

**Wage Differentials in the 1990s:  
Is the Glass Half-full or Half-empty?**

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and

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**Abstract:** There are many wrinkles and complexities that have been brought to our attention by the huge volume of research that addresses the growth in wage inequality during the last three decades. While not all of the facts fit a relatively simple story, we believe that many of them do; it is a story of supply and demand, a story of increasing opportunity, of opportunities for sustained economic growth. After sketching the main ingredients of change, we suggest a simple model and explore its implications. As a dynamic demand and supply story, it can accommodate swings in inequality as well as their rates of growth. If our interpretation is correct, the supply responses to the shifts in demand, that produced increasing wage inequality, will ultimately produce increasing equality; and both parts of the process, the demand growth and the supply response, will have contributed to increased productivity in the aggregate.

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**Introduction:** The growth in the wage premium for a college degree and the growth in wage inequality in the U.S. since 1980 are two of the most widely discussed labor market phenomena in recent memory. These observations have spawned literally hundreds of papers devoted to empirical documentation of the facts, the development of theories to explain these facts and empirical tests of competing theories. In light of the enormous literature, it should not be surprising that much of what we cover in this paper has been discussed somewhere else before. The goals of this paper are to draw together some of the facts, update the facts to reflect more recent developments and, most importantly, to attempt to weave these facts together into a consistent picture of relative wages for the three decades from 1967 to 1997. While not all of the facts can be fit easily into a neat little package, we think that the vast majority of the facts fit a relatively simple story, a story of supply and demand.

As would be expected, our observations on the facts for the 1970s and 1980s replicate earlier results. Wage inequality grew significantly from 1970 to 1990 with the 90<sup>th</sup> percentile worker gaining 15% in real terms while the 10<sup>th</sup> percentile worker lost about 25% in real terms. The college wage premium as most commonly measured (the ratio of wages for those with 16 or more years of schooling relative to those with a high school degree) skyrocketed from about 45% in 1980 to more than 65% by 1990. When we update these results using data through 1997 we find that these trends have changed somewhat in recent years. Our results for the 1990's suggest that both the rapid growth in wage inequality (the 90-10 difference, for example) and the rapid growth in the relative wages for college graduates have slowed significantly or in some cases may have even stopped since about 1994. Based on these data, it would appear that the growth in

inequality and the growth in the relative wages of more educated workers, which dominated the data for the 1980s, may have finally run their course.

When we examine data from the 1990s, we find that growth in inequality is now increasingly concentrated at the top end of the wage distribution. For example, we find that from 1990 to 1997 the 90-50 differential increased by about 10 percentage points while the 50-10 differential actually decreased slightly. Similarly, while growth in the wage differential between those with four years of college and those with only a high school degree slowed or stopped after about 1993, the wage premium for graduate degrees continued to increase throughout the period of our data. Interestingly, when we look back over the past several decades we see that this has been a consistent feature of the data. The growth in wage inequality has been increasingly concentrated at the high end of the wage distribution over time. This seems to be true for both men and women and for wage differentials by education as well as overall inequality.

Armed with a description of the basic facts, we then turn to examining the causes and consequences of the growth in inequality and attempt to fit the facts into a simple consistent story. Two major consequences of the rise in wage differentials are clear from the data. First, individual labor supply (time worked) has responded to the changes in relative wages. Groups with falling relative wages have reduced their labor supply significantly relative to groups with rising relative wages. This has reinforced the impact of widening wage differentials on income inequality. Second, investments in human capital have increased in response to the growth in the relative wages of more skilled workers. This is seen clearly in the data on college attendance where rates of attendance

of young workers rose sharply in the 1980s and 1990s after falling along with returns over the 1970s.

On the cause side we identify the usual suspects, changes in the demand for skilled workers (driven by both occupational and industrial change) and fluctuations in supply. Drawing on previous work, we illustrate how changes in the industrial and occupational structure have changed the relative demand for more skilled workers. We also identify an important role for supply. In fact, we find that the same supply side story that explained the College-High School premium through 1987 (Katz and Murphy (1992)) works reasonably well through 1997. The story we prefer is one of relatively stable growth in the demand for educated workers over the past three decades with fluctuating supply growth generating the observed pattern of changes in wage premiums. Over the 1970s the rapid growth in the supply of college workers out-paced demand growth leading to falling relative wages for college graduates while demand growth out-paced supply growth over the 1980s and 1990s.

In total, the facts seem to fit a relatively simple story: the demand for skill has increased continuously over time. When demand grows faster than supply prices rise; when supply grows faster than demand prices fall. The supply of skilled workers responds to the premium for skill. Higher premiums lead to more investment. In our view, this is really part of the long run process of technical change and growth. Changes in technology generate increases in the demand for skill which raises skill premiums and induces increased human capital investment. Skill biased technical change leads to human capital deepening much the same way that technical change drives physical capital deepening in the neoclassical growth model. In this view, growth in the demand

for skill is not something to be feared or avoided; it is really an integral part of the process that allows the economy to deepen its investments in human capital. Under this view, the glass is closer to half-full rather than half-empty.

### **I: The Data**

The data for are from the 1964 to 1998 annual demographic supplements to the March Current Population Survey (CPS). In order to make our results comparable to earlier work (Katz and Murphy (1992) and Murphy and Welch (1992)) we organize the data into groups defined by gender, education and years of potential work experience. We divide education based on years of education completed into five categories, those with less than 12 years, those with exactly 12 years, those with 13-15 years, those with 16 years, and those with 17 or more years of completed schooling. Potential work experience is defined as the minimum of age minus completed education minus six and age minus seventeen. We divide the population into groups based on five year intervals of potential experience, 1-5, 6-10, ..., 36-40. This gives a total of 80 groups (two genders by five education categories by eight experience categories). In some cases we combine the college and post college groups to make a total of 64 groups comparable to those used in Katz and Murphy (1992) and Murphy and Welch (1992).

We measure real hourly wages and the quantity of hours supplied to the market place for each group. The wage and hours data are from the CPS Annual Demographic Supplement and refer to the year prior to the survey; so we consider calendar years 1963 through 1997. For the hours measure we multiply an individual's weeks worked by average weekly hours (imputed for years prior to 1976) to get individual annual hours. Annual hours are then totaled for all individuals in the group. Average hourly wages are

measured as the ratio of total wage and salary earnings for workers in our wage sample divided by total annual hours for this same group. The wage sample includes those who worked full time, were employed for at least 39 weeks, were not unincorporated self employed and did not have imputed earnings. Wages for those with top-coded earnings were imputed as 1.45 times the top code value. When we measure real wages we deflate the CPS nominal wage data by the consumer expenditures deflator from the national income accounts.

As in Katz and Murphy (1992) and Murphy and Welch (1992), for some calculations we need to aggregate across groups. We do so using fixed weight wage indexes and the corresponding implicit hours index. To construct the wage index we use average hours supplied by each group over all of the years of our data as the weights. For example, when we wish to construct aggregated measures of wages (for example wages by education aggregated over gender and experience) we take fixed weighted averages of the data within education levels (using the average hours worked counts by sub-group as weights). The corresponding measure of aggregate hours is then calculated as the sum across sub-groups of the average hourly wage for that sub-group times sub-group hours (equal to total earnings) divided by the fixed weight average wage for the group.

## **II. Relative Wages and Inequality, 1967-1997**

Figure 1 uses the techniques described above to measure the returns to post-secondary education, measured by the ratio of the wage of those with at least 16 years of college to those with only a high school degree. The figure closely replicates the results in Katz and Murphy (1992) for the period through 1987 covered in that study. The data since 1987 show that relative wages for college graduates continued to increase through

the early 1990s but have grown more slowly since about 1993. The magnitude of the overall increase is impressive; the college wage premium rose from a low of about 45% around 1980 to about 80% today with half of the increase coming after 1987. In keeping with earlier results, we find that the rise in the college premium over the 1980s and 1990s contrasts sharply with the experience over the 1970s when the premium for a college degree actually fell by about 10 percentage points.

The data in Figure 1 compare wages for those with 16 or more years to schooling to wages for those with a high school degree. While these data are consistent with the measures used in earlier studies, they hide important differences within the population of college graduates. Figure 2 divides college graduates into two groups, those with exactly 16 years of schooling and those with 17 or more years. Wages for each group are expressed relative to the same high school group used in Figure 1. Clearly the increase in wage premiums is striking for both groups. The growth in both wage premiums was very similar through 1990 (roughly 15 to 20 percentage points). After 1990, the premium for those with exactly 4 years of college grew slowly until 1993 and was then roughly constant. Overall the increase for this group is impressive, the college wage premium for those with four years of college rose from 35% in 1980 to 60% in the mid-1990s.

