

**Age, Period, and Cohort Differences in the Effect of Military Service on Earnings.**

Meredith Kleykamp, University of Maryland  
Alair MacLean, Washington State University Vancouver

Extended Abstract for PAA Submission

September 21, 2012

Do not quote or cite without permission

## INTRODUCTION

For more than a decade, scholars have evaluated how the trend toward increased inequality has affected inequality among and between the members of different groups (Morris and Western 1999). They have produced a number of findings regarding the way that this trend has affected people categorized by, for example, educational attainment, family structure, occupational status, and union membership (Autor, Katz, and Kearney 2006; Juhn, Murphy, and Pierce 1993; Mouw and Kalleberg 2010; Western, Bloome, and Percheski 2008; Western and Rosenfeld 2011). According to this research, most people have seen increased inequality within their groups, becoming increasingly unequal from those who share their characteristics (Leicht 2008). Some have also experienced increased between-group inequality, becoming increasingly unequal from people in other categories (Autor, Levy, and Murnane 2003). The members of other groups, however, have experienced the opposite. Many have seen the inequality between groups decrease (Leicht 2008). And a small share of the population has seen the inequality within their groups decline.

Yet little is known about how increases in inequality may have affected the group of people who served in the armed forces, or veterans. Veterans represent an important share of workers. In the 1970s, when inequality began to increase, they constituted nearly half the male workers in the United States and a quarter of all workers. Today, they represent smaller, but still sizable shares: 12 percent of males and 8 percent of the total. Similar to other groups, they may have experienced increases in inequality both within- and between-groups. They may have been affected by the social trends in the society to which they returned. They may, however, have experienced changes in their between- and within-group inequality based on changes in how they enter the military and how they are treated while they serve that have affected particular cohorts differently. Some scholars have evaluated veterans' between-group inequality in particular time periods and cohorts, assessing whether veterans earned more or less than their non-veteran counterparts, producing findings that are mixed (e.g., Angrist 1990; Teachman and Tedrow 2004; Xie 1992)

Recently, we have extended this previous research, examining how veterans may have been affected in both between- and within-group inequality not just in cross-section, but over multiple cohorts and time periods (MacLean and Kleykamp forthcoming). Using the Merged Outgoing Rotation Groups (MORG) of the Current Population Survey (CPS) from 1979-2010, we employed a variance function regression model (VFR) used by Western and associates (Western and Bloome 2009; Western et al. 2008; Western and Rosenfeld 2011) to evaluate how covariates are associated with both mean and variances of earnings. The models extend the standard OLS regression model:

$$\hat{y}_i = x_i' \beta$$

Where  $x'$  is a vector of covariates and the  $\beta$  coefficients estimate the association between the covariates and the mean of the outcome. The variance function regression allows us to estimate the effects of the covariates not just on the means, but also on the variance in the outcome through the following equation:

$$\log \sigma^2 = x_i' \lambda$$

In this equation, the dependent variable is the log of the variance of the outcome. The  $\lambda$  coefficients therefore reflect the association between the covariates and the variance, and assess how the covariates are associated with the variance in wages.

