# Why Are Fewer Workers Earning Middle Wages and Is It a Bad Thing?*

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**Abstract**

Since 1979, there has been a steady decline in the share of both men and women earning middle wages. We examine this development by assigning workers to real wage bins and tracking shares of workers in each bin over time. The decline has been a good thing for women throughout and for men since 1992, representing mobility to higher wage bins propelled by rising age and education, and for women until 2001, beneficial changes in returns to industry and union status. The decline in the share of men earning middle wages in the 1980s was a bad development, representing mobility to lower wage bins associated with deunionization and the decline of manufacturing employment. We find no evidence of employment polarization and only a minor role for changes in returns to occupations, casting doubt on the theory that computerization is polarizing employment.

# 1 Introduction

A decline in the "middle class" has become a concern not only in the United States, but also in other countries, and not only for academics, but also for politicians and the public.[1] "Middle class" means different things to different people, but whatever the measure, a decline in the middle class is generally considered to be a bad thing. While some observers consider it undesirable in and of itself, others have specific concerns: that the decline in the middle is associated with greater inequality and "employment polarization" (Autor, Levy and Murnane 2003); that it implies a reduction in average income (New York Times 2015); that it is a threat to liberal democracy (Fukuyama 2009).

In this paper, we focus on workers' hourly wages, the building blocks of all other measures of income, and on the shares of workers within ranges fixed in real terms over time, an approach used only once previously (LoPalo and Orrenius 2015). We confirm that the share of workers with middle wages is declining over 1979–2015, and examine the short– and long–term employment patterns in the shares with high and low wages to determine whether the decline may be deemed good or bad for workers. To analyze underlying trends, we employ Oaxaca decompositions to decompose year–to–year and long–run changes in the share in each wage group into changes in individual and job characteristics and changes in returns to characteristics. Our use of yearly data, which is unusual in the literature analyzing the distribution of employment by wage, allows both analysis of business cycle effects and an accurate timing of longer–term patterns. We employ the U.S. Current Population Surveys' (CPS) Merged Outgoing Rotation Groups (MORG) from 1979–2015 to construct four wage bins, whose thresholds are those that divide 1979 workers into four equally sized groups: in years other than 1979, shares sum to one but are not necessarily equal. For some analysis, we augment the data with the CPS May supplements. We link our results to the wage inequality and employment polarization literatures which assess the effects of unions, the minimum wage, automation, outsourcing, trade and computerization on the wage structure.

Our real wage bin approach brings important complementary insights to the literature on "employment polarization", which observes that in the United States and abroad, employment has been expanding faster in low and high wage occupations than in middle wage occupations (Autor, Levy and Murnane 2003; Goos, Manning and Salomons 2009).

[1] E.g. Pew Research Center (2016); Bloomberg (2016); Figaro (2016) citing the International Labour Office (n.d.) study of Europe.

The original purpose of the focus on occupations was to infer worker tasks in the absence of individual–level task information and assess the influence of computerization on the wage structure. For the simpler purpose of describing employment growth at different wage or skill levels, wage bins are greatly preferable to the average wage by occupation: a ranking of occupations by average or median wage ignores the quantitatively important wage and skill variation that exists within occupations. Over time, employment growth may occur disproportionately in high-wage jobs within low-average wage occupations, or low-wage jobs within high-average wage occupations. Another disadvantage of a focus on occupations is that harmonization of changing occupation codes is necessarily imperfect, particularly over long periods of time. Indeed, the occupation codes change because the nature of occupations changes over time, including through upskilling (Levy, Murnane and Tyler 1995). The use of "job" as a synonym for "occupation" has served to muddy the distinction between changes in employment by wage and changes in employment by occupation.[2]

We find that the steady decline in the share of workers in the middle two wage groups belies offsetting forces that vary over time and by gender, and variously reflects either upward mobility (workers moving faster from the middle to the top than from the bottom to the middle) or downward mobility (workers moving faster from the middle to the bottom than from the top to the middle). The business cycle clearly has a tendency to cause downward mobility in recessions and upward mobility in recoveries and booms.[3] However, the share of workers in the top and bottom groups generally move in opposite directions over the longer term as well, though these lower frequency trends are very different by gender. After adjusting shares for HP–filtered log GDP, we see that women have experienced upward mobility since 1982, with the share in the bottom wage group falling considerably, the middle two groups falling slightly, and the top wage group rising considerably. This upward mobility includes composition effects generated by the 1980s surge in labor force participation. The decline in the middle is thus a positive development for women. Men have experienced mild upward mobility since 1992, with a small increase in the share in the top wage group at the expense of all lower groups. However, men

[2] The limitations of occupation–based analysis have been pointed out by Schmitt, Shierholz and Mishel (2013), who also dispute the presence of employment polarization even in occupation–based analysis. Gottschalk, Green and Sand (n.d.) grapple with the issue of the changing skills associated with occupations.

[3] This is notwithstanding the fact that unskilled workers disproportionately exit employment in recessions and disproportionately enter employment in booms.

experienced strong downward mobility in the 1980s as the shares of the upper two wage groups both shrank. The decline in the middle for men was thus deleterious in the 1980s and beneficial in the later period.

The patterns in our data may seem to suggest that, since 1990, American workers have been buffetted by temporary recessions rather than held back by more permanent headwinds, and that researchers aiming to improve their lot should focus on understanding the business cycle. However, a conclusion that underlying trends have been satisfactory since 1990 ignores several factors. One is that real GDP per capita has grown by more than one third since 1990, which ought to have led to much faster wage growth than observed; the decline in labor's share of output is, however, beyond the scope of this paper. Another consideration is that rising age and education would predict a much faster shrinking of the share of men with low wages than has occurred since 1990. Furthermore, the male downward mobility of the 1980s was so strong that men have yet to recover the position of 1979. Finally, women's progress has slowed since 2001, and women have yet to catch up with men. Understanding why longer term trends are not more beneficial to workers could lead to policies benefitting workers, which is why we probe for the non–cyclical causes of changes in the shares of workers in wage groups.

Our Oaxaca decompositions for 1983–2015 show that improved characteristics have been a strong force for upward mobility throughout, with age and education leading the shares of women in the bottom and top wage groups to fall and rise respectively by at least 0.20 percentage points per year over the study period, with annual changes for men varying between 0.15 and 0.23 percentage points in absolute value. The decline in manufacturing and especially deunionization help explain why men instead experienced downward mobility in the 1980s: together those factors increased the share of men in the bottom wage group by 0.15 percentage points per year and reduced the share in the top by 0.13 percentage points per year.

Changes in returns to characteristics led to upward mobility for women up until 2001 and downward mobility for men throughout the study period. Women's upward mobility was driven by the falling return to union membership and the changing returns to industry, which together reduced the share in the bottom group by 0.20–0.21 percentage points per year in the 1980s. Men's downward mobility resulted from small or moderate changes in the returns to several characteristics, including state of residence. Changes in the return to education were also influential, tending to move both male and female workers to the

middle wage groups in the 1980s and 1990s. Changes in returns to occupation are not influential.

Changes in observed variables and their returns capture satisfactorily the evolution of male and female shares since 1990, but provide an inadequate explanation of the rising shares of men and women in the bottom wage group and women in the top wage group in the 1980s. For women, these could plausibly reflect the omission of the trend towards more remumerative college majors in the case of the top group, and of actual experience in the case of the bottom group: age was likely to be rising more quickly than experience as older women entered the labor force. The unexplained component for men remains mysterious.

The deleterious effects of industry mix and deunionization on men in the 1980s are likely related to increased offshoring and automation of manufacturing, as recognized in related literatures, but these factors have since declined in importance and are no longer salient, the increased Chinese import penetration after 2001 notwithstanding. The beneficial effects on women from 1979 through 2001 of changing returns to industry are presumably in part the result of the sectoral realignment caused by changes in manufacturing, but also the result of an increase in teachers' salaries in the 1980s[4] and an increase in retail productivity in the 1990s. The declining return to unionization may be linked to the increasing share of union members in the public sector.

One important policy that did not drive our results is the federal minimum wage. The declining minimum wage of the 1980s is unlikely to have influenced employment by wage group, since our bottom wage group includes all workers with wages below $11.69 in 2014 dollars.[5][6]

Computerization is widely believed to have increased wage inequality via labor demand beginning in the 1990s, and is believed to have a polarizing effect on employment via the change in demand for types of occupational task.[7] Firpo, Fortin and Lemieux (2013) confirm the importance of changing returns to occupational tasks, particularly

[4] https://nces.ed.gov/programs/digest/d09/tables/dt09_078.asp

[5] The minimum wage has been found to have contributed to a particularly large rise in inequality and to have reduced wages for many in the 1980s (e.g. DiNardo, Fortin and Lemieux 1996, Autor, Manning, and Smith 2016).

[6] Beaudry, Green and Sand (2013) find that there was a fall in the return for cognitive skills after 2000 that is likely to have hurt wages for young well–educated workers. It is not clear how our changes around 2001 map to their findings.

[7] Autor, Levy, Murnane (2003); Autor, Katz, Kearney (2008); Autor, Dorn and Hanson (2015). See Foster and Wolfson (2009) for a more formal treatment of the definition of polarization.

tasks susceptible to offshoring, automation, and computerization, finding them helpful in explaining the evolution of the 90–50 and 50–10 wage differentials since the late 1970s. We find no polarization of employment nor any polarizing factor (with the exception of unexplained factors for women in the 1980s, which likely reflect omitted characteristics), and little role for changing returns to occupations. The influential changing returns to education, often believed to reflect technological progress, in fact work to compress workers into the middle wage groups in the 1990s, yielding the opposite of polarization. We show that the 1990s employment polarization found in papers such as Autor (2015) is an artifact of studying wages at the occupation level, while the polarization found between 1979 and 2012 in LoPalo and Orrenius (2015) is driven by the comparison of the share of workers in the bottom wage group in the relatively buoyant labor market of 1979 and the depressed labor market of 2012. Adjusted for the business cycle, the share of workers in the bottom group declined considerably between 1981 and 2015, and fairly steadily from 1990 onwards, driven by the upward mobility of women. If computerization does have a major effect on the wage structure, it is not one that results in employment polarization.[8][9]

Thinking through the determinants of evolution in employment shares may be helpful in predicting future developments. The main influence on wage shares since 2008, other than the Great Recession, is increasing education. The effect of increasing age has largely occurred already. However, particularly for men, the increase in education is strongly influenced by the retirement of earlier, poorly educated cohorts, making increased education for new cohorts essential for future wage growth. Increased unionization would also boost wages, but the high unionization rates of the past may not be attainable.

# 2 Data

We rely principally on the merged outgoing rotation groups (MORGs) from the Current Population Surveys (CPS) of 1979–2015, retaining imputed values following Card and DiNardo 2002. We draw a sample of workers aged 18–64 who are not self–employed, and compute hourly wages by using reported hourly wages for hourly–paid workers, and divid-

[8] In a future version, we will test the sensitivity of our results to using more detailed occupations, and to omitting industry to allow a better comparison with Firpo, Fortin and Lemieux (2013). We will also replace occupation dummies with task dummies.

[9] More research examining the interaction between long–term trends and the business cycle, along the lines of Foote and Ryan (2015), Jaimovich and Siu (2014) and Hershbein and Kahn (2016), but deemphasizing occupations, would be fruitful.

ing weekly earnings by weekly hours for salaried workers. We adjust wages to represent 2014 dollars by deflating with the CPI–U. We drop wages below $2 in 2014 $ or above $200 if usual weekly hours are less than or equal to 15.

Because the heaping of wages at round numbers would otherwise cause sudden jumps over time in the shares of workers in wage bins, we add some randomness to each wage. We draw a random value $k_i$ from a standard normal distribution and multiply the wage by $0.2k_i$, or equivalently, add $0.2k_i$ to the log wage. This acts to smooth the wage distribution by dispersing the heaps of workers who report particular round-number nominal wages like $10 per hour or $15 per hour. Without this randomness, inflation – combined with the clustering of workers at fixed nominal wages – causes frequent discontinuous shifts in employment shares.[10]

Because union status and coverage by a union contract are not included in the MORGs until 1983, in some analysis we substitute the CPS May supplement for the early years (while retaining the wage thresholds used in the MORGs). The disadvantage of the May supplement is that the sample size is considerably smaller, reducing the precision of the estimates. We do not drop imputed wages, which could affect the estimated changes in return to union status (Hirsch and Macpherson 2003).[11]

We allocate each worker in each year to one of four wage bins, whose thresholds are constant in real terms over time. We choose the thresholds that divide workers into quartiles in 1979 (in years other than 1979, shares sum to one but are not necessarily equal). The same bins are used whether men and women are pooled or examined separately. Workers in the bottom wage bin earn $11.69 or less (in 2014 dollars), workers in the lower middle group earn more than $11.69 and less than $16.99, workers in the upper middle group earn between $16.99 and $25.18, while workers in the top group earn more than $25.18. We confirm that patterns are similar when five groups are defined based on quintiles rather than quartiles in 1979.

To assess patterns by education group, we define six dummies: low dropout (eight or fewer years of education), high dropout (9–11 years of education), high school graduate (12 years of education), some college (13–15 years of education), college graduate (16 years of education) and post college (more than 16 years of education). We employ nine age dummies, a dummy for being a union member and a dummy for being covered by a union

[10] We have experimented with the amount of randomness to be added, and found that $0.2k_i$ is the smallest amount that serves to prevent the discontinuous shifts.

[11] We will check sensitivity to this in a future version.

contract without being a union member.[12] We harmonize 22 occupational categories and 34 industry categories across the surveys: see the Data Appendix. The means of the variables for women and men in selected years are given in Appendix Tables 1 and 2.

# 3 Methods

We present some data series adjusted for the business cycle, and we perform Oaxaca decompositions of the changes in shares of workers in each wage bin over time. We perform the decompositions both on a yearly basis and over longer periods.

## 3.1 Adjusting for the business cycle

We adjust time series for shares in each wage group for the business cycle in several steps. We first regress each time series of 37 observations on HP–filtered log GDP and its first two lags, using a linear probability model. We then compute the residuals and calculate the predicted share for 1979. We sum the predicted share for 1979 and the residual for each year, thus predicting what the shares would have been in each year had filtered GDP and its two lags remained at their 1979 values. Figure 1 plots HP–filtered log GDP: the interpretation of some results is likely influenced by the fact that GDP thus filtered did not begin to recover from the Great Recession until 2015.

## 3.2 Oaxaca–Blinder decompositions

We perform Oaxaca–Blinder decompositions of the change in the share in a wage bin between selected years. For this purpose, we use the Oaxaca command in Stata from Jann (2008), which permits the contributions of individual covariates and their coefficients to be computed. The base year is the earlier of the pair of years. Oaxaca decompositions are additive, meaning that 100% of the changes between any pair of years are explained by changes in covariates or their coefficients. Despite this, one can view the contribution of the change in the coefficient on the constant (the change in the intercept), as representing

[12] In early analysis we included a dummy for part–time status, but dropped it out of concern that it was influenced by measurement error in hours of work. Place of birth is available from 1994. In a future version, we will investigate the importance of being born abroad. Enrollment status is available from 1984: in early analysis, student status played no important role.

an unexplained component, as it is not associated with any observed variable.[13] The results are affected by selection – into and out of the labor force, and into and out of union membership, for example – and the estimated returns are not necessarily causal.

We perform Oaxaca–Blinder decompositions using the MORGs for the periods 1983–1990 and 1990–2008, but also for 1980–1990 using the May 1980 CPS. We select the years in question because the level and first two lags of HP–filtered log GDP are similar in 1980, 1990 and 2008 (see Figure 1). We also construct graphs based on Oaxaca decompositions of changes in wage group shares between each adjacent pair of years for 1983–2015. The aim is to show how the share of workers in a group would have evolved yearly from 1983 had only a single covariate or its coefficient evolved, with all others held constant. For example, to show the effect of changing education, we plot the 1983 predicted share for 1983, then add the contribution of changing education to the 1983–1984 group share and plot this for 1984, then add to this 1984 value the contribution of changing education to the 1984–1985 group share and plot this for 1985, etc. These adjacent-year plots facilitate a finer appreciation of the timing of various effects than do the 1980–1990 and 1990–2008 decompositions, but they do include business cycle effects.[14]

# 4 Is there employment polarization?

We depict in Figure 2 the simple time series of the shares of workers in each of the four wage groups from 1979–2015; by construction a quarter of workers are in each group in 1979. The graph does show a gradual decline in the share of the two middle groups, which is a characteristic of employment polarization. However, it does not show simultaneous increases in the shares in the top and bottom groups, which is the other characteristic of polarization. In the recessions of the early 1980s, early 1990s and late 2000s, the share in the bottom group rises and in the top group falls, while the opposite occurs in the expansion periods, and especially in the boom of 1996–2001. What is happening at lower frequencies than the business cycle is clearer when the shares are adjusted for the business cycle, as in Figure 3. With this adjustment, the top share trends upwards from 1992, while the bottom share trends downwards over the same period. Neither changes much during

[13] Some research using Oaxaca decompositions refers to changes in all coefficients – intercept and slope – as representing the "unexplained" component. We consider the unexplained component to consist only of changes in the intercept.

[14] We do not do graphical analysis of 1980–1982 because there is no union information in the CPS in 1982, and because the samples from the Mays are small, especially for 1981.

the 1980s, while the sharp fall in the top share and the sharp rise in the bottom share of 1979—1981, which appeared to be the result of the 1980 recession in Figure 2, remain despite the adjustment for the business cycle. These changes dwarf changes in the middle shares. The absence of employment polarization is particularly clear if the period since the apparently one–off changes of 1979–1982 is considered.