The premium for those with more than four years of college, those with graduate education, increase more steadily over the period from 1980 forward, slowing only modestly after 1993. The increase in the wage premium is also much larger for the more educated group rising from a low of about 55% in 1978 to over 110% by 1997. While much of this growth is undoubtedly growth in the premium for a given amount of post secondary education, some might also be due to the growth in the average years of

schooling for individuals in this top open-ended interval of our education taxonomy. Unfortunately, the top coding of education at 18 or more years of schooling in the CPS data prevents us from untangling these two effects. Nevertheless, it seems fair to say that the premium from graduate training has continued to grow throughout the 1990s while the premium for four year of college appears to have leveled off (albeit at a very high level).

The data on overall wage inequality among men shown in Figure 3, tells a story that is consistent with that of the returns to schooling. Figure 3 charts real indexed hourly wages for three groups of male workers, the median worker (50<sup>th</sup> percentile), a worker at the 10<sup>th</sup> percentile of the hourly wage distribution and a worker at the 90<sup>th</sup> percentile of the hourly wage distribution. Our data through 1990 essentially replicate the finding of Juhn, Murphy and Pierce (1993). As the figure shows, wages for all three groups increased at roughly the same rate through 1970. After 1970 the three series diverge, with real hourly wages falling by about 25% from their 1970 peak for men at the 10<sup>th</sup> percentile by 1991. For the median male worker real wages fall much less after 1970, with real hourly wages falling by about 5% relative to 1970 (10-15% from their peak in 1973) by 1990. In contrast, real wages for men at the high end (measured here by the 90<sup>th</sup> percentile) increased substantially from 1970 to 1990, rising by 10 to 15%. The magnitude of the growth in inequality from 1970 to 1990 is striking, with the wage differential between the 90<sup>th</sup> and 10<sup>th</sup> percentile rising by more than 40 percentage points.

The experience after 1990 is somewhat different. Since 1990, real wages have remained roughly constant for both the 10<sup>th</sup> and 50<sup>th</sup> percentile workers while real wages have continued to increase (by about 8%) for workers at the 90<sup>th</sup> percentile. Hence, just

as recent increases in wage differentials by education level are concentrated at the top of the education distribution (the graduate premium), increases in overall wage inequality since 1990 have also been concentrated at the top of the wage spectrum.

The four panels of Figure 4 illustrate even more clearly how the nature of the growth in wage inequality has changed over time. In these four panels we present wage growth by wage percentile level for three distinct periods. The intervals divide at 1968-70, 1977-79, 1986-88, and 1995-97. We use three-year averages (which we refer to by the middle year for convenience) to smooth some of the noise in annual estimates of hourly wages by percentile. The first panel looks at the growth in wages by percentile for the full period (roughly 1969-96). The most significant information in this panel is that the growth in inequality is a pervasive phenomenon, with inequality in wages increasing across the full spectrum. This is an important message. Over time, the focus of discussions on inequality has shifted from talk of an “underclass” falling away from the rest of the economy to stories of corporate executives and the “super-rich” capturing all of the gains in the economy while the rest of us fell further and further behind. The data in the first panel show that over the period as a whole, the growth in inequality is not a story of extremes but rather a general story of widening differentials at all levels.

The remaining three panels of Figure 4 show how the growth in wage inequality has changed over time. The second panel shows that from 1969 to 1978 inequality growth was concentrated in the lower half of the wage distribution, with wages for workers in the top 40% of the wage distribution growing about 15% relative to wages for workers at the 10<sup>th</sup> percentile. Differences in wage growth within the top 40% are minimal for this period. Wage growth by percentile for the 1978-87 period mirrors what

we find for the period as a whole, with wage inequality growing uniformly across the wage spectrum. The data for the most recent period (1987-96) illustrate that overall the growth in inequality has slowed and what growth remains is now concentrated within the top 40% of the wage distribution (the same group where inequality had not increased during the initial period). As these three panels clearly illustrate, over time, the growth in inequality has been increasingly concentrated at the top of the wage distribution.

Our basic findings for inequality for the 1990s can be summarized as follows: (1) overall the growth in inequality has slowed in recent years, (2) wage differentials are now wider than at any time in recent memory but may no longer be increasing as rapidly as during the 1980s, and (3) what growth remains seems to be concentrated at the very top of the wage distribution. Finally, this increasing concentration at the top has been going on over the entire period of our data. The growth in inequality was concentrated in the bottom half of the distribution in the 1970s, evenly spread throughout the distribution for the 1980s, and at the top of the distribution for the 1990s.

The results for women illustrated in Figure 5 mirror those for men for the 1980s and 1990s, with the major difference being that real wages increased for most groups of women over both periods while real wages fell for all but the highest wage groups of men. The growth in wage inequality for women over the 1978-1987 period shows a roughly uniform expansion in inequality while the growth in inequality for women over the 1990s has been concentrated at the top of the distribution just as it has for men.

Although the growth in wage inequality and the growth in education premiums are the two most widely discussed changes in relative wages over the past several decades, this same period has seen other significant changes in relative wages as well.

Figure 6 examines the hourly wages for blacks relative to whites separately for men and women over the same 1967-97 period. As the figures show, both black women and black men gained significantly on their white counterparts through the mid-1970s but progress has been non-existent (men) or even reversed (women) since about 1975. These same patterns, first noticed in the early 1980s, continue through the end of our data. One possible explanation for these facts advanced by (Murphy and Welch (1991)), Juhn, Murphy and Pierce (1991), Smith (1993) and others is that the same forces which have pushed up inequality within whites and between education levels have slowed progress for blacks. African-American workers have been, as it were, “swimming upstream” in a world where the economic consequences of lower average levels of education and being employed disproportionately in lower skilled jobs has worked to the disadvantage of black workers. If this interpretation is correct, the slowing in the growth of relative wages may lead to a resumption of wage convergence between blacks and whites in coming years.

Not all wage differentials mirror the trend to wider differences across individuals. In particular, as many authors have noted, the male-female differential has narrowed significantly over the past two decades. This is illustrated in Figure 7, where we graph the ratio of the average hourly wage for women relative to the average hourly wage for men separately for high school and college graduates. As the figure shows, the relative wage for women at both education levels was roughly constant at around 62% through the mid-1970s. From the mid-1970s through the early 1990s, the relative wages for women increased from roughly 62% to 74% (an increase in relative wages of about 18%). In our opinion, this increase is significant since it would seem to suggest that the

same forces that are pushing up wage inequality and the returns to education may also be working to the advantage of women relative to men. This view is bolstered by the fact that the growth in wages for women relative to men also slows over the mid-to-late-1990s, mirroring what we find for inequality among men and for the returns to schooling.

### **III: Causes and Consequences of the Growth in Inequality**

The changes in relative wages and inequality have had a profound direct impact on the U.S. economy. The indirect effects of these changes have also been substantial. As many authors have shown, the growth in wage inequality is the leading cause of the growth in family and household income inequality in the U.S. over this period. Moreover, the growth in inequality in wages has been reinforced by changes in employment. Employment rates for less educated and low wage males have fallen relative to the employment rates for their more educated and higher wage counterparts (Juhn (1991), Juhn, Murphy, and Topel (1991) and Topel and Murphy (1997)). The same is seen among women, where the growth in time worked has been more rapid among more educated and more skilled women than among their less educated and low wage counterparts and the association between the wages and time worked of husbands and wives has become increasingly positive over time (Juhn and Murphy (1997)).

The evidence on wages and time worked presents what many regard as a very negative picture of the U.S. economy. The rich are getting richer while the poor are getting poorer. However, in our view such a static focus on the downside of the growth in inequality misses a substantial positive side to these same labor market developments. In our view, the growth in wage differentials across education levels and the growth in wage inequality generally represent an increase in the economic rewards for education

and other investments in skills. These wider differentials represent an increase in the rate of return on investments in human capital. Higher rates of return on investment are generally a good thing in that they give us a greater payoff on the investments we would otherwise have made. Moreover, higher rates of return also increase investment, which should in turn increase the rates of growth of output and income.

Figure 8 illustrates the impact that the widening of wage differentials has had on investments in post-secondary schooling. The panel charts the fraction of men and women ages 21-25 with at least some post secondary schooling for the period 1963 through 1997 (we use fixed uniform weights across single years of age and gender in order to avoid composition effects within this group). As the figure shows, the fraction with at least one year of postsecondary schooling follows a pattern quite similar to the college-high school premium. The fraction attending college increased from 1963 to roughly 1973 (about 2 years after the college premium peaked) and then declined over the 1970s, reaching its minimum level in 1980. The fraction attending college then rebounded with the surge in the college premium. College attendance rose continuously over the 1980s and early '90s, surpassing its 1970 level by 1987. The clear implication of these data is that investment in human capital responds to the rate of return.

