

The Pensions and Labor Force Participation of Civil War Veterans and Non-Veterans

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Abstract

This paper examines the impact of Civil War pensions on the labor force participation of the veterans and non-veterans. The main question is how much the pensions reduce the labor force participation of pensioners. The analysis shows a substantial difference in the participation rate among the pensioners, which closely correspond to the variation in pension income. The pensions account for as much as 15 percent reduction in the participation rate. The analysis also finds a significant impact of health and occupation, and supports previous findings about the declining elasticity of retirement with respect to pensions. Furthermore, a comparison of the participation rate between veterans and non-veterans reveals a strong regional difference in retirement behavior. A lower participation rate of Union veterans who received the pensions was not only caused by the pensions, but also the lower participation rates in the Northern states.

1. Civil War Pensions and Retirement

During the last century, retirement became an important aspect of the U.S. labor market. The retirement rate has substantially increased, and more Americans leaved labor market at earlier age, changing the ratio of retirees and workers. These changes coincide with the advent of the social security system, old age and disability benefits programs, which has grown significantly. The extent to which these benefits affect retirement is not only an interesting issue to analyze, but also an important question to ask from the point of view of public policy. The desirability of these programs must be compared with the reduction in the labor force they produced. Several studies in the past have attempted to empirically measure the change in labor force participation produced by the change in non-labor income from several programs. This paper will approach the issue by using the Civil War pensions to identify the effect of pension income on labor force participation of the veterans.

The original study in this area is Costa (1993,1995, and 1998), which found that a substantially lower participation rate of the Union Army veterans compared to the US population resulted from the income effect of the federal pension system. In addition, a comparison over time reveals a declining elasticity of retirement with respect to income. Recently, the Center for Population Economics at the University of Chicago (CPE), and the IPUMS project at the University of Minnesota has released new data sets, which are suitable for this analysis. The availability of new data sets, which is larger and more comprehensive, made it sufficiently important to reexamine the earlier estimates of the impact of the Civil War pension on retirement rate.

Among the data sets analyzed here are the 1910 U.S. census data from IPUMS, and the pension, the 1910 and the 1900 census records of the Union Army veterans from the CPE. In addition to the variables from the Census, the pension records from the CPE provide information from all of the veterans' federal pension applications so life-cycle variables such as the amount of pension they received each year, and their occupation can be inferred. The CPE data were collected from the national archive in Washington DC under the project *Early Indicators of Later Work Level, Disease, and Death* by the Center for Population Economics at the University of Chicago, and the Brigham Young University.¹ A sample of 4,528 Union veterans who were found in both the pension records and the 1910 Census Data were selected from the CPE data. Another sample, which consists of 7,023 Union veterans who were linked to the

pension record and the 1900 census were selected. The IPUMS data set provides a 1% random sample of the 1910 census, which is the only census that asks whether the respondent is a Civil War veteran, and in which army the respondent served. Two veteran samples were selected from the IPUMS 1910 Census. The IPUMS Confederate sample consists of 617 Confederate veterans. The IPUMS Union sample consists of 1,500 Union veterans.

Table 1.1 provides summary statistics of several variables found in the three samples.² Despite their differences in size, the CPE sample and the IPUMS Union sample have similar summary statistics. The age distributions are similar in all of the 1910 samples. The mean age is 69 in 1910 and 60 in 1900. The Confederate sample differs in some aspects to both Union samples. In addition to the higher participation rate of the Confederate sample, Confederate veterans have larger family size, and are more likely to live in farm households and rural areas. The literacy rate is approximately 6% lower than the Union veterans. The proportion of Confederate veterans who owned a house, and those who own a house free of mortgage is higher than the corresponding proportion of the Union veterans. A comparison of the distribution of veterans by occupation³ reveals that, among the working veterans, more than 70 percent of the Confederates Army veterans are farmers, while less than 50 percent of the Union army veterans are. Finally, the data sets exhibit a strong regional difference in the distribution of the place of residence and the place of birth between the Confederate and the Union veterans. The majority of Union veterans from both samples were born in East North Central (ENC), Middle Atlantic (MA), New England (NE), and Pacific (PC). In contrast, the majority of Confederate veterans were born in East South Central (ESC), South Atlantic (SA), and West South Central (WSC).⁴ The same pattern is observed in the distribution of veterans by place of residence in 1910.

This paper is organized as follows. Section 2 discusses the federal pension system, and attempts to identify the effect of pensions by using the variation in pension income among the Union veterans to predict their participation status. Section 3 compares the participation rates of the Confederate and Union veterans, and examines several methods to estimate the pension effect by comparing the participation rate between the pensioners and non-pensioners. Section 4 provides concluding remarks.

2. Participation Rates of Pensioners and the Variation in the Pension Amount

The Civil War pension program granted large pension income to Union veterans. The pension was not compensation for a loss of a job nor were the veterans required to stop working to be eligible for the pension. The amount of the pension was granted based on the health status of veterans who fought for the Union Army. Therefore, the pension is a pure transfer from the federal government. By 1910, more than 90 percent of Union army veterans were receiving federal pensions. The average pension was \$189.08 a year. This amount represents 74% of a farm laborer's average annual income, 51% of a laborer's average annual income, and 22% of a professional's average annual income.⁵ Some Confederate states also granted state pensions. However, the pension amount is substantially lower. Federal pensions were originally granted to veterans who became disabled while serving in the Union Army during the Civil War. However, subsequent revisions allowed veterans to receive pensions based on old age or health problems unrelated to the war. Figure 2.1 shows the trend in the number of pensioners in the 1900 and 1910 CPE Union veterans sample. The number of pensioners increases slightly until 1890, when the increase begins to accelerate. The growth reaches a peak in 1890 and starts to level out in the 1890s and early 1900s.

Figure 2.2 plotted the mean of pension income per veteran⁶. To account for inflation and the changing interest rate, both the nominal value and the real value are plotted. The real profile was generated by multiplying the nominal value with the interest factor, which is the nominal interest rate.⁷ The base year is 1910. In contrast to the nominal pension profile, the real profile is relatively flat, and is bounded within range of \$150 to \$300 per year except for the years immediately follow the war. Since all of the profiles were constructed for veterans who received pensions at the particular year or age, they are conditional on the composition of pensioners. Humps observed in the left tail of the discounted real profile are expected. The left tail is composed of veterans who received pension immediately after the war at young ages. These veterans could attribute their disabilities to the war. Not only were the pension laws more favorable to them, but they also benefit by receiving the pension early. After the revision of the pension law in 1890, veterans were not required to trace their health problems to the war. Hence, the pensioners became composed of veterans who developed health problems after the war. In general, pension laws provided a smaller amount of pension income to these veterans. Therefore, the mean pension income falls, generating the hump shape. For this reason, the real profile appears to be more suitable for intertemporal comparison.

The effect of pension on participation rate can be estimated either by using the variation of pension income to predict participation status among the pensioners, or by comparing the participation rate of pensioners to non-pensioners. The first method is usually implemented by estimating the logistic or probit regression on a sample, which is restricted to the veterans who served in the Union Army and were eligible to receive the federal pension. The effect of pension is estimated by computing the change in the probability of participation between veterans who received a large amount of pension to the one with lower amount. This analysis was employed by most studies of the Civil War's federal pension system, and will be implemented in this section.