We find a much higher increase in the share of workers in the top wage group than LoPalo and Orrenius (2015). This study and others finding employment polarization have used data from the decennial census and the American Community Survey (ACS), which could be one reason for the different results. Indeed, we obtain slightly different results using the Census and the ACS, though the main differences between our CPS results and the LoPalo and Orrenius (2015) results are the addition of randomness to our CPS wages and the comparison in LoPalo and Orrenius of a boom year (1979) and a bust year (2012).

Another difference between our work and previous studies is that some of those studies have observed polarization in employment growth when sorting workers by the average wage of their occupations, rather than by the workers' actual wages. The former pattern has been found to be most marked in the 1990s (e.g. Autor 2015, and also Schmitt et al. 2013), and we accordingly group our data by occupation for 1989–1999 and show employment growth by occupation in Figure 4 (c.f. Figure 2 in Autor 2015). Putting agricultural occupations aside (they are not included in Autor's graph), there is indeed a weak pattern of polarization – employment growth in the occupations with the lowest average wage in 1979, a decline in three large low–wage to middle–wage occupations, and generally high employment growth in the better paid occupations – even if the exact numbers do not correspond to those based on census data.[15] By contrast, we find a strong decline in the share in the bottom wage group in the 1990s and a stable share in the middle groups. This is not an artifact of differently sized groups of workers. If we define the bottom group as the bottom 20% (rather than 25%) of workers in 1979, our bottom group comprises a very similar share of workers to the share in the low–paid occupations, and we obtain roughly the same results as when we use our preferred 25% bin.

More generally, while grouping by occupation is useful for some purposes, we do not believe it is useful as a way of summarizing employment patterns by wage. To the extent

[15] For example, employment in production occupations declines in our data while it rises in the census data, albeit weakly.

that employment growth happens disproportionately in low-wage jobs within high-wage occupations, or vice versa, the occupation-focused approach may be misleading.

The patterns in the shares of workers in our wage bins shown in Figures 2 and 3 mask very different evolutions over time for men and women, although for both the share of workers in the upper middle wage group declines and the share in the lower middle is stable. For women, the wage shares plotted in Figure 5 and especially the business–cycle adjusted wage shares plotted in Figure 6 suggest that the principal development is that women are steadily moving up through the wage groups (which continue to be defined based on the pooled male and female sample). The adjusted share in the bottom group declines steadily over time (with the exception of 1979–1981), the adjusted share in the top group rises steadily over time (with the same exception), the share in the upper middle is stable, and if the share in the lower middle falls, it must be because women are moving faster from the lower middle to the upper half than from the bottom to the lower middle. A decline in the lower middle share is a good thing in this situation.

The unadjusted shares in Figure 5 show some mild business cycle patterns, particularly in the late 1990s expansion which reduced the share in the bottom group considerably. The unadjusted patterns also suggest that female progress began to falter and employment began to polarize around 2002. The adjustment for the business cycle in Figure 6 shows that some of this slowdown is due to a change in the macro environment, but confirms a slight underlying slowdown.[16]

Men's patterns are quite different. The effects of recessions on the top and bottom wage groups are more marked than for women in the unadjusted wage shares of Figure 7. The adjusted shares in Figure 8 suggest two distinct periods for men: the 1980s, when men slid down through the wage groups; and post–1992, when there was a partial recovery with movement from the lowest three groups to the top group. The decline in the share of men in the upper–middle wage group therefore represents an unwelcome development in the 1980s, and a welcome one since then. The different patterns over time and the contrast with women show that a decline in the middle class cannot be examined in isolation from the larger context, and may be good or bad.

Appendix Figures A1–A5 show that the same conclusions obtain based on analysis of five wage groups (representing quintiles in 1979) rather than four.

[16] This result may be sensitive to the method of adjusting for the business cycle. We shall check this in a future version.

# 5 What is causing low–frequency changes in shares?

The analysis of the previous section suggested that underlying wage trends have been favorable to both men and women since about 1992, leaving only temporary cyclical departures from a positive trend. It may appear, therefore, that it is the task of counter-cyclical policy rather than long-run, structural policy to improve the lot of workers. There are several reasons why this is not correct. In addition to men's never having recovered their position of 1979 and women not having caught up with men despite this, wage trends since 1992 are less impressive than they seem once one considers the concurrent large increases in education and experience, as well as the swift rise in GDP per capita. While it is beyond the scope of the paper to investigate the decline in labor's share of GDP, we now use Oaxaca decompositions to assess what factors are working to slow the wage gains of increasingly educated and experienced workers. In order to consider union status and also use the preferred MORG data exclusively, we begin in 1983. We include all characteristics including occupation dummies. This has the advantage that the role of changing returns to occupations, which may reflect automation and offshoring, may be assessed. It has the disadvantage that the role of changing shares of workers in occupations must be assessed at the same time, and for women particularly, movement to better–paying occupations is an outcome of interest in its own right.

## 5.1 Aggregate analysis

We begin by presenting aggregated results of the decompositions. In Figures 9 for women and 10 for men, we first plot the predicted shares of workers in each wage bin for reference (in solid blue): note that the y–axis scales differ across graphs. With green triangles, we plot the contributions of changes in characteristics by adding the yearly contributions cumulatively to the 1983 share: this is how the shares would have evolved due to the changes in characteristics only. With red squares, we plot how the shares would have changed had only the returns to characteristics – except the intercept – changed. Finally, with yellow crosses, we plot the influence of the changing intercept, the truly unknown component.

If changes in observable characteristics and their returns fully explained employment shifts, the intercept lines would be flat at the original, 1983 shares. At the opposite extreme, the closer the intercept line lies to the predicted share line in blue, the lower the

explanatory power of observed characteristics and their returns.

The figures show that changes in characteristics are generally more influential than are changes in the return to their characteristics, and that improving characteristics have caused upward mobility, especially for women. Improving characteristics have moved women steadily from the lower two wage groups (especially the bottom) to the upper two (especially the top), reducing the bottom wage group by about six percentage points and raising the top group by about five percentage points. Improving characteristics reduced the share of men in all three lower wage groups fairly steadily, increasing the share in the top group by about five percentage points. Appendix Figures A9 and A10, which replicate the figures for decompositions without occupation as a characteristic, show that the contribution of changes in characteristics is not very sensitive to the inclusion of occupation, as its contribution comes to some extent at the expense of increasing education.

Changes in the returns to characteristics were favorable to women from 1983–2001, reducing the share in the bottom group as fast and steadily as improving characteristics, and increasing the share in the upper middle group correspondingly, suggesting upward mobility through the lowest three wage groups. Since 2001, changes in returns to characteristics have had no effect on women. The effect of changing returns to characteristics have a different effect on men, tending to reduce the share of men in the top wage group and increasing the share in the middle groups, suggesting downward mobility through the upper three wage groups.

The contributions of characteristics and their returns do not appear to capture business cycle fluctuations, with these fluctations tending to be reflected in the intercept line. The one exception is the share of men in the top wage group: returns to characteristics do capture some of the cycles (we shall see below this is driven by the return to union status). The intercept lines generally have little trend after about 1995 (after 2001 for the share of women in the top group), indicating that trends in observed variables and their return adequately characterize changes in shares. For both men and women, unexplained factors, possibly including macro factors, pushed up the share in the bottom from especially from 1987 to 1995. Together, the intercept lines suggest an unmeasured polarizing force or combinations of forces for women until 1995, while for men they suggest downward mobility from the upper half to the lower half, especially the bottom.

In the next two sections, we examine yearly graphs with the more detailed contribu-

tions of specific characteristics and their returns for 1983–2015, but also provide tables with decomposition results for 1983–1990, capturing most of the period of male downward wage mobility, and 1990–2008, so as to report exact estimates with standard errors (Appendix Tables 3 and 4). The tables also provide decompositions for 1980–1990 using the May CPS for 1980, permitting a comparison of three years at the same point in the business cycle (1980, 1990 and 2008), which is important particularly for the comparison of the unexplained component.[17]

## 5.2 Role of changes in specific characteristics

Figures 11 and 12 report the contributions to the changes in shares of changes in specific characteristics. These contributions are generally steady and monotonic. For both men and women, the most influential characteristic is education, whose increase caused upward mobility from the lower two to the upper two wage groups. Increased education reduced the share of women in the bottom group by about five percentage points and increased the share in the top by about four percentage points, while it reduced the share of men in the bottom by about two percentage points and increased the share in the top by more than three percentage points. Movement to higher-paying occupations has effects similar to rising education, not surprisingly, though smaller in magnitude and concentrated before 2002.[18] For men, rising age also has similar effects to rising education, though for women age effects are smaller. The effect of rising age tapers off around 2005, though this is compensated for by a greater effect of rising education.[19] Since men were experiencing downward wage mobility in the 1980s, rising education, occupation and age have the wrong signs in this period for explaining actual trends.

For men, deunionization helps explain downward mobility in the 1980s, moving men from the upper two groups, especially the top, to the lower two groups, especially the bottom, with the effects greatest in the 1980s. The magnitudes are smaller than those of education, occupation and age, with deunionization increasing the share in the bottom by less than two percentage points and reducing the share in the top by about two percentage

[17] Point estimates from pooling May 1979–1981 supplements are similar.

[18] The presence of only small jumps in the plots for industry and occupation suggest the code harmonizations are satisfactory. The change in the education questions in the CPS redesign appears to have some small effects.

[19] The contribution of age, education and occupation together does fall after 2005, but for this purpose we prefer to rely on the decomposition without occupation. In these unreported results, the contribution of age and education together holds steady (see also Figures A9 and A10).

points, but the patterns suggest the largest effect might have been in the omitted years 1979–1983. Changes in industry mix have effects on men qualitatively similar to the effects of deunionization but smaller. For women, deunionization and changes in industry mix have little impact. Changes in state of residence play no role for either men or women.[20]

## 5.3 Role of changes in returns to specific characteristics

Figures 13 and 14 report the contributions to the changes in shares of changes in the returns to specific characteristics. The contributions are more variable over time than the contributions of changes in characteristics, and the estimates have larger associated standard errors and some are visibly noisier: these considerations justifiy using the MORGs with their large sample size even at the cost of fewer years of data (alternatively, pairs of years could pooled).

The most influential return is the return to union status, which affects the shares approximately as much as increasing age in the previous figures, something not highlighted in the previous literature. For both men and women, the change in the return to union membership is beneficial, mainly due to a one–time change from about 1996–2002 tending to reduce the share of workers in the bottom and increase the share in the upper middle, implying upward mobility through the lower three groups. Over the whole period, the fall in the return to union membership reduced the share of women in the bottom by about three percentage points and the share of men by about two percentage points.[21] The shares of men and women in the top wage group are not very sensitive to changing returns, though the return to union status has a cyclical effect.

For women, the role of the returns to industry is similar to that of the return to union, though slightly smaller in magnitude. The unreported very detailed results of the decomposition show that a beneficial change in the return to the education sector is beneficial in the 1980s, when teacher salaries rose[22], and the favorable evolution of returns to retail trade and food and drinking establishments was influential after 1990 (possibly reflecting increased productivity in the retail sector in the 1990s). Conversely, changing

[20] The result for states is notwithstanding the finding of Diamond (2016) that college graduates are increasingly concentrated in high wage, high rent cities.

[21] In this case dropping 1979–1982 involves a qualitative loss of information, as analysis using the May 1980 and 1990 MORG data sets indicates that the change in return to union status raised the share of men in the bottom (see Appendix Table 4). The implication is that the contribution must have been such as to raise the share in the bottom from 1980–1983, or that the May CPS data differ.

[22] https://nces.ed.gov/programs/digest/d09/tables/dt09_078.asp

returns to industry play little role for men. Changes in the return to education from 1983 to the mid 1990s tended to move men and women from the top and bottom groups into middle groups. Changing returns to states in the second half of the period tend to cause modest downward mobility for both men and women. Changing returns to occupation play a secondary role for both men and women, with the small effects observed imprecisely estimated, while there is no role for the changing return to age.

## 5.4 Summary

Figures 9-14 together show that men fared worse before 1992 than after mainly due to an unmeasured force or forces, deunionization and industry shifts in the earlier period, and a favorable change in the return to union membership that occurred after 1992. Women fared better than men before 1992 due to a beneficial unmeasured effect on the share in the top group (possibly representing increasingly lucrative college majors), faster growth in education, and the irrelevance of deunionization and changing industry mix. Women's progress slowed after about 2002 due to the worsening of the macro environment and the end of beneficial changes in return to union status and industry (it was also influenced by the end of the changes in return to education tending to cluster men and women in the middle wage groups).

These summary effects are quantified in Table 1, which reports the magnitudes and standard errors of the most influential components for the bottom and top groups in 1983–1990 and 1990–2008, aggregated from the more detailed results presented in Appendix Tables 3 and 4. We aggregate components that tend to move together, and report components contributing more than 0.10 percentage points per year in absolute value.[23] The first row of Panel B shows that increasing age and education together reduced the share of women in the bottom wage group by 0.25–0.28 percentage points per year, while boosting the share in the top by 0.20–0.24 percentage points per year. The share of men in the bottom was reduced by 0.16–0.19 percentage points per year, while the share in the top was boosted by 0.15–0.23 percentage points per year.[24] Women's progress through greater occupational attainment provided upward mobility in the earlier period, reducing the share in the bottom it by 0.12 percentage points per year and expanding the share in

[23] We omit one component for the return to states of -0.101.

[24] Were occupation not included as a characteristic, the (reported) figures would be a fall in the share in the botto of 0.33–0.36 and a rise in the share of the top of 0.26–0.32. Compare also with Figure A9.

the top by the same amount (Panel B third row). Changes in the returns to occupation are not sufficiently influential to warrant reporting in the table.

For men, the joint effects of deunionization and changing industry mix were as detrimental in the earlier period as increasing age and education were beneficial, increasing the share in the bottom group by 0.15 percentage points per year and reducing the share in the top group by 0.13 percentage points per year (Panel B second row). While these effects were not influential for women, the changing return to union status and industry were very influential for the share of women in the bottom group in both periods, reducing it by 0.20–0.21 percentage points per year (Panel C second row).

The substantial effect of the changing return to education in moving workers to the middle two groups is also not well represented in the table (Panel C first row), due to the aggregation with age, whose return does not change in an influential way, and because the change in return to education straddles the two periods . Finally, many of the unexplained components are large, though not all of them are statistically significant (Panel C third row). Only those for 1990 and 2008 are measured at comparable points of the business cycle, however, and the intercept terms from Appendix Tables 1 and 2 column 2 should be used for 1980. These confirm that the largest unexplained components are for the 1980s, tending to increase the shares of men and women in the bottom wage group and women in the top.

# 6 Conclusion

Focusing on employment by wage level rather than by a wage ranking of occupations, we investigate the declining share of middle-wage employment. The explanations for this trend differ across men and women as well as across time periods. Labor market outcomes for women are characterized by strong improvement – though somewhat slowed starting in the early 2000s – with middle-wage jobs giving way to high-wage jobs. After a difficult labor market experience in the 1980s, employment for men behaved qualitatively similarly, but with weaker progress.

Our results highlight the disappointing wage growth of American workers given their increasing education and age, and provide some guidance as to what is holding workers back. Men experienced downward wage mobility in the 1980s due to deunionization, the decline in manufacturing, and (for the bottom share) an unexplained factor. These factors

no longer played an important role from the 1990s, which permitted mild upward mobility. However, male upward mobility was lower than that of women, as men failed to benefit from changing returns to industry, and benefited less than women from the changing return to union status, factors important for the bottom three female wage groups until 2001. Men also experienced downward mobility in the top three wage groups due to small or moderate changes in returns to several characteristics including state of residence. For their part, women's upward mobility slowed around 2001, as the beneficial changes in return to industry and union status ended and the macro environment worsened. The changing return to education compressed employment for men and women in the 1990s, reducing the share of workers in both the bottom and top wage groups; the ending of this phenomenon was detrimental to the share in the bottom wage group in the 2000s.

We no evidence of employment polarization, understood as a decline in middle-wage employment accompanied by increases in the shares of both the bottom and top parts of the employment distribution, nor of any polarizing factor, nor of any important role for occupations. This suggest that if changes related to returns to occupations or tasks, such as computerization, do have a major effect on the wage structure, it is not one that results in employment polarization.