The evidence also suggests that the return to human capital investment is in turn affected by the supply of more educated workers. The basic framework is that both the demand for educated workers and the quantity of educated workers supplied to the market are growing over time. When the growth in supply exceeds the growth in demand, the wage premium for a college degree falls. When the growth in demand exceeds the growth in supply the wage premium rises (such a model for these data was

originally suggested by Murphy and Welch (1989) and later estimated by Katz and Murphy (1992). The simplest story along these lines is that the demand for more skilled labor has been increasing steadily over time and that fluctuations in the growth of supply have led to fluctuations in the premium paid for a college degree. The model presented in Katz and Murphy (1992) is formulated exactly along these lines; they use a constant elasticity of substitution with a simple linear trend in the relative demand for more educated labor. Figure 9 presents the actual college wage premium for 1963-1997 (we start the analysis in 1963 to coincide with the start of the Katz-Murphy analysis) together with the predicted premium based on our estimates of the CES model. The vertical line in the figure separates the time period over which the model was estimated from the out of sample forecast. The forecasts correspond to an annual growth rate in the relative demand for college labor of 4.2% per year and an elasticity of substitution of roughly 1.7. As can be seen in the figure, the model fits the data reasonably well (even the out of sample period from 1988 to 1997). Under this interpretation, the rapid growth in the wage premium over the 1980s and 1990s was due to the relatively slow growth in the supply of educated workers over this period while the decline in the wage premium over the 1970s was driven by the enormous increase in the college population generated by the entry of the highly educated baby-boom cohorts into the market place.

The model used to generate the predictions in Figure 9 depends on the assumption of a constant growth rate in the relative demand for more educated workers. While this assumption appears to be consistent with the data (in the sense that the model fits the data reasonably well) these data cannot reject a more complicated structure in which the growth in demand has varied over time. If we continue to work with the constant

elasticity of substitution framework, alternative specifications of demand growth correspond to alternative values for the elasticity of substitution. In particular, if the elasticity of substitution is less than 1.7 then the slowdown in the growth of college labor in the 1980s would more than explain the upward surge in relative wages. This would require that demand growth actually slowed over the 1980s and 1990s. In contrast, if the elasticity of substitution significantly exceeds 1.7 then the growth in the relative demand for more educated workers must have accelerated during the 1980s and 1990s. In particular, an elasticity of substitution of about 4.0 implies a relatively extreme story where there was no growth in the relative demand for college labor in the 1970s and very rapid growth over the post-1980 period.

There are two main ways to try to resolve the question of whether demand growth accelerated over the 1980s and 1990s: (1) gather additional evidence on the elasticity of substitution or (2) gather direct evidence on the time pattern of demand growth. Some evidence on the elasticity of substitution can be gained by looking across countries. In particular, Riddell, Romer and Murphy (1998) analyze data for the U.S. and Canada over the 1980s. The U.S.-Canadian comparison is useful since many of the factors affecting the demand side industrial and technological change should be common to the two countries but the growth in supply is very different. In particular, the supply of educated workers in Canada grew much more rapidly than it did in the U.S. Wage differentials for college-educated workers also evolved very differently in the two countries. While the college wage premium grew rapidly in the U.S. it barely changed in Canada. As Riddell, Romer and Murphy show, an elasticity of substitution of about 1.5-2.0 would imply very close to the observed differences in wage patterns. This and other cross-country evidence

(see Fernandez Kranz (2000) for example) supports the view that supply growth does matter and that an elasticity of substitution around 1.5-2.0 may be reasonable.

When we try to look at demand side growth we must ask what forces are driving the growth for more educated workers. As many authors have stressed, two major sources exist, industrial change (changes in the mix of output) and technological change (changes in the way in which output is produced). While direct measures of technological change are difficult to find, industrial change is more easily tracked. Figure 10 (adapted from Welch (1999)) provides a simple graphical representation of how industrial change has affected the relative demand for more educated labor. Using data from the 1968 to 1998 CPS we divide the 3 digit industries into four groups based on their intensity of use of college labor. We order industries according to the ratio of college to high school labor and then divide them to give each of the four groups roughly equal shares of employment over the period as a whole. Educational intensity varies greatly across these industry aggregates from roughly 4 college graduates per high school graduate in the most education intensive quarter of industries to only about .4 college graduates per high school graduate in the least education intensive quartile of industries. As the figure shows, the growth rate of industry employment varies directly with education intensity across these four quartiles. Over the 30-year period of our data, employment in the most education intensive quartile of industries increased roughly 75% while employment fell by about 25% in each of the bottom two quartiles.

The data in Figure 10 also helps address the question of whether the growth in the demand for more educated workers has accelerated over time. As the figure shows, growth in the highest skilled sectors (the top quartile) was relatively steady over time

while growth in the second to highest sector (employing on average 1.15 college graduates per high school graduates) actually decelerates over time. This has two interesting implications. First, these data would favor the constant growth in the demand scenario associated with an elasticity of substitution of about 1.5-2.0 over stories that emphasize accelerated demand growth over the 1980s and 90s. Second, these data also show that the industrial component of the demand for skilled labor shows increased concentration at the top of the distribution over time since we find that the relative demand for the highest quartile grows steadily throughout the period of our data while growth in the second highest quartile essentially stops after about 1983. This evidence fits in very well with our finding on wages. In particular, the growth in both our relative demand measures and relative wages have become increasingly concentrated at the top of the wage distribution.

Juhn and Murphy (1995) reach a similar conclusion on the changing nature of demand growth when they examine census data over the longer, 1940 to 1990, period; growth in demand for the top relative to the bottom decile of workers (calculated through changes in the industry-occupation mix) has been remarkably constant while the shifts between adjacent deciles has progressively moved toward the top. This is illustrated in Figure 11, adapted from Juhn and Murphy (1995), where estimates of demand growth by wage percentile for men for the 1940-1980 period (normed to decade basis) is compared to estimates for the 1980 to 1990 decade. While the top to bottom comparison is similar (showing a difference of about 15 to 20 percentage points between the top and bottom deciles) the relative demand change for the earlier period is uniform across deciles while the change during the 1980s is concentrated at the top of the distribution. Again, this

suggests that while the overall rate of the growth in the demand for skill has been relatively constant over time, there has been a consistent drift toward higher skills.

#### **IV: Putting the Pieces Together**

While it is difficult to reach definitive conclusions based on the thirty-one labor market equilibria that we observe between 1967 and 1998, we feel that the data fit a simple story. Namely, the relative demand for skilled labor has grown monotonically over time. Moreover, as measured by differences at the extremes of the skill distribution, the rate of this demand growth may in fact be relatively stable. Against this more-or-less constant growth, there has been a secondary trend that has magnified wage differentials at increasingly higher levels within wage rankings. Based on a simple model that addresses the bottom-to-top differentials, it appears that both demand and supply side factors are important. Long run growth in demand has helped absorb the ever-increasing supply of educated labor while fluctuations in the rate of growth of supply have led to first declining (over the 1970s) and then increasing (over the 1980s and early 1990s) premiums for college degrees. The data on enrollments also suggest that supply responds significantly to changes in returns; greater returns lead to substantial increases in the fraction of young workers that go on to college.

In our opinion, this model is not just applicable to the recent period, it reflects a fundamental aspect of economic growth: technological progress continuously increases the demand for more skilled workers. With fixed relative supplies, this would lead to a constantly rising premium for skill. But supply is not fixed, the supply of educated workers responds to the premium for education. Thus technical change biased in favor of more skilled workers, leads to both a direct effect on output (TFP growth) and an indirect

effect on output through human capital or skill deepening. With diminishing returns, the growth in human capital moderates or eliminates (depending on the long-run elasticity of the supply) the wage increasing effect. This “human capital deepening effect” is analogous to the physical capital deepening effect in the standard neo-classical growth model where technological progress perpetually raises the demand for capital and the investment response leads to an increase in capital intensity reinforcing the technological effect on real output, wages and living standards. We believe the recent evidence is that a similar process takes place on the human capital side. In this view of the world, changes in the relative demand for more skilled workers are an integral part of the long run growth. The growing demand for skills allows for the on-going accumulation of human capital without perpetual diminishing returns to investment.