The neoclassical model of labor force participation in economic theory provides a general equilibrium framework that leads to the use of the variation of pension income in the estimation procedure. In the labor supply model, the objective of the veterans is to maximize their utility subject to their lifetime budget constraint. By making labor supply decisions, they trade off their leisure with labor income. They will choose to retire if their reservation wage is greater than the market wage. The reservation wage of the veteran is represented by the marginal rate of substitution between consumption and labor supply. Therefore, the decision to retire depends crucially on the determinants of the marginal rate of substitution, which is the amount of consumption after retirement.

Denote the market wage rate by w_t , the consumption by c_t , the labor supply by l_t , and the utility function by U , the probability to observe a veteran working in period t can be written as,

$$\text{Prob}(\text{work in } t) = \text{Prob}\left(-\frac{U_{l_t}(c_t, 0)}{U_{c_t}(c_t, 0)} \leq w_t\right).^8$$

Let the variable C represents consumption, X stands for socioeconomic variables, which affects reservation wage, and Z stands for the instrument for wage. Take the first order approximation of the marginal rate of substitution and market wage as follows,

$$-\frac{U_{l_t}(c_t, 0)}{U_{c_t}(c_t, 0)} = X\mathbf{b} + bC + \mathbf{e},$$

$$w_t = Z\mathbf{j} + \mathbf{m},$$

After some manipulation, the probability of working at time t is

$$\text{Prob}(\text{work in } t) = \text{Prob}(\mathbf{e} - \mathbf{m} \leq \mathbf{Zj} - \mathbf{Xb} - bC).$$

Under the assumption that the two disturbance terms, \mathbf{e} and \mathbf{m} , have the Weibull distribution, the above probability statement is the logistic function, which can be estimated using the observed retirement decision as the dependent variable, and the variable C, X, and Z as the explanatory variable. The level of consumption after retirement is determined from the veterans' full income after retirement, which is the total pension income, and the accumulated wealth.⁹ To proxy for this amount, home ownership status and mortgage status several measures of pension income were used in the regression. In addition, the proxies for reservation wage are age, health, and several socioeconomic characteristics. Proxies for health are body mass index (BMI), wound rating,¹⁰ a dummy whether the veteran was discharged from military service with disability, the number of year the veteran lived after 1910, and a dummy variable indicating whether the veterans served as a private. The BMI was constructed by Song (2000), and the wound rating was created by Sanchez. Both variables were created from the Surgeon's Certificates data set. Other proxies for socioeconomic characteristics include marital status, a dummy whether the veteran lived in farm household, a dummy whether the veteran was foreign-born, a dummy whether the veteran lived in urban county,¹¹ and state unemployment rate. Proxy for wage is occupation, which is divided into four broad categories, professional, clerk, laborer, and farmer. Retirees were assigned the most recent occupation they stated in their pension application before they retired.

The logistic model was estimated for a cross section sample from the 1900 CPE and 1910 CPE samples. The estimation results are reported in Table 2.1. The estimates of the coefficients of annual pension income are negative, and statistically significant. Using four other measures of pension income yield the same results. Table 2.2 reports the slope, elasticity, and the estimated change in participation rate due to the pension effect. The probability of participation in 1910 is lower by 0.00076 for every dollar of the average monthly pension income. If the veterans were granted the average monthly pension, which is \$188.70, the participation rate will be lower by 14 percent ($= -0.00076 * 188.70$). Applying the same computation to other measures of pension income results in a reduction in the 1910 participation rate between 6 to 14 percent. The estimates slope of the probability of retirement in 1910 from the 20 company sample is 0.0112, and the average annual pension income is \$171.90. (Costa, 1998) If the veterans were given the average pension, the participation rate will reduce by 19 percent ($= 0.0112 * 16.94$), which is

larger than the figures computed above. For 1900, the procedure implies reduction in participation rate between 1 to 3 percent.

The estimated elasticity of retirement with respect to pension income is reported in Table 2.2. The estimates vary substantially with the measure of pension income. The elasticity computed from lifetime pension or nominal measure of pension tends to be larger than those computed from annual or real measure. In 1910, the maximum estimate, 0.51, occurs when the monthly nominal pension income is used, and the minimum estimate, 0.18, occurs when then annual pension received in 1910 is used. The maximum elasticity from the 1900 sample, 0.43, occurs when the monthly average pension is used, while the minimum, 0.19, occurs when the lifetime real pension is used. This result suggests that life cycle consideration is an important aspect of the pension effect. The veterans react more toward the annuity feature of the federal pension, than toward the amount of pension in a particular period. The larger impact of nominal provides an evidence for imperfect capital market. A comparison between the elasticity between 1910 and 1900 does not provide a clear trend whether the elasticity is rising or falling. Elasticity computed from lifetime pension are rising from 1900 to 1910, while those computed from pension income received around 1910 and 1900 are falling. Nevertheless, the elasticity is much larger than zero, which confirms the hypothesis that the income elasticity of retirement is falling after 1910. In addition, the 1910 estimate from the 20 company sample, 0.47, is very close to the estimate for the monthly nominal pension income, 0.51, and the lifetime nominal pension income, 0.45. However, the 1900 estimate is lower than the estimate based on the 20 company sample, 0.73.

An important extension to the 20 company analysis is the inclusion of the interaction term in the regression. Table 2.3 shows that several of the pension-occupation interactions are statistically significant, although the magnitude of the interaction effect vary with the measure of pension income used in the regression. In 1910, the majority of the estimate indicates that professionals are the most sensitive to pension income, followed by clerk. Farmers and laborers are the least sensitive. Professionals are also the most sensitive to pension in 1900, followed by laborers and clerks. The most radical difference is that the income elasticity of farmers is mostly indistinguishable from that of professionals in 1900, implying that farmers are the most sensitive to pension in 1910. In addition, the occupation dummies together with the farm dummy variable indicate that farmers who lived in farm households are the most likely to participate

in labor market and farmers who live in non-farm households are the least likely. Most of the latter type of farmers was retired. This result confirms Lee (1995), which argued that liquidating the farm is an important means of financing retirement. Most farmers exit the labor force by transferring their farm to either their children or selling the farm to outsiders. Ostergen (1981) found that the latter method was gaining popularity when land value increased between 1885 and 1915. The high participation rate among farmers and the reduction in retirement elasticity from 1900 to 1910 may have resulted from the increase in land value as well as the self-employment nature of the occupation.

The regressions also found the effect of health on retirement. In both regressions, the number of year the veterans lived after the census and both the linear and quadratic mass index (BMI) are statistically significant. The longer the veterans lived after 1910, the less likely they are to retire. The estimated coefficients of BMI suggest that the participation rate initially rises as BMI increases, but after BMI has reached 26.35 in 1910 and 25.59 in 1900, the participation rate fall. Costa (1998) also found a U-shaped relationship between the retirement rate and BMI in the 20 company sample. Furthermore, veterans who were discharged from military service with disability were less likely to participate in the labor market. This effect is statistically significant in the 1900 sample. The estimate of wound rating, which measures the severity of body wounds mainly due to gun shot during the war, is negative as expected but not significant. The veterans who served as non-private are more likely to participate in the labor force. This suggests that non-privates were in better health, although it is not significant.

