The Evolution of U.S. Earnings Inequality: 1961–2002

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Abstract

The goal of this article is to summarize the main trends in the earnings and employment distribution in the United States using data drawn from the March Current Population Surveys covering the period between 1961 and 2002. We show that inequality started to increase for men in 1974, and for women in 1981, and for both genders inequality continued to increase throughout 2002. During the same period the wage premium of college graduates over non-college workers increased substantially and the ratio of college educated workers to non-college workers also increased. These facts support the popular s*kill-biased technical change (SBTC)* hypothesis. However, other facts raise some doubts about the SBTC hypothesis. First, the college wage premium is mainly due to workers with a postgraduate degree, but their increase in the labor force started much earlier than the spectacular rise in their wages. Also there has been no marked change in recent decades in the occupational distribution of workers. However, the earning premium of professional over blue collar workers followed the same trend as the college earning premium. And finally, the most dramatic changes in the labor market took place among women.

The Evolution of U.S. Earnings Inequality: 1961–2002*

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This article summarizes the main trends in the earnings and employment distribution in the United States during the last four decades, using data drawn from the March Current Population Surveys (March CPS) covering the period between 1961 and 2002, with an emphasis on the evolution of earnings inequality. The rising overall earnings inequality has been accompanied by a large increase in earnings dispersion both among and within groups (defined by characteristics such as education or experience). A large and growing body of research, reviewed in Katz and Autor 1999, documents the increase in wage dispersion that took place between the mid '70s and the mid '90s. These facts have motivated much research aimed at revealing the underlying economic process generating the increase in earnings inequality.

Our aim in this article is twofold. First, we will revisit the empirical evidence on the trends in earnings inequality. We document that overall earnings inequality continued to increase sharply all through 2002, especially among men. Second, and more importantly, we will look at a more broad set of facts than what is usually studied in the earnings inequality literature.

After documenting the rise in overall earnings inequality, we follow the literature and document the rise in the wage premium of college graduates and the concurrent increase in the proportion of workers that graduated from college. These two facts have led many researchers to claim that the only way to explain the two trends is by a large increase in the demand for skilled workers relative to that for less-skilled individuals due to skill-biased technical change (SBTC). The computer revolution that started in the early '80s, and its spectacular growth over the last two decades, provides an appealing reason to accept the SBTC hypothesis as the explanation for the rise in earnings inequality and the widening earnings gap between college and non-college educated workers.[1] See Aghion 2002, Acemoglu 2003, and Krusell et al. 2000 for recent related literature.

We show that, once more facts are brought to bear on the SBTC hypothesis, it is unclear whether that hypothesis provides a sufficient explanation for the development of earnings inequality over the last four

[1] Card and DiNardo (2002) recently challenge this hypothesis by reviewing many detailed data sources including the CPS.

decades. It is an open question whether the skill level of workers should be measured by their schooling level or by their occupation. Casual observation on the way labor markets operate would indicate that employers post their vacancies and employees apply for jobs by specifying first the occupation and only second the level of education. [We show that the only marked change in recent decades in the occupational distribution has been the increase in the share of professional women.] The earnings premium of professional workers over blue collar workers rose at almost the same rate and during the same time period as the earnings premium of workers with a college degree. It is unclear how the SBTC hypothesis can explain these trends.

We emphasize that the most dramatic changes in the labor market during the past four decades took place among women. (See McGrattan and Rogerson 2004 on hours worked in the U.S. labor market.) The wage gap between men and women declined as women's educational attainment grew, and their workforce participation increased dramatically. Women made up a significantly smaller share of the workforce, yet accounted for 55 percent of the increase in the number of workers with at least some college education. Despite this fact, women experienced less of an increase in inequality than men did, and, in fact, it was in the most educated groups that women succeeded least in closing the wage gap. The SBTC hypothesis needs to address these differences among the genders to provide a sufficient explanation of the evolution of earnings inequality.

Since wage and employment decisions are determined simultaneously by forward-looking optimizing workers and employers, we look at facts, year by year, not only on the earnings distribution, but also on the employment distribution. Our aim is to state the facts in a simple descriptive way, which then enables readers to formulate their own judgment on how well existing theories explain the recent trends and what other explanations might be important contenders.

Following the literature we restrict our sample to individuals between the ages of 22 and 65. We focus on weekly gross wage and salary earnings of full-time full-year employees (those working at least 40 weeks and 35 hours per week) between the ages of 22 and 65. Formally, this gives us a measure of weekly earnings, but since we focus on full-time full-year workers, the variation in hours worked per week is limited, so our measure is also a fairly good measure of wages. Therefore, at times we refer to our measure as wages. We also

look at employment of this same age group, as reported by the March CPS. Appendix A describes our data source and our sample selection choices further.

The main aggregate facts on the trend in inequality are discussed in the next section, where we show that inequality started to increase for men in 1974 and for women in 1981, and for both genders inequality continued to increase throughout 2002. This is a robust fact regardless of what specific statistic is used to measure inequality. In the following section we lay out the main facts on earnings and employment by education. During the same period that earnings inequality increased, the wage premium of college graduates over non-college workers increased substantially, and the premium of postgraduate workers increased even more. The ratio of college educated workers to non-college workers also increased from 1961 to 2002, implying that the two main facts that motivate the SBTC are also borne out in our study. We add two observations to the literature: first, the most important group contributing to the increase in the college wage premium is workers with a postgraduate degree; and second, the increase in the proportion of postgraduate workers in the labor force started much earlier than the spectacular rise in their wages. The share of these workers has stabilized since the early '90s, especially among men, while their wage premium continued to increase.

The SBTC hypothesis posits an increase in the *demand* for skilled labor. Are there in fact more professional workers today among the working population than there were 20 to 30 years ago? In the section entitled "Occupations: Has There Been a Skill Bias?" we show that after some increase in the '70s, the employment share of the different occupations for men have stayed roughly constant from 1983 to 2001, with no significant increase in the share of professional workers (30 percent to 33 percent). The occupational composition changed much more markedly for women, with the share of professional workers showing a secular increase from 8 percent in 1970 to 28 percent in 2001. At the same time, the wage premium of professional workers over blue collar workers continuously rose during the same period that inequality increased.[2]

In the next to last section on regressions, we discuss the trends in the estimated coefficients of a standard

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[2]See Appendixes A and B for the exact description of our division of the sample by education and occupation as well as for a description of other important aspects of the data selection decisions.

Mincerian earnings function. The coefficients on schooling have been rising since the early '80s, and, hence, rising inequality should be attributed at least partly to the increase in the returns to education. We find that the return to (potential) experience is notably higher for men than for women all through the period of study. In addition, we find that the coefficients on the professional and white-collar occupational dummies are substantial and are much higher for women than for men. Moreover, the coefficient on the professional occupation indicator is comparable both in magnitude and in time trend to the coefficient on the college graduate indicator, implying that occupation is indeed as important an indicator of skill as education. Finally, the evolution of the standard deviation of log wages and that of the standard deviation of the conditional error term from the OLS regression have exactly the same shape. This means that the increase in the dispersion of the residual from the Mincerian earnings function is a dominant factor in the rise in overall inequality.[3]

In the final section we provide data on labor supply. Despite the very different trends in male and female participation rates, unemployment rates show similar fluctuations for both genders, implying that men and women of the same education compete in the same labor market. It is clear that over the last 40 years there has been a dramatic change in the composition of the labor force not only by education, but also by gender. While the SBTC hypothesis can potentially explain the changing educational composition of the labor force, it is less clear to what extent the change in the gender composition can be related to that hypothesis.[4]

Earnings: Growth and Inequality

In this section we provide a summary of the trends in average earnings and earnings inequality for U.S. workers from 1961 to 2002. To achieve our goal of a simple summary of trends, we had to choose a method for presenting the facts to minimize the impact of our choice of moments on interpretation and, at the same time, keep the description simple. Since our focus is on changes over time, we express and graph all variables as an index, where the value of the index is set to 100 in 1961, the first year of CPS data available to us.[5] This way we can clearly point out the timing of the main changes in the trends in the data.[6]

Wage and salary earnings are the main component of labor income, but non-wage compensation has become a non-negligible fraction of labor income in recent de-

cades. The cross-section data on income from the CPS include *only* wage and salary earnings, and we use them here following the literature. It should be noted, however, that total compensation is the measure that we would ideally like to describe, since total compensation is what measures a worker's return to working.[7] To get a sense of the size of the bias introduced by using CPS earnings measures and not total compensation, we compare the trends in compensation and those in wage and salary accruals per full-time employee using national income data (NIPA) to the trends of mean and median earnings per full-time employee from the CPS. This comparison is also useful in closing the gap between data normally used in macro analysis and those used in micro analysis.

Figure 1 makes three points: first, it compares the trend in earnings to the trend in total compensation; second, it compares the NIPA and CPS data on earnings; and third, it shows the trend in overall inequality by comparing the trend of mean and median earnings. First, notice in Figure 1 that the period of lower earnings growth (1973–96) is also the period when compensation was growing faster than earnings. In other words, while the share of non-wage compensation (benefits) was about 8 percent to 10 percent during the '60s, it rose rapidly to almost 17 percent by 1980, then peaked at 19 percent in 1994, after which it declined to 15.7 percent by 2001.

Second, notice that the trend of mean earnings in the CPS closely corresponds to the trend of wage and salary accruals per full-time employee in the NIPA for the entire period of study.[8] Average earnings from the

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[3]Katz and Autor (1999) replicate the findings of Juhn, Murphy, and Pierce (1993) that the error term in the Mincerian function accounts for about one-half of the rise in earnings inequality and that the inequality in this term rises from 1963 to today. Lemieux (2004) disputes the extent of the rise in the residual inequality.