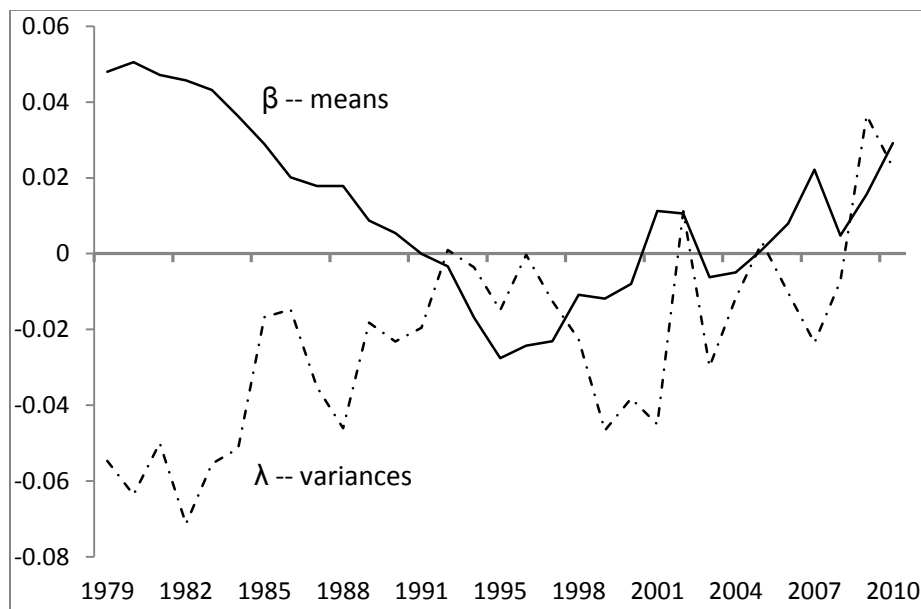
## SUMMARY OF FINDINGS FROM VARIANCE REGRESSIONS

According to our findings, veterans used to but no longer earn more than non-veterans. They also grew more similar to non-veterans in terms of their within-group inequality. According to the descriptive statistics, veterans saw smaller increases in the variance in their wages than did non-veterans. Yet the regression findings suggest that this pattern likely stemmed from changes in the measured characteristics of veterans compared to those of non-veterans. Veterans have always differed from non-veterans in their average age, race, ethnicity, and sector of employment. When these factors are controlled, veterans were less unequal from each other than were non-veterans in the late 1970s. By the end of the first decade of the twenty-first century, they no longer experienced lower within-group inequality than did non-veterans.

### Adjusted trends by period

Figure 1 presents estimates from the model predicting log wages, which show that in some years veterans earned a premium while in others they paid a penalty in their wages. According to these estimates, veterans earned higher average wages than did non-veterans for much of the 1980s and the last 5 years of the 2000s. They earned lower wages during the mid-1990s. This veteran estimate is net of age, education, racial and ethnic differences between veterans and non-veterans, as well as differences in employment sector. It provides further evidence consistent with some research that has demonstrated a decline in inequality between groups by period. The recent increase in the gap between veterans and non-veterans, however, complicates the picture. Overall, the findings suggest that the values of the credentials or skills of veterans may have fluctuated over time when compared to those non-veterans.

Figure 1: Veteran status coefficients from variance function regressions by period



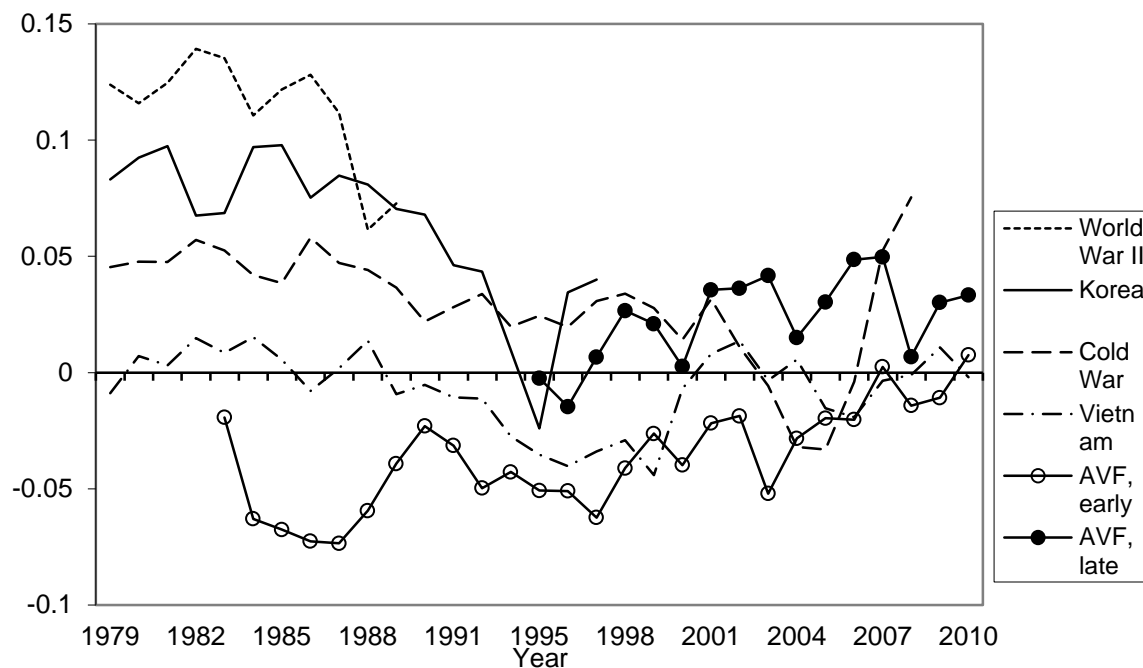
Also shown in figure 1, the lambda coefficients tell a different story from that presented by the descriptive statistics with respect to within-group inequality. In the early 1980s, net of the covariates, veterans had lower variance in wages than did non-veterans. The variance steadily became more similar to that of non-veterans. By the early-1990s, veterans had similar variance in wages to that of non-