There is no conclusive evidence that different cohorts behave differently. In general, participation rate declines with age, but the interaction term between pension income and age are not statistically significant. The 1910 regressions generate positive estimates, while the 1900 regressions generate negative estimates. Similarly, the interaction term between pension income and urban/rural status are not significant. However, the urban/rural status itself is significant. In 1900, the estimate is negative, suggesting that veterans living in the urban area are more likely to retire. The estimate is positive but not significant in 1910. This result is consistent with the estimations based on the 20 company sample, which produce the same pattern.

Another finding are as follows. Veterans, who were head of household, rent a house or own a house, which is not free of mortgage, are more likely to participate in labor market. There is no evidence

that foreign-born veterans behave differently from the native. Both widowed and single veterans are more likely to retire. Veterans who have missing values in the own-rent variables and farm household status are significantly less likely to participate. The regressions also support Lee (1995), which found little evidence that veterans liquidate houses to finance retirement. The estimates suggest that veterans who rented a home have a higher probability of labor force participation. Homeowners are likely to be wealthy, allowing them to stay outside the labor market.

3. The Participation Rate of Pensioners and Non-Pensioners

An alternative method of analyzing the effect of pension on labor force participation is by examining the participation rate of the pensioners and the non-pensioners. This analysis identifies the pension effect by separating veterans into two groups, those who received the pension and those who did not receive the pension. Each group is subdivided by socioeconomic characteristic and the difference in the participation rate of the corresponding subgroup is compared. Using the data from the 1910 census, the labor force participation rates of the IPUMS Confederates, IPUMS Union, and CPE Union veterans can be compared by several demographic variables, proxies of wealth, and farm variables. There is a large discrepancy between the Union and Confederate veterans. The participation rate of the Union army veterans in 1910 from both IPUMS and CPE samples are 55%. These proportions are lower than the participation rate of the entire population in the same cohort, 66%, and the participation rate of the Confederate army veterans, 71%. The differences in participation rate may not be due to the pension effect alone. Several econometric approaches were employed in this study to separate other factors, which influence the divergence in participation rate, and identify the pension effect. The results below show that the difference in the participation rates between the Confederate veterans and the Union veterans reduce substantially when the data were conditioned by farm variables. However, the gap in participation rates were not reduced much when controlling by demographic variables such as age, marital status, family size, and head of household status.

Figure 3.1 presents the participation rates by age group. Age is grouped into three-year intervals. All samples generate a declining participation-age schedule, with the older veterans less likely to participate in the labor force. The Confederate's schedule lies uniformly above both the Union's schedules with the exception for the right tail, which exhibits fluctuations due to a small sample size of veteran older

than 82 years old. A similar pattern is observed in the participation by family size profile, as illustrated in Figure 3.2. The Confederate veterans' participation schedule lies uniformly above the Union counterpart, except at the right tail. In addition, the participation rate of veterans who live alone is substantially lower.

Comparisons by head of household status, marital status, mortgage status, and home ownership status are presented in Table 3.1. In general, the participation rate of the Confederate veterans is significantly different from the participation rate of the Union veterans in both samples. In all of the three samples, a head of household and a married veteran have a substantially higher participation rate than the non-head and the widowed veterans. Veterans who owned a home that is not free of mortgage or rent a home also have a higher participation rate, with the exception of the Confederate army veterans in the second case. Both characteristics are the only two proxies for wealth available. The higher participation rate suggests that they are reasonable proxies for wealth. However, these variables contain a sizable proportion of missing values. Moreover, the veterans who have missing values in these two variables tend to be retirees. Their participation rates are all significantly lower than their non-missing counterparts.

The 1910 census provides two farm variables. It indicates whether a veteran lived in a farm or non-farm household.¹² In addition, the enumerators asked the number of farm schedules¹³ any member of the household received for the purpose of the agricultural census. This number indicates the number of farms the household operates. Table 3.1 compares participation rates with respect to the two farm variables. When the data is conditioned on the farm household variable, the participation rate of the Confederate army veterans lies between the participation rate of the IPUMS Union veterans and the CPE Union veterans. In addition, the participation rate of veterans who lived in farm households are higher than those who live in the non-farm household in all of the three samples. Similarly, when the veterans is compared by the number of farm schedule, the gap in their participation rate is narrowed down substantially for veterans who live in households that received at least one farm schedule. Furthermore, the participation rate of veterans who live in the households that received at least one farm schedule is higher.

These results are anticipated because the pension was not randomly granted. Several factors that affect the composition of pensioners must be taken into account. That the differences in participation rate reduce and become statistically insignificant when the data are conditioned on farm variables implies that regional differences account for a large portion of the differences. Most Union veterans were born and lived

after the war in the northern states, which are less agricultural. Figure 3.3, which illustrate the participation rate of the US population by state, show that the labor force participation rate in the south is generally higher. Therefore, the regional effect is an important factor, which contributes to the lower participation rate of the Union veterans in addition to the pension effect. Comparison of the participation rate of the Confederate and Union veterans must adequately control for the regional difference in order to identify the effect of pension income on labor force participation. Otherwise, the pension effect will be overestimated.

The overestimation of the pension effect can be formally demonstrated as follows. Let X denotes individual characteristics such as age. Let R denotes region, which is either north, n , or south, s . Let V denotes the veteran status, where V is equal to c for Confederate veterans, u for the union veterans, and n for non-veteran. Let A denotes pension status. A is equal to 0 if the individual did not receive a pension and 1 if the individual received pension. For each person, denote the participation function by $P(A,R,V|X)$. The direct comparison of the participation rate of the Union and Confederate veterans, $P(A = 1, R = n, V = u | X) - P(A = 0, R = s, V = c | X)$, can be written as

$$[P(A = 1, R = n, V = u | X) - P(A = 0, R = n, V = n | X)] - [P(A = 0, R = s, V = c | X) - P(A = 0, R = s, V = n | X)] - [P(A = 0, R = s, V = n | X) - P(A = 0, R = n, V = n | X)]$$

The term in the first bracket is the pension effect in the north. Although it can be decomposed into the effect of pension and the effect of health, the health effect will be close to zero, if the health condition of the veterans and the non-veterans are approximately the same. The second bracket is close to zero because the participation rates of Confederate and non-veterans living in the south are close to each other. The third term represents the regional effect. Because the participation rate of the southern population is greater, this term will be negative. Therefore, it will make the estimate larger in absolute value than the true pension effect.