The stylized view sketched out above is here a long run steady state while the data for the recent period shows the bumps and jumps that provide the impetus for the longer term smoothing. To maintain a steady premium for a college degree the shifts in both supply and demand must be in constant balance. However, as we have emphasized above, this has not been the case for the 1967 to 1997 period. Several factors are important. First, there is the baby boom and, just preceding the highly educated baby boom, there was the Viet Nam War with draft deferments for those enrolled in school. The combined effect of large and highly educated job-market entering cohorts in the early-to-mid-1970s alongside the retirement of older less educated cohorts is that the supply of college labor grew rapidly over the decade as the cohort-specific rates of college enrollment fell over the last half of the decade. This dramatic divergence

between stocks and flows is driven by the very long-lived nature of human capital investment together with fluctuations in cohort size.

Growth in the aggregate supply of college labor depends on the education levels of the cohorts entering and leaving the labor force relative to the education levels of the population as a whole together with the size of entering and exiting cohorts. In fact, the education level of the population is much like the temperature of a tub of water. The change in the temperature of the water depends on the temperature of the water entering the tub and the temperature of the water leaving the tub and the rates at which water is entering and leaving. In terms of this analogy, the rapid growth in education levels over the 1970s reflected the enormous volume of water entering the tub more than the relative temperature of the water. The slow growth in education levels over the 1970s meant that by 1980 the relative education level of those entering the workforce (measured relative to the workforce as a whole) was low by historical standards. This together with the relatively small size of the entering cohorts led to the relatively slow growth in supply seen over the 1980s. Over time, growth in the fraction going on to college has begun to reverse this trend but given the long lived nature of human capital and the small size of entering cohorts relative to the population of college graduates it will most likely take some time before these effects can be reversed and supply growth significantly out-paces demand growth.

So where does this leave us? As of 1997 the return on human capital investment would appear to be at its highest level in recent memory. This is good news. It implies that the long run growth in human capital that will occur over coming years will provide greater dividends in future decades than it would have otherwise. The top panel of Table

1 illustrates this idea by calculating the historical increases in real output generated by the growth in human capital (measured here by the fraction of the population with a college degree) and comparing these actual contributions with what they would have been at the 1997 return to human capital investment. As the table illustrates, the increased return to human capital has the potential to add something like 1 to 2 percentage points to the growth of output over a decade or roughly .1 to .2 percentage points to the average annual growth rate.

The data in Table 1 give this growth effects of higher returns assuming that the rate of growth of human capital is unaffected by the higher rate of return. However, as we have seen, this is not the case; greater returns lead to more investment. In Table 2 we estimate the potential additional growth in output that would be generated by increased investment. We take the 1971 rate of return as the long run value of the return to schooling and calculate how much the supply of college labor would need to grow to reduce the rate of return to this level for various values of the elasticity of substitution (long run perfectly elastic supply). We then calculate the implied increase in real output from the calculated increase in the quantity of college labor. As the table shows, the supply response to higher returns has the potential to add significantly to output growth. In fact, even if the supply response is spread over a period of two decades it would still add about 1.4% ( $2.8/2$ ) per decade to economic growth with an elasticity of substitution of 1.5 and 1.9% per decade with an elasticity of substitution of 2.0.

The results in Table 2 may actually underestimate the economic impact of the growth in the premium for skill. The data in the table address only education skills while we know that education is only one component of our investment in human capital. The

growth in overall inequality (the majority of which has occurred within education levels) suggests that the premium for skills has risen more generally. If the supply response for these other skills (such as on the job investment) are proportionately as great as those for education then the numbers in Table 2 could be at least doubled.

Our basic conclusion is that while the growth in inequality and wage differentials has increased the disparity in incomes between those with more skills and those with less skills it also represents a significant opportunity, an opportunity to expand our nation's investments in skills and reap historically high rates of returns on those investments. From the very first observations in the early 1980s we have been treated to the dire consequences of growing inequality. Recall, for example, the “bad jobs” discussion of the 1984 campaigns. We are fully aware of the “half-empty” side of the story. Yet there is another side, one that we believe deserves more attention. It is the “half-full” side, the side that points to the opportunity implicit in growth in the demand for skill.

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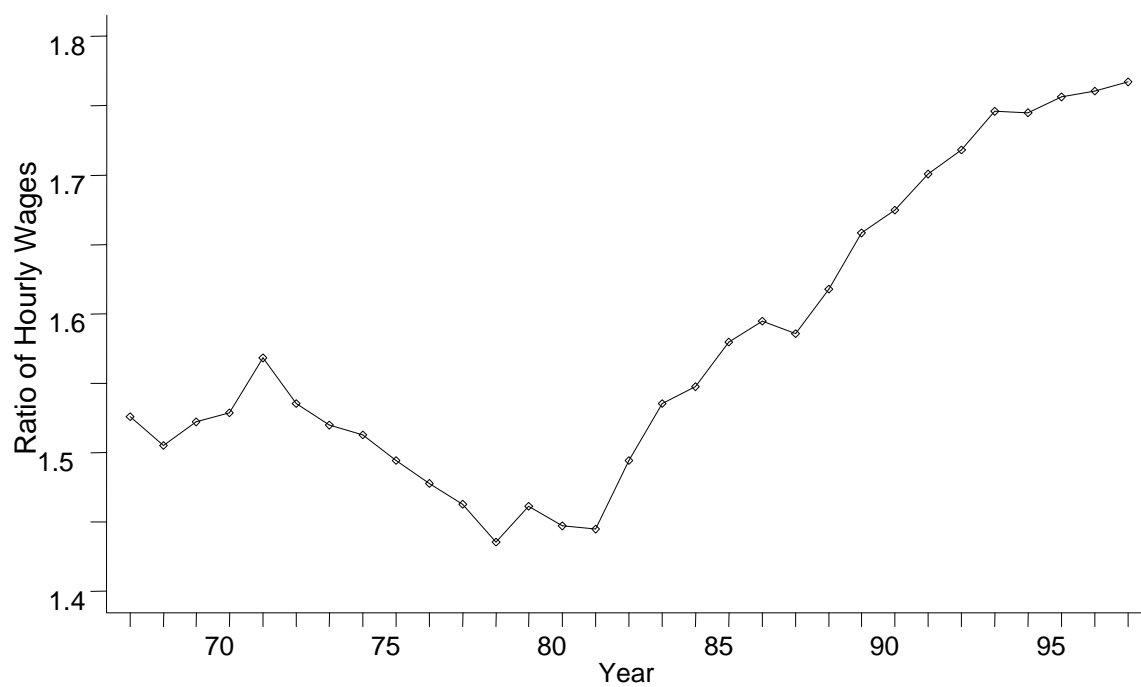


