older	0	-	-	
20+ Years Older	N/A			

What was the World War II "Effect"?

Figures 1-3 display trends in the probability of graduating from high school and college respectively for white and nonwhite women. Figure 1 suggests a decrease in the probability of graduating from high school for white women who turned 18 during World War II, or around the year 1943. However, while nonwhite women experienced a continued upward trend in the probability of graduating from high school, there does not appear to be a differential effect due to the war. Figures 2 and 3 suggest an increase in the probability of graduating from college for white women who turned 18 during World War II, seen in the significant jump in the year 1943. Again, the effect does not seem to hold for nonwhite women; while the trend for nonwhite women is upward, it does not show a jump of magnitude similar to that of white women. Thus, trends seem to show that World War II affected white women's educational attainment, and although the upward trend continued for nonwhite women, it does not show evidence of a major change during the years of the war.

Channels of the World War II "Effect"

Empirical analysis continues to confirm the trends suggested by Figures 1-3 and examine the mechanism through which World War II may have affected female

educational attainment. Specifically, analysis will consider the marriage market and labor market channels through which the number of men at war may have influenced women's decisions with regards to education.

Probability of Graduating from High School for White Women

Table 1 presents results on the probability of graduating from high school for white women. The coefficient on %Veterans 0-6 Years Older and on its interaction terms are insignificant. Further, results show no differential effect for women born 1919-1924 or 1925-1929 (and thus turned 18 during World War II), given the lack of significance for the interaction terms. This suggest no correlation between the percentage of men in the marriage market and probability of graduating from high school for white women. Coefficients for %Veterans 7-19 years older show similar insignificant results, suggesting no correlation between the percentage of men in the labor market and the probability of graduating from high school for white women. However, the coefficient on War Contracts is negative and significant, suggesting that additional employment opportunities created by the war negatively affected a woman's probability of graduating from high school. It seems that there was no differential effect for women who turned 18 during the war, though, given the insignificance of the War Contracts interaction terms.[1]

Probability of Graduating from High School for Nonwhite Women

Table 2 displays results on the probability of graduating from high school for nonwhite women. Results are strikingly similar to that of white women, showing no significance for %Veterans 0-6 Years Older and 7-19 Years Older. This again suggests that the amount of men at war did not affect a nonwhite woman's probability of graduating from high school through the marriage market or labor

[1] In all regressions, the interaction term of %Veterans Younger and $I_{1930\text{-}1936}$ are of too large a magnitude to be accurate. This is likely because there were no men younger than women born 1930-1936 who actually fought in World War II, but few probably reported to the Census that they did so. Thus, the coefficient on this interaction term has no real meaning in all regressions.

market. Also, as with white women, the coefficient on War Contracts is negative and significant, but interaction terms with War Contracts show no significance.

Probability of Graduating from College for White Women

Table 3 presents results on the probability of graduating from college for white women. In examining the coefficients on interaction terms including %Veterans 0-6 years older, we see that they are all negative and significant. This suggests a negative correlation between a higher percentage of men at war and a white woman's probability of graduating from college, falling in line with predicted effects of the marriage market channel. In fact, for a woman born 1925-1929 (who turned 18 from 1943-1947), we would expect a 1 percentage point increase in the number of men at war 0-6 years older than a given birth cohort of women to increase the probability of graduating from college by an additional .281%, compared to women born 1913-1918. For interaction terms of other year groups, we see coefficients of similar magnitude. Coefficients hold for women born 1930-1936, possibly because these women would have been children or young teenagers during the war, making plans for their future and education based on societal trends in education. As a whole, we see a small net effect of %Veterans 0-6 years older on the probability of white women born 1919-1936 graduating from college. Results hold when the sample is limited to women who have previously graduated from high school, as seen in Panel B.