Despite this problem, the pension effect can be properly estimated from the cross-sectional census data by several methods. The first method employed in this study is to compare the difference in the participation rate of the Union veterans and non-veterans living in the north to the difference in the participation rate of the non-veterans living in the south. This difference in difference estimate can be written as,

$$[P(A = 1, R = n, V = u | X) - P(A = 0, R = n, V = n | X)] - [P(A = 0, R = s, V = c | X) - P(A = 0, R = s, V = n | X)]$$

The underlying assumption for this estimate to be unbiased is that the participation function is additively

separable, $P(A, R, V | X) = f(A | X) + g(R | X) + h(V | X)$. With this assumption, the estimate will reduce to $[f(A = 1 | X) - f(A = 0 | X)] + [h(V = u | X) - h(V = c | X)]$. If there is no systematic difference in participation due solely to serving a different army, the second term will be zero. The estimates will then equal to the first term, which is the true pension effect.¹⁴

The participation rates are computed from a sample which consists of 364 IPUMS Confederate veterans living in the south, 563 non-veterans living in the south, 1,033 IPUMS Union veterans living in the north, 3,802 CPE Union veterans living in the north, and 5,563 non-veterans living in the north¹⁵. Individuals between 61 to 73 years old are divided into 13 age groups by the exact value of age. Individuals older than 73 years old are divided into 3 groups, 74 to 76 years old, 77 to 80 years old, and above 80 years old. Averaging across all age groups, the difference in participation rate of Union veterans and non-veterans in the north is -0.1177 , when using the Union veterans from the IPUMS data set, and -0.0793 when using the Union veterans from the CPE data set. Table 3.2 presents several test statistics for the above differences in participation rates. The t test, the sign test, and the Wilcoxon signed-ranks test suggest that the participation rates of Union veterans are significantly less than the rates of the non-veterans living in the north. When the IPUMS Union veterans were used, the difference also passes the Wilcoxon-Mann-Whitney rank sum test. In the south, the difference participation rate of the Confederate veterans and non-veterans is -0.0203 . It is not statistically significant in any of the test. Figure 3.4 plots the differences of the differences in participation rate of veterans and non-veterans in the north and in the south by age group. The majority of the plot is negative and is neither increasing nor decreasing with an increase age group. Depending on whether the Union veterans were sampled from the CPE or the IPUMS data set, the difference suggests that the pension income reduce participation rate by approximately 6% or 10%, respectively. These estimates are statistically significant in every test.

Another approach for the identification of the pension effect is to compute the difference in the participation rates by restricting the sample of both the Confederate and Union veterans to those who lived in the Border States.¹⁶ Restricting the sample to veterans who lived in the northern states or southern states will also control for the regional effect. However, it practically infeasible to directly compare the participation rate of the veterans with the data from the northern states or the southern states because the regional distribution of the Confederate and the Union veterans are very different. By limiting the analysis

to the Border States, the proportion of the veterans is similar so the participation rates of the two groups of veterans can be directly compared. Denote b for the Border States. This estimate can be written as $P(A = 1, R = b, V = u | X) - P(A = 0, R = b, V = c | X)$. Again, this estimate is unbiased if the participation function is additively separable, and the Union and the Confederate veterans have similar health status.

The participation rates for Confederate veterans and the Union veterans who lived in the Border States were computed and compared for each age group. The sample consists of 223 Confederate veterans, 283 Union veterans from the IPUMS data set, and 548 Union veterans from the CPE data set. Because the sample size is smaller than the first sample, a new definition of the age group was used. Individuals between 61 to 76 years old are divided into 8 age groups. Each group consists of two consecutive values of age. Individuals older than 76 years old are divided into 2 groups, 77 to 80 years old and above 80 years old. Figure 3.5 presents the comparison of the participation rate of the 3 group of veterans. The participation rate of the Confederate veterans is slightly higher than the participation rates of IPUMS and CPE Union veterans, with the exception of veterans between 71 to 74 years old, and above 80 years old.

When the participation rate of the CPE Union veterans were compared with the participation rate of the Confederated veterans, the average pension effect is -0.0771 . This number is approximately 2% different from the estimated pension effect in the previous method, 6%. When the participation rate of the IPUMS Union veterans was used, the average pension effect is -0.0438 , a 6% difference from the previous method, 10%. The sample size of the CPE Union veterans who lived in the Border States is larger than the IPUMS counterpart so the estimates from the CPE sample are expected to be closer to each other. Nevertheless, Table 3.3 suggests that the participation rate of the Confederate veterans is not significantly different from the Union veterans. The difference in participation rate computed using the IPUMS Union veterans did not pass any of the test procedures, while the difference computed using the CPE Union veterans marginally passes the t test. Therefore, the border state analysis is not as powerful an instrument to identify the pension effect. This weakness is most likely to be the result of the small sample size.

Finally, The effect of pension was estimated by computing the marginal effect of the estimated coefficient of the dummy variable indicating that the individual is a Union veteran in the logistic regression analysis. The pension effect was estimated from the random sample of population, which consists of 10,321 individuals who are older than 60 years old, not blind and not deaf. This sample was obtained from the

IPUMS 1910 census, and consists of Confederate veterans, Union veterans, and non-veterans living in every region. The regional effect was controlled by using proxies for regional differences as explanatory variables. They are a dummy variable indicating a farm or non-farm household, the number of farm schedules, a dummy variable indicating urban county, a dummy variable indicating foreign-born, and the ratio of regional income to the US per capita income.¹⁷ Proxies for socioeconomic characteristics are age, marital status, head of household status, home ownership status, and mortgage status. Unfortunately, the census data do not provide any proxy for health. Without controlling for health, the logistic regression will overestimate or underestimate the pension effect depending on whether the health condition of the Union veterans were worse or better than the US population.

Table 3.4 presents the estimation results. Three models were estimated to test the significance of regional differences. The first model includes five proxies for regional difference. The second model used a dummy variable indicating that the individual lived in the south as the only proxy, while the third model does not include any regional proxies. The estimates of the dummy variable indicating Union veteran status are always positive and significant. The slope of the probability of participation with respect to this dummy in the third model is the highest, -0.1318. This result is expected because the regional effect was not controlled for in the third model. The first model produces the smallest marginal effect, which is -0.11564. This number is slightly larger than the estimates from the other methods, and suggests that the regional effect may not be adequately controlled or that the Union veterans are in worse health than the non-veterans of the same cohort.

4. Concluding Remarks

This paper estimates the effect of the federal pension system on labor force participation of Civil War veterans and non-veterans in the same cohort. The paper has made 2 major points. First, the effect of pension income was statistically significant. The variation in pension income among the Union veterans accounts for differences in the participation rate by as much as 15 percent. The estimated effect varies with the measure of pension income used in the regression, and the effect from the 1910 census tends to be larger than the estimates from the 1900 census. The elasticity of nonparticipation with respect to pension income also varies between occupations.

Second, a substantial portion of the difference between the participation rate of the Confederate and Union veterans is due to the difference in participation behavior in the north and the south. The Confederate veterans' participation rate is higher than the Union veterans' because of both pension and regional effect. Nevertheless, the findings indicate a strong impact of pension on labor force participation. A comparison of participation rates between pensioners and non-pensioners, controlling for regional effect, suggests that pensions reduce participation rate by 6 to 10 percent. The logistic regression analysis of the random sample of the US population suggests that the upper bound of the pension effect is 12%.

