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The Evolution of the Returns to Human Capital in Canada, 1980-2006

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Abstract

This paper examines the evolution of the returns to human capital in Canada over the period 1980-2006. Most of the analysis is based on Census data, and on weekly wage and salary earnings of full-time workers. Our main finding is that the returns to education increased substantially for Canadian men between 1980 and 2000, in contrast to conclusions reached in previous studies. For example, the adjusted wage gap between men with exactly a bachelors' degree and men with only a high school diploma increased from 34 percent to 43 percent during this period. Most of this rise took place in the early 1980s and late 1990s. Returns to education also rose for Canadian women, but the magnitudes of the increases were more modest. For instance, the adjusted BA-high school wage differential among women increased about 4 percentage points between 1980 and 1985 and remained stable thereafter. Results based on Labour Force Survey data show the upward trend in returns to education has recently been reversed for both men and women. Another important development is that after fifteen years of expansion (1980-1995), the return to work experience measured by the wage gap between younger and older workers declined between 1995 and 2000. Finally, we find little difference between measures based on means and those based on medians of log wages for both genders. Also, the use of broader earnings measures (such as including self-employment earnings, using weekly earnings of all workers, or using annual earnings of full-time workers) does not alter the main conclusions from the analysis based on weekly wage and salary earnings of full-time workers.

JEL Classification: J24, J31
Key words: Human Capital, Wage Differentials, Returns to Education, Canada

Executive Summary

This paper examines the evolution of the returns to human capital in Canada over the period 1980-2006. While particular emphasis is given to the returns to education, the evolution of the returns to experience is also examined.

Good and reliable estimates of the returns to human capital, in general, and the returns to education, in particular, are essential for assessing the benefits of the large investments made by governments in Canada. Furthermore, in order for the market for education to function well, it is essential for individuals contemplating investments in education to know the kinds of returns they should expect on these investments. Unfortunately, the existing Canadian literature on the returns to education presents a somewhat confusing picture. On the basis of studies such as Freeman and Needels (1993), Murphy, Riddell and Romer (1998) and Burbidge, Magee and Robb (2002) it is widely believed that, for the labour force as a whole, the wage gap between more- and less-educated workers remained stable during the 1980s and 1990s. Indeed, Burbidge et. al. (2002) conclude that the education wage premium – the gap in earnings between university-educated workers and those with less than a university degree – was approximately constant for males over the period 1981-2000 and declined for females. In contrast, Boudarbat, Lemieux and Riddell (2006) conclude that education wage differentials (adjusted for experience) increased substantially over the period 1980-2000. They find that the education wage premium rose for both men and women, although the gains for women were more modest.

The principal objective of this paper is to reconcile these divergent conclusions about the behaviour of the returns to education in Canada. We focus in particular on accounting for the different findings of the two most recent studies – those of Burbidge, Magee and Robb (2002) and Boudarbat, Lemieux and Riddell (2006). We also update earlier work to incorporate data since 2000 and examine the evolution of the returns to experience.

Most of our analysis is based on the Census because it allows a long time perspective, and provides consistent information on educational attainment, as well as labour market outcomes. However, available data cover the 1980-2000 period only. To obtain recent information and, at the same time, to check the consistency of the findings from the Census, we also use data from the Labour Force Survey (LFS) from 1997 to 2006, and from the Survey of Labour and Income Dynamics (SLID) from 1996 to 2004. In addition, we focus on "adults" age 16 to 65 and use weekly wage and salary earnings of full-time workers as our main measure of wages. However, we also examine the impact on our results of using broader earnings measures.

Our investigation with Census data yields several conclusions. For men, returns to education – as measured by the skill premium relative to high school graduates -- have been increasing between 1980 and 2000. For example, we

find that the raw BA-high school differential rose from 32 percentage points in 1980 to 38 percentage points in 2000. Most of this rise took place in the early 1980s and late 1990s. The BA-high school differential expands when we control for differences in years of potential experience, and, unlike the unadjusted wage gap, it shows an overall positive trend over the period, going from 34 percent in 1980 to 43 percent in 2000. The growth in (adjusted) wage differentials occurs steadily throughout the period and among all education groups above high school graduates.

This finding contrasts with conclusions of studies based on SCF data that show little change in returns to education for men during the 1980s and 1990s. The rise in the return to education among Canadian men, while significant, is, however, much less dramatic than that experienced in the U.S.

The results for women are quite different from those for men. First, returns to education are systematically larger than for men. Second, most education wage differentials among women have been relatively constant over time. The adjusted wage differentials increase over the period 1980-2000, but the increases are not substantial – growth of 2 to 4 percentage points for most education categories. Given the modest changes in education wage differentials for females, there has been some convergence between the returns to education of men and women. However, returns to education remain larger for women than men.

Regarding returns to work experience, our results show that the wage gap between younger and older men expanded between 1980 and 1995. During the subsequent period 1995-2000 young workers did relatively well in terms of earnings, and the gap narrowed. Results for women show similar trends over the period. In contrast to the case of education, the returns to experience are lower for women than for men.