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# Data Appendix

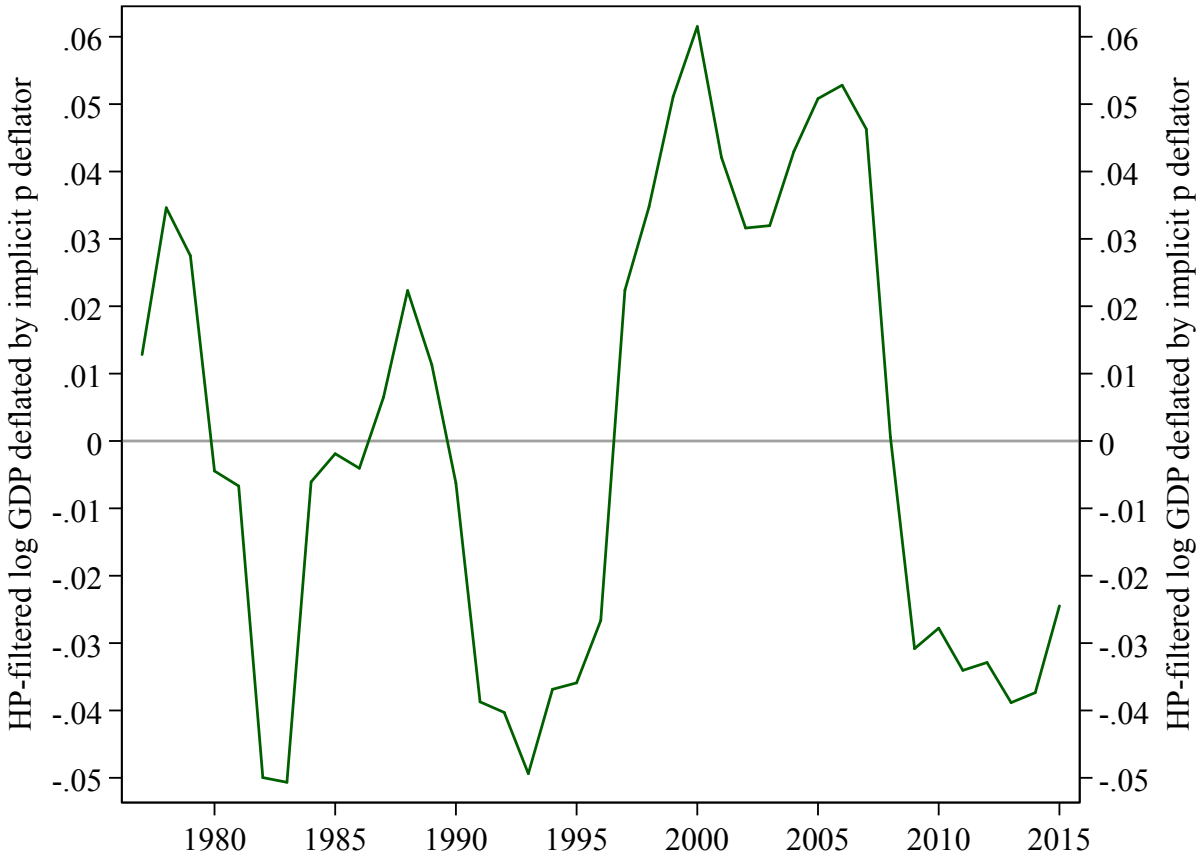
## 6.1 Harmonization of industry codes

The basis for the harmonization of the industry codes is the aggregate industry codes in the NBER MORG extracts. The NBER itself combines the 1970, 1980 and 1990 codes to generate 48 harmonized aggregate codes, leaving the main task the harmonization of this set of codes with the 2000 aggregate codes. Our general approach is to make the later codes conform to the earlier codes, but we do make some changes to the earlier codes. We reassign those in the 1970–1990 agricultural services category (which does not exist in the 2000 codes) based on their detailed industry code to other professional services (veterinary services), business services (landscaping and horticultural services) or agriculture (other agricultural services). We also split the 1970–1990 retail trade and food services category into two (retail trade, food services). The largest set of changes to the 2000 codes involve the professional and technical services and administrative and support services categories, which crudely correspond to other professional services and business services respectively. However, we reassign specialized design services, computer systems design and related, management, scientific and technical consulting, and advertising and related services from professional and technical services to business services; the aggregate category of membership associations and organizations to other professional services; rental and leasing services from rental/leasing to business services (except video leasing, which is assigned to arts and entertainment); data processing from other information services to business services; travel services from administrative and support services to transportation. We also change the 2000 codes so as to move librarians from other information services to educational services. We merge the 2000 categories (and in some cases 1970–1990 categores) of agriculture and forestry; beverage and tobacco production; petroleum/coal and mining; primary, fabricated and not specified metals; furniture and wood; paper and printing, textiles, apparel and leather; aircrafts and parts, motor vehicles and parts, and transportation equipment; toys/amusements/sporting goods, professional and photographic equipment, miscellaneous manufacturing; accomodation and personal and laundry services; broadcasting, telecommunications, internet publishing and broadcasting and internet services and data provision; paper/printing and publishing; electrical machinery production and computer and electronics production. Some of these merges are done because the more detailed categories are small.

## 6.2 Harmonization of occupation codes

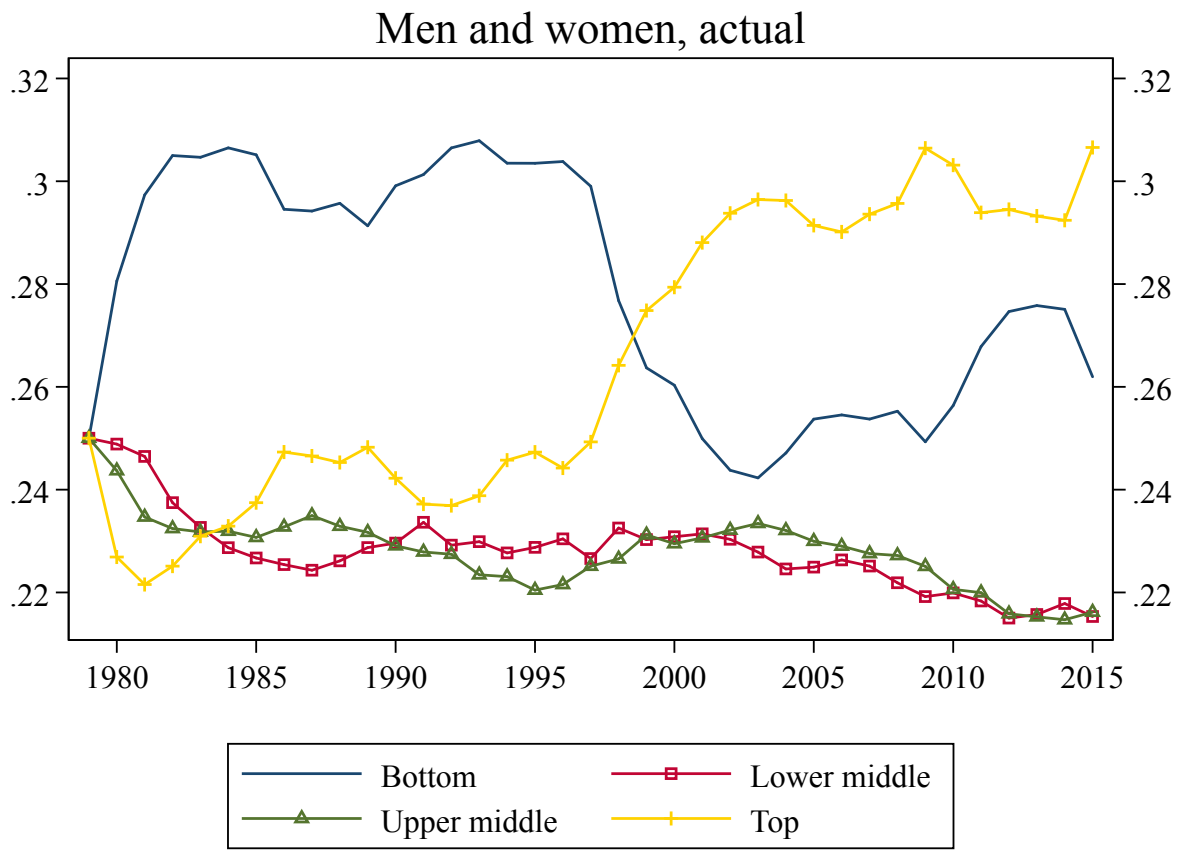
The basis for the coding of occupations is the categories available in the NBER extract covering 2000–2015. For 2002–2015, we use the NBER–assigned aggregate categories available for 2000–2015 ("docc00"). We use the detailed occupation code "occ", available for 1979–2002 to assign occupations for 1979–2002 based on which docc00 code they best correspond to in the overlap years of 2000–2002. In these overlap years, the BLS coded occupations using both old and new categories. The most difficult category to match is the aggregate category Office and Administration Occupations.

Figure 1: HP–filtered log real GDP, 1977–2015



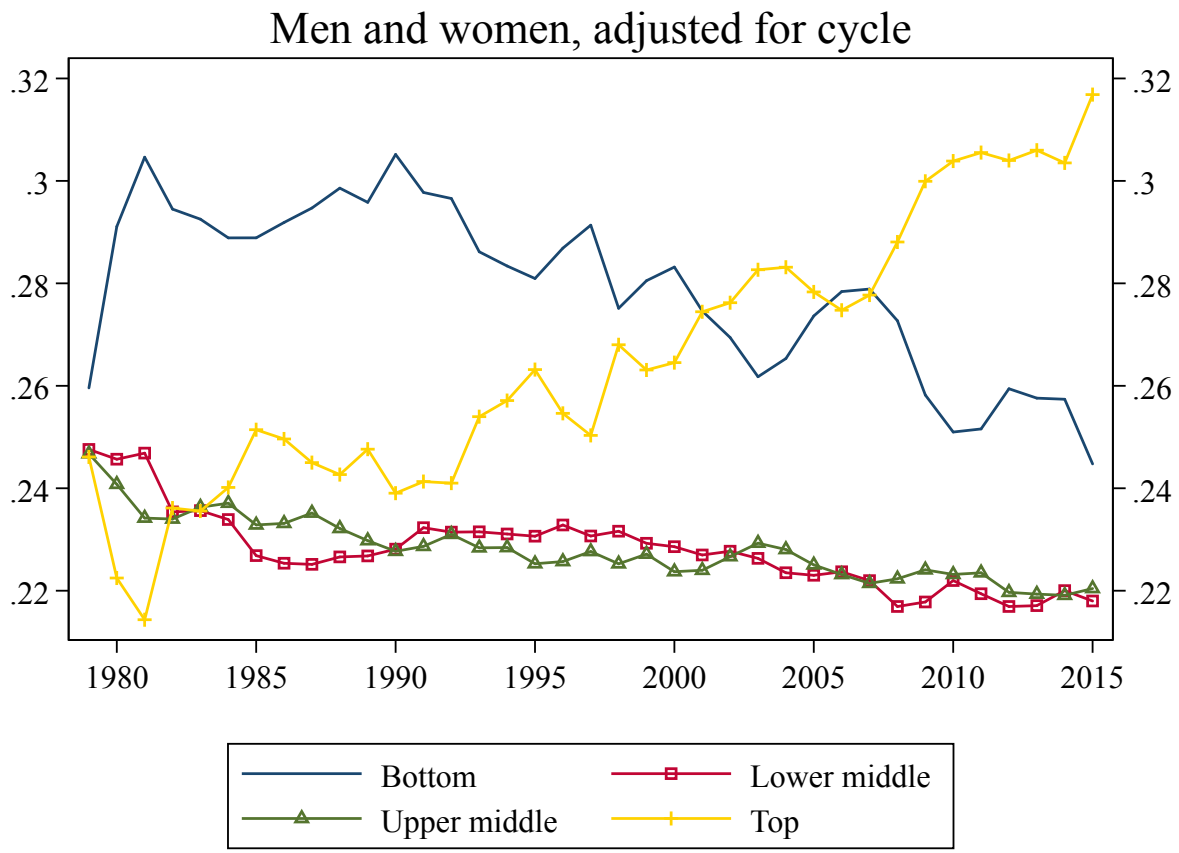

Source: CPS MORGs.

Figure 2: Shares of workers in four wage bins, 1979–2015



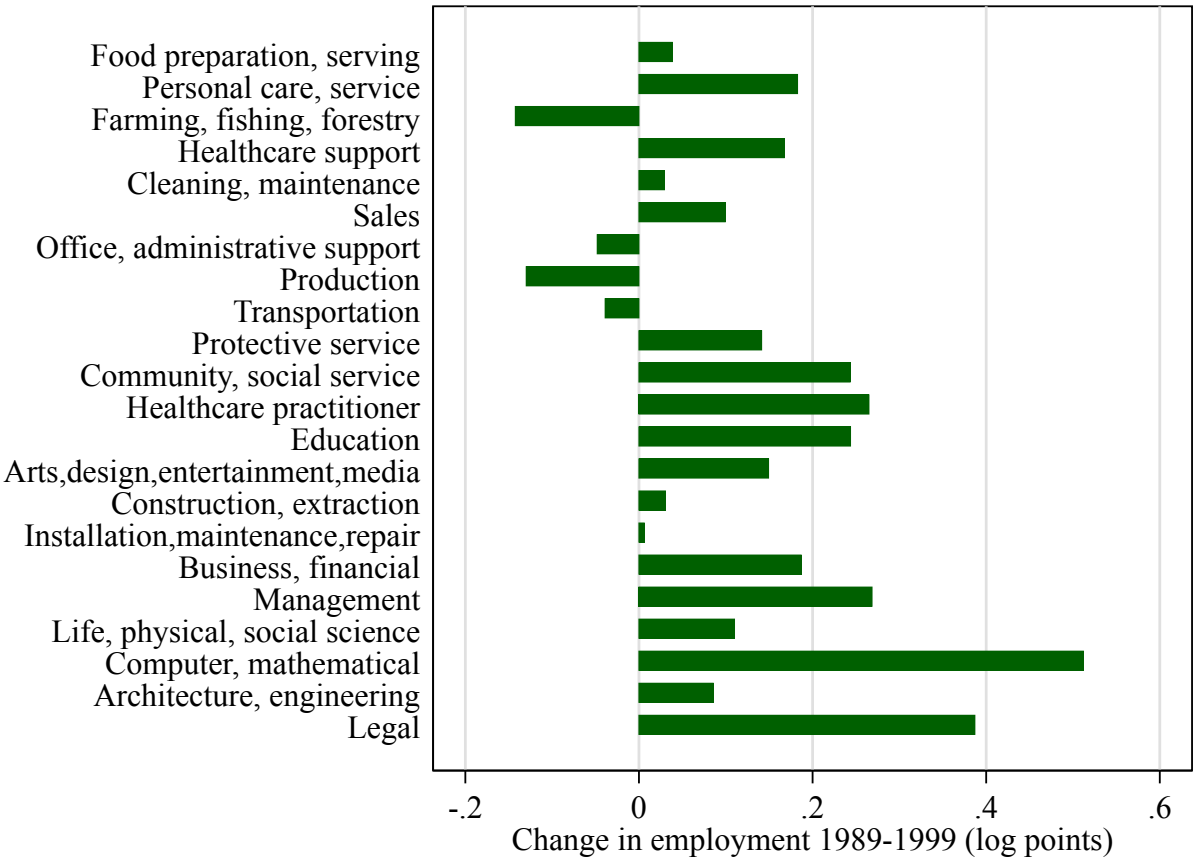

Source: CPS MORGs.

Figure 3: Shares of workers adjusted for HP–filtered GDP, 1979–2015



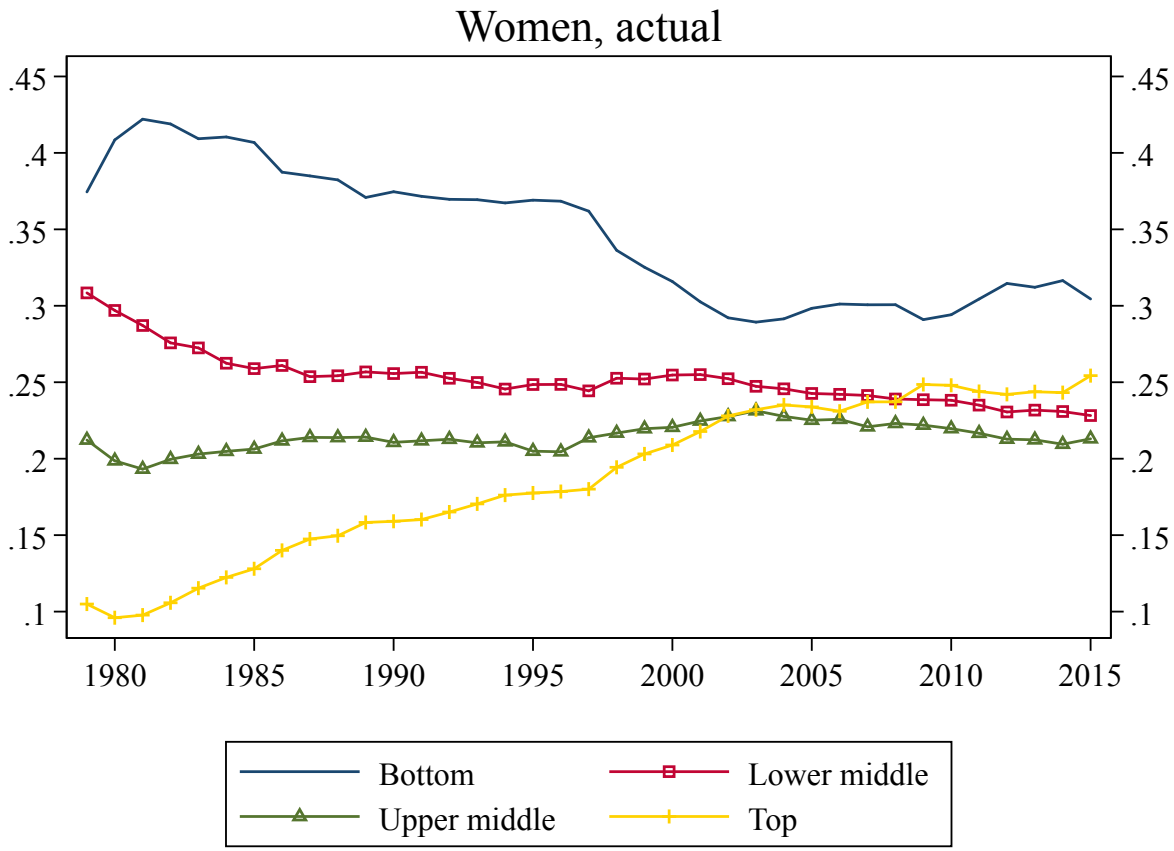

Source: CPS MORGs.