The study also found an evidence in support of the hypothesis that farmers liquidate farms when they retired. Compared to other occupation, farmers who lived in non-farm households are the least likely to participate in labor market, while farmer who lived in farm households are most likely to participate. Health and several socioeconomic characteristics are significant predictors of participation status. Veterans who are more likely to participate in labor force tends to be a head of household status, lived in farm household, rented a home or own a home which is not free of mortgage.

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Table 1.1 Summary Statistics of IPUMS Confederate, IPUMS Union, and CPE Union Sample

<i>Variables</i>	<i>IPUMS Confederate</i>	<i>IPUMS Union</i>	<i>CPE Union 1910</i>	<i>CPE Union 1900</i>
Number of Observation	617	1500	4528	7023
Participation Rate	71%	55%	55%	93%
<i>Age</i>				
Mean	69.64	69.38	69.12	59.95
Standard Deviation	6.09	5.30	5.33	6.09
<i>Family Size</i>				
Mean	4.13	3.03		
Standard Deviation	2.42	1.85		
Number of Farm Schedule				
Mean	1.64	1.27		
Standard Deviation	0.55	0.47		
<i>Literacy Rate</i>				
	88%	94%	94%	95%
Farm Household	61%	27%	24%	40%
Head of Household	79%	77%	84%	93%
Free of Mortgage	61%	53%	51%	42%
Own House	70%	68%	64%	64%
Live in Urban Area	14%	36%		
Married	73%	71%	75%	86%

Table 2.1 Logistic Estimation of Probability of Labor Force Participation in 1910 with Participation Status as the Dependent Variable

<i>Variables</i>	<i>1910</i>			<i>1900</i>		
	<i>Estimate</i>	<i>Marginal Effect</i>	<i>Mean</i>	<i>Estimate</i>	<i>Marginal Effect</i>	<i>Mean</i>
Intercept	7.0011*			8.5126*		
Monthly Pension Income	-0.0049*	-0.0008	188.6980	-0.0028*	-0.0002	166.5970
Dummy if Professionals	1.9761*	0.3719	0.1050	1.9406*	0.0384	0.1440
Dummy if Clerks	2.0876*	0.4148	0.2040	1.5655*	0.0366	0.2010
Dummy if Laborers	1.3795*	0.3045	0.2290	1.6471*	0.0397	0.2300
Interaction Professionals	0.0029^	0.0004	20.1860	0.0018	0.0001	25.0850
Interaction Clerks	0.0005	0.0001	38.1940	0.0008	0.0000	32.8600
Interaction Laborers	0.0025#	0.0004	42.8460	0.0004	0.0000	37.3320
Age	-0.0889*	-0.0138	69.1160	-0.0525*	-0.0028	59.9460
Dummy if Head of Household	1.4477*	0.3436	0.8170	0.5707^	0.0240	0.9190
Dummy if Not Married	-0.1950	-0.0484	0.0570	0.2940	0.0087	0.0500
Dummy if Widowed	-0.1894^	-0.0469	0.1900	-0.3653#	-0.0141	0.0920
Dummy if Rent House	0.4485*	0.1073	0.1610	0.1920	0.0062	0.2600
Dummy if Ownership missing	-0.7244#	-0.1791	0.2000	0.4167	0.0120	0.1030
Dummy if House Mortgaged	0.4058*	0.0971	0.1210	0.3746#	0.0113	0.1980
Dummy if Non Farm Household	-3.4545*	-0.6757	0.5730	-3.4656*	-0.1421	0.5460
Dummy if Non Farm Missing	-2.0043*	-0.4510	0.1920	-2.9067*	-0.3075	0.0920
Dummy if Urban County	0.0992	0.0244	0.3140	-0.2621#	-0.0093	0.2650
State Unemployment Rate	-0.1721	-0.0267	0.2010	-5.9103^	-0.3150	0.2100
Dummy if Foreign Born	-0.0896	-0.0221	0.1400	-0.1140	-0.0040	0.1490
Number of Year Lived after Census	0.0631*	0.0098	9.6170	0.0257*	0.0014	15.5150
Dummy if BMI not Missing	-2.8620#	-0.4947	0.8230	-3.8484*	-0.0622	0.8330
BMI	0.2108#	0.0327	19.0220	0.2958*	0.0158	19.2640
BMI Squared	-0.0040#	-0.0006	450.1540	-0.0058*	-0.0003	455.5460
Dummy if Discharged with Disability	-0.0623	-0.0154	0.1880	-0.4072*	-0.0153	0.1940
Dummy if Wound Rate not Missing	0.0202	0.0050	0.1230	0.2013	0.0063	0.1360
Wound Rating	-0.0587	-0.0091	0.2050	-0.1345	-0.0072	0.2210
Dummy if Not Private	0.1324	0.0323	0.0940	0.1444	0.0046	0.1070
R-square	0.3436			0.0871		
Rescaled R-square	0.4634			0.2265		
Observations	4520			7007		

Note: The symbol *, &, and # indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively. The slope reported here was computed by averaging the individual slope calculated from the predicted probability of each observation.

Table 2.2 Mean, Marginal Effect and the Pension Effect Evaluated at Mean

<i>Pension Income</i>	<i>Mean</i>	<i>Marginal Effect</i>	<i>Pension Effect at Mean</i>
<i>1910 Census</i>			
Average Monthly Pensions	188.70	-7.61E-04	-0.1436
Average Monthly Real Pensions	223.85	-5.23E-04	-0.1171
Total Pensions	6474.65	-1.97E-05	-0.1274
Total Real Pensions	8122.86	-9.29E-06	-0.0754
Annual Pensions in 1910	190.21	-2.94E-04	-0.0559
Total Pensions 1900-1910	1630.38	-3.81E-05	-0.0622
Total Real Pensions 1900-1910	1962.90	-3.14E-05	-0.0616
<i>1900 Census</i>			
Average Monthly Pensions	166.60	-1.51E-04	-0.0251
Average Monthly Real Pensions	149.75	-1.16E-04	-0.0174
Total Pensions	5291.87	-3.78E-06	-0.0200
Total Real Pensions	4928.50	-2.26E-06	-0.0111
Annual Pensions in 1900	119.27	-1.31E-04	-0.0157
Total Pensions 1890-1900	1133.59	-1.39E-05	-0.0157
Total Real Pensions 1890-1900	1382.77	-1.12E-05	-0.0155