[4]Lee and Wolpin (2004) provide an empirical model that attempts to link the SBTC hypothesis to the observed changes in labor supply.

[5]Since we have consistent data available on educational attainment starting in 1963 and on occupation starting in 1970, when we include these variables we set the value of the indexes equal to 100 in these years.

[6]Gottschalk (1997) and Katz and Autor (1999), like many other authors, use graphs that measure the percentage change in values at the same percentile between two periods (for example, 1963 to 1995) to measure the change in inequality. These are restrictive moments that are less informative than the graphs we show here.

[7]It should be emphasized that there is no data set that continuously collects cross-section data on labor income that includes all sources of employee compensation and individual characteristics in a way equivalent to the data available in the CPS.

[8]Their level differs by about 8.5 percent in the '60s and about 13.5 percent from the '70s onward, reflecting the fact that the full-time full-year workers of prime age in the CPS sample earn higher wages than the average worker in the NIPA sample that includes part-time workers, and young and old workers. We use our sample of workers at ages 22 to 65 to show that even this sample is not that different from the relevant NIPA data used in macroeconomic studies.

Figure 1

Aggregate Wage and Compensation Growth

Index of Compensation and Wage and Salary Accruals per
Full-Time Employee from NIPA, and Mean and Median Wage
of Full-Time Full-Year Workers Ages 22–65 from CPS

Index, 1961=100

- Compensation from NIPA
- Wages and Salary Accruals from NIPA
- Mean Wage from CPS
- Median Wage from CPS
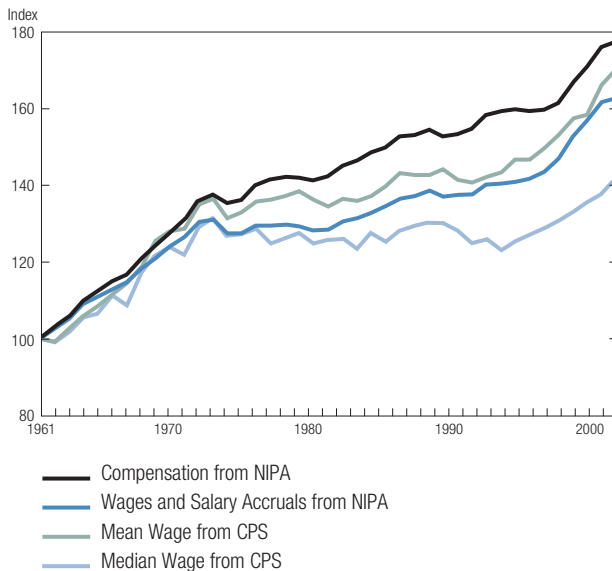
Sources: NIPA and CPS

two sources and the wage and non-wage components of compensation have about the same high growth rate between 1961 and 1973. From 1974 onward, for about 20 years, earnings from both sources exhibit much lower growth rates, although, as pointed out above, the growth in compensation does not slow down as much as the growth in earnings. From 1996 to 2002 growth in compensation and in earnings returns to the same level as it was in the '60s.

The final point of Figure 1, and the main focus of this article, is the increase in the inequality in the earnings of workers. Starting in the late '60s, mean earnings began to diverge from median earnings, but it is clear from Figure 1 that the rate of divergence sped up in 1974, and from that point onward mean earnings grew faster than median earnings.[9] Mean earnings were 8.5 percent above median earnings in 1961, 9.8 percent in 1968, 18.6 percent in 1980, 19.8 percent in 1990, and 32.6 percent

by 2002. The fact that the period of increasing inequality implied by the divergence of mean and median earnings coincides with the period during which total compensation grew faster than earnings implies that the two trends may be related.

To understand the extent to which trends in earnings inequality allow us to draw conclusions about trends in compensation inequality, note that the relationship between compensation and earnings inequality depends on two factors: whether benefits are given to employees as fixed amounts (for example, health insurance) or as a proportion of earnings (for example, retirement contributions), and how the incidence of benefits varies across the earnings distribution. Pierce (1999), using the Employment Cost Index micro data, finds that most benefits are proportional to earnings and that workers at the upper end of the compensation distribution receive a larger share of their labor income as benefits, implying that in the cross-section earnings inequality understates compensation inequality.[10]

To summarize, Figure 1 shows that the last quarter of the twentieth century was a period of continuously growing earnings inequality and that this period coincided with an increase in the share of employee benefits in compensation. Furthermore, the NIPA and CPS earnings data are consistent and, given what we know about the incidence of non-wage compensation, the trend in inequality that we observe in the CPS earnings is probably a lower bound for the trend in compensation inequality.

An important characteristic of the data is the difference in trends by gender, and, thus, throughout the article, we separate our data by gender.[11] Figure 2 shows the trends in mean and median real wages for each gender from 1961 to 2002. Over the 41-year period, male wages increased by 75 percent while female wages more than doubled at an increase of 107 percent. Most of the differential wage growth took place between 1978 and 1994 when, over a decade and a half, mean wages of men grew a mere 4 percent while those of women increased by 27 percent. The catching up from the late '70s to the

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[9]Since earning distributions are approximated fairly well by a log normal distribution, the change in the distance between the mean and the median is a good measure of the change in inequality.

[10]There is very little work comparing wage inequality with compensation inequality due to the lack of comprehensive compensation data.

[11]It is our view, however, that the practice of separating data between the genders or, worse yet, focusing almost solely on male earnings, has hindered past research on wage inequality, a point we will return to in our conclusion.
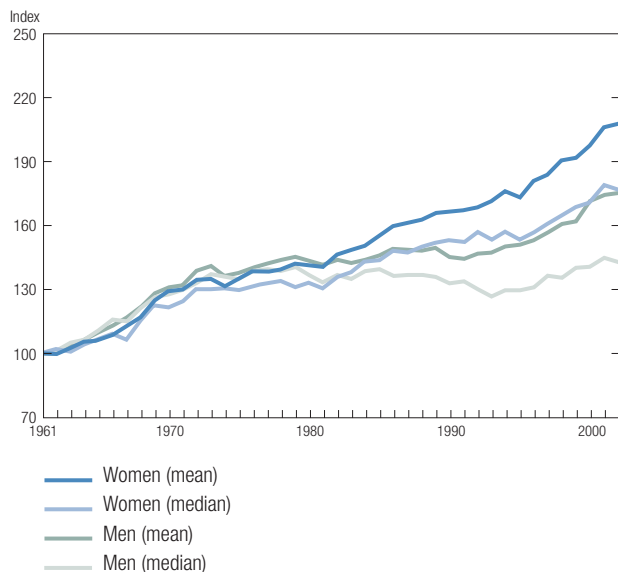
Figures 2–3 Two Ways of Looking at Gender Trends

Figure 2 Wages by Gender

Index of Mean/Median of Real Wage of Full-Time
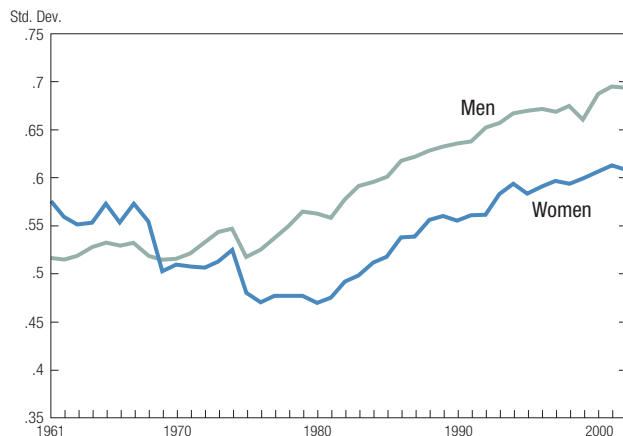Full-Year Men and Women Ages 22–65

Index, 1961=100

Figure 3 Inequality Trends by Gender

Standard Deviation of Log Wages of Full-Time Full-Year
Men and Women Ages 22–65

See Appendix A for data information.

early '90s was a period of reducing inequality between men and women, since women have earned less than men throughout our period of study. (In 2002 women earned only 69 percent as much as men, $36,831 compared to $53,661 using annualized 2002 values.)

From 1961 to 1973 mean and median wages of men and women increased substantially and their trends moved closely together. Starting in 1974 wage growth slowed down while the difference between the mean and the median started to grow. Faster wage growth resumed for women in 1981, and female wages have increased uniformly ever since, while male wages started to show a noticeable increase only since the early '90s. The divergence between the mean and the median of both male and female wages continued throughout the '90s until 2002.[12] In 1974 the mean wage of men was about 10 percent higher than the median (5 percent for women), while in 2002 this difference increased to 34 percent for men (and 23 percent for women). Note that

the real median wage for men slightly *decreased* from 1974 to 1998.

From Figure 2 we conclude that from 1978 to 1994 the earning trends of men and women caused a decrease in inequality between the sexes. Male earnings inequality, measured by the mean-to-median ratio, has been increasing from 1974 to 2002, and female earnings inequality has been increasing from 1981 to 2002. The fact that female wages started to converge to male wages at the same time that inequality within gender groups increased implies that there could be a link between these two phenomena.[13]

In Figures 1 and 2 we measure changes in inequality

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[12]Card and DiNardo (2002) find smaller increases in inequality in the CPS in recent years (using two fewer years of data) and attribute any increase in inequality in the '90s to changes in data collection methods, which we find an insufficient explanation.
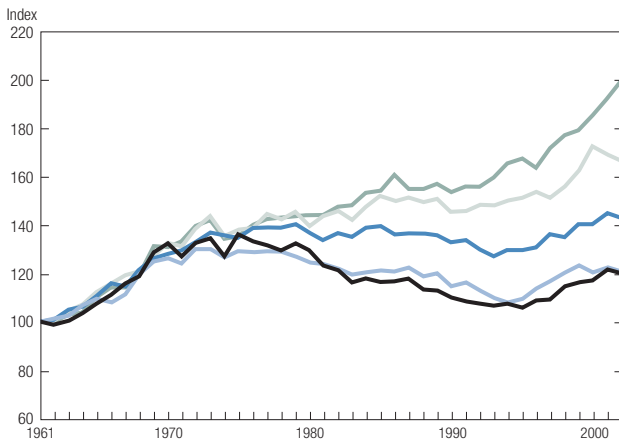
[13]Several authors fail to note this aspect of the data, as they focus exclusively on men, for instance, Juhn, Murphy, and Pierce (1993).