Similarly, Panel A shows negative and significant coefficients on interaction terms that include %Veterans 7-19 years older, suggesting a negative effect of openings in the labor market due to men at war on the probability of a white woman graduating from college. For a woman who was born 1925-1929 (and turned 18 from 1943-1947), we would expect a 1 percentage point increase in the number of men at war 7-19 years older than a given birth cohort of women to decrease the probability of graduating from college by an additional .322%, in comparison to the cohort of women born 1913-1918. Again, significance and sign on the coefficient for women born 1930-1936 holds, although magnitude decreases, likely due to future planning reasons, as previously mentioned. We see a net effect of %Veterans 7-19

years older that is small and negative for each birth cohort of women. As in Tables 1 and 2, the coefficient on war contracts is negative and significant, again suggesting that additional wartime employment opportunities negatively affected a woman's likelihood of graduating from college. Similar results hold in Panel B which includes only women who have previously graduated from high school, although coefficients on interaction terms are slightly different in magnitude.

Interestingly, the number of men at war who were younger than a given birth cohort of women also seemed to matter for a white woman's probability of graduating from college. Given the negative sign of the coefficient, it is possible that this effect also ran through the labor market; maybe some of these men who were old enough to fight in World War II held part time jobs as teenagers that became available to women during the war. Although this correlation is difficult to explain through the marriage market and labor market channels, it reinforces the idea that the number of men at war mattered for a woman's educational attainment.

Probability of Graduating from College for Nonwhite Women

Table 4 presents results for the probability of graduating from college for nonwhite women. As with Table 2, the coefficients on interaction terms that include %Veterans 0-6 Years Older and %Veterans 7-19 Years Older are not significant, suggesting that the labor market and marriage market channels did not affect nonwhite women in the same way as they affected white women. Surprisingly, we see a small but positive coefficient on the interaction term War Contracts * $I_{1925\text{-}1929}$. This does not fall in line with predicted signs and is difficult to explain.

Overall Trends

Taken together, my results suggest that World War II did impact female educational attainment. However, the effect was most pronounced for the probability of graduating from college for white women. My results suggest that the number of men at war affected white women both through the marriage market and labor market in the expected directions.

As a whole, World War II does not seem to have affected the probability of graduating from high school in the same way as college; many of the results for both the marriage market and labor market were insignificant. However, it seems that spending on war contracts did play some role in encouraging women to enter the labor force, although the effect was not different for women who graduated from high school during World War II. It is possible that the war affected high school graduation rates less than that of college due to the lower cost of and easier access to high schools for women during this time period.

It is also not surprising that my results show little to no effect of World War II on the educational attainment of non-white women. Because few non-white men fought in the war, we would not expect the large total number of men at war to affect non-white women in the same way. Literature has also documented that a greater percentage of nonwhite than white women were in the labor force women at the start of the war, so it makes sense that nonwhite women would not experience a large effect of the labor market (Goldin 1977). Further, given the racial inequality that was still prevalent in the United States in the 1940s, we would not expect white and non-white women to receive equal benefits in educational attainment and societal role stemming from World War II.

Multiple mechanisms likely worked in opposite directions during World War II to affect the educational attainment of women, creating a net effect on the probability of graduating from high school or college that was relatively small and has gone largely unnoticed in literature by economists and historians alike. Results in this paper suggest that the war did impact female education, positively in some channels and negatively in others, but in a much more pronounced fashion for white women.

VII. Summary

World War II was a major, worldwide event of the 20th century that created lasting effects on the United States. Given the large numbers of soldiers at war and the way in which the United States rallied behind the cause, it is reasonable to expect large effects, both concrete and ideological, to result from the war. Literature

has shown the positive influence of World War II on male educational attainment through the G.I. Bill. It has also shown modest positive effects on female labor force involvement during the war, though the lasting effects are more debatable. Further, literature has theorized about ideological changes resulting from World War II, especially regarding the female role in society and even female educational attainment.