Figure1. College Plus / High School Wage Premium 1967-1997

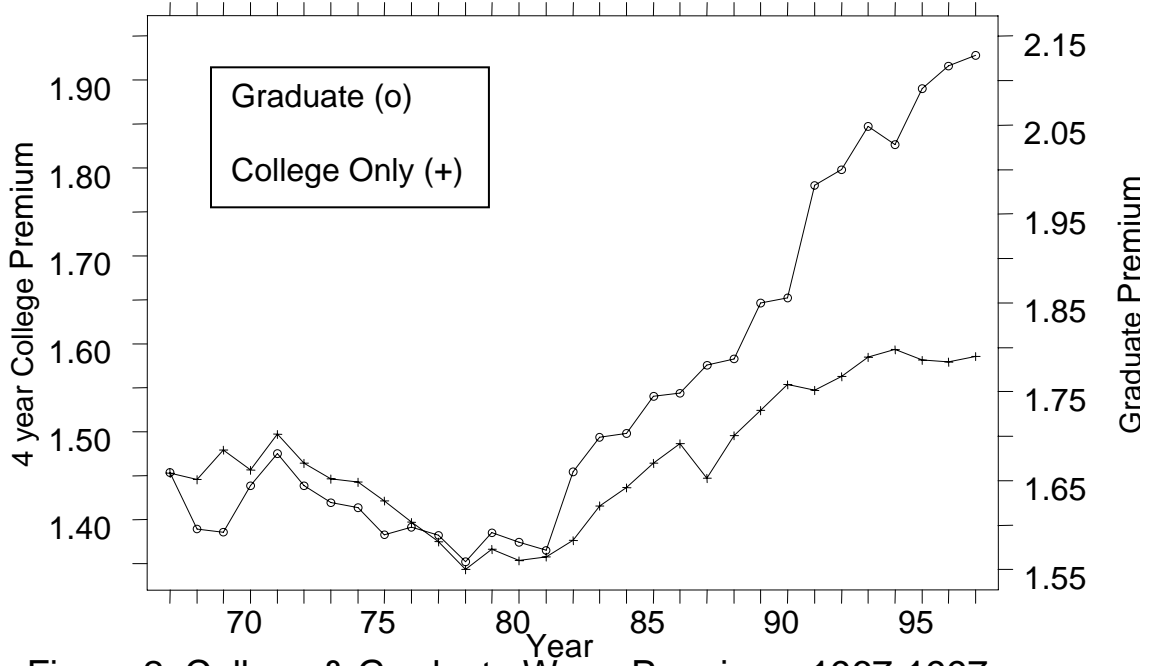


Figure 2. College & Graduate Wage Premiums 1967-1997

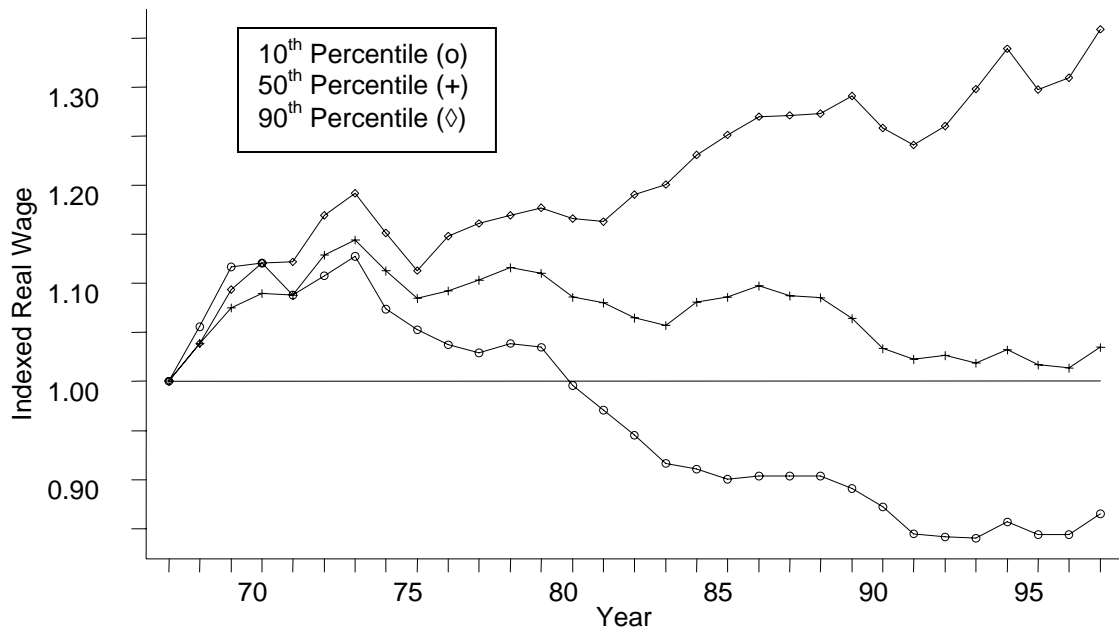
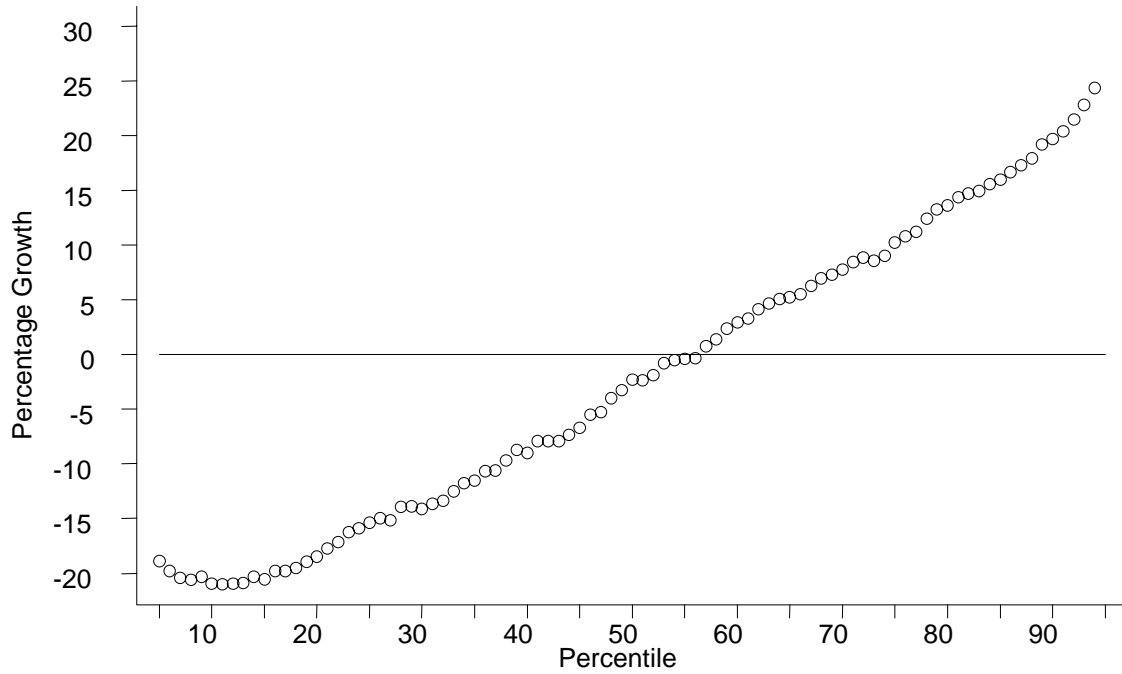
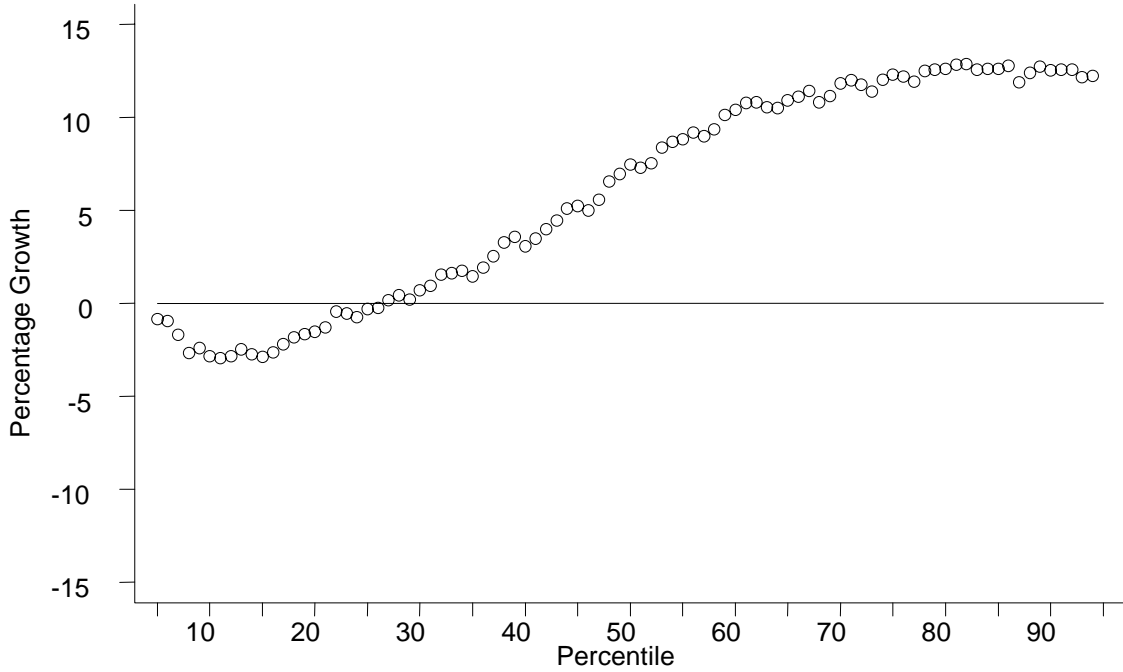