Figure 4: Changes in employment by occupation, ordered by median 1979 wage



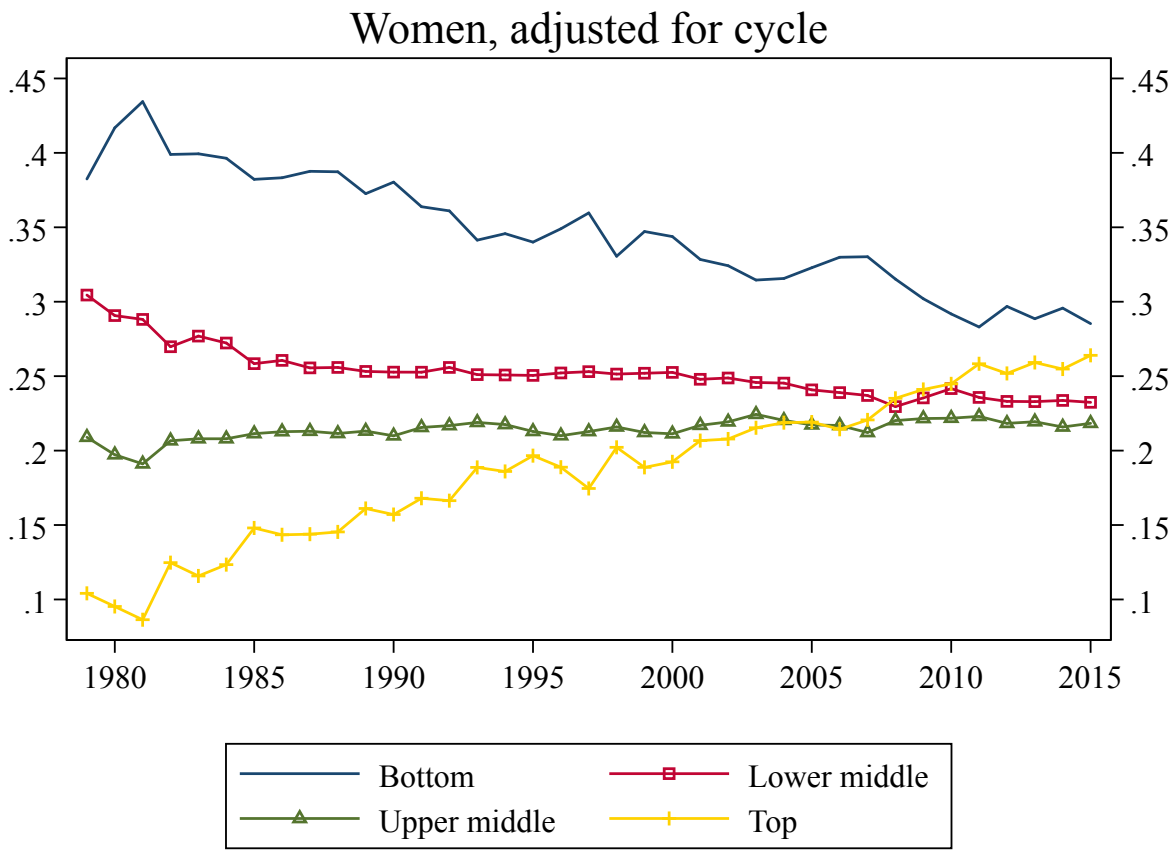

Source: CPS MORGs.

Figure 5: Shares of women in four wage bins, 1979–2015



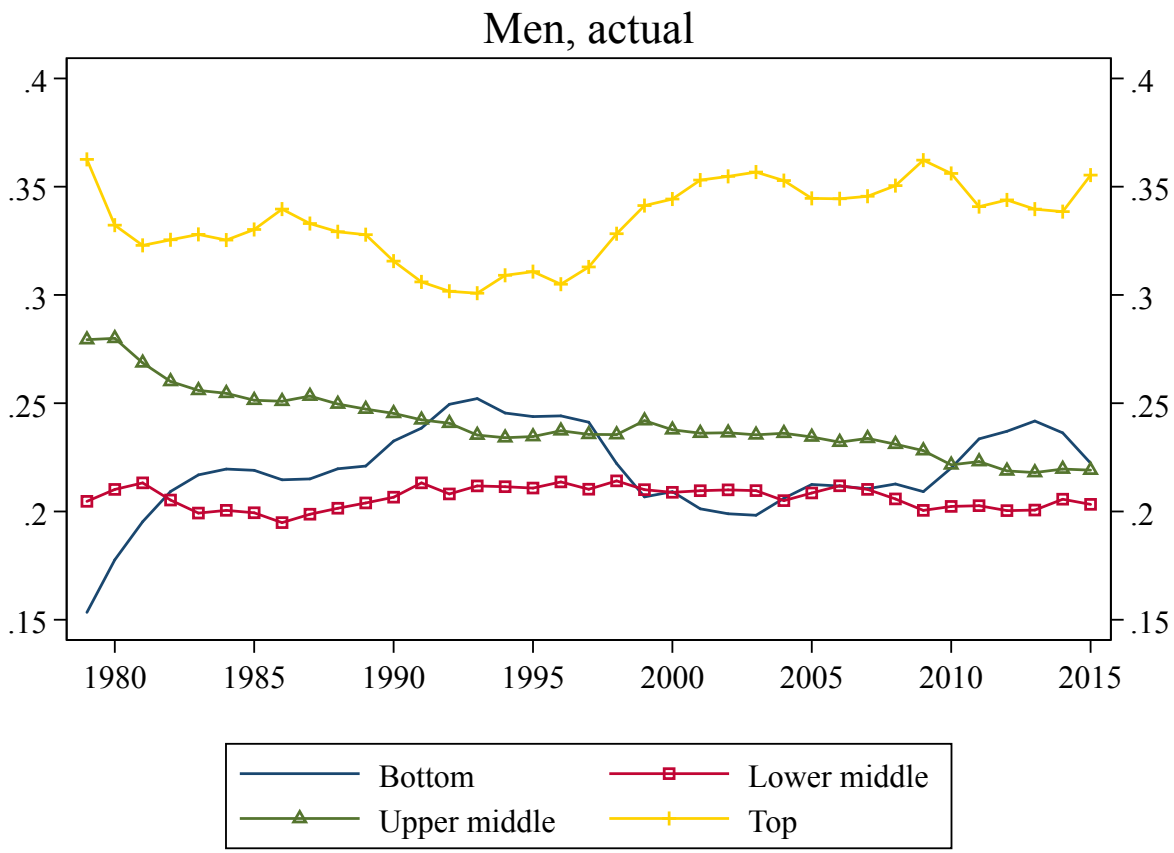

Source: CPS MORGs.

Figure 6: Shares of women adjusted for HP–filtered GDP, 1979–2015



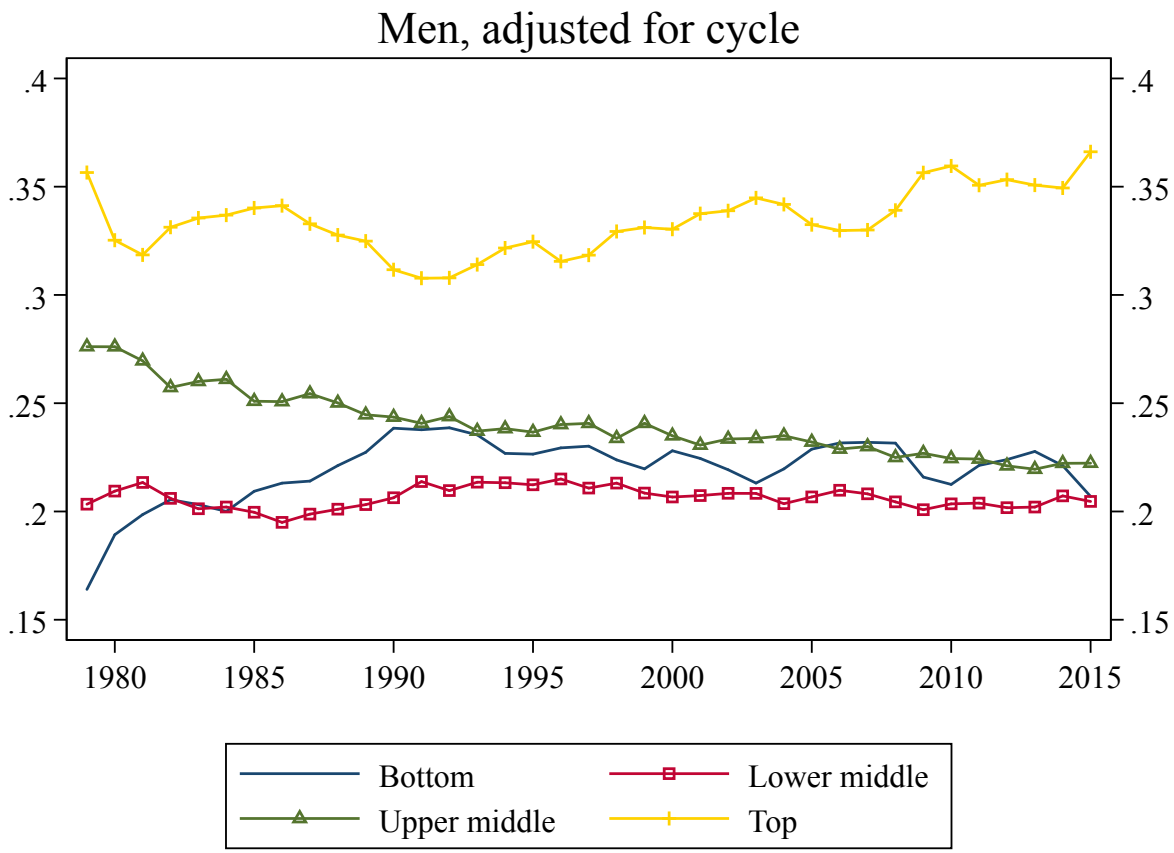

Source: CPS MORGs.

Figure 7: Shares of men in four wage bins, 1979–2015



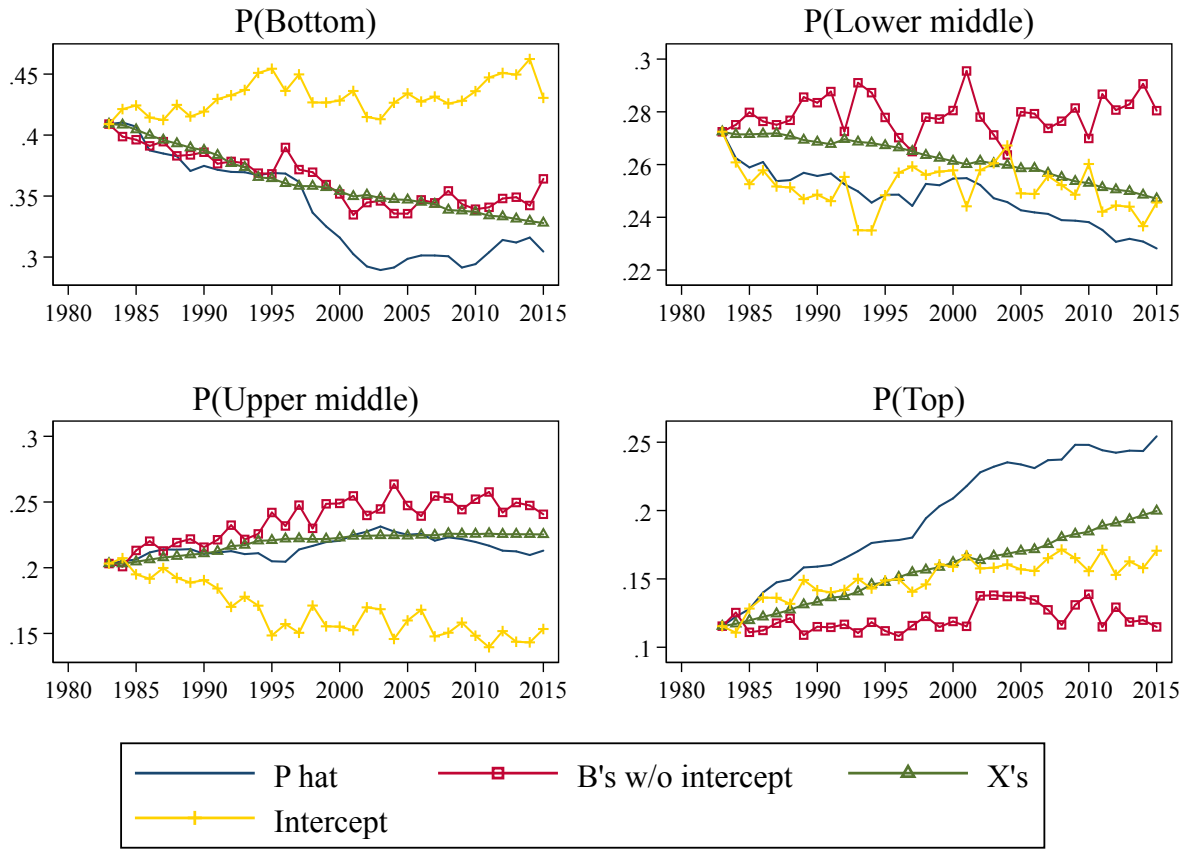

Source: CPS MORGs.

Figure 8: Shares of men adjusted for HP–filtered GDP, 1979–2015



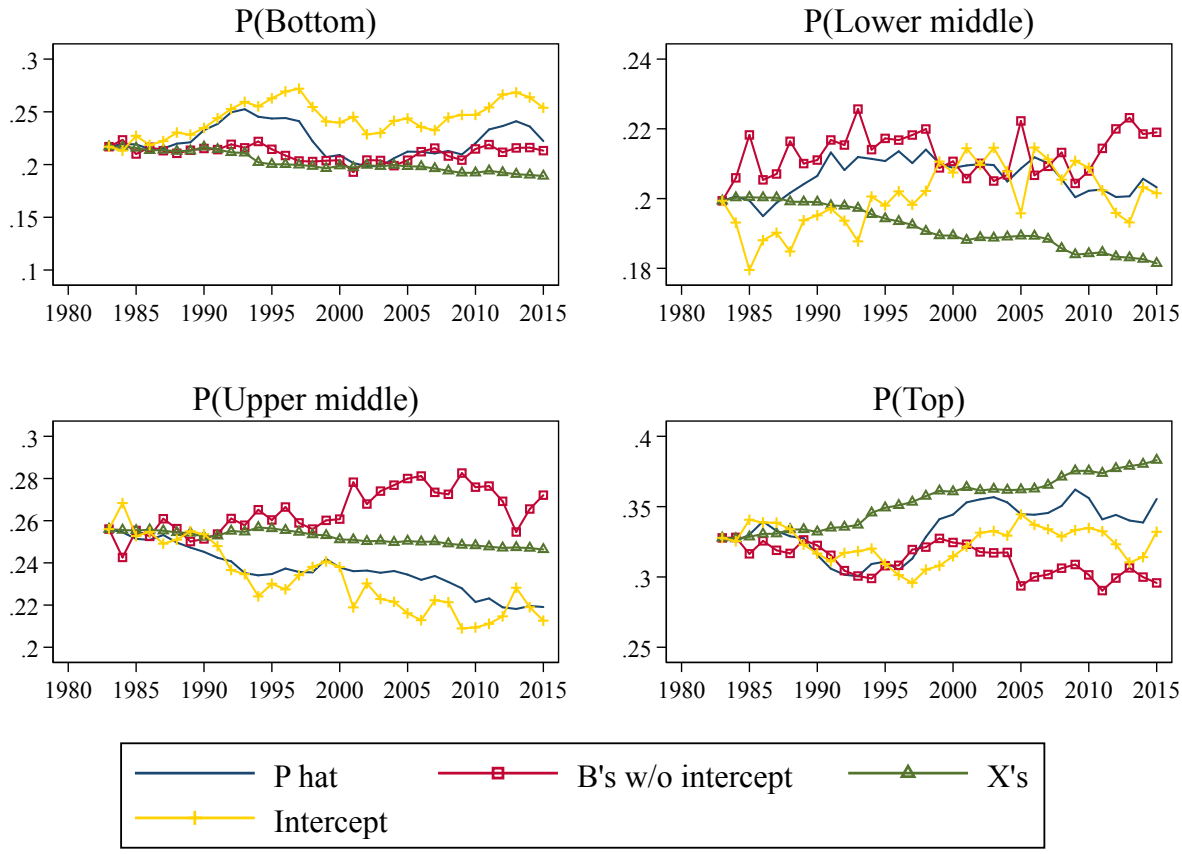

Source: CPS MORGs.