Table 2.3 Elasticity of Retirement with Respect to Pension Income by Occupation

	Non- interacted	<i>Farmer</i>	<i>Professionals</i>	<i>Laborers</i>	<i>Clerks</i>
<i>1910 Census</i>					
Average Monthly Pensions	-0.5123	-0.4382	-0.2928	-0.2515	-0.5121
Average Monthly Real Pensions	-0.3894	-0.3381	-0.7183	-0.3912	-0.2891
Total Pensions	-0.4544	-0.4016	-0.5206	-0.2705	-0.3640
Total Real Pensions	-0.2468	-0.2186	-0.3591	-0.1778	-0.0935
Annual Pensions in 1910	-0.1826	-0.1622	-0.5197	-0.5139	-0.0795
Total Pensions 1900-1910	-0.2001	-0.1810	-0.4324	-0.3777	-0.2266
Total Real Pensions 1900-1910	-0.1982	-0.1794	-0.4202	-0.3644	-0.2221
<i>1900 Census</i>					
Average Monthly Pensions	-0.4395	-0.4389	-0.1721	-0.3716	-0.3153
Average Monthly Real Pensions	-0.3014	-0.3033	-0.2380	-0.3923	-0.2057
Total Pensions	-0.3509	-0.3671	-0.5220	-0.3172	-0.2852
Total Real Pensions	-0.1925	-0.2001	-0.2395	-0.2121	-0.0962
Annual Pensions in 1900	-0.2699	-0.2809	-0.2887	-0.1086	-0.2217
Total Pensions 1890-1900	-0.2707	-0.2856	-0.2702	-0.2205	-0.1744
Total Real Pensions 1890-1900	-0.2661	-0.2811	-0.2645	-0.2304	-0.1680

Table 3.1 Participation Rate in 1910 by Head of Household Status, Marital Status, Mortgage Status, Home Ownership Status, Farm Household and Number of Farm Schedule

<i>Value</i>	<i>IPUMS Confederate</i>	<i>IPUMS Union</i>		<i>CPE Union</i>	
	<i>Participation Rate</i>	<i>Participation Rate</i>	<i>Chi-square</i>	<i>Participation Rate</i>	<i>Chi-square</i>
Head of Household Status					
Head	81%	62%	57.43*	63%	64.13*
Non-Head	33%	28%	0.87	28%	1.51
Marital Status					
Married	79%	60%	48.26*	62%	49.39*
Widowed	50%	42%	1.87	41%	3.22^
Mortgage Status					
Mortgage	76%	67%	2.07	74%	0.128
Free	76%	56%	41.47*	60%	33.98
Missing	60%	46%	9.51*	46%	11.774*
Home Ownership Status					
Own	76%	59%	39.53*	63%	29.31*
Rent	64%	61%	0.38	67%	0.35
Missing	7%	10%	0.20	29%	3.71^
Farm Household Status					
Farm	84%	80%	2.12	89%	4.52#
Non-Farm	50%	45%	1.85	52%	0.40
Number of Farm Schedule					
0	49%	45%	1.71		
1+	85%	83%	0.75		

Note: The Chi-square statistics tests whether the participation rate of IPUMS Confederate is larger than the participation rate of the corresponding CPE veterans. The symbol *, #, and ^ indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively.

Table 3.2 Mean Estimates, Test Statistics and the p-value of the Difference in Participation Rate

<i>Estimates</i>	<i>Mean</i>	<i>t Statistics</i>	<i>Sign Test</i>	<i>Signed Rank</i>	<i>Rank Sum</i>	<i>KS</i>
IPUMS Union vs. North non-veteran	-0.1177	-5.3561*	-5#	-62*	-1.8279^	0.3750
p-value		0.0001	0.0213	0.0004	0.0676	0.2106
CPE Union vs. North non-veteran	-0.0793	-7.7685*	-8*	-68*	-1.3003	0.3125
p-value		0.0001	0.0001	0.0001	0.1935	0.4154
IPUMS Confederate vs. South non-veteran	-0.0203	-0.6795	-2	-17	-0.4713	0.2500
p-value		0.5072	0.4545	0.4037	0.6374	0.6994
Pension Effect (IPUMS)	-0.0973	-2.6079#	-5#	-46#	-2.5063#	0.5625#
p-value		0.0198	0.0213	0.0155	0.0122	0.0127
Pension Effect (CPE)	-0.0590	-1.8447^	-4^	-35^	-2.0164#	0.5625#
p-value		0.0849	0.0768	0.0739	0.0438	0.0127
Non-veterans: North vs. South	-0.0940	-5.0797*	-7*	-66*	-1.7906^	0.3750
p-value		0.0001	0.0005	0.0001	0.0734	0.2106

Notes: The null hypothesis for the t test, the sign test, the Wilcoxon signed-ranks test is that the difference in participation rates is zero. For the Wilcoxon-Mann-Whitney rank test and the Kolmogorov-Smirnov two samples test (KS), the null hypothesis is that the two participation rates the difference are drawn from the same distribution. The statistic reported for the sign test is the McNemar's test statistic. The statistic reported for the Kolmogorov-Smirnov test is the absolute value of the maximum distance of the two empirical distribution functions. The symbol *, #, and ^ indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively. The pension effect (IPUMS) is equals the average of the difference in the first and the third row by each age group. The pension effect (CPE) is equals the average of the difference in the second and the third row by each age group.

Table 3.3 Mean Estimates, Test Statistics and the p-value of the Difference in Participation Rate in the Border States

<i>Estimates</i>	<i>Mean</i>	<i>t Stat</i>	<i>Sign test</i>	<i>Signed Rank</i>	<i>Rank Sum</i>	<i>KS</i>
Pension Effect (IPUMS)	-0.0437	-1.0348	-2	-10.5	-0.4914	0.3
		0.3278	0.3438	0.3223	0.6232	0.7591
Pension Effect (CPE)	-0.0771	-1.8549^	-2	-15.5	-1.0210	0.4
		0.0966	0.3438	0.1309	0.3075	0.4005

**Table 3.4 Logistic Estimation of Probability of Labor Force Participation in 1910
with Participation Status as the Dependent Variable**

<i>Variables</i>	<i>Model 1</i>		<i>Model 2</i>		<i>Model 3</i>	
	<i>Estimate</i>	<i>Slope</i>	<i>Estimate</i>	<i>Slope</i>	<i>Estimate</i>	<i>Slope</i>
Intercept	8.3966*		8.2640*		8.3187*	
Dummy if Union veterans	-0.5183*	-0.1156	-0.5635*	-0.1297	-0.5717*	-0.1318
Dummy if Confederate veterans	-0.0054	-0.0011	0.1211	0.0258	0.2858*	0.0591
Age	-0.1296*	-0.0205	-0.1224*	-0.0210	-0.1228*	-0.0211
Dummy if head of household	1.4861*	0.3391	1.2113*	0.2811	1.2085*	0.2806
Dummy if widowed	-0.1738*	-0.0371	-0.1871*	-0.0413	-0.1878*	-0.0415
Dummy if not married	0.6453*	0.1192	0.5485*	0.1080	0.5427*	0.1071
Dummy if rent	0.4945*	0.0989	0.2270*	0.0484	0.2243*	0.0479
Dummy if home ownership not available	-0.4703*	-0.1060	-1.0931*	-0.2623	-1.0996*	-0.2639
Dummy if house mortgaged	0.2765*	0.0556	0.3748*	0.0772	0.3614*	0.0746
Dummy if living in the south			0.3216*	0.0663		
Number of farm schedule	1.0614*	0.1678				
Dummy if living in non-farm household	-0.7329*	-0.1455				
Dummy if foreign born	-0.2373*	-0.0505				
Dummy if living in urban county	0.5905*	0.1208				
Ratio of regional income to the US per capita income	0.0012	0.0002				
R-square	0.2751		0.2201		0.2192	
Rescaled R-square	0.3799		0.3039		0.3027	
Number of Observations	10321		10321		10321	