Figure 3. Indexed Real Wages for Men by Percentile 1967-1997

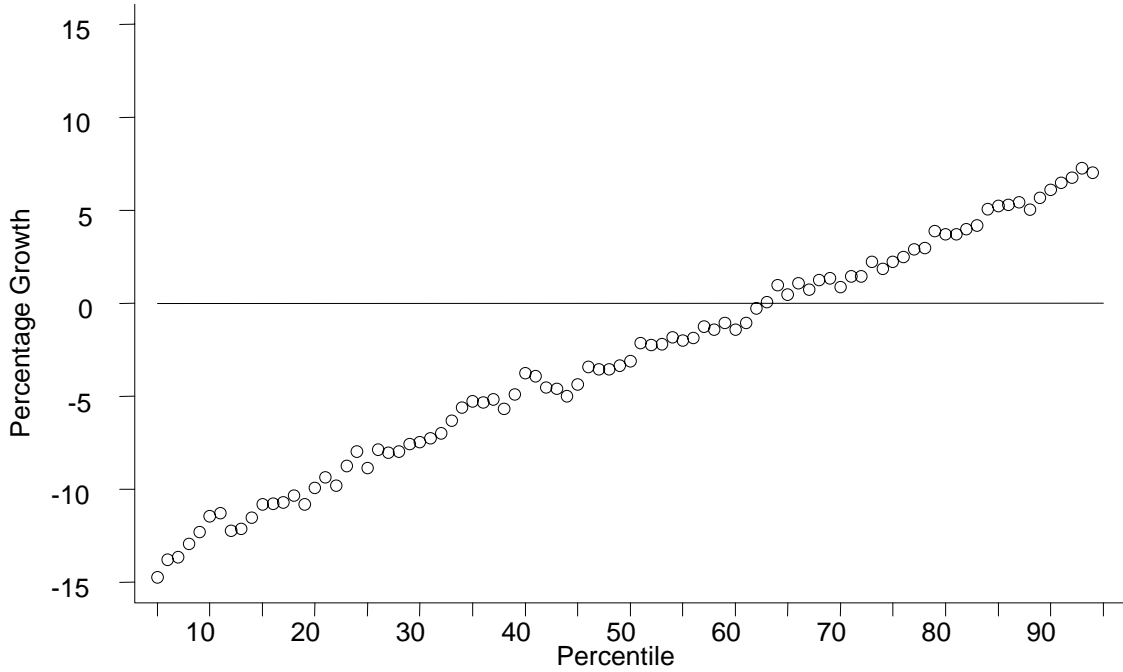


4a. Percent Growth in Real Hourly Wages 1969-1996

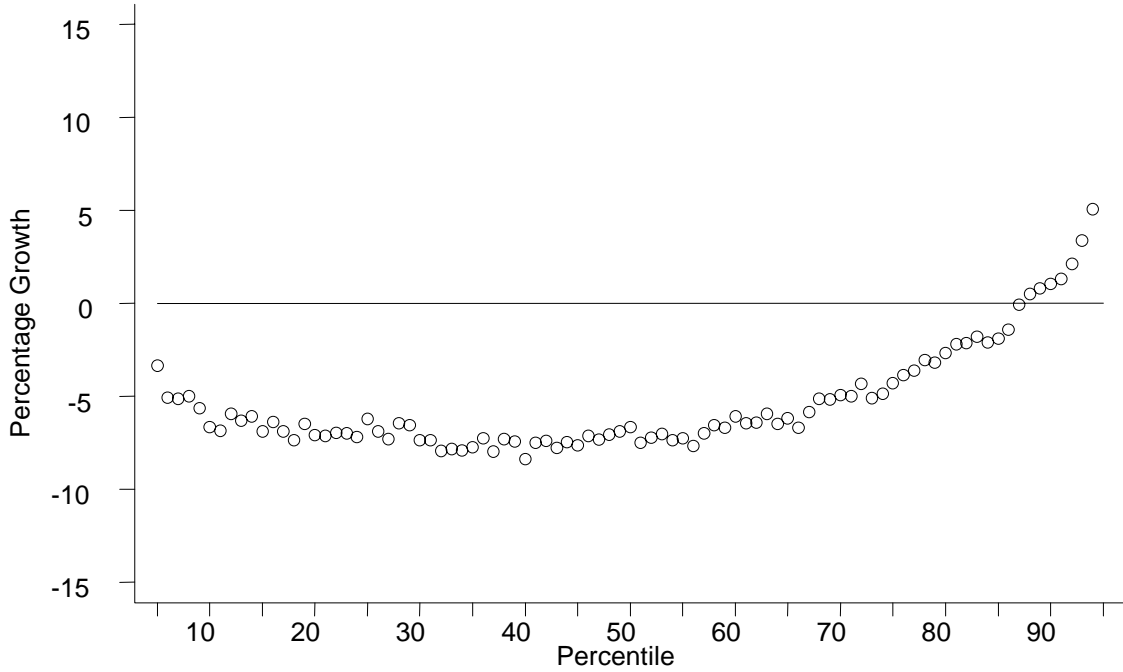
Figure 4. Wage Growth for Men by Percentile 1969-1996



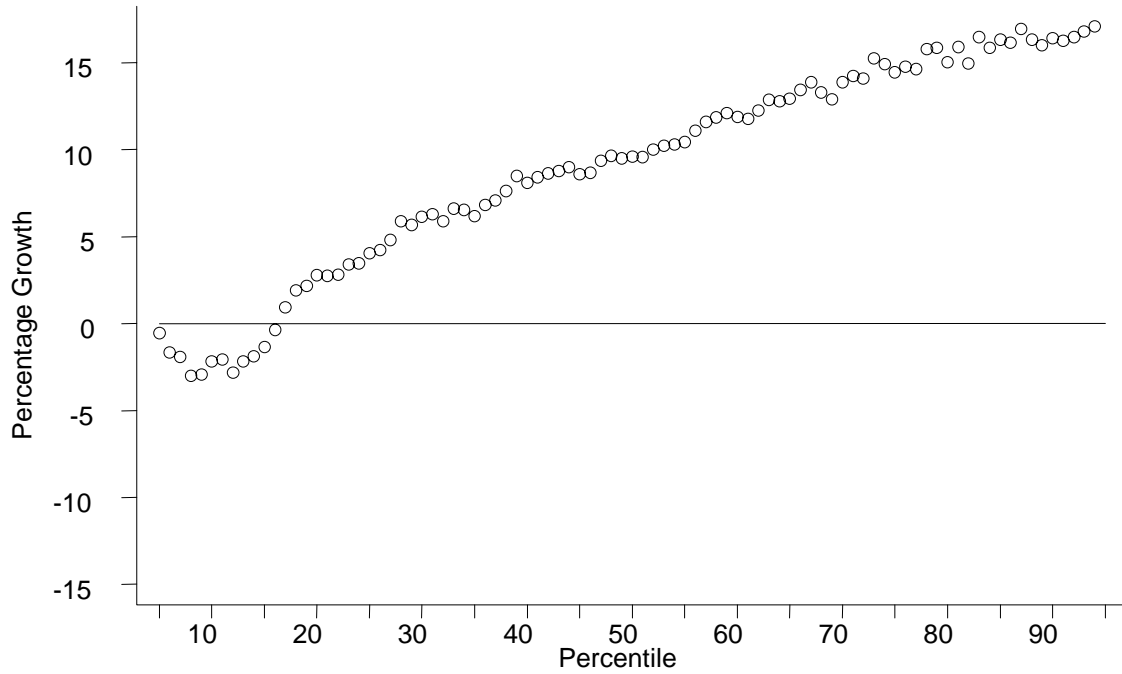
4b. Percent Growth in Real Hourly Wages 1969-1977