Figures 4–5 Increase in Inequality

Figure 4 Men's Earnings by Quantiles

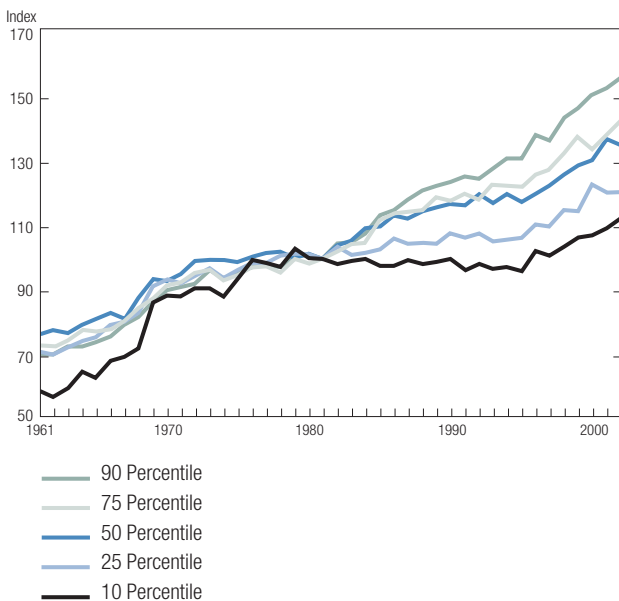Index of Real Wages of Full-Time Full-Year Men
Ages 22–65 by Specific Percentiles

Index, 1961=100

Figure 5 Women's Earnings by Quantiles

Index of Real Wages of Full-Time Full-Year Women
Ages 22–65 by Specific Precentiles

Index, 1981=100

- 90 Percentile
- 75 Percentile
- 50 Percentile
- 25 Percentile
- 10 Percentile

by comparing the trends of mean and median wages. Obviously, there are many other moments than the mean-to-median ratio that can be used to describe inequality, such as the 90th-to-10th percentile ratio, the standard deviation of log wages, the Gini coefficient, or the coefficient of variation (standard deviation of wages divided by the mean of wages).

Figure 3 shows the standard deviation of log wages for men and women from 1961 to 2002 as a measure of inequality, and it shows the same trends in inequality that we noted from Figures 1 and 2.[14] Between 1961 and 1975 inequality was roughly constant for men and was declining for women, the latter trend mostly due to the decline of female employment in some low-paid jobs (such as private household services). Between 1976 and 1981 inequality started to grow for men while it stayed constant for women, while after 1981 it was growing steadily for both genders, but at a lower level for women. Given the initial fall in inequality for women, even with the subsequent rise, the level of inequality for women in 2002 is just 5 percent higher than it was in 1961. For men, the overall rise in inequality is much more marked with the level being 34 percent higher in 2002 than in 1961.

To get a more detailed picture of the trend in the earnings distribution by gender, we graph the trend of earnings at the 90th, 75th, 50th, 25th, and 10th percentiles. Figure 4 shows that the trend of male earnings by percentile started to fan out in the mid '70s, exactly at the same time as our other measures of inequality in Figures 1 through 3 started to increase. Real wages at all percentiles increased through 1973, after which the lower 25th and 10th percentiles declined together until 1995, dropping to the same level as 1965, and even in 2002 they are only back to the level of 1968. The median remained roughly the same between 1974 and 1995, with some increase in the years since then. Workers in the 75th and 90th percentiles made considerable gains between 1974 and 1995, which increased even further in recent years. The year 1995 marked the reversal of the decline of real wages at lower percentiles. After this date all percentiles experienced increases, though the increases at the upper half of the distribution were still more substantial than those in the lower half of the distribution. In particular, from 1996 to 2002, wages at the 90th percentile increased dramatically.

[14]Sample selection choices have a significant impact on the measure of standard deviation. See our discussion of this issue in Appendix A.

Figure 5 (on which, for expositional clarity, 1981 is the year in which all indexes are set to 100) shows that the decrease in inequality for women in the '60s was mostly due to the fast growth of real wages at the lowest 10 percentiles. The increase in inequality for women started later than for men, around 1981, and the overall distribution did not fan out as much as it did for men.

In sum, Figures 4 and 5 confirm that the increase in earnings inequality is a robust fact of the last quarter of the twentieth century. The increase started for men around 1974 and for women around 1981.

Finally, there have been some differences across the evolution of earnings by ethnic groups. The most notable one has been the decline in the relative wages of Hispanic men, whose wages increased at a rate 20 percent below those of their white counterparts between 1980 and 2002, which led to an increase of the Hispanic/white wage gap from 26 percent in 1970 to 41 percent in 2002. During the same period, the black/white wage gap among men declined slightly from 37 percent to 33 percent, while the gap between other ethnic groups and whites declined from 15 percent to 6 percent. For women, the ethnic wage gaps have been generally smaller (in fact, other ethnic groups had a 5 percent higher mean wage than white women), and the changes between 1970 and 2002 have also been smaller. The female black/white wage gap remained the same at 17 percent between 1970 and 2002 (with some decline during the '70s and subsequent rise in the '80s), while the Hispanic/white wage gap widened from 16 percent to 30 percent during the same time.

Education: The Case for Skill-Biased Technical Change

In this section we discuss the main facts that establish the close link between the increase in overall earnings inequality and the increase in the wage premium of college graduates over non–college graduate workers. Figures 6 and 7 show the trends in mean wages for men and women by education group from 1963 to 2002, setting the indexes equal to 100 in 1963. We divide observations into five education categories: high school dropouts (HSD), high school graduates (HSG), workers with some college (SC), college graduates (CG), and postgraduate (master's or above) degree holders (PG).[15]

Figures 6 and 7 show that, within each gender, from 1963 to 1981 wages of all education groups had almost identical trends, with the exception of postgraduate men. The year 1974 is the year that inequality for men among the education groups started to increase, and it is also the year that postgraduate earnings for men started to increase more than the earnings of all other schooling groups. Both trends continued throughout 2002. From 1981 to the present, we observe a divergence of earnings by education group for both genders, with more-educated groups gaining on less-educated ones.

Figures 6 and 7 clearly indicate that the ratio of the earnings of college educated workers (college graduate and postgraduate) to those of non–college graduate workers (defined as including groups HSD, HSG and SC) increased substantially. This observation is central to the argument that SBTC is the main cause for the observed rise in inequality. (See, for example, Acemoglu 2003). Note, however, that the increase in the earnings of postgraduate workers dominates this observation. For example, the ratio of earnings of postgraduate (college graduate) to high school graduate men was 1.4 (1.3) in 1963, 1.8 (1.4) in 1981, and 2.6 (1.8) in 2002, when postgraduate male workers were earning more than (U.S.) $100,000 per year on average.

There are two notable differences between men and women. First, the greater increase in overall earnings of women shows up clearly for most education groups, just as it does in Figure 2. Second, the increase in inequality across education groups after 1981 is not as marked for women as it is for men. This is due to the fact that lower-educated women did better in terms of catching up to their male counterparts then did higher-educated women over this period. In fact, college graduate and postgraduate women saw their relative wages compared to men *decrease* between 1963 and the late '70s. The college graduate female-to-male wage ratio dropped from 60 percent in 1963 to 54 percent in 1978, after which point it started to increase and rose to 68 percent by 2002. The postgraduate female-to-male wage ratio dropped from 68 percent in 1963 to 55 percent in 1978, rising to 61 percent by 2002, which was still lower than what it was in 1963. Between 1963 and 1974 the HSD, HSG, and SC groups saw no significant change in their female-to-male wage ratio, while from 1974 to 2002, the HSD female-to-male wage ratio grew from 55 percent to 73 percent, the HSG ratio grew from 55 percent to 71 percent, and the SC ratio

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[15]Note that previous studies do not generally distinguish between the college graduate and the postgraduate groups, which is an important innovation of our study, especially given the substantial differences between the two groups we document below. See Appendix A for a comparison of findings using four versus five education groups, and on how we deal with the change in the way educational attainment is recorded.