Figure 9: Predicted shares and their components 1983–2015 – women



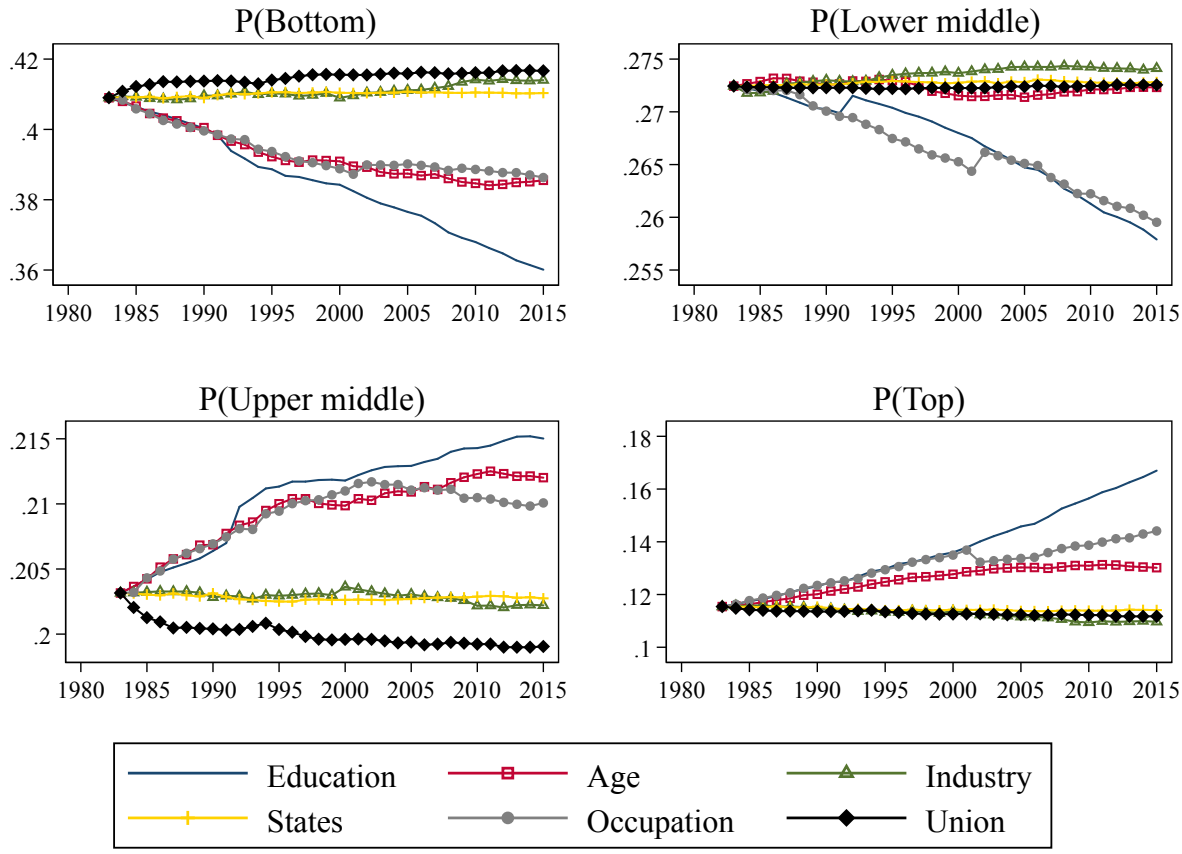

Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

Figure 10: Predicted shares and their components 1983–2015 – men



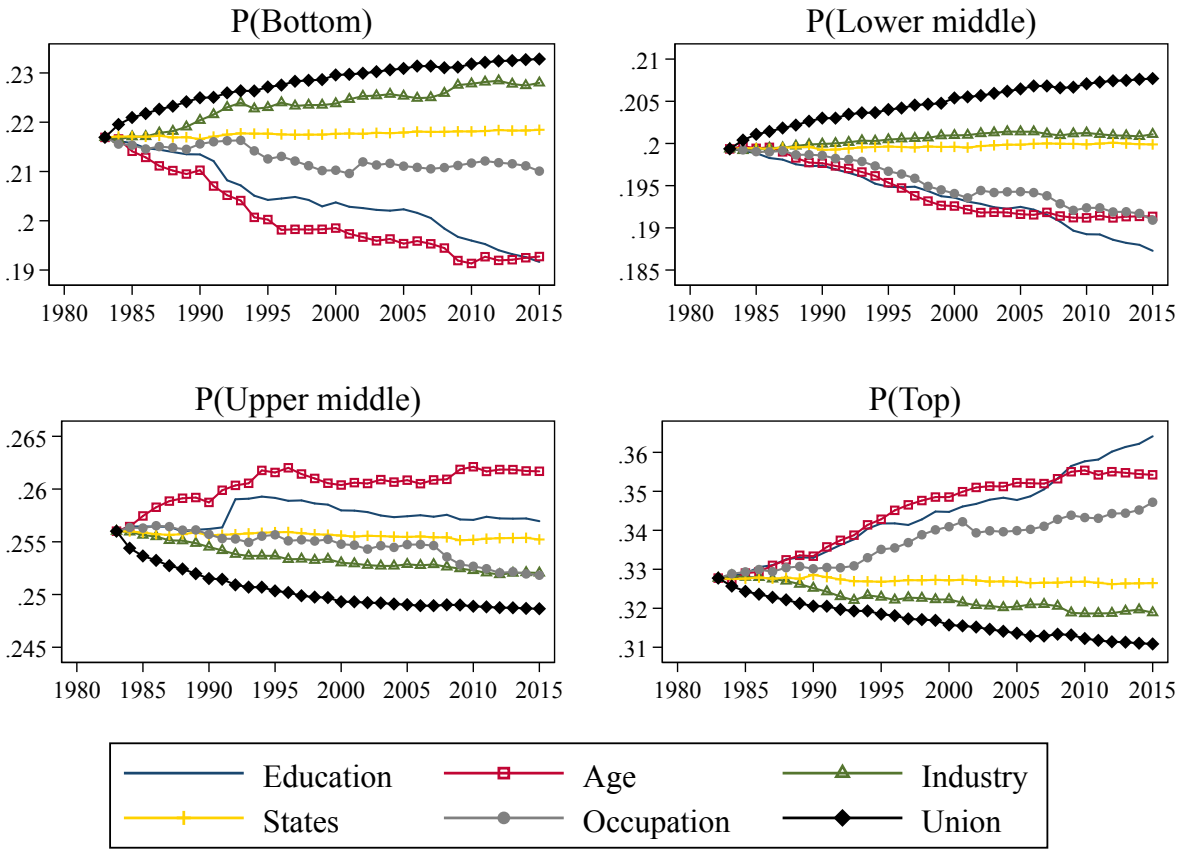

Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

Figure 11: Contributions of individual X's 1983–2015 – women



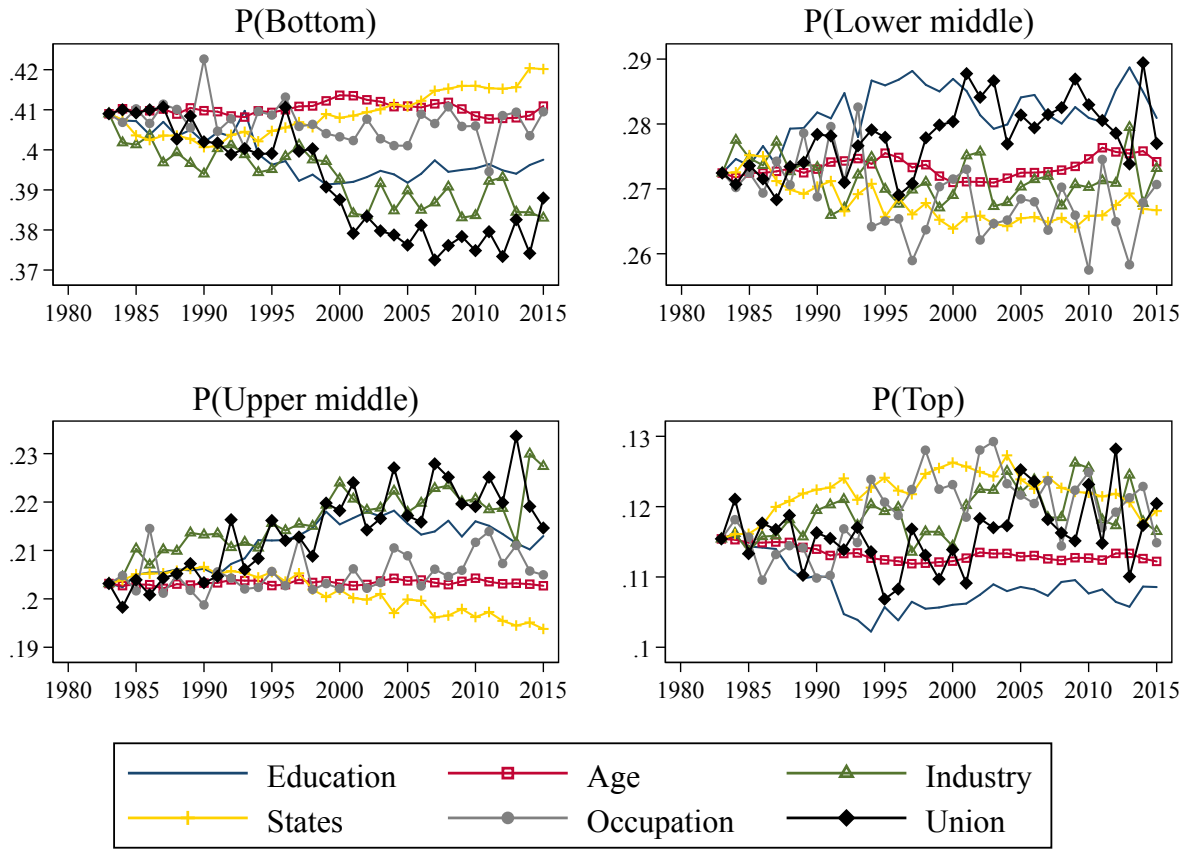

Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

Figure 12: Contributions of individual X's 1983–2015 – men



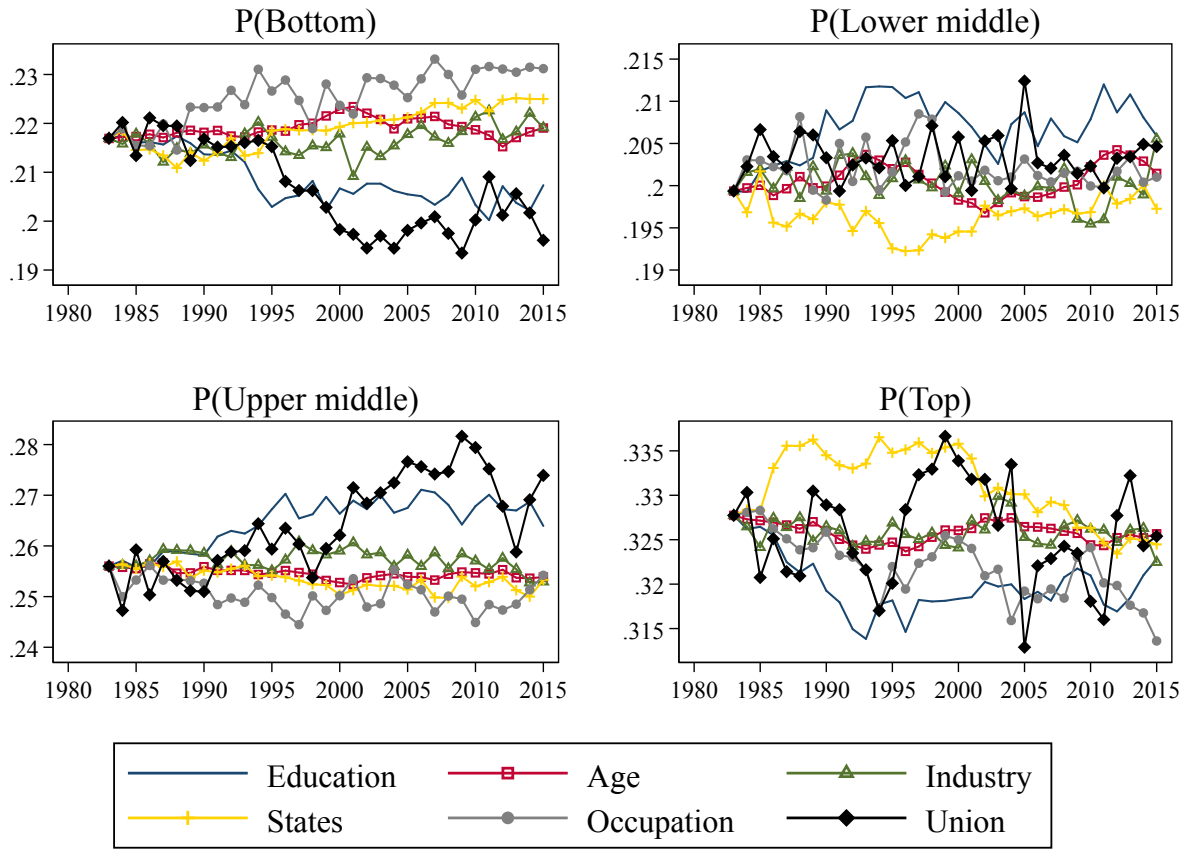

Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

Figure 13: Contributions of individual $\beta$'s 1983–2015 – women




Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

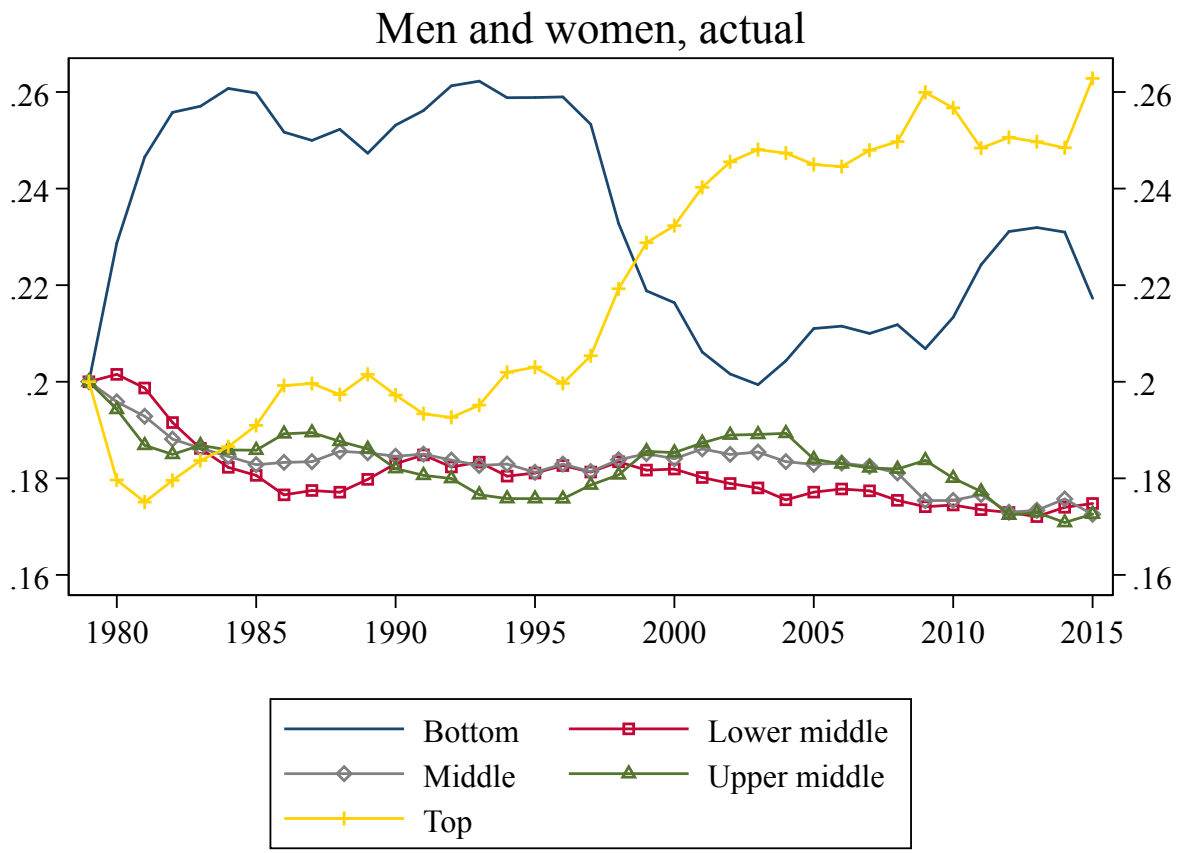
Figure 14: Contributions of individual $\beta$'s 1983–2015 – men




Note: Oaxaca decomposition based on education, age, state, union status, industry and occupation.
Source: CPS MORGs.