veterans. Since that time, this estimate has fluctuated. This finding suggests that the military may have reduced inequality among veterans at the beginning of the period, but that it no longer does so, or does so to a lesser extent. They present evidence that veterans were at least partly subject to the overall increase in inequality within most other groups over time.

### Changes across cohorts

Figure 2 presents the beta coefficients from the models estimated on veterans grouped by birth years, which suggest that the observed changes likely stem not from period changes alone, but also at least partly from cohort effects. In older cohorts and in the most recent cohort, veterans appear to have benefited from a wage premium. They consistently earned higher wages than did other workers if they were born in years that made them eligible to serve in the years before the Vietnam War, during World War II, or the Korean or Cold wars. This premium appears to have decreased as they grew older. Among those who were eligible to serve in the second decade of the all-volunteer force (AVF, late), veterans again likely have earned more than comparable non-veterans.

Figure 2: Veteran status coefficients from variance function regressions by period and cohort

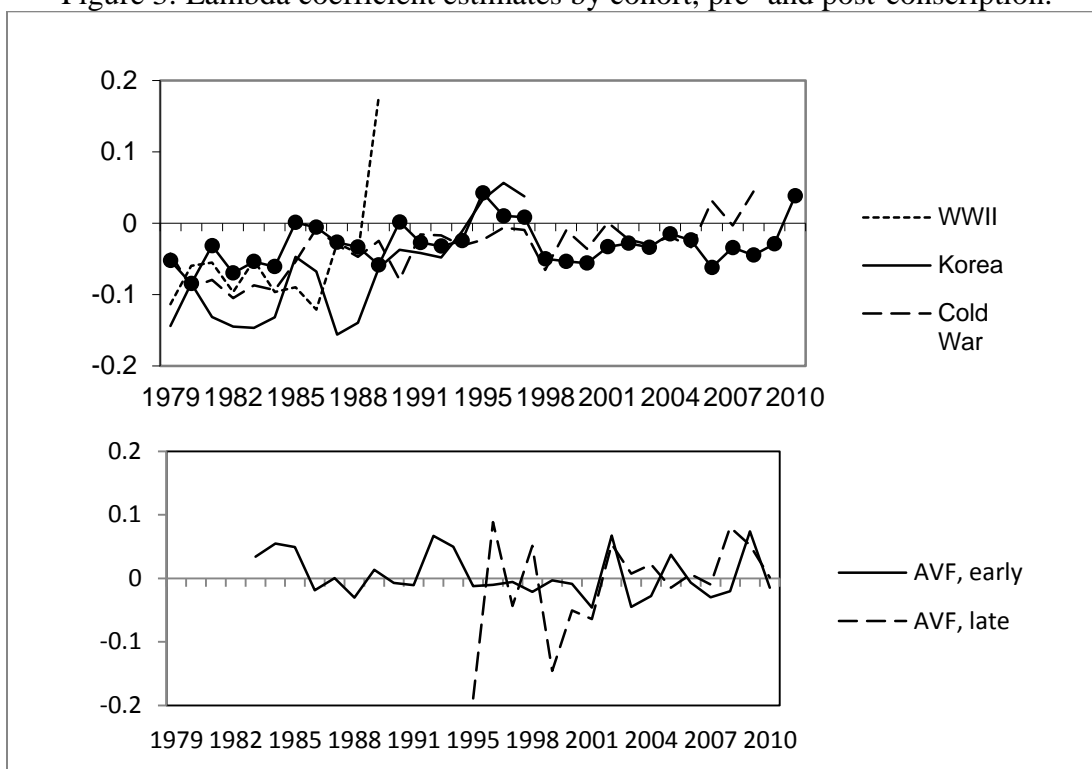


Among male workers who were eligible to serve between the 1960s and 1980s, however, veterans appear to have suffered a penalty for at least some of their work lives. According to the figure, they earned wages that were similar to those of non-veterans in many years, but their wages were lower during the 1990s. More recently, they earned no more or less than non-veterans from the same cohort. Among those who were eligible to serve in the first decade of the volunteer force (AVF, early), veterans tended to suffer a wage penalty. They earned lower wages than comparable non-veterans throughout the period, though they appear to earn more similar wages to non-veterans in more recent years.

These findings are at least partly consistent with previous research on veterans in cross-section, which has suggested that pre-Vietnam veterans benefited from between-group inequality, earning a premium relative to non-veterans. Yet they also suggest that veterans were affected by period changes. Veterans of all cohorts were most likely to experience a penalty relative to non-veterans in the 1990s, though they improved their position relative to non-veterans in the early 2000s. Nevertheless, the gap between veterans and non-veterans seems to stem less from period changes and more from the relative positions of these men by cohort.