Adjusting for experience and using the consistent and larger samples from the Census appear to account for the bulk of the difference between our results and those of Burbidge, Magee and Robb (2002). In contrast, using means (as is done I n this paper) or medians (as is done by Burbidge et. al.) plays a very modest role.

The use of broader earnings measures – such as including self-employment earnings, using weekly earnings of all workers, or using annual earnings of full-time workers -- does not alter the principal findings from our benchmark analysis based on weekly wage and salary earnings of full-time workers. However, the use of broader measures of the impact of education does increase the magnitudes of the estimated returns, in some cases quite substantially. These increases in the magnitudes of the returns arise because higher education is associated with a larger amount of work – as well as a "skill premium." The use

of broader measures also tends to result in greater growth in the return to education over the period 1980-2000.

Finally, results from the two alternative data sources (LFS and SLID) support our findings based on the Census data. Indeed, estimated returns to education based on weekly earnings of full-time workers from the LFS are broadly similar to those obtained with Census data. The equivalent results based on data from the SLID are also generally consistent with those based on the Census, showing growth in the returns to education from 1996 to the early 2000s. Interestingly, results for the post 2000 period, which is not covered by Census data, show a downward trend in the BA-high school wage gap starting in 2003. Thus some of the growth in the return to education over the period 1980-2000 appears to have recently been reversed. The causes of this reversed trend and its impacts on university participation, are interesting subjects for future research.

Introduction

The purpose of this paper is to provide a comprehensive and up-to-date examination of the evolution of the returns to education and experience in Canada over the past 25 years. Particular emphasis is given to the returns to education.

Good and reliable estimates of the returns to human capital, in general, and the returns to education, in particular, are essential for assessing the benefits of the large investments in human capital made by local, provincial and federal governments in Canada. Furthermore, in order for the market for education to function well, it is essential for individuals contemplating investments in education to know the kinds of returns they should expect on these investments. This is particularly important in an era of rising tuition fees. We cannot expect as many young people to continue attending colleges and universities in the face of rising costs, unless they are aware of large pecuniary benefits associated with these costly investments.

Unfortunately, the existing Canadian literature on the returns to education presents a somewhat confusing picture. On the basis of studies such as Freeman and Needels (1993), Murphy, Riddell and Romer (1998) and Burbidge, Magee and Robb (2002) it is widely believed that, for the labour force as a whole, the wage gap between more- and less-educated workers remained stable during the 1980s and 1990s. Indeed, Burbidge et. al. (2002) conclude that the education wage premium – the gap in earnings between university-educated workers and those with less than a university degree – was approximately constant for males over the period 1981-2000 and declined for females. In contrast, Boudarbat, Lemieux and Riddell (2006) conclude that education wage differentials (adjusted for experience) increased substantially over the period 1980-2000.

They find that the education wage premium rose for both men and women, although the gains for women were more modest.

Differences across studies are even more evident when one examines specific demographic groups. Burbidge, Magee and Robb (2002) find that the return to schooling remained stable for young men over the last two decades. This appears to contradict studies by Bar-Or et al. (1995), Beaudry and Green (1998), Card and Lemieux (2001) and Boudarbat, Lemieux and Riddell (2006) that all find that the return to schooling grew substantially for young men during the 1980s and early 1990s.

The principal objective of this paper is to reconcile these divergent conclusions about the behaviour of the returns to education in Canada. We focus in particular on accounting for the different findings of the two most recent studies – those of Burbidge, Magee and Robb (2002) and Boudarbat, Lemieux and Riddell (2006). We also update earlier work to incorporate data since 2000 and examine the evolution of the returns to experience.

Measuring returns to human capital

Human capital refers to the skills, knowledge and competencies of individuals. Although a person's human capital is the outcome of many influences, we focus on two key influences – formal education and work experience (or age). Acquisition of skills and knowledge has many consequences for individuals and society. Private benefits to the individual include higher lifetime earnings, reduced unemployment, greater employment opportunities, improved health and longevity, and inter-generational benefits that accrue to one's children in the form of higher education and improved health. For many people there is also some "consumption value" associated with learning new skills and acquiring

additional competencies. Social benefits include increased civic participation, reduced criminal activity, government tax revenue from higher earnings, and contributions to higher average living standards that arise from increased innovation and technological change as well as spillover effects from higher education that raise the productivity and earnings of others.[1] In this paper we will restrict our attention to the private benefits to the individual in the form of higher earnings and employment. Thus we will not attempt to estimate the social returns to education and experience, nor will we provide estimates of the total private returns. Nonetheless, the impact of education and experience on lifetime earnings are among the most important consequences of human capital investments, and are thus a suitable focus for investigation.