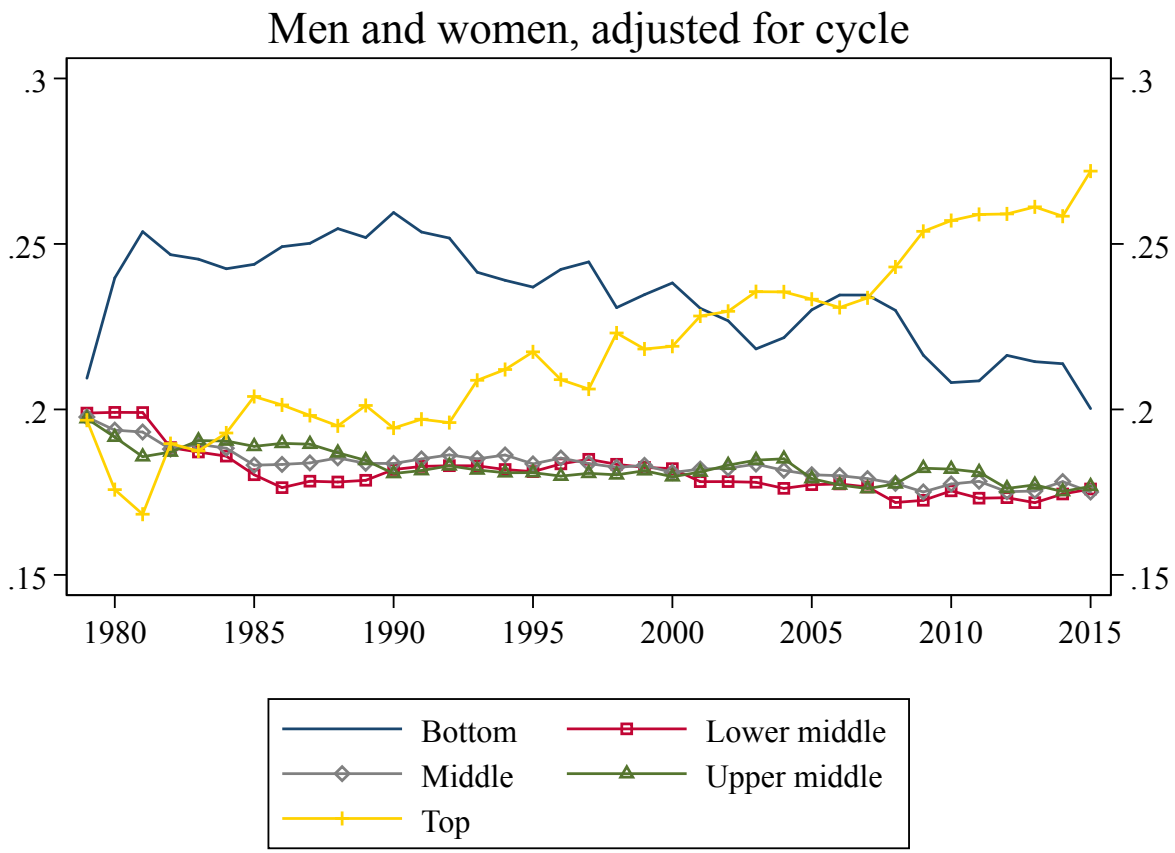
| | Women | | | | Men | | | |
|---|---|---|---|---|---|---|---|---|
| | 1983-1990 | | 1990-2008 | | 1983-1990 | | 1990-2008 | |
| | Bottom | Top | Bottom | Top | Bottom | Top | Bottom | Top |
| **ΔP** | **-0.640** | **0.622** | **-0.368** | **0.435** | **0.225** | **-0.174** | **-0.110** | **0.194** |
| | **(0.041)** | **(0.024)** | **(0.013)** | **(0.011)** | **(0.028)** | **(0.032)** | **(0.011)** | **(0.013)** |
| **ΔX** | | | | | | | | |
| Age+edu | **-0.279** | **0.199** | **-0.251** | **0.238** | **-0.158** | **0.148** | **-0.191** | **0.227** |
| | **(0.011)** | **(0.022)** | **(0.006)** | **(0.006)** | **(0.010)** | **(0.011)** | **(0.005)** | **(0.006)** |
| Union+ industry | -- | -- | -- | -- | **0.154** | **-0.127** | -- | -- |
| | | | | | **(0.008)** | **(0.007)** | | |
| Occ | **-0.123** | **0.116** | -- | -- | -- | -- | -- | -- |
| | **(0.009)** | **(0.006)** | | | | | | |
| **Δβ** | | | | | | | | |
| Age+edu | -- | **-0.118** | -- | -- | -- | **-0.138** | -- | -- |
| | | **(0.022)** | | | | **(0.019)** | | |
| Union+ industry | **-0.210** | -- | **-0.202** | -- | -- | -- | -- | -- |
| | **(0.089)** | | **(0.033)** | | | | | |
| Constant | **0.103** | **0.375** | -- | **0.165** | **0.253** | **-0.159** | -- | -- |
| | **(0.129)** | **(0.081)** | | **(0.040)** | **(0.078)** | **(0.088)** | | |
| Obs | 156,290 | 160,735 | 157,128 | 161,573 | 178,859 | | 168,422 | |

Figure A1: Shares of men and women in five wage bins, 1979–2015



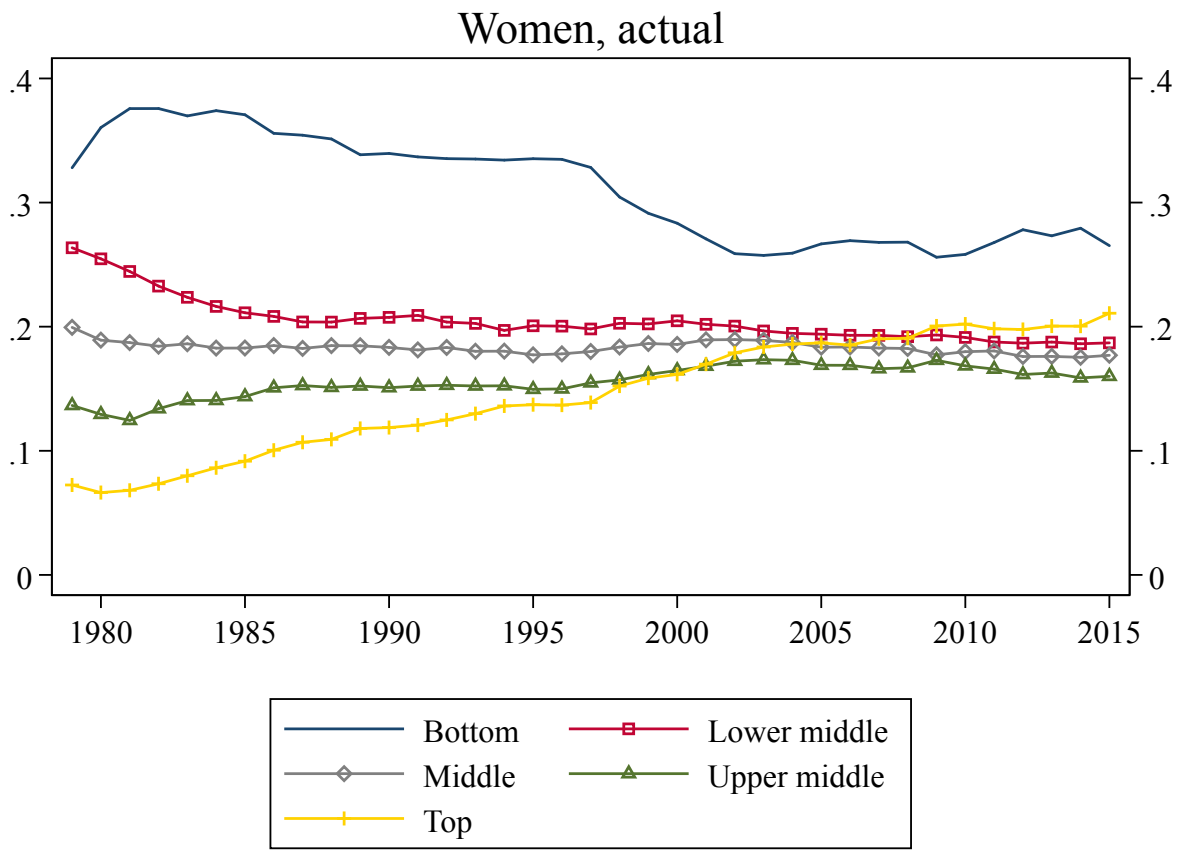

Source: CPS MORGs.

Figure A2: Shares of men and women in five wage bins, 1979–2015



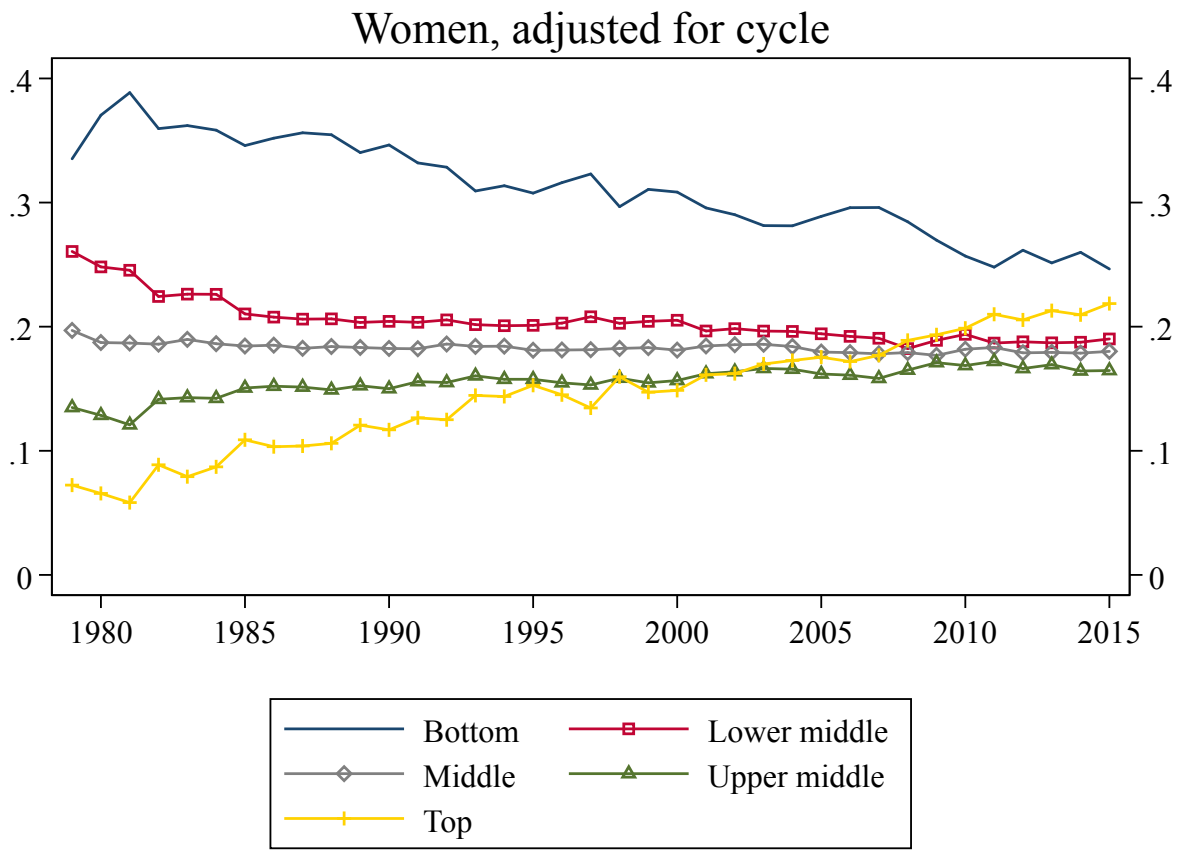

Source: CPS MORGs.

Figure A3: Shares of women in five wage bins, 1979–2015



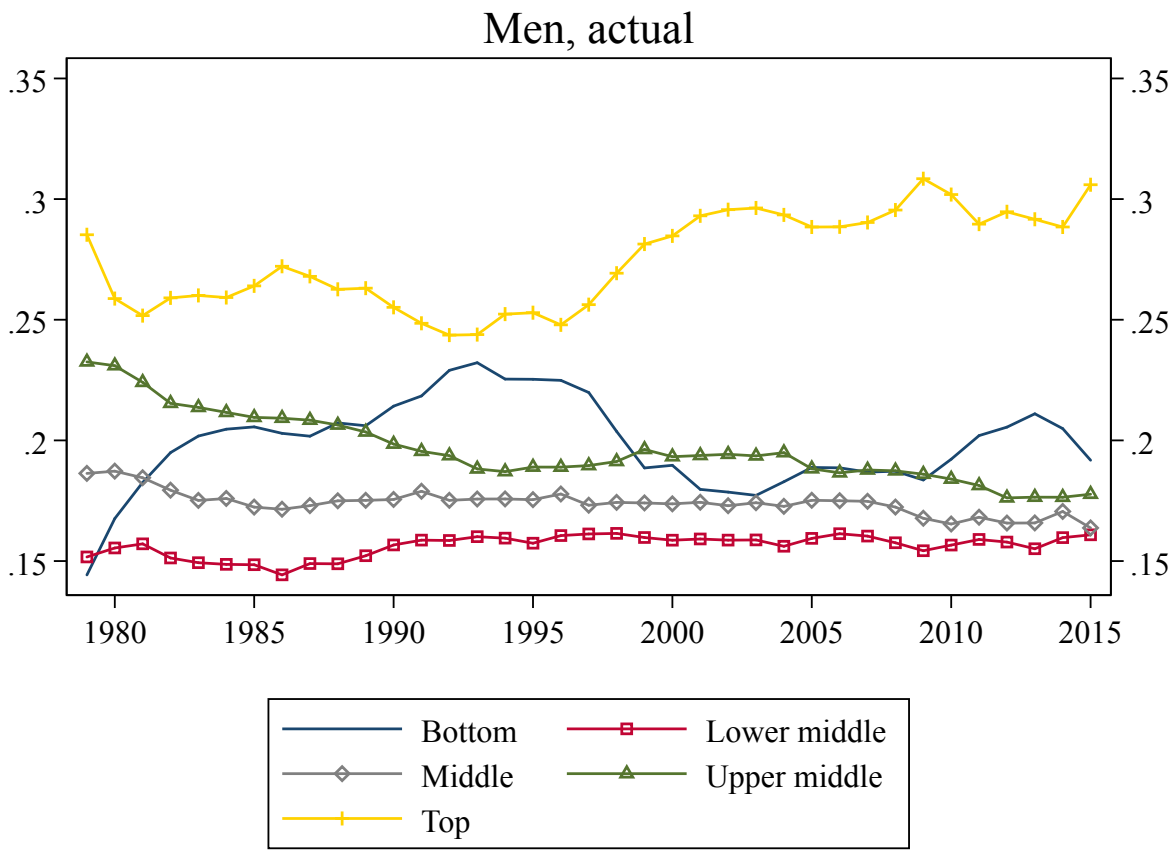

Source: CPS MORGs.

Figure A4: Shares of women in five wage bins, adjusted for cycle, 1979–2015



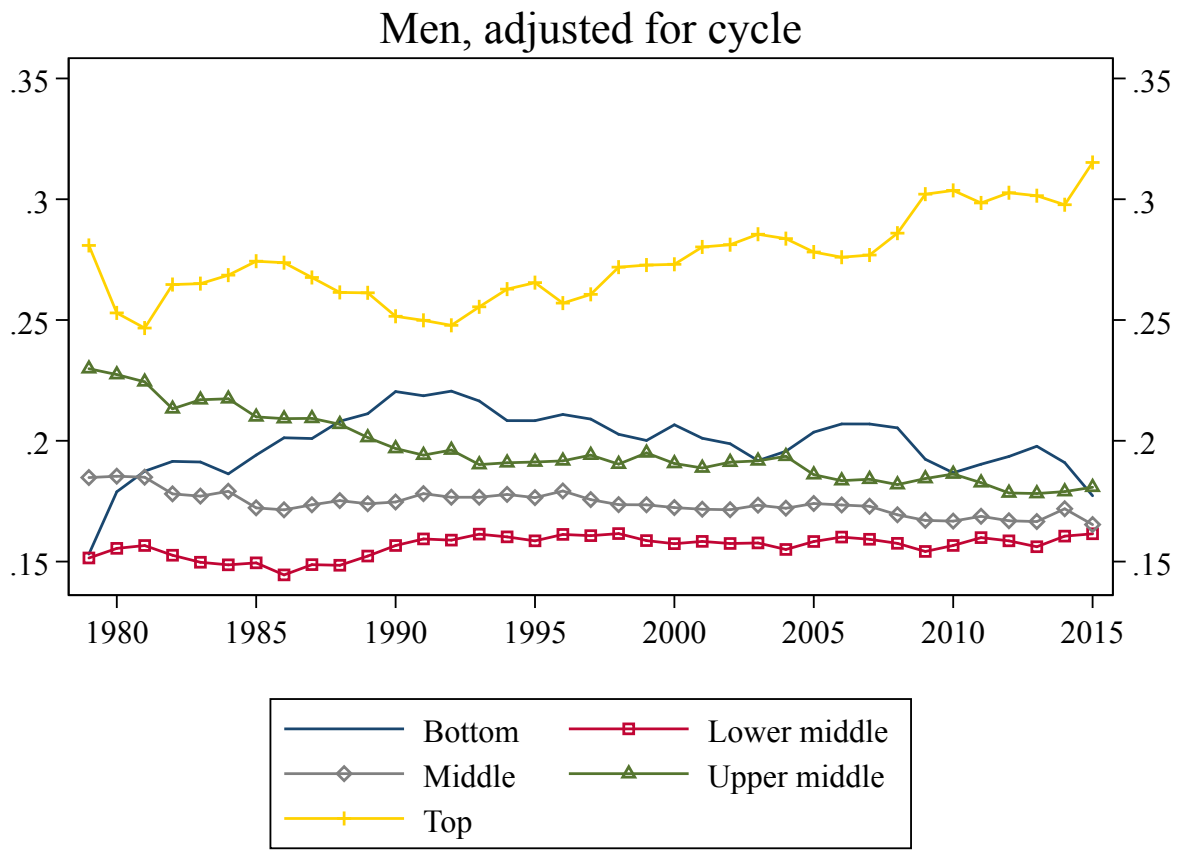

Source: CPS MORGs.