Figure 3 contains the lambda coefficients by cohort. The top panel A shows the estimates for the men who became eligible to serve during the draft era. The bottom panel B presents similar estimates for those who could have enlisted during the volunteer era. According to panel A, veterans had lower variance in earnings than did non-veterans among draft era cohorts until the mid- to late-1980s. After those years, veterans had similar variance in earnings to non-veterans if they were eligible to serve after the Korean War, in the Vietnam or Cold wars. Among cohorts that were eligible to serve in the volunteer era, the pattern is less clear. The estimates fluctuate, though these veterans appear to have had variance in earnings that is similar to their non-veteran counterparts throughout their work lives. These findings provide further evidence that veterans were subject to the general trend toward increased within-group inequality. They contradict the reasoning behind expectations derived from changes in recruitment and treatment affecting people serving in the armed forces, which suggested that veterans should have become increasingly equal to each other. We therefore conclude that the increased variance among veterans stems less from cohort effects affecting military service, and more from period effects.

Figure 3: Lambda coefficient estimates by cohort, pre- and post-conscription.



## **CONCLUSIONS FROM VFR ANALYSIS**

The findings suggest that similar to other groups (Leicht 2008), veterans have experienced decreased between-group inequality and increased within-group inequality, and that these changes may stem not just from period but also from cohort effects. In the late 1970s, veterans earned more than non-veterans, but this advantage disappeared by the 1990s, leading to lower inequality between groups, consistent with the findings of previous research on veterans in cross-section. Veterans had different average characteristics from non-veterans, and these differences changed over time, particularly with respect to race and education. When the analyses do not adjust for these changing differences, veterans appear to have had the same variance in wages as did non-veterans at the beginning of the period and to have experienced smaller increases in inequality within their group. Net of these changing differences, however, the pattern appears to have been the reverse. Veterans had lower levels of within-group inequality relative to non-veterans at the beginning of the period and similar levels by the end.