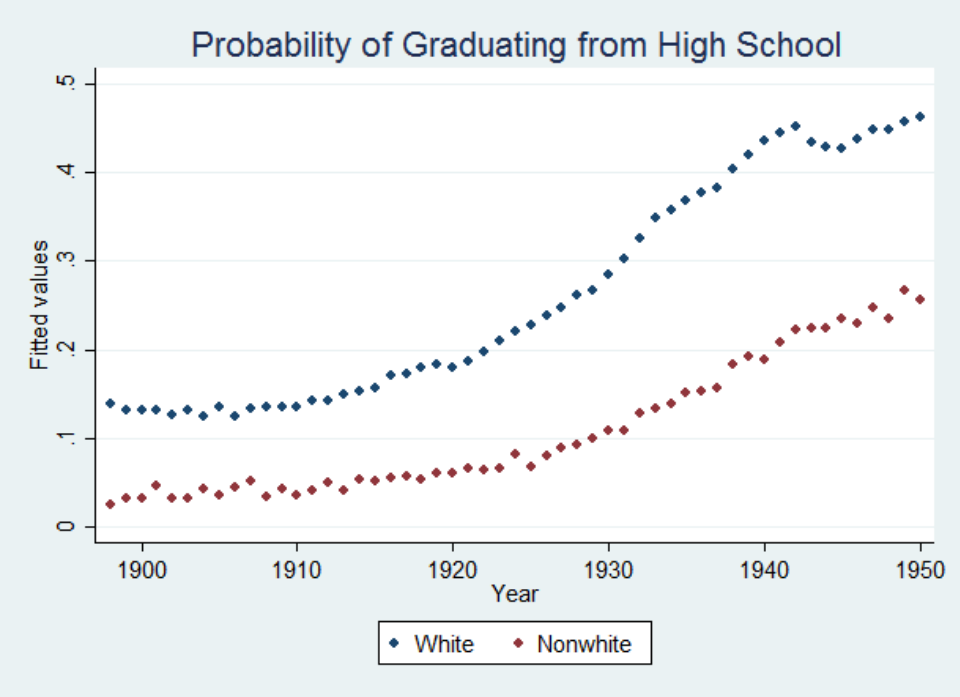
This paper finds a positive correlation between the amount of men of age to marry a given birth cohort of women and the probability of white women graduating from college. It seems that the amount of men at war influenced women's decisions about their education; this is not surprising, given the large percentage of men from each state who were absent from the home front during this time. However, this paper also shows evidence that this large male absence also opened jobs in the labor market, allowing some women to enter the labor force and forgo additional education in an effort to support their families or increase their own economic wellbeing. These effects may have worked against each other to create a small net effect on female educational attainment.

As Trey (1972) suggests, it is possible that ideology about the female role in society changed during World War II. With women being forced into the labor market to support a family, or being given the opportunity to continue their education in the large absence of men from society, their view of themselves and society's view of a woman's capability likely evolved during the war. In a world that has still not reached complete gender equality, any change in female educational attainment or ideology surrounding female capability may be of particular note. Thus, understanding the reason behind the changes that occurred during World War II is of interest in grasping the overall picture.

Further research should examine how the changes that took place during World War II played out in the following years. Did the trend of female education return to its previous level in the decades the war, or did the war really cause a change in ideology surrounding a woman's role in society? How did these potentially permanent changes in female education affect job placement in the labor market? How did the behaviors and decisions of men respond to these ideological