Figure 2.1 Numbers of Pensioners by Year

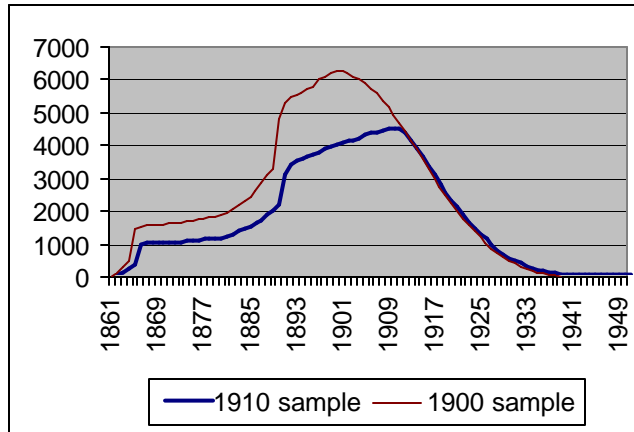


Figure 2.2 Average Pension Incomes in 1910

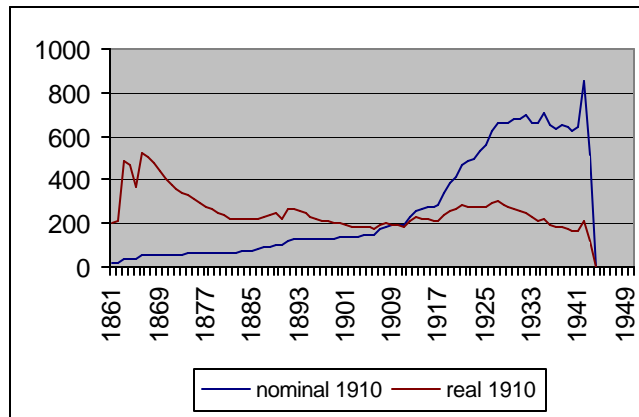


Figure 3.1 Participation Rates by Age Group of Union Veterans and Non-Veterans Living in the Northern States

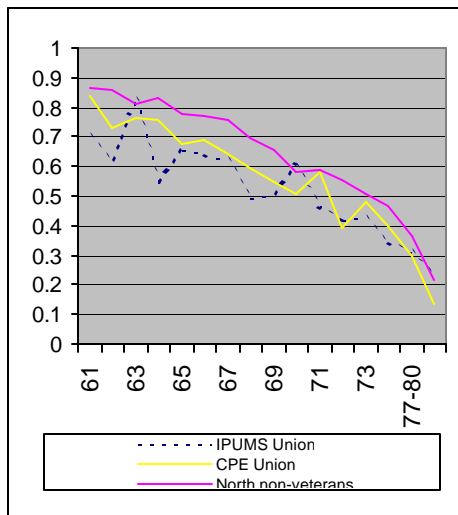


Figure 3.2 Participation Rates by Age Group of Confederate Veterans and Non-Veterans Living in the Southern States

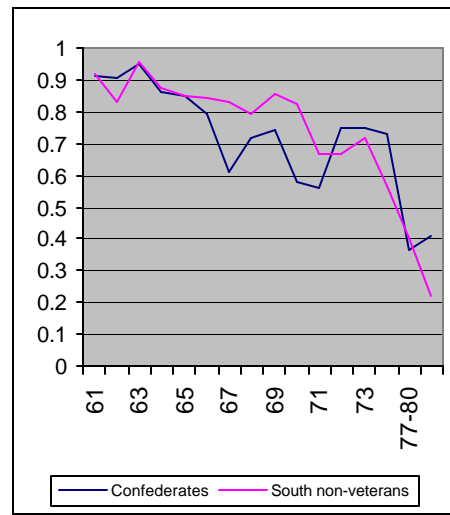


Figure 3.3

Participation Rate of White Male above 60 Years old by State in 1910

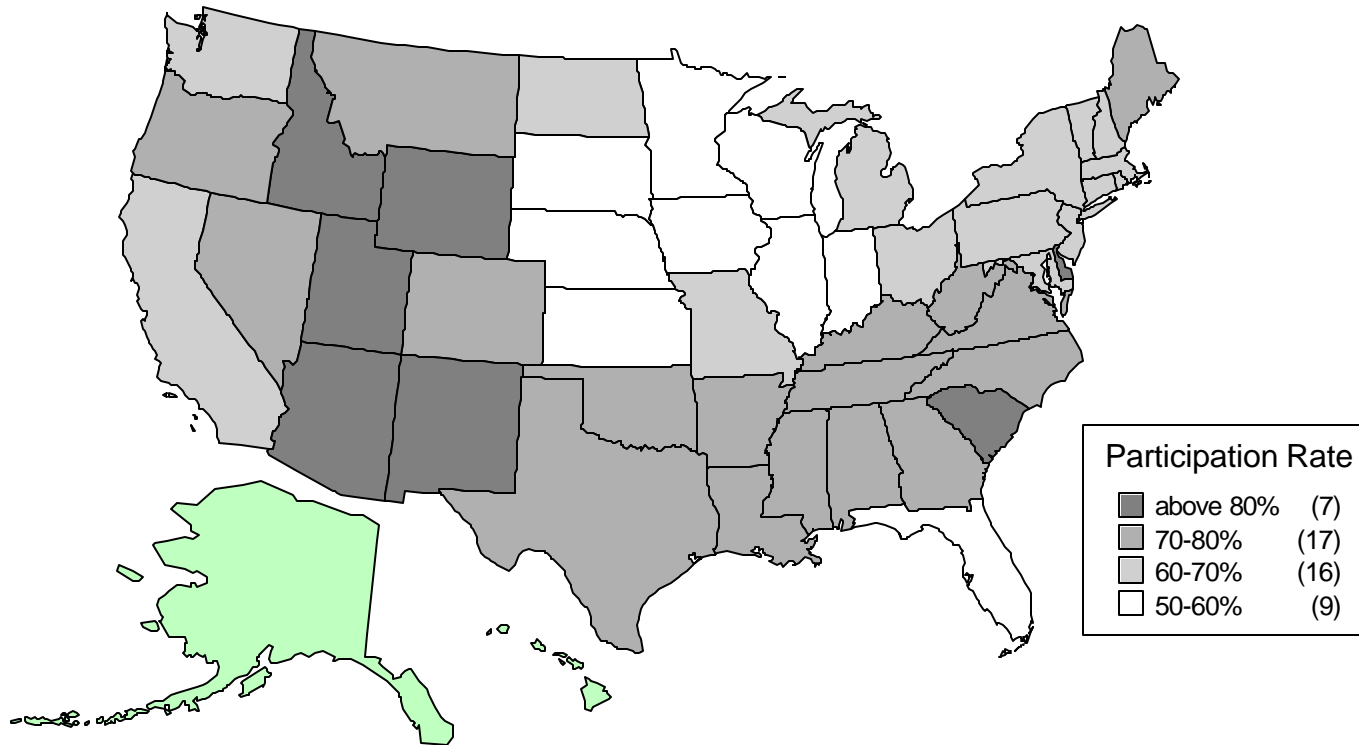


Figure 3.4 Differences in the differences of Participation Rates in the North and the South by age group