Figure A5: Shares of men in five wage bins, 1979–2015



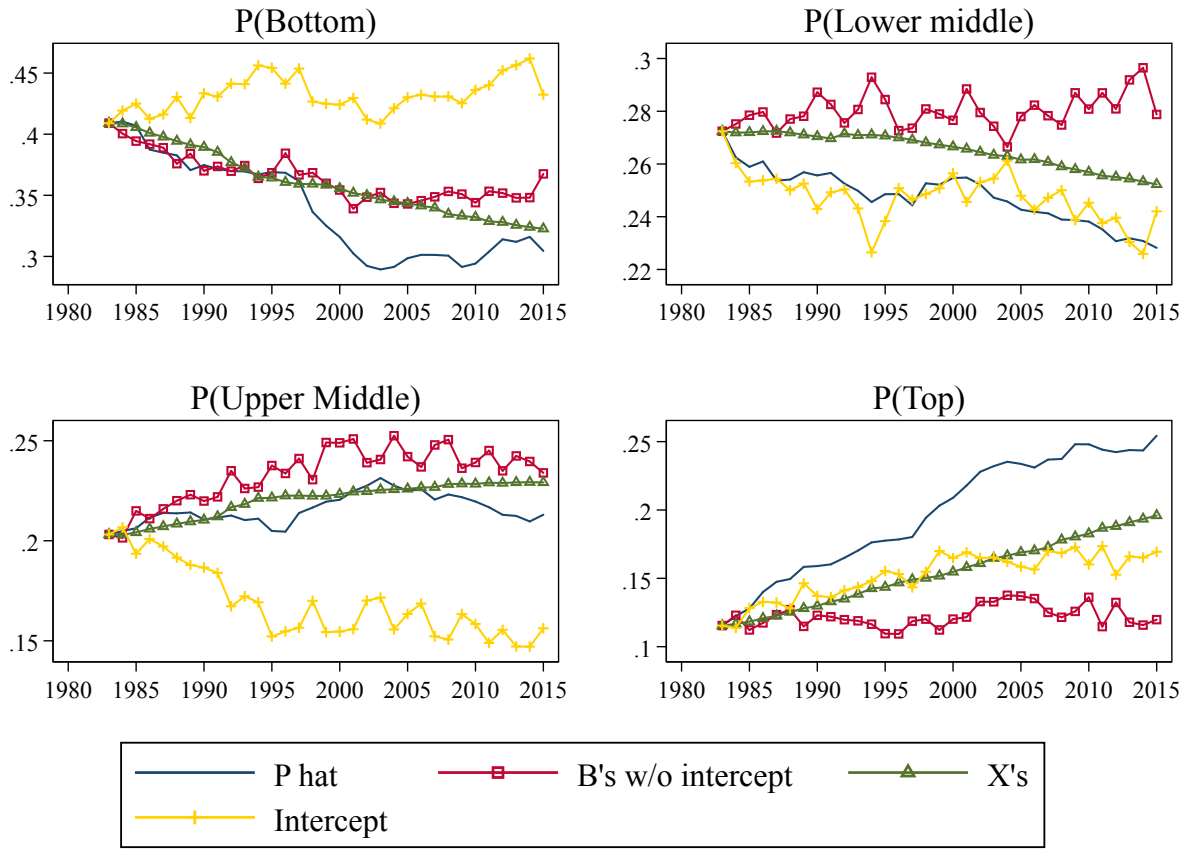

Source: CPS MORGs.

Figure A6: Shares of men in five wage bins, adjusted for cycle, 1979–2015



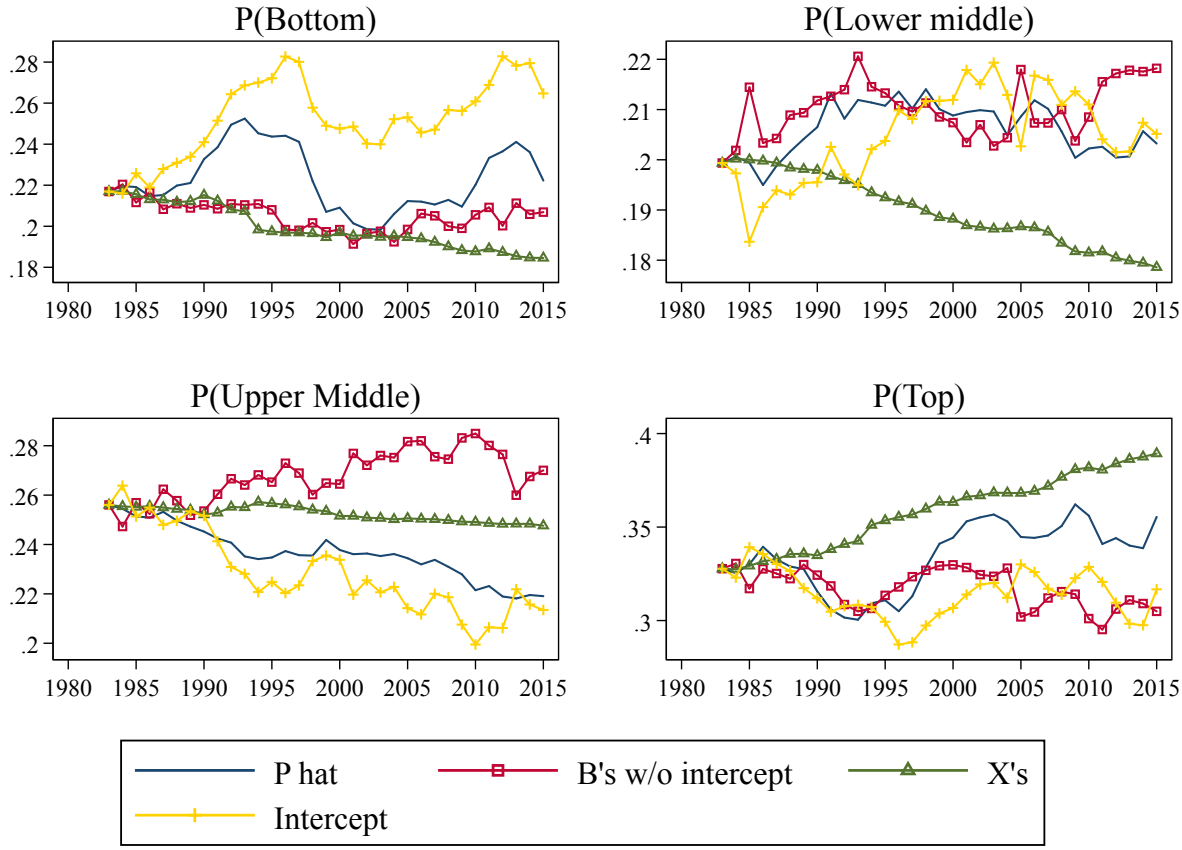

Source: CPS MORGs.

Figure A7: Predicted shares and their components without occupation 1983–2015 – women



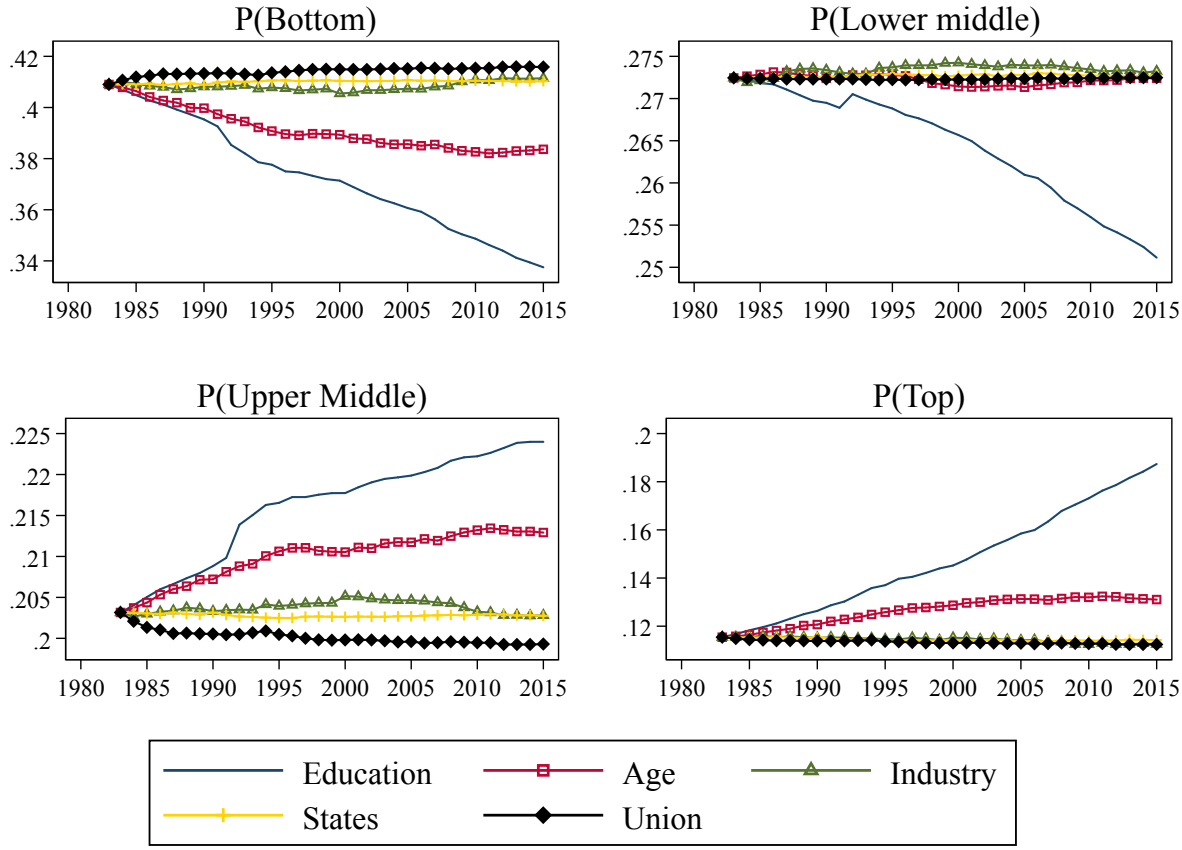

Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Figure A8: Predicted shares and their components without occupation 1983–2015 – men



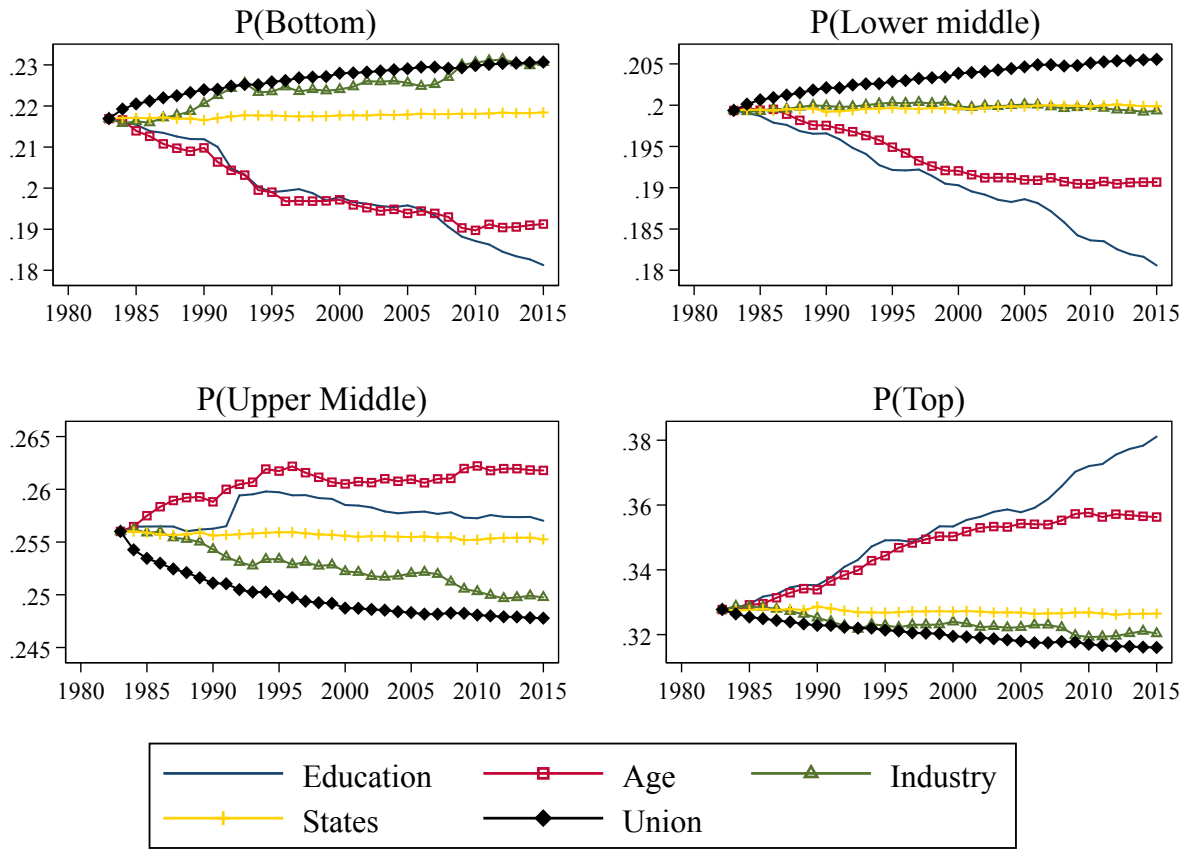

Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Figure A9: Contributions of individual X's without occupation 1983–2015 – women



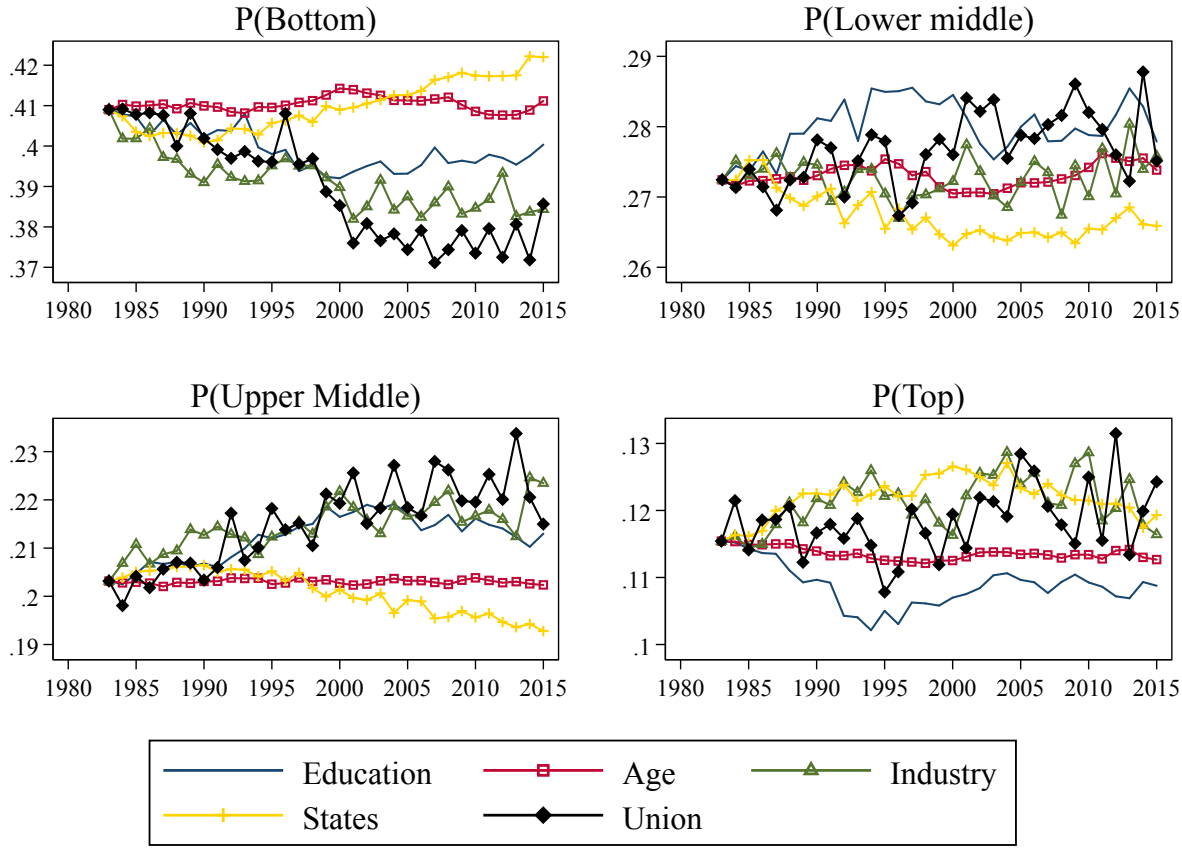

Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Figure A10: Contributions of individual X's without occupation 1983–2015 – men



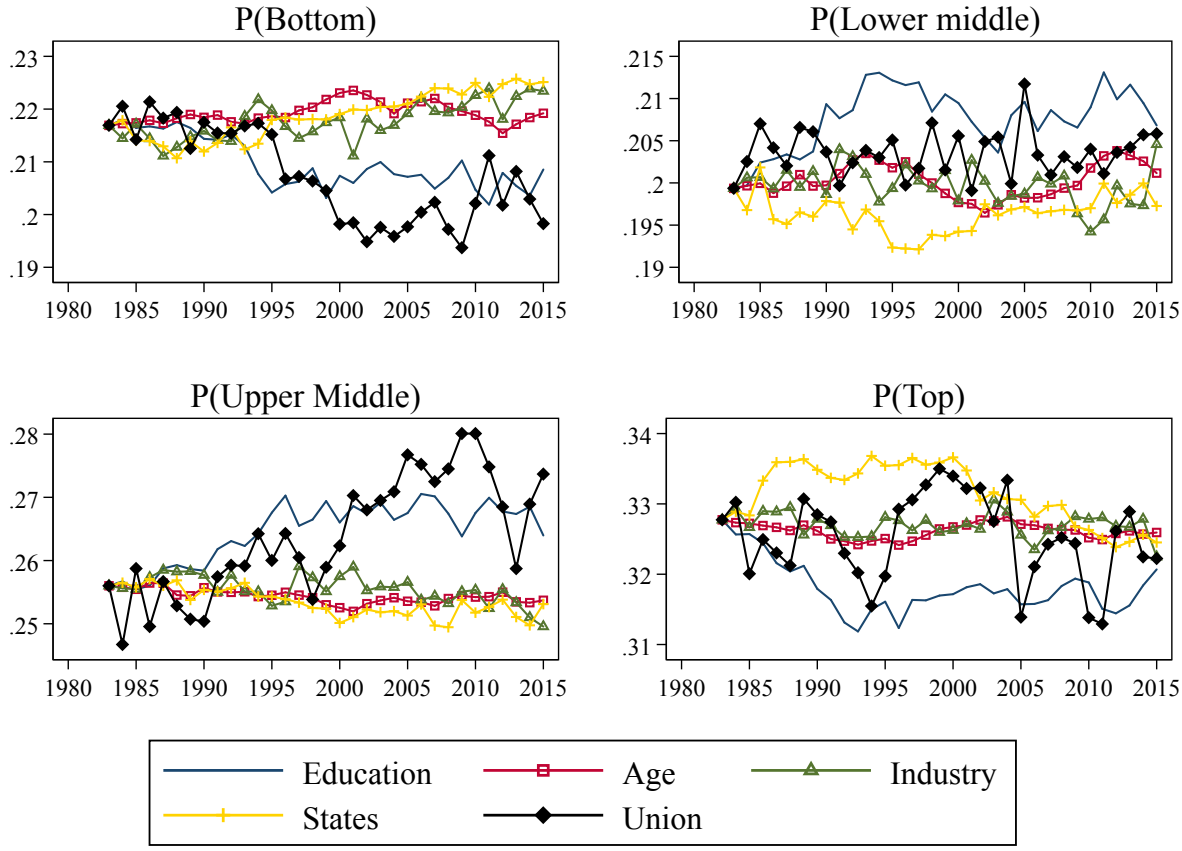

Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Figure A11: Contributions of individual $\beta$'s without occupation 1983–2015 – women




Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Figure A12: Contributions of individual $\beta$'s without occupation 1983–2015 – men




Note: Oaxaca decomposition based on education, age, state, union status, and industry.
Source: CPS MORGs.