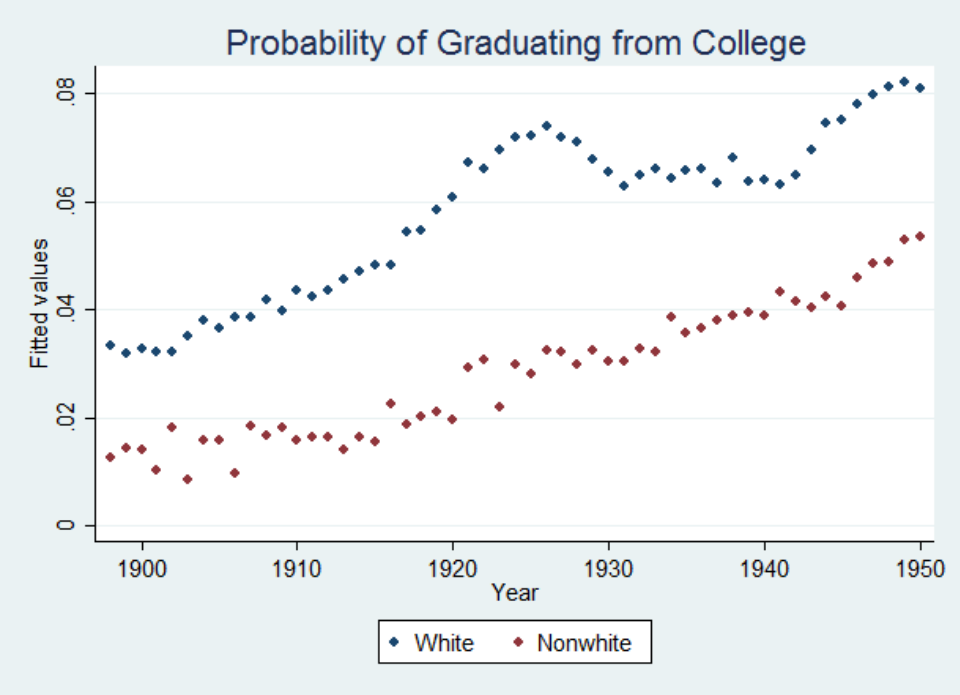
changes surrounding women? In attaining the ultimate goal of gender equality in education, these questions may be important for economists and scholars in other fields to address.

Figure 1: Probability of Graduating from High School



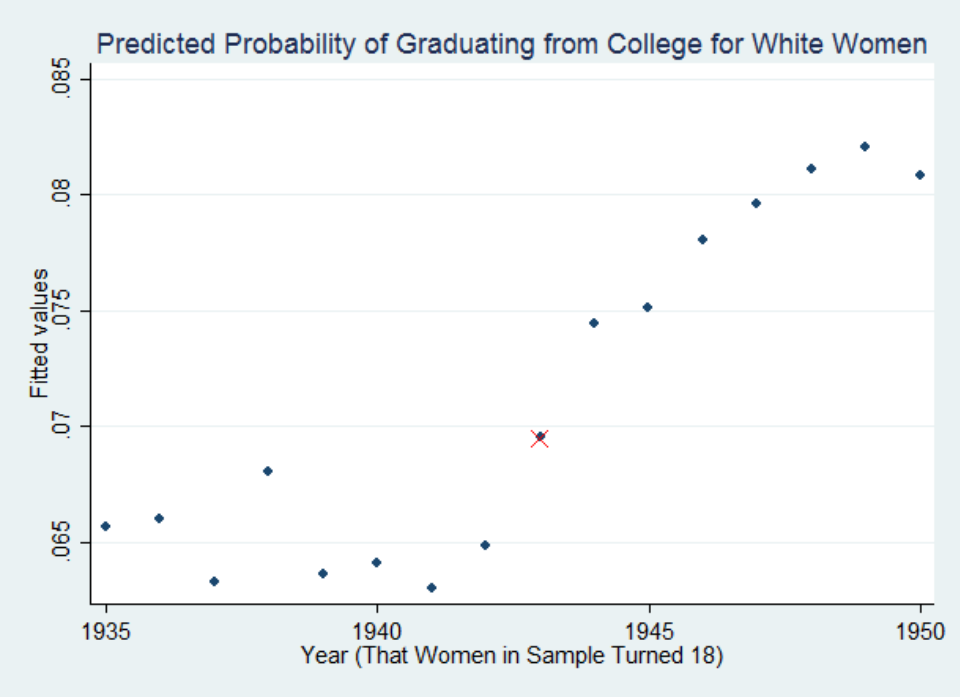
Notes: X-axis shows the year in which the female turned 18 years old. Data comes from the 1960 US Census.