Figures 6–7

Figure 6 Men's Earnings by Education

Index of Mean of Real Wages of Full-Time Full-Year Men
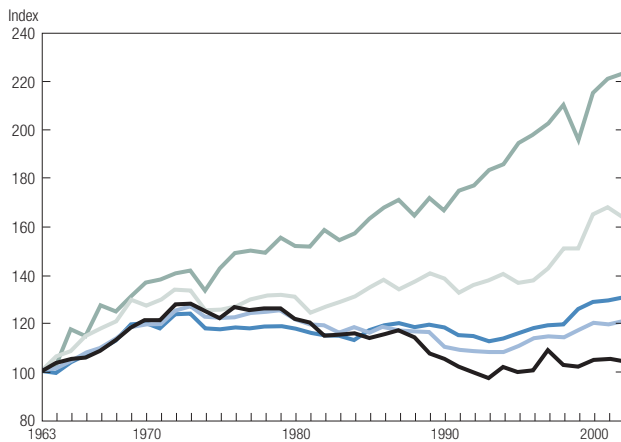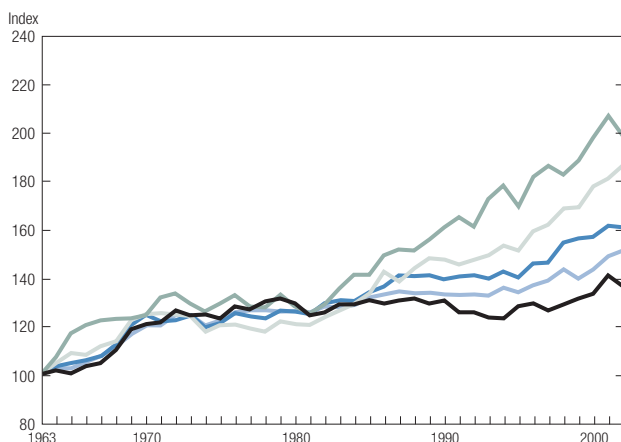Ages 22–65 by Education Group

Index, 1963=100

Figure 7 Women's Earnings by Education

Index of Mean of Real Wages of Full-Time Full-Year Women
Ages 22–65 by Education Group

Index, 1963=100

PG
CG
SC
HSG
HSD

grew from 57 percent to 69 percent.

The deterioration of the female postgraduate wage position compared to the male position is not because postgraduate women did poorly in absolute terms. On the contrary, they have seen the largest wage increases of all education groups among women over the past four decades. However, postgraduate men's wages increased spectacularly from 1963 to 2002, by almost 123 percent over this 40-year period, almost twice as much as the increase in the wages of male college graduates. The postgraduate increase for women has been less striking; hence, the female-to-male wage ratio within this group deteriorated.[16]

Not only was there a significant difference in the trends of earnings by schooling during the period of study, but there also has been an increase in the schooling attainment of entering cohorts, which generated large changes in the educational composition of the working population. This composition is shown in Figures 8 and 9. From 1964 to 1995 we observe substantial changes in the educational composition for both men and women, with a slowdown in the rate of change starting in the second half of the '90s. The share of high school dropouts went from 45 percent of men in 1964 to 12 percent in 2003 (and from 39 percent of women in 1964 to 8 percent in 2003). For both men and women the high school graduate group increased first and then declined to around 30 percent by 2003, while the some-college group continuously increased and reached 27 percent for men and 31 percent for women. Finally, the share of postgraduates was less than 4 percent among men and 2 percent among women in 1964 and reached 10 percent for both employed men and women by 2003. It is interesting to note that the trends in the educational distribution of the working population of men and women are similar and that the male and female educational distributions seem to reach some stability and similarity by the end of the millennium, with the distribution of workers being 12 percent HSD, 30 percent HSG, 26 percent SC, 21 percent CG, and 11 percent PG among men, and 8 percent HSD, 29 percent HSG, 31 percent SC, 22 percent CG, and 10 percent PG among women.

[16]When comparing means to medians within groups defined by gender and education, we see that means grow faster than medians, indicating that there has been an increase in inequality within all groups. Based on the mean-to-median ratio, the increase in within-group inequality has been more substantial for higher education groups and for men. When we examine figures for the five percentiles (90th, 75th, 50th, 25th, and 10th) within each schooling level for men, we find that for all schooling levels there has been an increased diversity that started around 1970, a few years earlier than the increase in inequality in the aggregate.

Figures 8–9 Educational Composition

Figure 8 Men's Employment by Education

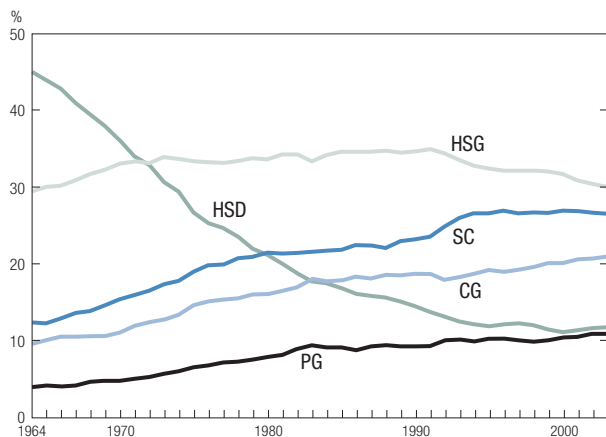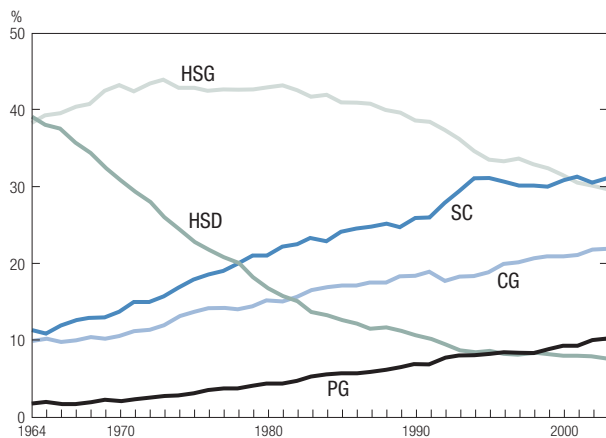Educational Composition of Employed Men Ages 22–65

Figure 9 Women's Employment by Education

Educational Composition of Employed Women Ages 22–65

Figures 6–9 provide the main evidence that motivates the SBTC hypothesis. That is, the earnings of workers with a college degree relative to the earnings of non-college workers grew during the same period as overall inequality increased. At the same time, the share of college degree male (female) workers in the labor market increased from about 13 percent (11 percent) in 1964 to about 32 percent (32 percent) in 2003. This observation led to the view that the main cause of the rise in

inequality is due to changes in labor demand resulting from skill-biased technical change.[17]

Occupations: Has There Been a Skill Bias?

The division of workers by occupation has not been a standard practice of economists who emphasize competition and mobility in the labor market. Search theory introduces frictions into the labor market, while the theory of specific human capital introduces mobility costs. Thereby, both restrict mobility and, hence, point to the importance of the division of the labor market by occupation.[18]

We divide workers into three occupation groups: professionals including managers (PRO), white collar (WC), and blue collar (BC). Professionals include physicians, lawyers, scientists, engineers, computer specialist, college professors, and managers in corporations and smaller firms. White collar workers are teachers, sales workers, tellers, technicians, and the like, and blue collar workers are service workers, laborers, machine operators, and such.[19] See Appendix B for a list of which detailed occupations belong to our three occupation groups. In Figure 10 we provide the employment shares of the various occupations from 1970 onward for men and women. The share of male professionals grew somewhat until 1983 from 24 percent in 1970 to 30 percent in 1983, with the blue collar group making up for most of the decline within the other two groups. It is striking to see that, despite the change in the educational composition and in wage inequality that took place at the same time, the employment shares among men of various occupations have stayed roughly constant from 1983 to 2001. (The share of professional workers increased slightly from 30 percent to 33 percent, with the share of the other two groups each declining 1.5 percentage points.)

The occupational composition changed much more markedly for women, with the share of professionals showing a secular increase from 8 percent in 1970 to 28 percent in 2001, which was compensated by a roughly

[17]Note, however, that most of the increase in the share of college graduates was prior to the period of growth in earnings inequality, and during the recent period of rise in earnings of PG workers (1996–2002), we do not observe the increase in their share in the labor market.

[18]The question regarding the importance of the division of the labor market by education or by occupation or by both is an open one that deserves more attention.

[19]Due to repeated changes in occupational classification in the CPS, any study using occupation data has to attempt to make the classifications consistent over time, which, in our opinion, can be done reliably only since 1970.

Figures 10a–10b

Employment by Occupation and Gender

Figure 10a   Occupational Composition of Male
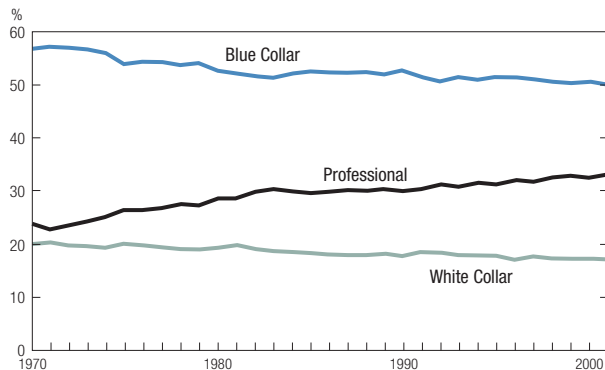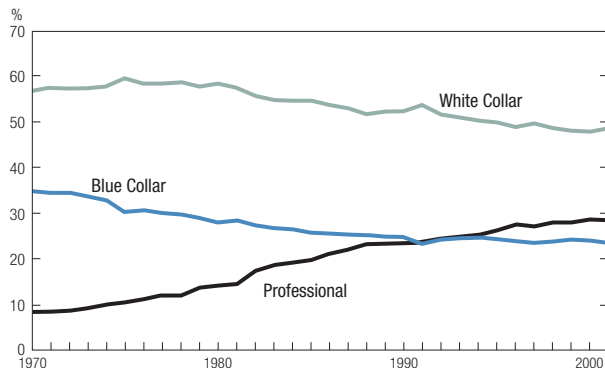   Full-Time Full-Year Workers

Figure 10b   Occupational Composition of Female
             Full-Time Full-Year Workers

See Appendix B for explanation of occupations.

and 52 percent among SC workers in 2001), while the top two education groups are dominated by professional workers (the share of which is 58 percent among CG and 72 percent among PG workers). Moreover, there have been important trends in the last three decades leading to an increased correlation between education and occupation among men. The share of blue collar men increased among the lower education groups, which was compensated for by declines in the share of white collar and professional men with the former being somewhat larger. (The share within the HSD, HSG, and SC groups increased by 4, 10, and 17 percentage points, respectively.) The share of white collar men declined among the college graduate and postgraduate groups (by 9 and 6 percentage points, respectively), which was compensated for by an increase in the share of blue collar men (perhaps surprisingly) among college graduates and an increase in professional men among postgraduates.