The analyses present apparently the first evidence regarding within-group inequality among veterans longitudinally or even in cross-section. They suggest that veterans have become increasingly unequal as a group, which is consistent with the general pattern of increased within-group inequality over the last forty years (Morris and Western 1999). They do not bear out the predictions derived from previous research on veterans by cohort, however, which suggested that those of the pre-Vietnam and post-Vietnam eras should have had lower within-group inequality relative to comparable men than Vietnam veterans should have. Instead veterans began the period with lower variance in earnings than non-veterans, but saw their within-group inequality increase. In this respect, they are similar to the members of many other groups, who also experienced increases in within-group inequality (Leicht 2008; Western and Rosenfeld 2011). We conclude that veterans' within group inequality increased primarily as a consequence of a larger period trend.

The results indicate, however, that the changes in inequality between groups were more likely due to differences between veterans and non-veterans that were specific to cohorts. Veterans followed the same pattern as did the members of many other groups, such as those defined by gender and union membership (Leicht 2008; Western and Rosenfeld 2011), in that the inequality decreased between groups. They differ from the members of groups defined by occupation or education, such as college graduates who earned increasingly more than non-college graduates (Fischer and Hout 2006; Mouw and Kalleberg 2010). It may be that the social changes that produced the increase in the college premium also led to a decline in the veteran premium. Yet previous researchers have shown, for example, that veterans were most likely to suffer relative to non-veterans if they came of age during the Vietnam era (Angrist 1990). Indeed, our findings show that veterans benefited relative to non-veterans if they were in cohorts that came of age before Vietnam and in cohorts that came of age more recently. They suffered relative to their age peers if they came of age between 1960 and 1990.

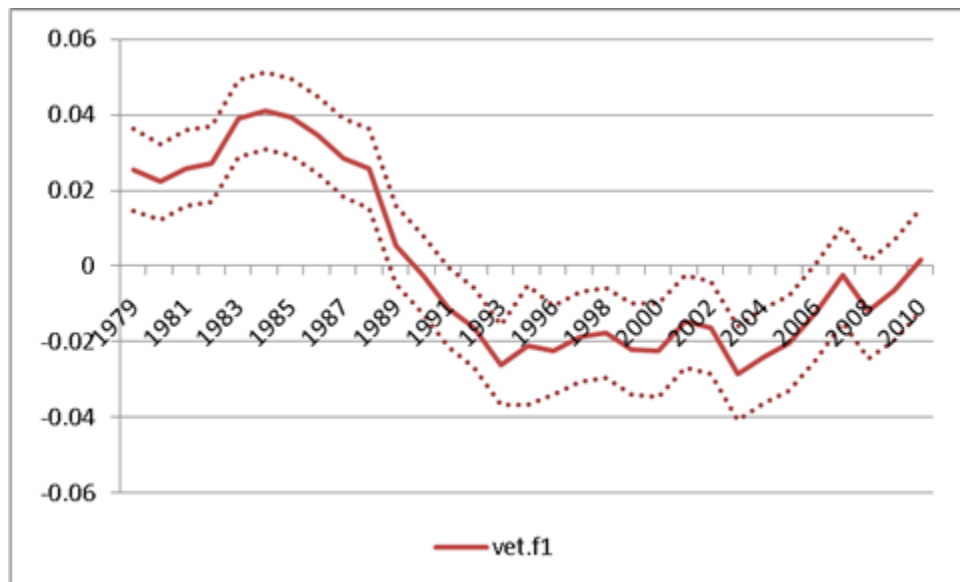
However, more research is needed to disentangle the relative influences of period and cohort on the returns to military service. Based on our VFR analysis, there is evidence consistent with both period and/or cohort effects, but little means to statistically tease out their relative contributions. Additional research is needed to disentangle the relative effects of period and cohort change on veterans' earnings inequality.