Figure 2: Probability of Graduating from College



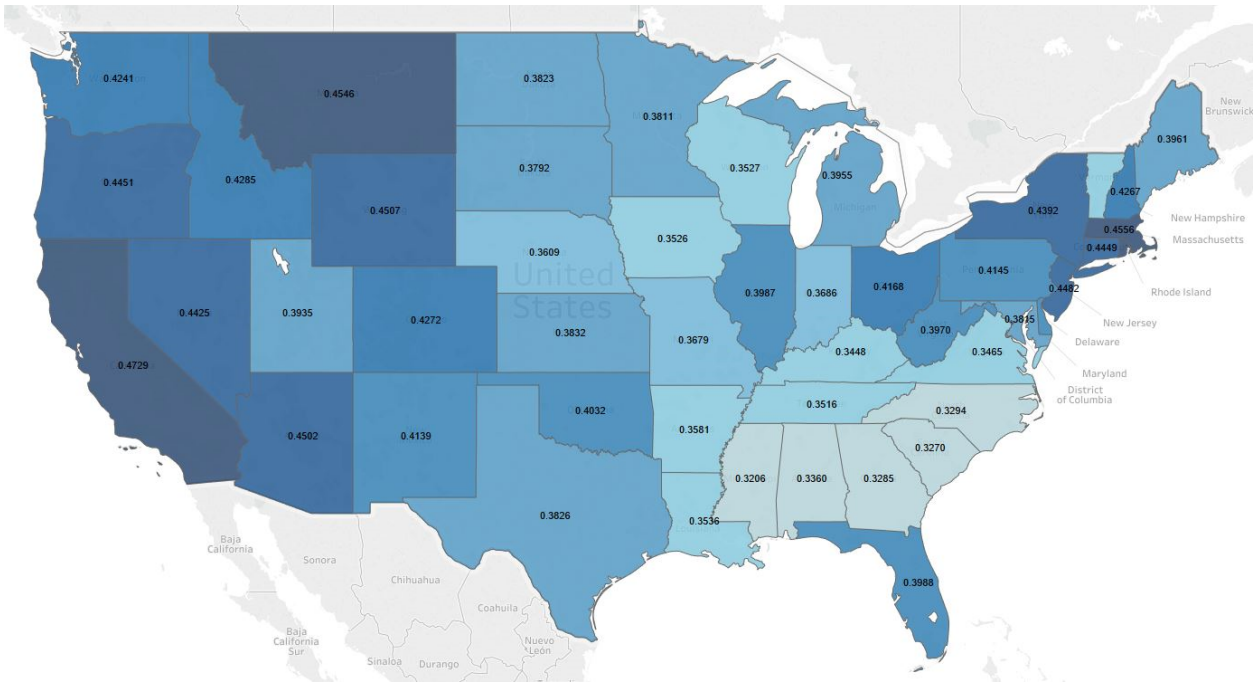
Notes: X-axis shows the year in which the female turned 18 years old. Data comes from the 1960 US Census.