The trends within female occupation groups have been quite different. While there is, of course, a strong correlation between education and occupation among women, too, most education groups among women are dominated by white collar workers (except for HSD women, among whom blue collar workers are the largest group at 71 percent in 2001). White collar workers make up 45 percent of the HSG group, 55 percent of the SC group, and 52 percent of the CG group. Even among postgraduate women, the largest group is that of white collar workers at 50 percent. The dominance of white collar occupations holds despite the fact that the share of professional women increased in *all* schooling groups between 1970 and 2001, by 5, 11, 15, 27, and 18 percentage points in the HSD, HSG, SC, CG, and PG groups, respectively. These trends were mostly compensated for by the decline in the share of white collar women by 3, 19, 19, 30, and 19 percentage points, respectively, with the remainder being explained by changes in the proportion of blue collar women. It is worth noting that the share of professionals among women is still quite a bit lower in the college graduate and postgraduate groups than among their male counterparts, who are still 50 percent more likely than women to have a professional occupation. This might go a long way toward explaining why postgraduate women have experienced a less spectacular rise in their relative wages than postgraduate men.

Figure 11 shows that the trends of mean earnings by occupation for men have very similar features to the trends by education in Figure 6. More specifically, professional, white collar, and blue collar wages grew at

10 percentage point decline in both the white collar and the blue collar group. In 2001 about 50 percent of men are BC, 17 percent are WC, and 33 percent are PRO. Among women 23 percent are BC, 48 percent are WC, and 28 percent are PRO.

Looking at the occupational composition of workers within schooling groups reveals that while the correlation between education and occupation is strong, it is far from perfect. The lowest three education groups among men are dominated by blue collar workers (their share being 89 percent among HSD, 74 percent among HSG,

a similar rate until 1981, at which time inequality across occupation groups started to increase. Professional men gained 16 percent on blue collar men and 7 percent on white collar men during the '80s. In the '90s, they gained an additional 15 percent on blue collar men, while the wage growth of white collar men kept up with that of professional men and even exceeded it slightly (by 2 percent). Overall, the gain of professional men on blue collar men has been very similar to the gain of college graduate men on high school graduate men from 1981 to 2001 (34 percent compared to 35 percent).

Figure 12, the equivalent graph for women (where the index is set to 100 in 1981 to facilitate visual interpretation), shows that the blue collar group gained up to the mid '80s compared to the other two groups, which reduced inequality across occupations. After 1985 we see an increase in inequality across groups, which had been more pronounced in the late '80s but continued into the '90s. Once again, the gain of professional women on blue collar women has been very similar to the gain of college graduate women on high school graduate women from 1981 to 2001 (26 percent compared to 27 percent). This points toward the idea that occupation is as good a measure of skills as education, a conclusion that is supported by the findings on the regression coefficients reported below.

The message of Figures 10–12 is clear. While the wage premium of professional workers relative to blue collar workers grew during the last two decades at a rate similar to the wage premium of college graduates over high school graduates, the ratio of professional workers to blue collar workers has not changed for men but has changed noticeably for women. There has been a large change in the educational composition of workers within each occupation, however. This may be due to the change in the way labor markets allocate workers to different positions, but it is not clear that it is the result of the higher ratio of skilled workers required in machine operation (as assumed in Krusell et al. 2000).

In terms of the closing of the female/male wage gap, it is worthwhile to point out that while blue collar women have closed 31 percent of the wage gap with respect to their male counterparts, professional and white collar women closed only 15 percent and 5 percent of their wage gap, respectively. Inequality within the occupation groups started increasing for men in the mid '80s, with similar increases for all groups. For women, inequality within each group started to grow earlier: in the mid '70s for the professional group (within which

Figures 11–12

Earnings by Occupation and Gender

Figure 11 Mean Wages by Occupation Groups for Men
Index, 1970=100
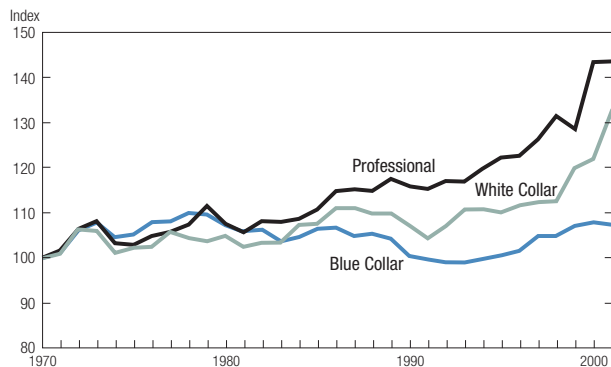
Figure 12 Mean Wages by Occupation Groups for Women
Index, 1981=100
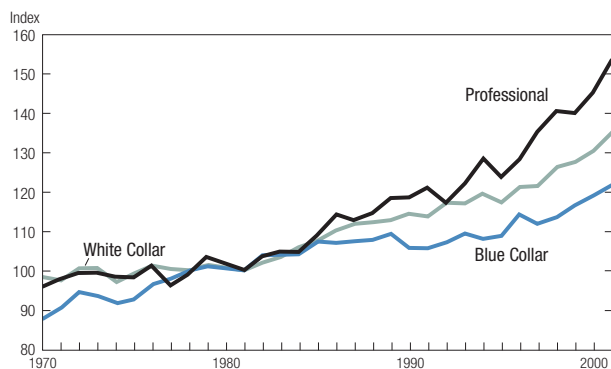
See Appendix B for explanation of occupations.

inequality grew the most), in the late '70s for the blue collar group, and in the early '80s for the white collar group. Again, the trend of mean and median wages by occupation is similar to the trend by education both in pattern and in magnitude.

Regressions: Education, Occupation, or Unobservables?

The linear Mincerian log wage specification is among the most frequently estimated stable regressions that economists have been using over the last 40 years. It is a hedonic price relation where the right-side variables

represent human capital and labor market segmentation indicators.[20] The most common human capital indicators are schooling (by years or level) and experience (normally measured as potential experience = age − 6 − years of schooling). We add to these occupation indicators as an additional measure of human capital. Labor market segmentation indicators included are race and region. We use dummy variables for schooling relative to high school graduates, the largest and most stable schooling group over the whole period, and we also use dummy variables for occupations relative to blue collar workers.

We estimate this version of the log wage regression by OLS separately for men and women using the cross section of each year separately. We include a linear and a quadratic term in experience to allow for nonlinear effects. The estimated vector of coefficients is the yearly conditional means, and we report the trends in these coefficients for the relevant right-side variables. Specifically, let W_{it} be the weekly earnings of individual i in year t, and let X_{it} be the corresponding vector of human capital and labor market segmentation variables. Then the Mincerian equation is $W_{it} - \beta'_t X_{it} = U_{it}$, where β_t is a vector of estimated coefficients (often using OLS) for year t, and U_{it} is the log wage residual that stands for unobserved components such as unobserved human capital (ability/ambition), firm productivity differences, and labor market (search) frictions and for measurement and estimation errors.

Figures 13 and 14 present the OLS estimated coefficients for the schooling dummies (where HSG is the default group) with and without the occupation dummies for men and women. When not including occupation dummies, between 1963 and 1981 there has not been considerable change in the coefficients on HSD women and on SC and CG for either gender. (If anything, the coefficient on CG women declined somewhat.) The coefficient on PG men increased and that on HSD men declined slightly. In 1982 a secular growth began in the coefficient on the dummies for college graduates and postgraduates, representing the return to these education levels, which grew from 33 percent and 50 percent in 1981 to 59 percent and 85 percent by 2002 for men, and similarly from 33 percent and 55 percent in 1981 to 56 percent and 82 percent in 2002 for women. The difference in the coefficients on college graduate and postgraduate education for both genders at all years is striking and emphasizes the importance of treating them as separate skill groups. The increase in the SC

coefficients and the decline in the HSD coefficients that start in 1981 are also nonnegligible, though not as stark as the change in the CG/PG coefficients. It should be noted that the timing and the level of the change in trends of the coefficients are consistent with the unconditional means of earnings by sex and education reported in Figures 6 and 7. Moreover, it is worth noting that the level of the coefficients for men and women is very similar for all years and all schooling groups, except that the return to college and especially postgraduate education was higher for women during the '60s and '70s.

Once occupational dummies are included in the regression, the coefficients on the educational dummies all decline, indicating that some of the gains to education are through a worker's ability to secure an occupation with higher earnings. For the male SC, CG, and PG groups, occupational dummies capture on average 29 percent, 31 percent, and 28 percent of the return to these education levels, respectively. This is striking, given the very coarse nature of our occupational classification using only three groups, and underscores the fact that occupation should be routinely included in studies of labor market returns. For women, the occupational dummies capture less of the return to the SC, CG, and PG education levels (24 percent, 18 percent, and 15 percent, respectively), but more of the return to a high school education (34 percent).

Figure 15 shows the increase in earnings for an additional year of potential experience over time for both men and women (evaluated for labor market entrants for whom the quadratic term is negligible). We see that the return to potential experience for men was substantially higher than for women and that it increased somewhat between 1963 and 1976, but did not change much from 1976 to 1994. For women the return to experience increased from 1964 until 1994, which coincides with the period during which their participation rate increased (and therefore during which time their actual experience grew as a share of potential experience). Since 1994 the return to experience declined for both genders. The inclusion of the occupational dummies does not have a noticeable impact on the coefficients on experience, which implies that the return to experience does not come through moving into occupations with higher earnings over a worker's career.