4c. Percent Growth in Real Hourly Wages 1978-1987

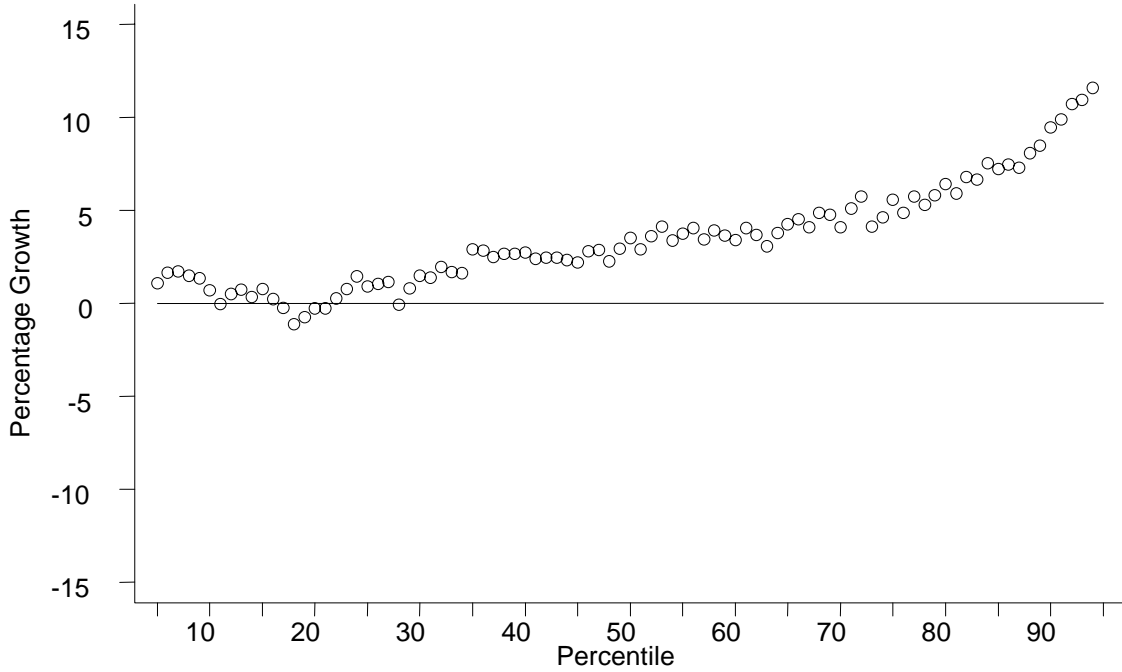


4d. Percent Growth in Real Hourly Wages 1987-1996



5a. Percent Growth in Real Wages for Women 1978-1987

Figure 5. Wage Growth for Women by Percentile 1978-1996



5b. Percent Growth in Real Wages for Women 1987-1996

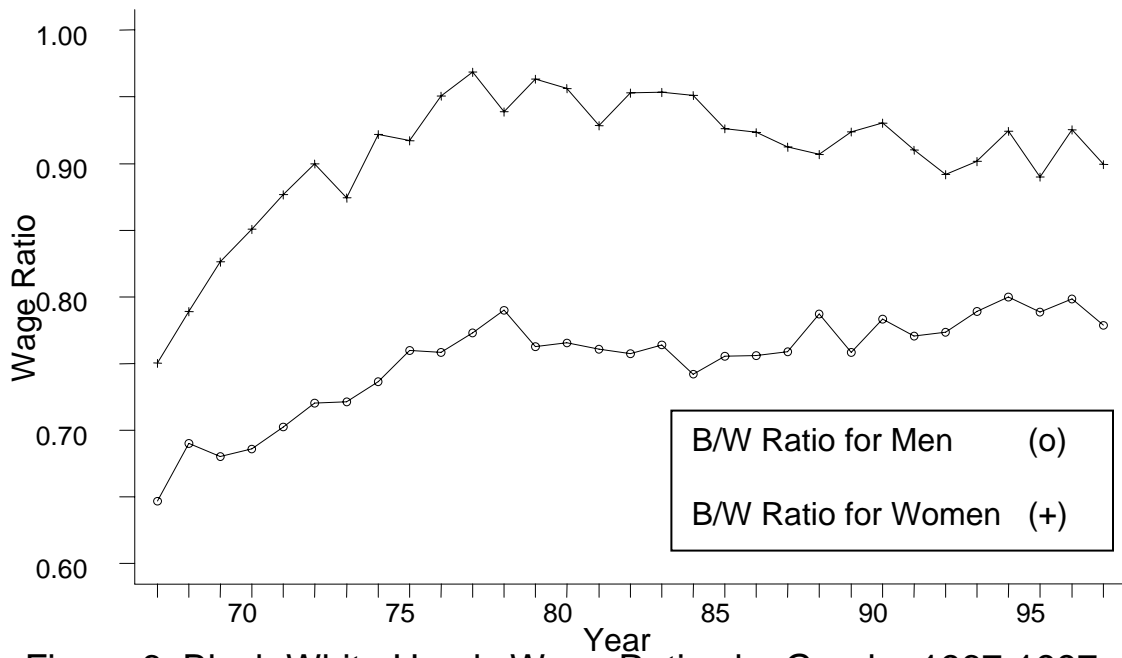


Figure 6. Black-White Hourly Wage Ratios by Gender 1967-1997

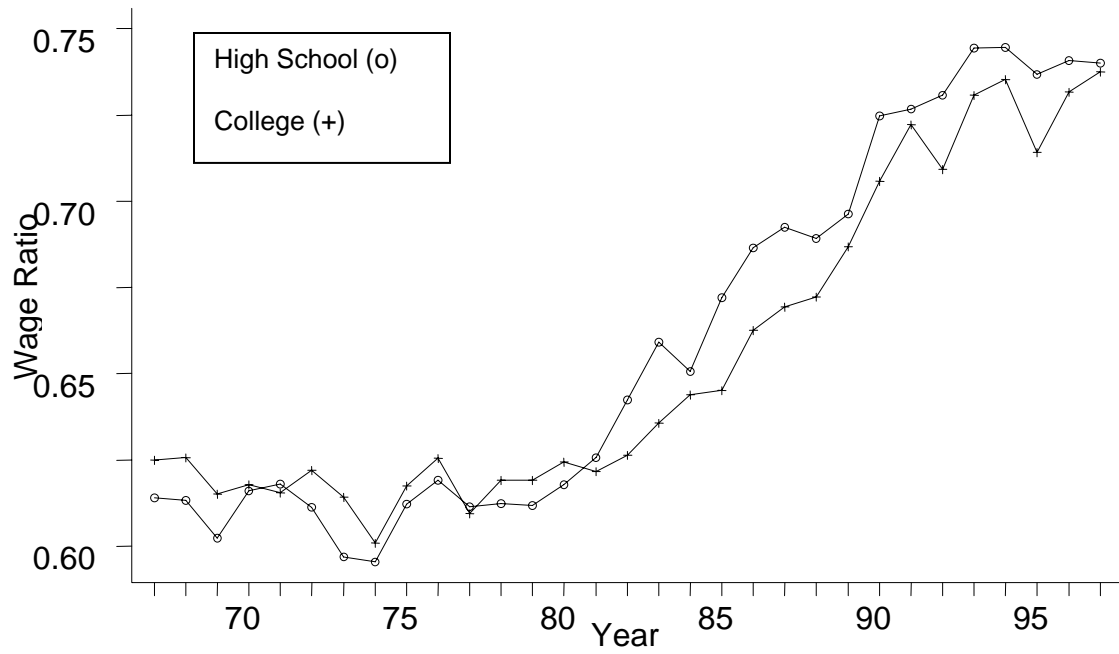


Figure 7. Female-Male Wage Ratios 1967-1997

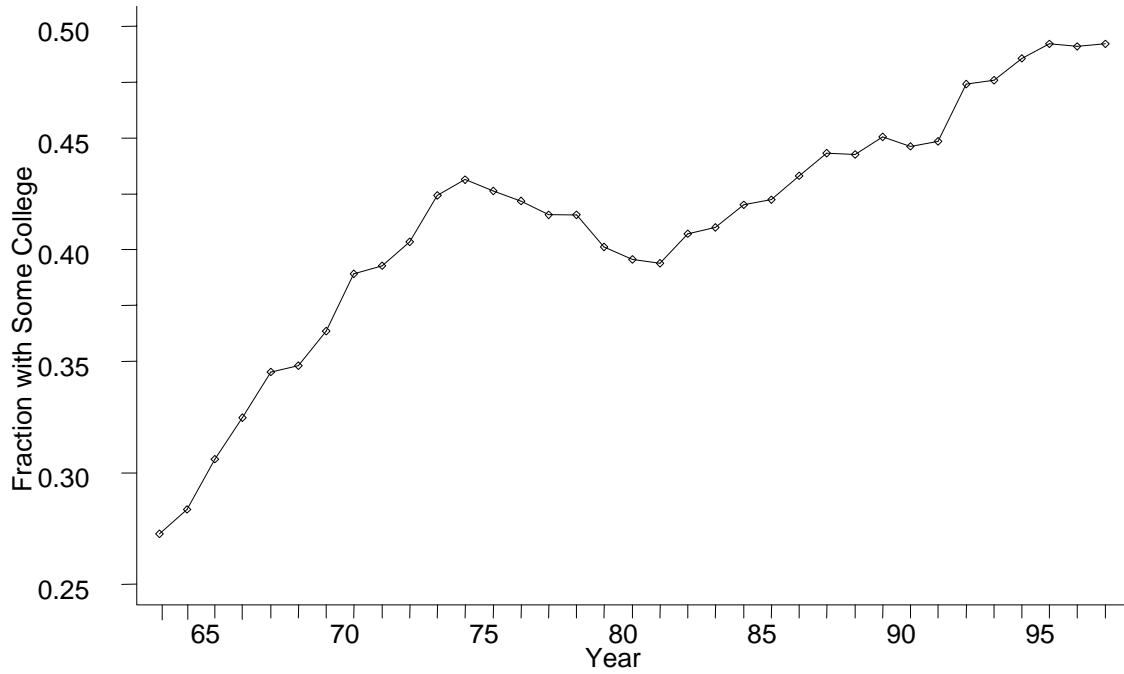


Figure 8. Fraction of 21-25 Year-olds with Some College 1963-1997

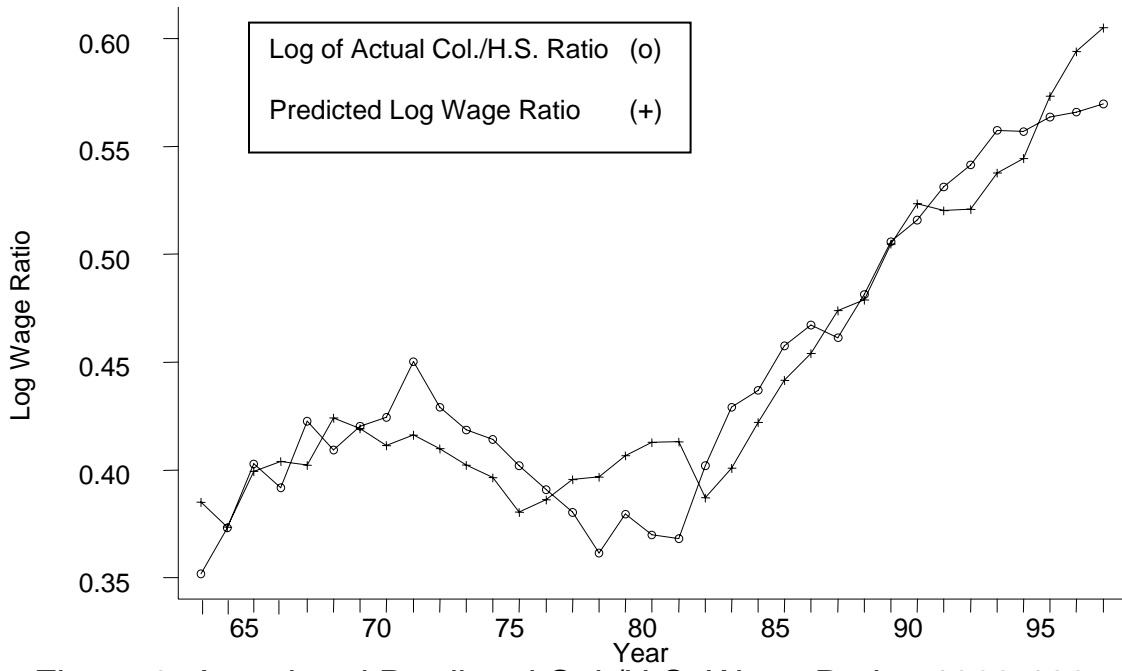


Figure 9. Actual and Predicted Col./H.S. Wage Ratios 1963-1997

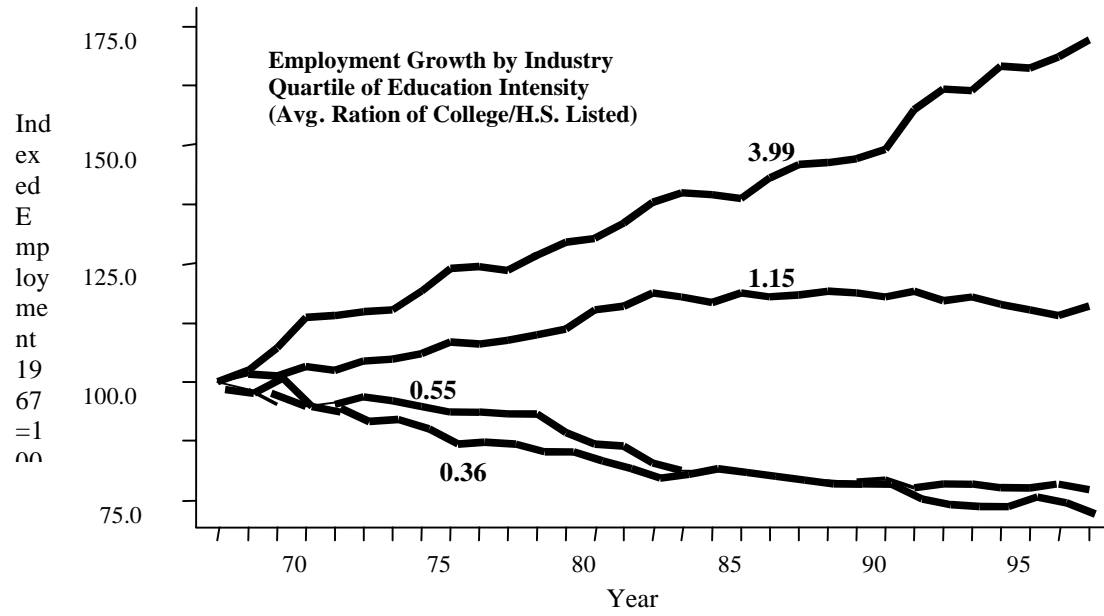
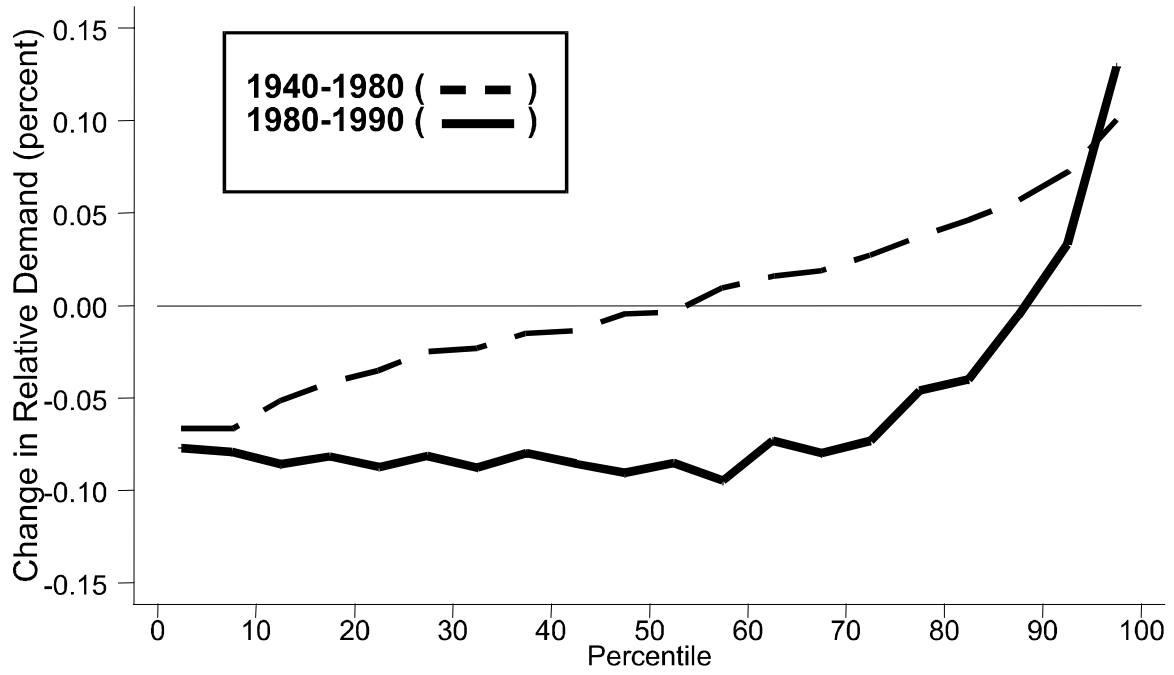


Figure 10. Industry Employment Growth by Education Intensity



**Figure 11. Changes in Relative Demand for Men by Wage Level  
1980 to 1990 vs Average for 1940-1980**

## Growth In College/HS Quantity and Wage Ratios

YEAR	Percent College	Wage Ratio	$\ln(C/HS)$	$\ln(W_c/W_{hs})$	Actual Growth Effect	Growth Effect @ 1997	Diff.
1967	0.17	1.52	-1.59	0.42			
1977	0.26	1.46	-1.07	0.38	4.21%	6.62%	2.41%
1987	0.33	1.58	-0.73	0.46	3.59%	5.31%	1.73%
1997	0.38	1.77	-0.48	0.57	3.85%	4.39%	0.54%

## The Potential Effects of Supply Responses on growth

<b>Elasticity of Substitution</b>	1.50	2.00
<b>Required Increase in <math>\ln(\text{col}/\text{hs})</math></b>	0.23	0.30
<b>Implied Fraction College (1997)</b>	0.44	0.46
<b>Implied Growth in Output</b>	2.80%	3.74%
<b>With Non-education Skills</b>	5.60%	7.47%