Figure 3: Probability of Graduating from College for White Women



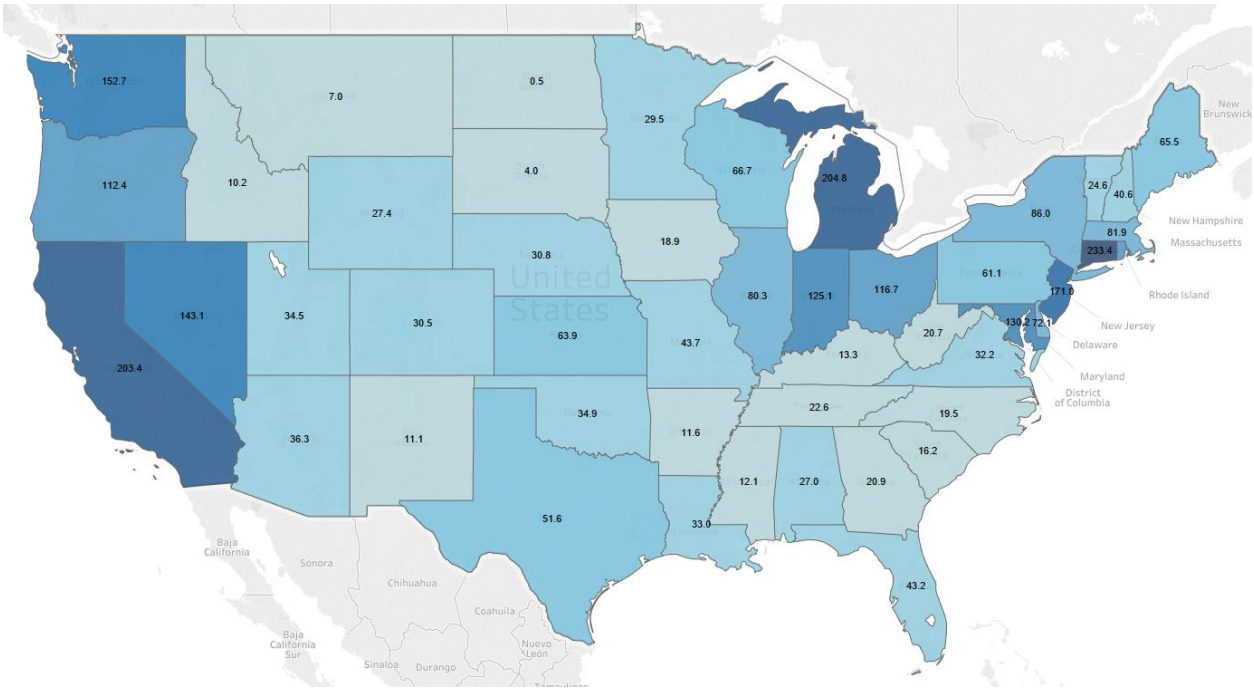
Notes: X-axis shows the year in which the female turned 18 years old. Data comes from the 1960 US Census. Red X marks the year 1943, where the upward trend in the probability of graduating from college begins.

Figure 4: Percentage of Men at War



Notes: Measurement includes men who were 18-44, or of age to be in combat, at the start of World War II in 1941. Darker shades indicate higher percentages. Percentages range from 32% in Mississippi to 47% in California.

Figure 5: War Contract Spending Per Capita



Notes: Total state spending is measured on a per capita basis. Values indicate dollar amounts. Darker shades indicate higher spending. Spending ranges from $0.50/person in North Dakota to $233.40/person in Connecticut.

Table 1: White High School Graduates

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	-0.347*	0.154	0.463	134.4
	(0.174)	(0.113)	(0.314)	(209.100)
0-6 Years Older	0.381	-0.0976	-0.185	0.153
	(0.253)	(0.163)	(0.224)	(0.212)
7-19 Years Older	0.517	0.104	-0.206	-0.495
	(0.332)	(0.297)	(0.315)	(0.334)
20+ Years Older	0.836	-0.35	-0.422	-0.352
	(0.809)	(0.540)	(0.666)	(0.688)
War Contracts	-10.99***	0.000434	-0.00658	-0.00657
	(2.988)	(0.006)	(0.009)	(0.011)

Notes: The dependent variable is the probability of graduating from high school for white women. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 1,167,158 observations. R-squared = 0.026. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 2: Non-White High School Graduates

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	-0.598*	0.311	-1.643	-82.78
	(0.331)	(0.292)	(1.218)	(52.190)
0-6 Years Older	-0.0414	-0.198	0.209	0.256
	(0.170)	(0.138)	(0.155)	(0.184)
7-19 Years Older	0.132	0.278	-0.0511	0.0631
	(0.215)	(0.228)	(0.237)	(0.243)
20+ Years Older	0.57	-0.14	-0.934	-1.346*
	(0.660)	(0.722)	(0.695)	(0.757)
War Contracts	-25.26***	0.0215	0.0152	-0.0193
	(3.355)	(0.017)	(0.018)	(0.025)