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[20]See Heckman, Lochner, and Todd 2003 for a recent survey of the Mincerian equation and Griliches 1977 and Willis 1986 for classic discussions of the theory and empirical motivations and limitations of this equation.
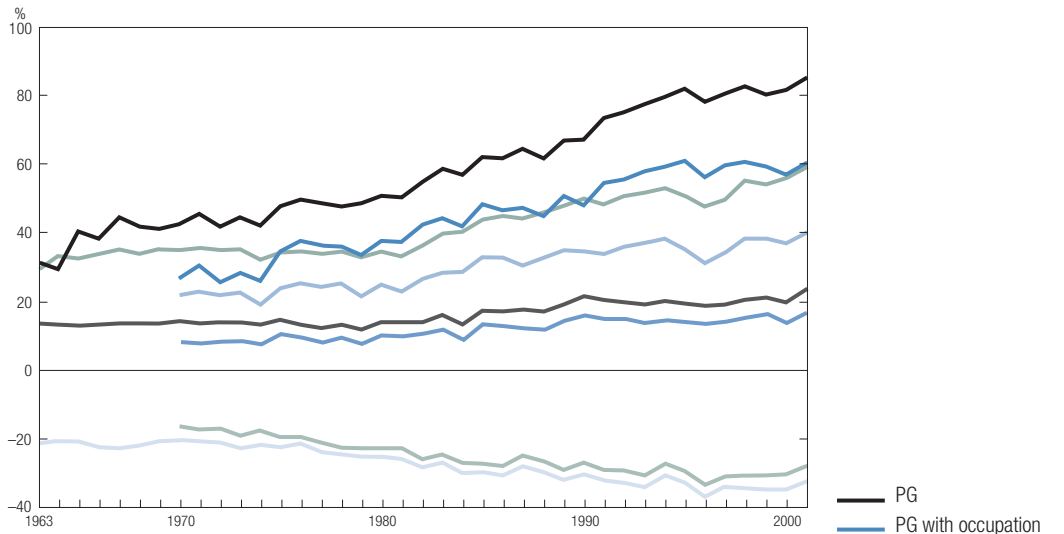
Figures 13–14

Educational Coefficients by Gender

Figure 13 Educational Coefficients for Men

Coefficient on Educational Dummies in the Mincerian Wage Regression for Men
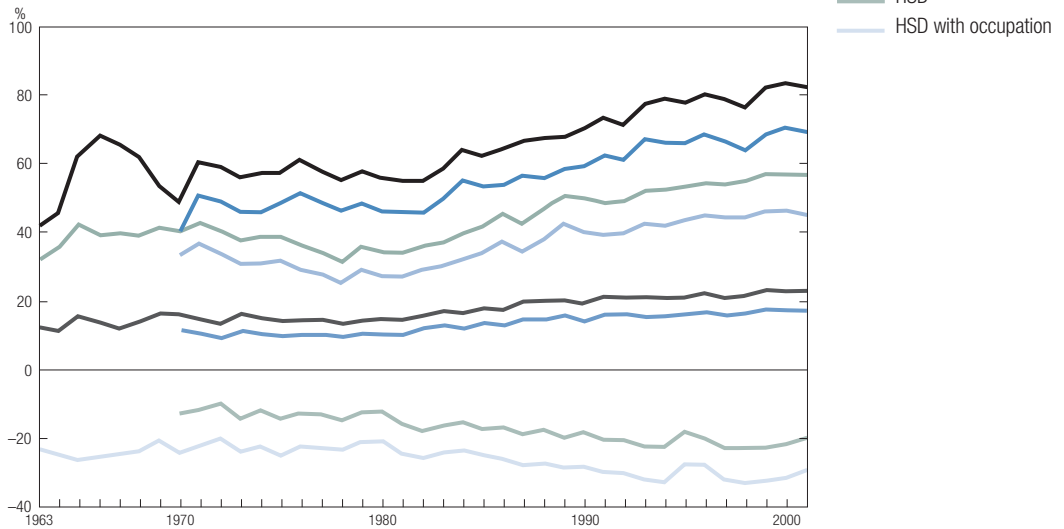With and Without the Inclusion of Occupation Dummies

Figure 14 Educational Coefficients for Women

Coefficient on Educational Dummies in the Mincerian Wage Regression for Women
With and Without the Inclusion of Occupation Dummies

Legend:
- PG
- PG with occupation
- CG
- CG with occupation
- SC
- SC with occupation
- HSD
- HSD with occupation

Two important facts arise from Figure 16, which plots the coefficient on the occupational dummies for men and women. First, the occupational dummies for professionals have increased for both men and women since the late '70s in a way similar to the increase in the coefficients for education. This implies that occupations are related to the increase in inequality as much as education is, but the causation between the three is far from being clear. The other important feature of these coefficients is that they are much higher for women, both in professional and in white collar occupations. The fact that the inclusion of occupational dummies reduces the coefficients on education less for women implies that there is a weaker correlation between occupation and education among women than among men (as we have already seen when looking at the occupational distribution within education groups for women). Moreover, the higher estimates of the coefficients on the occupational dummies imply that occupation is a more important indicator for women than for men. Not surprisingly then, we also find that the inclusion of the occupational dummies increases explanatory power more for women than for men. The R^2 with the inclusion of the occupation dummies is 21 percent higher than without their inclusion for women and 13 percent higher for men. Once again, it is surprising that such a coarse occupational classification can increase explanatory power substantially.

The magnitude of the return to professional occupations is substantial; as noted above, it is comparable in its order of magnitude and time trend to the return to a college education (relative to HSG). In fact, the predicted wage of a male high school graduate professional is only 13 percent below the predicted wage of a college graduate white collar worker, while the predicted wage of a male some-college professional worker is 4 percent above the predicted wage of a college graduate white collar worker. In terms of time trends, the largest change took place in the return to a professional occupation. This return for men decreased in the '70s from 29 percent in 1970 to 21 percent in 1978, then increased fairly steadily to 41 percent by 2001. At the same time, the return to a college education—once controlling for occupation—was roughly constant in the '70s, then increased from 21 percent in 1979 to 40 percent by 2001. As for the return to a white collar occupation, it declined from 6 percent in 1970 to *below* zero by the end of the '70s, then increased again to reach 9 percent by 2001. For women, the return to a professional occupation declined somewhat during the '70s from 36 percent in 1970

Figures 15–16 Experience and Occupation

Figure 15 Experience Coefficients by Gender

Coefficients on Experience in the Mincerian Wage Regression
With and Without the Inclusion of Occupation Dummies

Men
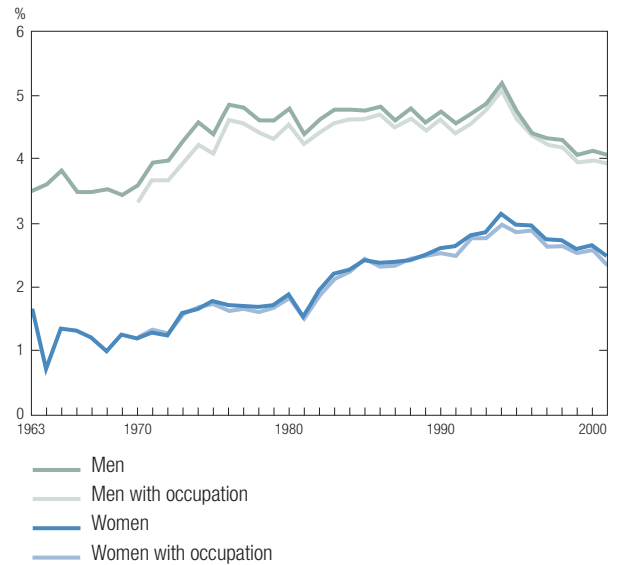Men with occupation
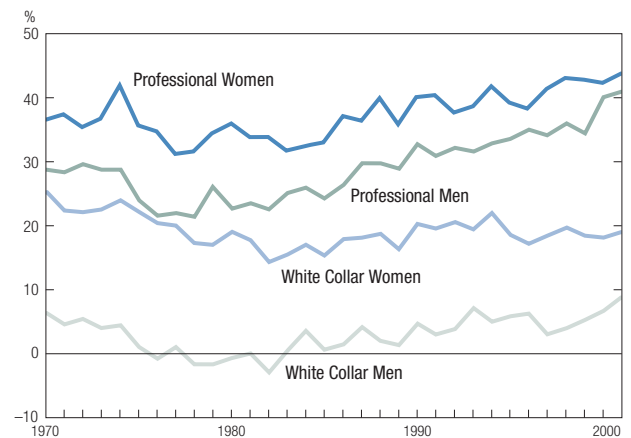Women
Women with occupation

Figure 16 Occupational Coefficients by Gender

Coefficient on Occupational Dummies in the Mincerian Wage Regression

See Appendix B for explanation of occupations.

to 32 percent in 1978. Then it increased to 44 percent by 2001, while the return to a college education declined from 33 percent in 1970 to 25 percent in 1978, then

increased to 45 percent by 2001. The return to a white collar occupation for women declined from 25 percent in 1970 to 14 percent in 1982 after which it rebounded somewhat to reach 19 percent by 2001.

Finally, Figure 17 shows that after we condition on all the observables, the standard deviation of the residual error estimated by the OLS has a shape and timing of change similar to that of the standard deviation of the unconditional log wage distribution (Figure 3). It is worth noting that including occupational dummies decreases the standard deviation of the residuals only slightly (by about 2.5 percent).