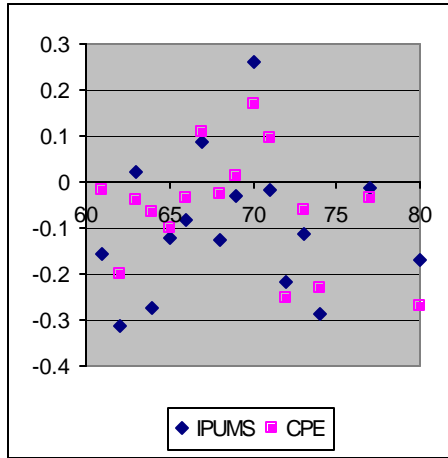
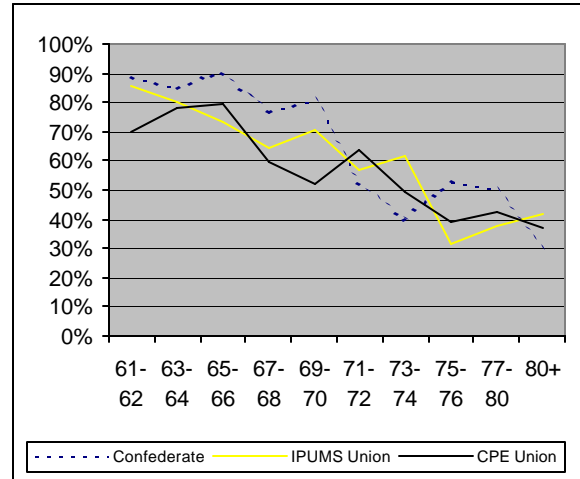


Figure 3.5 Participation Rates of Confederate IPUMS Union and CPE Union Veterans in the Border States



Notes

1 The CPE website contain a detailed discussion on sample design and variables. The three data sets can be downloaded. The URL address is <http://www.cpe.uchicago.edu/>.

2 Since the IPUMS Confederate and the IPUMS Union samples are drawn from the same source, all variables can be compared. However, only some variables from the CPE Union sample can be compared with the IPUMS variables.

3 Occupational classification is based on 1950 occupational categories. This paper groups the 1950 category into 4 broad occupations: professionals, clerks, laborers, and farmers. Professionals include professional, technical, and managers and proprietors. Clerks include clerical and kindred workers, craftsmen, and service workers. Laborers consist of sales workers, operative workers, and laborers. Farmers include farmers and farm laborers.

4 Regional divisions are the same as Census divisions.

5 The average annual income of farm laborers, laborers, and professional are the imputed annual income in 1900 calculated by Preston and Haine (1991).

6 The CPE data set records the amount of money provided by the pensions from each pension application. The construction of the pension schedule decomposes the pension amount into annual pension, and combines amounts in the same year from all applications together. Missing values in the ending date of the pension ruling are replaced by the beginning date of the next pension ruling. The fluctuation in the right tail of the plot occurs because of the small sample size.

7 The nominal interest rate used for the computation is the yield of the American railroads bond. The yield stops being published in 1937. After 1937, Corporate bonds' yield (Moody's Aaa) is used. The price index is the Bureau of Labor Statistics' Consumer Price Indexes. These numbers are obtained from Series X 476-477 and Series E 135 in US Bureau of Census (1975). The computation of the discounted real profile and the inflation-deflated profile is as follows. Denote nominal pension income by A_t , real interest rate by r , and price index by p . Let the discount factor at time t be \mathbf{r}_t . For the discounted real profile, $\mathbf{r} = r$. For the

inflation-deflated profile, $\mathbf{r} = p$. For any period t after 1910, the new profile is $\frac{A_t}{\prod_{i=1910}^t (1 + \mathbf{r}_i)}$. For any period t before 1910, the new profile is $A_t \cdot \prod_{i=t}^{1910} (1 + \mathbf{r}_i)$.

8 This expression can be obtained from the lifecycle problem as follows. Denote a time period by t , the discount rate by b_t . Let the utility function be strictly increasing, concave, and separable over time. Denote the real interest rate by r_t , the nominal interest rate by i_t , the pension income by A_t , and all other non-labor income by A_0 . The veterans maximize their utility by solving the following problem,

$$\max_{c_t} \sum_t^T b_t U(c_t, l_t)$$

$$\text{s.t.} \quad \sum_t^T \frac{c_t}{1+r_t} \leq A_0 + \sum_t^T \frac{w_t l_t}{1+r_t} + \frac{A_t}{1+i_t}$$

The optimality condition of the above problem is the equality of the marginal rate of substitution and the ratio of price of consumption to wage rate,

$$\forall t, \quad -\frac{U_{l_t}}{U_{c_t}} \geq w_t \quad (> \text{if } l_t = 0)$$

9 In symbols, the consumption must satisfy $\sum_{t=R}^T \frac{c_t}{1+r_t} \leq A_0 + \sum_{t=R}^T \frac{A_t}{1+i_t}$, where the summation is from the period the veterans retired to the period they died and A_0 is the veterans' stock of wealth as of retirement.

10 When veterans applied for a pension, the federal pension board ordered them to take an examination conducted by a group of surgeons. The surgeons rated the veterans based on their overall health conditions as well as the specific conditions. The rating was then submitted to the pension board for approval (Glasson 1918). The wound rating used in the regression is based on gunshot wound or body injury, most of which were due to the war.

11 A county is defined as urban if it consists of one or more cities with more than 25,000 inhabitants in 1910.

12 A household is classified as farm household if it is located on either a tract of 3 or more acres used for any agricultural operations, regardless of the amount of labor or produce involved. Alternatively, a household is considered a farm household if it is located on a tract of fewer than 3 acres which either yielded above \$250 in produce sales in the previous year, or employed at least one full-time farmer or agricultural laborer. (IPUMS)

13 See footnote 3 for the definition of farm schedule.

14 The Confederate veterans might be in worse health conditions than the Union veterans. This could result in a lower participation rate for the Confederates, making the second term positive. However, following Costa (1995,1998), it will be assumed that the effects of health cancel out, so the second term is zero.

15 The northern states include Connecticut, Washington DC, Delaware, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, and Wisconsin. The southern states include Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Virginia. All other states are excluded from this analysis.

16 The border states include Kansas, Kentucky, Maryland, Missouri, Oklahoma, Tennessee and Texas. The definition of the northern and southern states is the same as the last section.

17 This number is the ratio of regional per capita income to the US per capita income. It is obtained from Series F 287-296 in US Bureau of Census (1975). Foreign born individuals are assigned a zero value.