Notes: The dependent variable is the probability of graduating from high school for non-white women. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 146,013 observations. R-squared = 0.068. Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 3: White College Graduates

Panel A: All Women

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	-0.013	-0.0847*	-0.620***	71.37
	(0.092)	(0.049)	(0.152)	(68.840)
0-6 Years Older	-0.266***	0.230***	0.281**	0.269***
	(0.098)	(0.080)	(0.106)	(0.099)
7-19 Years Older	0.242*	-0.389***	-0.322**	-0.250*
	(0.136)	(0.123)	(0.129)	(0.137)
20+ Years Older	-0.238	0.247	0.184	0.187
	(0.358)	(0.309)	(0.341)	(0.342)
War Contracts	-4.656***	-0.000892	0.00403	0.00971*
	(1.517)	(0.002)	(0.004)	(0.005)

Notes: The dependent variable is the probability of graduating from college for white women. Panel A includes all women in the sample. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 1,167,158 observations. R-squared = 0.007. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Panel B: Only including high school graduates

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	0.0104	-0.122	-0.928***	80.43
	(0.120)	(0.082)	(0.258)	(95.310)
0-6 Years Older	-0.296***	0.256***	0.283**	0.238**
	(0.108)	(0.089)	(0.119)	(0.114)
7-19 Years Older	0.195	-0.440***	-0.285*	-0.172
	(0.163)	(0.150)	(0.157)	(0.165)
20+ Years Older	-0.538	0.318	0.297	0.31
	(0.520)	(0.471)	(0.493)	(0.486)
War Contracts	0.00754	-6.88E-05	0.00766*	0.0132**
	(0.009)	(0.003)	(0.004)	(0.006)

Notes: The dependent variable is the probability of graduating from college for white women. Panel B includes only women who have previously graduated from high school. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 697,717 observations. R-squared = 0.006. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4: Non-White College Graduates

Panel A: All Women

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	0.1	-0.336*	-0.647	40.48
	(0.131)	(0.173)	(0.531)	(41.230)
0-6 Years Older	-0.125*	0.0852	0.0846	0.0848
	(0.071)	(0.059)	(0.073)	(0.069)
7-19 Years Older	-0.119	0.00501	-0.0485	-0.0168
	(0.082)	(0.091)	(0.096)	(0.103)
20+ Years Older	-0.18	-0.0295	0.116	-0.118
	(0.242)	(0.256)	(0.275)	(0.285)
War Contracts	0.126	-6.43E-05	0.0157**	0.0165
	(1.489)	(0.005)	(0.008)	(0.010)

Notes: The dependent variable is the probability of graduating from college for non-white women. Panel A includes all women in the sample. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 146,013 observations. R-squared = 0.008. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Panel B: Only including high school graduates

	X	$X * I_{1919\text{-}1924}$	$X * I_{1925\text{-}1929}$	$X * I_{1930\text{-}1936}$
%Veterans				
Younger	0.0661	-0.636	-1.726	49.7
	(0.414)	(0.442)	(1.348)	(107.000)
0-6 Years Older	-0.303	0.226	0.168	0.1
	(0.181)	(0.150)	(0.198)	(0.183)
7-19 Years Older	-0.308	0.0179	0.0667	0.129
	(0.191)	(0.216)	(0.239)	(0.233)
20+ Years Older	-0.453	-0.0288	0.391	0.0489
	(0.627)	(0.662)	(0.763)	(0.745)
War Contracts	-2.229*	0.00173	0.0264	0.0334
	(1.176)	(0.015)	(0.025)	(0.027)

Notes: The dependent variable is the probability of graduating from college for non-white women. Panel B includes only women who have previously graduated from high school. Coefficients on interaction terms compare to cohort of women born 1913-1918. Each measurement of %Veterans includes a different age range of men. Regression includes State Fixed Effects and Region-by-Year Fixed Effects., and is measured using 45,593 observations. R-squared = 0.034. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

References

Acemoglu, Daron, and D. Autor. "The basic theory of human capital." Lectures in labor economics (2012): 3-34.