Appendix Table 1: Means of age, school and union status

| | Women | | | | Men | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | 1983 | 1990 | 2008 | 1980 | 1983 | 1990 | 2008 |
| Age 18-20 | 0.092 | 0.080 | 0.067 | 0.045 | 0.080 | 0.069 | 0.064 | 0.045 |
| Age 21-24 | 0.132 | 0.134 | 0.105 | 0.088 | 0.124 | 0.125 | 0.106 | 0.088 |
| Age 25-29 | 0.153 | 0.163 | 0.151 | 0.120 | 0.153 | 0.164 | 0.158 | 0.128 |
| Age 30-34 | 0.138 | 0.142 | 0.151 | 0.109 | 0.146 | 0.149 | 0.158 | 0.119 |
| Age 35-39 | 0.114 | 0.122 | 0.141 | 0.116 | 0.110 | 0.124 | 0.141 | 0.124 |
| Age 40-44 | 0.097 | 0.101 | 0.130 | 0.122 | 0.087 | 0.099 | 0.122 | 0.124 |
| Age 45-49 | 0.087 | 0.081 | 0.097 | 0.132 | 0.085 | 0.081 | 0.090 | 0.127 |
| Age 50-54 | 0.077 | 0.073 | 0.070 | 0.120 | 0.086 | 0.077 | 0.070 | 0.110 |
| Age 55-64 | 0.110 | 0.106 | 0.089 | 0.148 | 0.129 | 0.112 | 0.091 | 0.134 |
| <= 8 years school | 0.051 | 0.042 | 0.033 | 0.019 | 0.097 | 0.071 | 0.060 | 0.038 |
| 9-12 years school | 0.112 | 0.092 | 0.075 | 0.040 | 0.132 | 0.111 | 0.097 | 0.059 |
| 12 years school | 0.480 | 0.455 | 0.422 | 0.279 | 0.374 | 0.388 | 0.387 | 0.321 |
| 13-15 years school | 0.189 | 0.217 | 0.243 | 0.326 | 0.196 | 0.197 | 0.211 | 0.276 |
| 16 years school | 0.107 | 0.121 | 0.143 | 0.226 | 0.116 | 0.131 | 0.144 | 0.205 |
| >16 years school | 0.060 | 0.073 | 0.084 | 0.110 | 0.085 | 0.101 | 0.101 | 0.101 |
| Union member | 0.169 | 0.152 | 0.129 | 0.120 | 0.301 | 0.255 | 0.197 | 0.139 |
| Union coverage | 0.026 | 0.035 | 0.024 | 0.014 | 0.026 | 0.031 | 0.021 | 0.012 |
| Not member or covered | 0.805 | 0.813 | 0.847 | 0.866 | 0.673 | 0.714 | 0.782 | 0.849 |
| Observations | 6,975 | 76,122 | 84,613 | 76,960 | 8,343 | 88,093 | 90,766 | 77,656 |

Source: 1980 is from May CPS; other years are from MORGs.

Appendix Table 2: Means of industries

| | Women | | | | Men | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | 1983 | 1990 | 2008 | 1980 | 1983 | 1990 | 2008 |
| Agriculture/forestry | 0.005 | 0.005 | 0.004 | 0.003 | 0.019 | 0.019 | 0.015 | 0.012 |
| Mining/petroleum/coal | 0.004 | 0.005 | 0.003 | 0.002 | 0.017 | 0.019 | 0.013 | 0.012 |
| Construction | 0.009 | 0.010 | 0.010 | 0.013 | 0.086 | 0.089 | 0.095 | 0.109 |
| Furniture/wood | 0.006 | 0.005 | 0.006 | 0.004 | 0.015 | 0.018 | 0.020 | 0.012 |
| Non-metallic minerals | 0.003 | 0.003 | 0.003 | 0.002 | 0.012 | 0.009 | 0.009 | 0.006 |
| Metals | 0.013 | 0.010 | 0.008 | 0.005 | 0.053 | 0.035 | 0.031 | 0.022 |
| Machinery except electrical | 0.017 | 0.014 | 0.012 | 0.005 | 0.051 | 0.039 | 0.034 | 0.016 |
| Electrical machinery | 0.026 | 0.023 | 0.017 | 0.011 | 0.029 | 0.026 | 0.023 | 0.020 |
| Transportation equipment | 0.011 | 0.011 | 0.012 | 0.009 | 0.037 | 0.039 | 0.037 | 0.028 |
| Misc manufacturing | 0.014 | 0.012 | 0.011 | 0.008 | 0.014 | 0.013 | 0.012 | 0.011 |
| Food/beverage/tobacco | 0.012 | 0.014 | 0.013 | 0.011 | 0.025 | 0.025 | 0.023 | 0.018 |
| Textile/apparel/leather | 0.041 | 0.036 | 0.025 | 0.006 | 0.015 | 0.014 | 0.012 | 0.004 |
| Paper/printing | 0.021 | 0.020 | 0.020 | 0.011 | 0.025 | 0.029 | 0.028 | 0.016 |
| Chemicals | 0.010 | 0.009 | 0.008 | 0.007 | 0.021 | 0.018 | 0.017 | 0.013 |
| Plastics/rubber | 0.007 | 0.006 | 0.005 | 0.003 | 0.008 | 0.010 | 0.009 | 0.006 |
| Transportation/warehousing | 0.017 | 0.021 | 0.026 | 0.025 | 0.059 | 0.061 | 0.063 | 0.066 |
| Broadcasting/communication | 0.018 | 0.017 | 0.015 | 0.012 | 0.018 | 0.017 | 0.015 | 0.019 |
| Utilities/waste management | 0.007 | 0.007 | 0.006 | 0.005 | 0.023 | 0.026 | 0.023 | 0.021 |
| Wholesale trade | 0.024 | 0.026 | 0.024 | 0.018 | 0.054 | 0.056 | 0.052 | 0.039 |
| Retail trade | 0.119 | 0.125 | 0.124 | 0.114 | 0.100 | 0.098 | 0.102 | 0.111 |
| Finance | 0.043 | 0.048 | 0.046 | 0.045 | 0.016 | 0.020 | 0.021 | 0.028 |
| Insurance/real estate | 0.043 | 0.042 | 0.046 | 0.039 | 0.026 | 0.026 | 0.028 | 0.024 |
| Private households | 0.022 | 0.017 | 0.013 | 0.010 | 0.003 | 0.003 | 0.002 | 0.001 |
| Business services | 0.027 | 0.032 | 0.045 | 0.043 | 0.026 | 0.035 | 0.049 | 0.065 |
| Repair | 0.004 | 0.002 | 0.002 | 0.003 | 0.013 | 0.015 | 0.017 | 0.019 |
| Personal services | 0.027 | 0.029 | 0.033 | 0.029 | 0.011 | 0.014 | 0.017 | 0.015 |
| Arts/entertainment | 0.006 | 0.009 | 0.010 | 0.018 | 0.008 | 0.011 | 0.011 | 0.021 |
| Hospitals | 0.086 | 0.086 | 0.077 | 0.080 | 0.018 | 0.022 | 0.020 | 0.022 |
| Healthcare except hospitals | 0.060 | 0.065 | 0.073 | 0.107 | 0.009 | 0.008 | 0.010 | 0.022 |
| Educational services | 0.136 | 0.126 | 0.124 | 0.150 | 0.053 | 0.060 | 0.055 | 0.058 |
| Social assistance | 0.026 | 0.024 | 0.030 | 0.035 | 0.015 | 0.006 | 0.007 | 0.006 |
| Other professional services | 0.027 | 0.035 | 0.043 | 0.059 | 0.023 | 0.029 | 0.031 | 0.049 |
| Public administration | 0.052 | 0.048 | 0.050 | 0.051 | 0.070 | 0.060 | 0.059 | 0.057 |
| Food services | 0.056 | 0.058 | 0.056 | 0.058 | 0.026 | 0.033 | 0.039 | 0.050 |
| Observations | 6,975 | 76,122 | 84,613 | 76,960 | 8,343 | 88,093 | 90,766 | 77,656 |

Source: 1980 is from May CPS; other years are from MORGs.

Appendix Table 3: Oaxaca decomposition of women's share in bottom and top wage groups

| | 1980-1990 May 1980, MORG 1990 | | 1983-1990 MORGs | | 1990-2008 MORGs | |
|---|---|---|---|---|---|---|
| | ΔX | Δβ | ΔX | Δβ | ΔX | Δβ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| A. Bottom | -0.271 | | -0.640 | | -0.368 | |
| | (0.068) | | (0.041) | | (0.013) | |
| Age | -0.121 | 0.038 | -0.139 | 0.024 | -0.075 | 0.005 |
| | (0.011) | (0.014) | (0.008) | (0.009) | (0.003) | (0.003) |
| Education | -0.192 | -0.124 | -0.140 | -0.051 | -0.176 | -0.041 |
| | (0.011) | (0.057) | (0.008) | (0.034) | (0.005) | (0.012) |
| Industry | 0.010 | -0.196 | -0.006 | -0.205 | 0.025 | -0.037 |
| | (0.012) | (0.089) | (0.009) | (0.053) | (0.004) | (0.018) |
| States | 0.011 | -0.018 | 0.004 | -0.101 | -0.000 | 0.071 |
| | (0.008) | (0.078) | (0.005) | (0.046) | (0.001) | (0.014) |
| Union | 0.067 | -0.129 | 0.073 | -0.005 | 0.007 | -0.165 |
| | (0.007) | (0.127) | (0.005) | (0.071) | (0.001) | (0.028) |
| Occupation | -0.088 | 0.091 | -0.123 | -0.076 | -0.058 | 0.022 |
| | (0.015) | (0.163) | (0.009) | (0.076) | (0.004) | (0.022) |
| Constant | -- | 0.380 | -- | 0.103 | -- | 0.056 |
| | | (0.238) | | (0.129) | | (0.044) |
| Sum | -0.313 | 0.042 | -0.331 | -0.310 | -0.279 | -0.090 |
| | (0.036) | (0.062) | (0.022) | (0.036) | (0.008) | (0.012) |
| Observations | 87,143 | | 156,290 | | 157,128 | |
| B. Top | 0.699 | | 0.623 | | 0.435 | |
| | (0.037) | | (0.024) | | (0.011) | |
| Age | 0.052 | -0.031 | 0.075 | -0.029 | 0.069 | -0.021 |
| | (0.006) | (0.008) | (0.004) | (0.006) | (0.003) | (0.003) |
| Education | 0.165 | -0.131 | 0.124 | -0.089 | 0.168 | -0.009 |
| | (0.011) | (0.032) | (0.007) | (0.022) | (0.005) | (0.011) |
| Industry | -0.011 | -0.004 | -0.011 | 0.057 | -0.026 | -0.002 |
| | (0.007) | (0.051) | (0.004) | (0.033) | (0.003) | (0.016) |
| States | -0.003 | 0.114 | -0.000 | 0.100 | -0.005 | -0.002 |
| | (0.005) | (0.044) | (0.003) | (0.029) | (0.001) | (0.013) |
| Union | -0.031 | 0.093 | -0.028 | 0.014 | -0.005 | -0.001 |
| | (0.004) | (0.072) | (0.003) | (0.044) | (0.001) | (0.025) |
| Occupation | 0.104 | -0.173 | 0.116 | -0.081 | 0.097 | 0.006 |
| | (0.012) | (0.092) | (0.006) | (0.047) | (0.004) | (0.019) |
| Constant | -- | 0.556 | -- | 0.375 | -- | 0.165 |
| | | (0.136) | | (0.081) | | (0.040) |
| Sum | 0.276 | 0.424 | 0.275 | 0.348 | 0.299 | 0.136 |
| | (0.021) | (0.037) | (0.013) | (0.023) | (0.008) | (0.011) |
| Observations | 91,588 | | 160,735 | | 161,573 | |

Note: Annualized changes multiplied by 100. Standard errors in parentheses. For the bottom shares, 1989 is used instead of 1990.

Appendix Table 4: Oaxaca decomposition of men's share in bottom and top wage groups

| | 1980-1990 May 1980, MORG 1990 | | 1983-1990 MORGs | | 1990-2008 MORGs | |
|---|---|---|---|---|---|---|
| | ΔX | Δβ | ΔX | Δβ | ΔX | Δβ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| A. Bottom | 0.558 | | 0.225 | | -0.110 | |
| | (0.044) | | (0.028) | | (0.011) | |
| Age | -0.101 | 0.012 | -0.094 | 0.017 | -0.089 | 0.011 |
| | (0.014) | (0.011) | (0.008) | (0.007) | (0.003) | (0.003) |
| Education | -0.128 | -0.012 | -0.064 | -0.032 | -0.101 | -0.029 |
| | (0.009) | (0.023) | (0.005) | (0.015) | (0.003) | (0.007) |
| Industry | 0.061 | 0.089 | 0.043 | -0.013 | 0.024 | 0.008 |
| | (0.009) | (0.037) | (0.005) | (0.023) | (0.003) | (0.011) |
| States | -0.001 | 0.008 | -0.003 | -0.066 | -0.000 | 0.074 |
| | (0.005) | (0.051) | (0.003) | (0.032) | (0.001) | (0.013) |
| Union | 0.127 | 0.187 | 0.110 | 0.003 | 0.029 | -0.103 |
| | (0.007) | (0.077) | (0.005) | (0.048) | (0.002) | (0.026) |
| Occupation | 0.008 | 0.061 | -0.015 | 0.086 | -0.026 | 0.036 |
| | (0.011) | (0.067) | (0.006) | (0.038) | (0.003) | (0.015) |
| Constant | -- | 0.246 | -- | 0.253 | -- | 0.055 |
| | | (0.124) | | (0.078) | | (0.037) |
| Sum | -0.033 | 0.591 | -0.023 | 0.248 | -0.163 | 0.053 |
| | (0.027) | (0.040) | (0.016) | (0.024) | (0.007) | (0.011) |
| B. Top | -0.171 | | -0.174 | | 0.194 | |
| | (0.054) | | (0.032) | | (0.013) | |
| Age | 0.039 | -0.022 | 0.073 | -0.017 | 0.105 | 0.005 |
| | (0.012) | (0.012) | (0.007) | (0.008) | (0.003) | (0.004) |
| Education | 0.168 | -0.089 | 0.075 | -0.121 | 0.122 | -0.001 |
| | (0.013) | (0.028) | (0.008) | (0.017) | (0.004) | (0.008) |
| Industry | -0.040 | -0.016 | -0.037 | -0.018 | -0.018 | -0.007 |
| | (0.008) | (0.045) | (0.005) | (0.027) | (0.003) | (0.013) |
| States | 0.019 | 0.029 | 0.013 | 0.095 | -0.004 | -0.038 |
| | (0.006) | (0.063) | (0.004) | (0.036) | (0.002) | (0.015) |
| Union | -0.109 | 0.024 | -0.091 | 0.005 | -0.042 | -0.024 |
| | (0.007) | (0.094) | (0.005) | (0.054) | (0.002) | (0.029) |
| Occupation | 0.003 | -0.094 | 0.038 | -0.030 | 0.080 | -0.051 |
| | (0.014) | (0.082) | (0.007) | (0.043) | (0.004) | (0.017) |
| Constant | -- | -0.083 | -- | -0.159 | -- | 0.067 |
| | | (0.151) | | (0.088) | | (0.041) |
| Sum | 0.081 | -0.251 | 0.071 | -0.245 | 0.243 | -0.049 |
| | (0.029) | (0.049) | (0.017) | (0.028) | (0.009) | (0.012) |
| Observations | 99,109 | | 178,859 | | 168,422 | |

Note: Annualized changes multiplied by 100. Standard errors in parentheses.