## EXTENDING THE ANALYSIS TO APC MODELS

We anticipate that an age-period-cohort (APC) analysis would provide useful insights into understanding the patterns of inequality revealed in our variance regression analysis. We have conducted preliminary analyses of the age, period, and cohort effects on mean earnings using the HAPC model developed by Yang and colleagues (Yang 2008; Zheng, Yang, and Land 2011). These models use cross-classified random effects models with period and cohort operating as the cross classified effects in a hierarchical model. Below we present results from preliminary HAPC models of earnings.

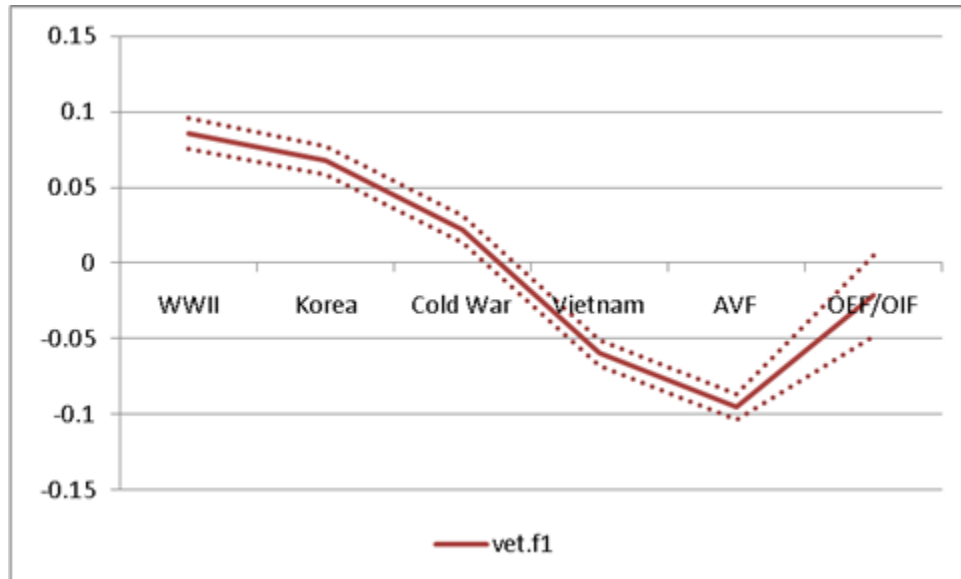
Based on the results from Figure 4, we interpret these results as indicating that, net of age and cohort effects, over time, the veteran premium was positive until about the post-Cold War military drawdown, when it begins to decline. Upon completion of the drawdown, the veteran premium becomes negative and holds steadily there until the mid-2000s when it creeps back up to about a net 0 effect.

Figure 4: Period-level random coefficient estimates for veteran status (95% CI's represented by dashed lines)



The cohort patterns in Figure 5 below suggest steady declines over birth cohort, with a slight uptick for the most recent veterans. This last cohort result is somewhat provocative, given the reality of heavy unemployment among recent OEF/OIF era veterans. However, selectivity in who gains employment, thus becoming an earner among recent cohorts of veterans may produce this result.

Figure 5: Cohort-level random coefficient estimates for veteran status (95% CI's represented by dashed lines)



These APC models suggest the presence of both period effects (net of the effects of age and cohort) and cohort effects (net of age and period). But these models only involve trends in mean earnings, and do not include the trends in the variance. Our VFR analyses revealed patterns in between-group inequality (the beta coefficients) we interpreted as most consistent with a cohort story. The HAPC analysis of between-group inequality suggests both a period and cohort effect on the returns to military service.

Our VFR analysis revealed striking trends in variance as well as means. We interpreted the patterns in within-group inequality as a product of period trends, and less as a consequence of cohort effects. What the above HAPC analysis does not allow for in an analysis of the APC effects on variance, or within-group inequality.

### ANTICIPATING A VFR-APC ANALYSIS

We are currently working to extend our APC analyses to incorporate models of variances using the HAPC-VFR models recently employed by Zhang and colleagues (Zheng et al. 2011). These analyses will combine the conclusions from our recent VFR analysis, with our preliminary HAPC analysis, allowing us to draw out more definitive insights about age-period-cohort effects on inequality among veterans, not just between veterans and non-veterans.