Acemoglu, Daron, and David Lyle. "Women, war, and wages: The effect of female labor supply on the wage structure at midcentury." Journal of political Economy 112, no. 3 (2004): 497-551.

Bound, John, and Sarah Turner. "Going to war and going to college: Did World War II and the GI Bill increase educational attainment for returning veterans?" *Journal of labor economics* 20, no. 4 (2002): 784-815.

Coleman, Mary T., and John Pencavel. "Trends in market work behavior of women since 1940." ILR Review 46, no. 4 (1993): 653-676.

Elliott, Diana B., Kristy Krivickas, Matthew W. Brault, and Rose M. Kreider. "Historical Marriage Trends from 1890-2010: A Focus on Race Differences." United States Census Bureau. https://www.census.gov/hhes/socdemo/marriage/data/acs/ElliottetalPAA2012presentation.pdf.

Goldin, Claudia. "Female labor force participation: The origin of black and white differences, 1870 and 1880." The Journal of Economic History 37, no. 01 (1977): 87-108.

Goldin, Claudia. "The quiet revolution that transformed women's employment, education, and family." (2006).

Goldin, Claudia D. "The role of World War II in the rise of women's employment." *The American Economic Review* (1991): 741-756.

Goldin, C., & Olivetti, C. Shocking labor supply: A reassessment of the role of world war II on women's labor supply. The American Economic Review, 103(3), 257-262. (2013).

Haines, Michael R., and Inter-university Consortium for Political and Social Research. Historical, Demographic, Economic, and Social Data: The United States, 1790-2002. ICPSR02896-v3. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-05-21. http://doi.org/10.3886/ICPSR02896.v3

Larsen, Matthew F., T. J. McCarthy, Jeremy G. Moulton, Marianne E. Page, and Ankur J. Patel. "War and Marriage: Assortative Mating and the World War II GI Bill." Demography 52, no. 5 (2015): 1431-1461.

Lazerson, Marvin. "The disappointments of success: Higher education after World War II." *The Annals of the American Academy of Political and Social Science* (1998): 64-76.

National Women's History Project. "Timeline of Legal History of Women in the United States." http://www.nwhp.org/resources/womens-rights-movement/detailed-timeline/.

Olivetti, Claudia. *The female labor force and long-run development: the American experience in comparative perspective*. No. w19131. National Bureau of Economic Research, 2013.

PBS. "War Production." http://www.pbs.org/thewar/at_home_war_production.htm.

Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. *Integrated Public Use Microdata Series: Version 6.0* [dataset]. Minneapolis: University of Minnesota, 2015. http://doi.org/10.18128/D010.V6.0.

Schweitzer, Mary M. "World War II and Female Labor Force Participation Rates." The Journal of Economic History 40, no. 01 (1980): 89-95.

Snyder, Thomas D. "120 Years of American Education: A Statistical Portrait." Center for Education Statistics. http://nces.ed.gov/pubs93/93442.pdf.

"State Summary of War Casualties from World War II for Navy, Marine Corps, and Coast Guard Personnel." NARA—WWII Casualties— Military Records. [Online version,https://www.archives.gov/research/military/ww2/navy-casualties, National Archives and Records Administration, August 15, 2016.

Trey, Joan Ellen. "Women in the war economy--World War II." *Review of Radical Political Economics* 4, no. 3 (1972): 40-57

Turner, Sarah, and John Bound. "Closing the gap or widening the divide: The effects of the GI Bill and World War II on the educational outcomes of black Americans." The Journal of Economic History 63, no. 01 (2003): 145-177.

"World War II Honor List of Dead and Missing Army and Army Air Forces Personnel." NARA—WWII Casualties— Military Records. [Online version, https://www.archives.gov/research/military/ww2/army-casualties, National Archives and Records Administration, August 15, 2016.