The trends in the estimated coefficients of the wage regressions with and without occupational dummies provide similar results to the analysis of the unconditional means based on Figures 1–12. The main message is that (1) there has been a large and coincidental increase in the earnings of highly educated workers and of workers in highly ranked occupations, and this increase took place at the same time as the increase in inequality, which implies that these could be related phenomena; (2) the unobserved component of earnings function that was estimated as orthogonal to the included variables shows a trend in standard error that matches the pattern of the growth in unconditional earnings inequality.

Labor Supply: A Gender Hypothesis?

Labor force participation measures labor supply as a percentage of the population. Having documented the trends in wages by gender, education, and occupation, we now turn to the corresponding labor force participation rates to document the changes that took place on the supply side during the period of increased inequality. Figure 18 shows the evolution of the labor force participation and of the unemployment rate from 1962 to 2003.[21] Since the unemployment rate in the United States does not show a secular trend during this period, the trend of the labor force participation rate closely corresponds to the trend of the employment rate without being influenced as much by business cycle variations. The participation rate also has a very similar trend to the average number of weeks worked by men and women over this period; hence, it measures well the amount of labor supplied by the two genders. The male participation rate declined from 94 percent in 1962 to 89 percent in 1976 and has declined more gradually since then, reaching 86 percent by 2003. The female labor force participation rate increased steadily from 42 percent in 1962 to 72 percent in 1997, with the fastest growth taking place in the '70s.

Figure 17

Inequality Trend Due to Unobservables

Standard Deviation of Residuals from Mincerian Wage Regression
With and Without the Inclusion of Occupation Dummies

Men
Women
Men with occupation
Women with occupation
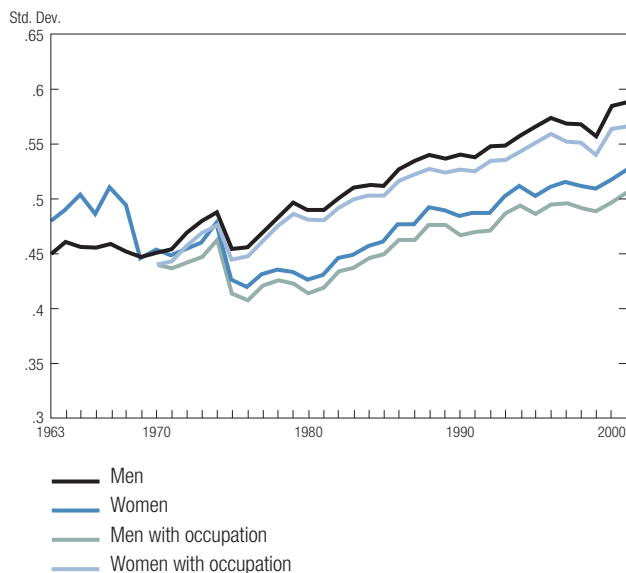
(The average increase was 0.77 percentage points between 1962 and 1973, 1.36 percentage points between 1973 and 1979, and 0.73 percentage points between 1979 and 1997). Female labor force participation has remained stable since 1997. These dramatic and different trends correspond well to the dramatic differences in the trend of mean wages of men and women (Figure 2). Together Figures 2 and 18 imply lower inequality in labor market earnings regardless of gender within a hypothetical representative household.[22]

The decreasing trend of the male participation rate and the increasing trend of the female rate are observed at all schooling levels (Figures 19 and 20), at least until 1994, though to a different extent. In particular, postgraduate, college graduate, and some-college male participation rates decreased much less (4 to 6 percentage points over the whole sample) than those of high school graduate
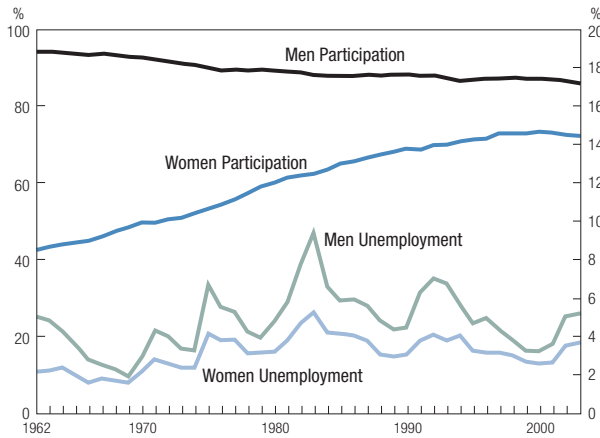
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[21]The labor force participation rate is defined as the total number of age 22–65 people working or looking for work divided by the population of that age group.

[22]It should be noted that the household earnings distribution also showed an increase in inequality. See Katz and Autor 1999. This fact could be explained by positive assortive matching among men and women.

Figure 18

Labor Supply Trends

Labor Force Participation (left axis) and Unemployment Rate (right axis)
of Men and Women Ages 22–65

Figure 19 **Men's Labor Supply by Education**

Labor Force Participation Rate of Men Ages 22–65 by Educational Group

Figure 20 **Women's Labor Supply by Education**

Labor Force Participation Rate of Women Ages 22–65 by Educational Group
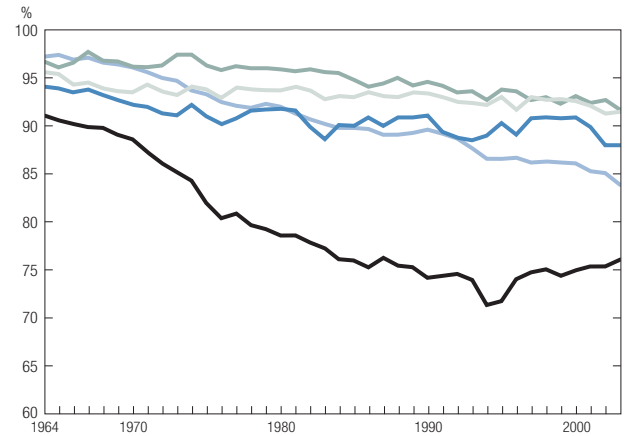

- PG
- CG
- SC
- HSG
- HSD

and high school dropout men (13 and 15 percentage points over the whole sample, respectively). High school dropout male participation plummeted from 91 percent in 1964 to 71 percent in 1994, with a bounce back after 1994 to 76 percent by 2003. For women, the increase in the participation rate showed up most markedly among high school graduate, some-college, and college graduate women. Postgraduate women experienced only a small increase in their participation rate, as they started at a much higher level in the '60s (almost 20 percentage points above college graduate women), while the high school dropout women's participation rate started low at 39 percent in 1962 and increased only moderately to 49 percent by 2003. It should be noted that since the mid '90s participation rates of men and women, both overall and conditional on education, show relative stability, which coincides with the stabilization of the female/male wage gap. At the same time, despite the stabilization of participation rates, both overall and between education group inequality continued to grow.

The unemployment rate relates to the difference between the participation rate and the employment rate. It shows a clear ranking by schooling, for both men and women, such that high school dropout unemployment is the highest and postgraduate unemployment is the lowest from 1962 to 2003. The male unemployment rate

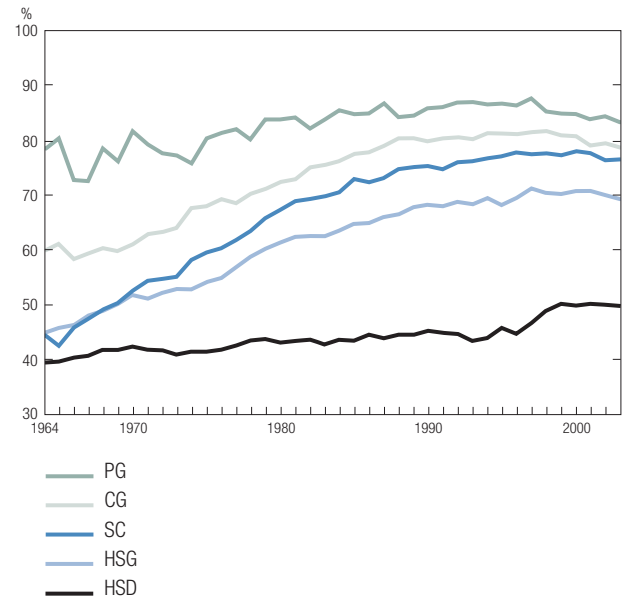exceeds the female rate at all schooling levels except for the postgraduate group, with the difference being larger at lower educational levels. Moreover, male and female unemployment rates at all schooling levels show

the same cyclical movement as the aggregate. These facts imply that the fluctuations in the labor market for men and women of the same education are highly correlated even though the trends in the participation rate are very different, which leads one to conclude that men and women of the same education compete in the same labor market.

White and nonwhite men follow similar trends with nonwhite men having a consistently lower rate of participation and a higher rate of unemployment. Nonwhite women workers start out with a markedly higher participation rate (53 percent compared to 41 percent). The two participation rates converge by the late '80s and follow a similar trend since then. At the same time, the unemployment rate of nonwhite women is higher than that of white women in all years.

Figures 18–20 show that during the past 40 years the diversity of the labor force grew in terms of gender and schooling. These dramatic changes are potentially as important in explaining the trends in wages as the technological changes of the last 25 years. In other words, it is possible that forces other than technological shifts directly affected the labor supply of women, and these forces could be equally important in understanding the trend in wage growth and inequality. The empirical and theoretical economic literature on wage inequality has not given sufficient attention to such alternatives, as it has most often treated supply changes as responses to exogenous changes in technology.