We anticipate this analysis would be of interest to the demography community by employing relatively recent methodological innovations to the HAPC modeling framework. Additionally, there is a small but growing community of demographers interested in the short and long term consequences of military service for socioeconomic attainment and mobility. The wars in Iraq and Afghanistan over the past decade have reminded the scholarly community of the importance of considering military service as one of the institutions influencing socioeconomic status and attainment. Based on our preliminary analyses there is both continuity and change in the effects of veteran status on earnings. Variance regression



results suggest a pattern wherein reductions in between-group inequality come with increases in within-group inequality. An overall trend finds decreasing between- and increasing within-group inequality among veterans. However, an APC analysis finds trends in between group inequality contain both period effects as just described, but also cohort effects which reverse declining between group inequality with the most recent cohort of OEF/OIF veterans. Our additional analyses will enable us to evaluate whether the within-group inequality also varies by both period and cohort.

## REFERENCES

- Angrist, Joshua D. 1990. "Lifetime Earnings and the Vietnam Era Draft Lottery - Evidence from Social-Security Administrative Records." *American Economic Review* 80(3):313-336.
- Autor, David H., Lawrence F. Katz, and Melissa S. Kearney. 2006. "The Polarization of the Us Labor Market." *American Economic Review* 96(2):189-194.
- Autor, David H., Frank Levy, and Richard J. Murnane. 2003. "The Skill Content of Recent Technological Change: An Empirical Exploration." *Quarterly Journal of Economics* 118(4):1279-1333.
- Fischer, Claude S. and Michael Hout. 2006. *Century of Difference: How America Changed in the Last One Hundred Years*. New York: Russell Sage Foundation.
- Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce. 1993. "Wage Inequality and the Rise in Returns to Skill." *Journal of Political Economy* 101(3):410-442.
- Leicht, Kevin T. 2008. "Broken Down by Race and Gender? Sociological Explanations of New Sources of Earnings Inequality." *Annual Review of Sociology* 34:237-255.
- MacLean, Alair and Meredith Kleykamp. forthcoming. "Income Inequality and the Veteran Experience." in *Living in a High-Inequality Regime*. eds. Alair MacLean and David Grusky.
- Morris, Martina and Bruce Western. 1999. "Inequality in Earnings at the Close of the Twentieth Century." *Annual Review of Sociology* 25:623-657.
- Mouw, Ted and Arne L. Kalleberg. 2010. "Occupations and the Structure of Wage Inequality in the United States, 1980s to 2000s." *American Sociological Review* 75(3):402-431.
- Teachman, Jay D. and Lucky M. Tedrow. 2004. "Wages, Earnings, and Occupational Status: Did World War II Veterans Receive a Premium?" *Social Science Research* 33(4):581-605.
- Western, Bruce and Deirdre Bloome. 2009. "Variance Function Regressions for Studying Inequality." Retrieved: April 12, 2011 (<http://dash.harvard.edu/handle/1/2645469>).
- Western, Bruce, Deirdre Bloome, and Christine Percheski. 2008. "Inequality among American Families with Children, 1975 to 2005." *American Sociological Review* 73(6):903-920.
- Western, Bruce and Jake Rosenfeld. 2011. "Unions, Norms, and the Rise in U.S. Wage Inequality." *American Sociological Review* 76(4):513-537.
- Xie, Yu. 1992. "The Socioeconomic Status of Young Male Veterans, 1964-1984." *Social Science Quarterly* 73(2):379-396.
- Yang, Yang. 2008. "Social Inequalities in Happiness in the United States, 1972 to 2004: An Age-Period-Cohort Analysis." *American Sociological Review* 73(2):204-226.
- Zheng, Hui, Yang Yang, and Kenneth C. Land. 2011. "Variance Function Regression in Hierarchical Age-Period-Cohort Models: Applications to the Study of Self-Reported Health." *American Sociological Review* 76(6):955-983.