Concluding Remarks

In this article, we provided a summary of facts on the evolution of the U.S. labor market from 1961 to 2002. These facts give rise to some doubt about the dominant role of the popular hypothesis that during the last two decades the United States experienced a skill-biased technical change. First, there has been no marked change in recent decades in the occupational distribution, except for the increase in the share of professional women, who did not experience a spectacular rise in the returns to their skills (unlike, for example, postgraduate men). Despite the stability of the occupational distribution, the wage gap between occupations rose at the same time that inequality increased and at about the same rate as the wage gap by education. Therefore, we believe that any theory addressing the changes in the wage and employment structure should also incorporate occupation as a measure of skill.

Second, the most dramatic changes in the labor market during the past four decades took place among women. The change in their labor supply cannot be ignored when trying to understand the changes in the wage structure of men, since the facts clearly indicate that it is wrong to assume that women and men participate in separate labor markets. Therefore, we argue that a theory that attempts to provide an explanation for the main changes in the wage and employment structure over the last 40 years should incorporate an explanation for the dramatic change in women's performance in a labor market.

Alternative leading hypotheses to explain the rising wage inequality include the decline of unions and the decline in the real minimum wage, or, more generally, changes in institutions. These explanations focus mainly on the reduction in earnings of the less educated during the '80s and early '90s. The role of globalization and the increase in trade and out-sourcing emphasizes the decline in the return to less-skilled workers in the United States. It seems that it is possible that these factors were important between 1979 and 1993, when wages of the less-skilled went down. But the spectacular rise in wages of postgraduate workers that started in the mid-'60s, continued throughout the four decades, and increased in the second half of the '90s cannot be explained by these alternative hypotheses. In fact, the continuous rise of postgraduate wages also raises some questions regarding the SBTC hypothesis as it is used in the literature described by Aghion (2002).[23]

It is, of course, more likely that there are several factors that account for the main changes that have occurred in the labor market during the last four decades. To understand the importance of the various mechanisms, it is necessary to formulate dynamic models that can quantitatively include the main alternative explanations so that one can measure the impact of each one of them. Such models are needed since they enable us to understand the observed trends in labor markets and they provide guidance regarding the evolution of the economy and the potential for policy intervention to improve welfare. To attain these goals, it is crucial to measure the impact of the alternative explanations regarding the facts on the evolution of the labor market that have been reviewed in this article.

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[23]The continued rise in the postgraduate wage premium is inconsistent with the view that the economy discretely moved from one stochastic steady state, prior to 1980, to another stochastic steady state, since the mid '90s.

Appendix A: Data

We use data from the 1962–2003 March CPS Annual Demographic Survey files provided by Unicon. In choosing our sample restrictions, we have two goals in mind: to maintain comparability between our work and earlier studies and to give an accurate description of the data. We deviate from the conventions used in earlier studies only in cases where we believe there is a well-justified reason to do so.

We restrict the sample to civilian adults between the ages of 22 and 65. When constructing the employment and weeks worked samples, we make no further restrictions. In our wage and occupation sample, we further restrict our attention to full-time full-year workers, where a worker is considered full-time if he or she works at least 35 hours a week and full-year if he or she works at least 40 weeks a year. For these workers, we construct the wage sample by taking the annual wage and salary earnings, dividing it by the number of weeks worked, and annualizing the resulting weekly wage by multiplying it by 52. Nominal wages are then deflated using the personal consumption expenditure deflator from the NIPA to express all real wages in constant 2002 dollars.

For both the occupation and the wage sample, we exclude observations where the worker is working without pay or is self-employed. The exclusion of the self-employed is an unfortunate necessity. While it would be desirable to have them included in our wage sample, the wage information reported on them is of very poor quality, especially before 1988 when almost half of the self-employed report wages below half the minimum wage. This ratio abruptly drops to less than 10 percent in 1988, indicating that the change in March 1989 in the way earnings data were collected had a significant impact on the reliability of earnings data for the self-employed. As the self-employed have a larger variance of wages than those who are not self-employed (at least past 1988) and there is a larger fraction of them in the beginning of our sample, there is reason to believe that the exclusion of the self-employed reduces any measure of inequality more in the '60s than later on, which gives further indirect evidence of a U-shape in inequality that appears to some extent in the data.

With regard to the wage sample, we need to make two additional choices: how to treat topcoded observations and how to treat very low reported wages. In terms of the topcoding, there are two periods that are informative since we know something about very high earnings in these periods. Between 1961 and 1966 the real value of the topcode is very high, close to half a million dollars (in 2002 dollars); hence, no observations are topcoded in practice. If in this period a similar topcode was imposed (in real terms), as was in place in the '70s and '80s, then the thus topcoded observations would average 1.5 times the topcode. The second period is past 1995, since starting with the 1996 March CPS, topcoded observations take on the value of the average of all topcoded observations instead of the topcode value as before. In this second period topcoded observations average two times the topcode. Given these two observations we assign topcoded observations prior to 1995 a value of the topcode multiplied by 1.75. (This value also works well in avoiding any jump in mean wages when the topcoding method changes.)

The treatment of the very low wages is more contentious. Clearly, some lower bound needs to be established in order to eliminate implausibly small wage observations (such as a couple hundred dollars per year for a full-time full-year worker in 2002 dollars). Previous authors have taken the approach of dropping observations that would imply an hourly wage that is less than half the minimum wage. This would imply imposing a lower limit of around $4,200 per year in our sample. Observations below this limit are most common among women in the '60s. Examining these very low observations, we conclude that in fact it is very plausible that they are valid observations of very low wages as opposed to being the result of measurement error, as previous authors contend. Most such low wage observations are for high school dropout women whose occupation is classified as private household worker or farm worker. In fact, in the early to mid '60s close to 50 percent of observations among women making between one-sixth and one-half of the minimum wage are of these two occupations (mostly private household), while only 4 percent of all female observations are of these occupations. (This latter fraction quickly drops to below 1 percent by the late '70s.) Minimum wage laws did not apply to these occupations in the '60s; hence, it is very plausible that these workers earned much less than the official minimum wage. With the decline in the share of women who worked in the private household sector, the fraction of these very low wage observations has dropped considerably. In sum, instead of using the more common half-of-minimum-wage benchmark, we use one-sixth of the minimum wage as the lower limit below which we drop wage observations. Note that the conclusions regarding the evolution of female inequality are very sensitive to how one treats these very low observations of weekly wages. If these low observations were dropped from the sample, then there would be no fall in female inequality in the '60s.

Once the samples are constructed, we divide them by gender and into five education groups: high school dropouts (HSD), high school graduates (HSG), workers with some college (SC), college graduates (CG), and postgraduate degree holders (PG). Past 1992, when we have information on an individual's highest degree received, the construction of the education variable is straightforward. Prior to 1991, however, we only have information on the number of grades attended and completed. In order to determine the best educational classification of our five groups, we match observations between

1991 and 1992 to see what the same individual reported as educational attainment under the two classification systems. (Due to the design of the CPS, half of the March sample overlaps from one year to the next.) Based on this it is clear that the best correspondence is to classify those who have completed less than 12 years of schooling as HSD (with an 89 percent overlap), those who completed exactly 12 years of schooling as HSG (with an 87 percent overlap), those who started 13th grade but did not complete 16 years of schooling as SC (with an 84 percent overlap), those who completed 16 years of schooling but only started their 17th year as CG (with an 83 percent overlap), and those who completed 18 years of schooling as PG (with an 83 percent overlap). The only difficult decision was how to consider those who completed 17 years of schooling but not 18, as 48.5 percent of these report having a college degree while 45.2 percent of them report having a postgraduate degree. We decided to classify these as college graduates since this gave the smallest break in the composition graphs at the time of the classification change. Also note that compared to the size of college graduates and those who are definitely postgraduate degree holders (those with 18 years of education or more), the group of those with 17 years of education is small (less than 20 percent of college grads and less than 30 percent of postgraduate degree holders).

To gauge the effect of using five education groups as opposed to the more standard four groups, in figures available online we compare the trends in wages by education groups with five compared to four groups. We see that once PG workers are included among the college graduates when using four groups, the trends in CG earnings change both in their level and in their timing. It is also clear that the differences between the PG and CG groups are at least as large as those between the CG and SC groups, and comparable in size to the difference between the CG and HSG groups, which very much justifies treating the PG group separately.

Appendix B: Occupations

In this appendix we provide a detailed description of the way we constructed the three occupational levels. This is important since the definitions of occupations have changed significantly during the sample period.

Prior to the 1971 March CPS, the 1960 Census of Population Occupational Classification System was used, which was sufficiently different from later years to exclude these years from our study of occupations. Starting with the 1971 March CPS, the 1970 Census classification was used. Starting with the 1983 March CPS, the 1980 Census classification was used. And starting with the 1992 March CPS, the 1990 Census classification was used, which was very similar to the 1980 classification system. Starting with the 2003 March CPS, the North American Industry Classification System (NAICS) based on the Census 2000 industry and occupation codes was used. We did not recode this system to be consistent with previous years of data, since this would have given us only one more year of observations.

We constructed the following three categories by consistently aggregating the various classification systems:

Professional and managerial occupations: Executive, administrative, and managerial occupations; sales supervisors; engineers and architects; mathematical, natural, and computer scientists; computer programmers; social scientists; physicians, dentists, and related practitioners; postsecondary teachers; lawyers and judges; writers, artists, and entertainers.

White collar occupations: Registered nurses, pharmacists, dietitians, therapists, and physicians' assistants; kindergarten, elementary, and secondary teachers; counselors; librarians, archivists, and curators; social, recreation, and religious workers; technologists and technicians; sales representatives, workers, and related occupations; administrative support occupations; records processing occupations; computer equipment operators; information clerks; material recording, scheduling, and distributing clerks; adjusters and investigators.

Blue collar occupations: Service occupations; billing, posting, and calculating machine operators; farming, forestry, and fishing occupations; precision production, craft, and repair occupations; operators, fabricators, and laborers.

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