Even when we restrict our attention to the employment and earnings impacts, there are several dimensions to the "return" to the human capital investments and therefore several ways of estimating these returns. It is helpful to discuss these in the context of a specific example – the return to attending university compared to entering the work force at the completion of high school. One important distinction is that between the average return and the marginal return to a university education. The average return – which is what we estimate in this paper -- is based on a comparison of the average lifetime earnings streams of all university graduates to the average lifetime earnings experienced by all those who enter the workforce after completing high school. This measure corresponds to what is called the "average treatment effect on the treated" in the evaluation literature. It is based on a comparison of the average outcome experienced by those who received the treatment -- in this case a university education -- to the average outcome experienced by those who did not receive the treatment – in this

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[1] See Riddell (2007) for a survey of evidence on private and social benefits of education.

case those who ended their formal education upon completing high school. In contrast, the marginal return is based on the earnings gain that would be observed if an additional high school graduate were to attend university. The average return is the relevant measure if one is interested in knowing the return on existing investments in higher education. However, for some purposes the marginal return is the more relevant measure. For example, if government is considering expanding the university system to allow additional students to enroll, it is the return at the margin that matters for this decision rather than the average return experienced by those who are already attending (or have attended) university.

Another noteworthy feature of the consequences of additional education and experience is that there are "price" and "quantity" dimensions. In our example, the price dimension is the difference in the market wage rate of university graduates compared to that received by high school graduates. This "skill premium" or wage differential reflects the higher value placed by the labour market on those with additional education. The quantity dimension involves differences in the amount of work activity undertaken by those with different levels of education – such as hours of work per week, weeks worked per year, or years worked over the lifetime. Although both the price and quantity dimensions contribute to the total returns to human capital investments, in this paper (as is the case in most of the empirical literature) we devote most of our attention to providing estimates of the price dimension – the earnings differentials between groups of individuals with different levels of education and experience. The reason for focusing on the "skill premium" is that this is a clean measure of the impact of higher education on individuals' lifetime opportunities. That is, on average a university graduate faces a

higher market wage rate over the lifetime than does a high school graduate, and this market wage differential is the product of market forces influencing the demand and supply of university and high school graduates. It is a measure of the greater earnings opportunities available per unit of time to university graduates relative to high school graduates. In contrast, the quantity dimension may partly reflect differences in opportunities by educational attainment but also reflects the choices that individuals make about how much time to devote to market work. In economists' terminology, the quantity dimension is at least in part "endogenous" while the market wage differential is exogenously determined by market forces.

A further observation is that, when comparing the earnings of groups with different levels of education it is usually important to also control for other factors that may influence earnings. Otherwise the differences in earnings between two educational categories may understate or overstate the true returns to education. For example, because of rising educational attainment over time, older (and thus more experienced) workers are generally less well educated than younger, and less experienced, workers. Comparing the earnings of the well educated to the less well educated will tend to understate the true impact of education if one does not control for differences in labour market experience.[2] To illustrate the importance of this point we present both raw (unadjusted) and adjusted measures of the return to education.

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[2] Note that an individual wanting to assess the costs and benefits of additional education should use the adjusted returns, but should also take into account the opportunity cost of acquiring additional education. For example, a high school graduate considering entering university should use the adjusted earnings differential between university and high school graduates as an estimate of the earnings premium associated with higher education, but should also take into account the fact that entry into the workforce and the accumulation of work experience will be delayed by four years.

Although we control for observed differences among educational groups, there may also be unobserved differences such as motivation, ability and perseverance that we cannot take into account with available data. If such unobserved factors influence both educational attainment and earnings, standard OLS estimates that do not control for such factors will be biased estimates of the true causal impact of education on earnings. It should also be noted that educational attainment is measured with error in most surveys, and that measurement error biases the OLS estimates downward, thus at least partially offsetting any upward bias due to unobserved ability and motivation. Although there is some debate about the magnitudes of these biases, recent surveys suggest that the net effect of these offsetting forces is that there is a modest (e.g. 10-15%) upward bias in the OLS estimates (Card, 1999, 2001).

Data sources

One reason for the divergent conclusions reached by Burbidge, Magee and Robb (2002) and Boudarbat, Lemieux and Riddell (2006) may be differences in the data sources employed in these studies. We believe that the Census is the best data source for documenting trends in the wage structure in Canada. One reason for this belief is that since 1981 the Census has been collecting consistent information on educational attainment, as well as earnings and work experience during the previous year and other socio-economic characteristics of individuals. In contrast, the Survey of Consumer Finances (SCF) – the data source used in much previous Canadian research, including the study by Burbidge, Magee and Robb (2002) – suffers from the disadvantage that the educational attainment questions changed several times during the past 20 years, in some

cases very dramatically. In addition, the SCF was, unfortunately, discontinued in 1997 so cannot be used to study recent developments.

Another advantage of the Census is that the information on educational attainment is unusually rich. The Census provides detailed information on years of schooling as well as all degrees and diplomas received. The information on years of schooling allows the researcher to construct a precise measure of (potential) experience. In contrast, the SCF does not contain information on years of schooling so work experience is generally imperfectly proxied by age.

The Census also provides large sample sizes, and is much less affected by non-reporting of earnings and other information at the bottom of the income distribution, a problem that has been identified in the SCF (Frenette, Green and Picot, 2006).

Because of these advantages, much of the analysis in this paper employs Census data. In addition, in order to provide more current information we also use data from the Labour Force Survey (LFS) from 1997 to 2006, utilizing the feature that the LFS provides information on earnings since 1997. In order to provide a complete assessment using all available data sources, we also provide evidence based on the Survey of Labour and Income Dynamics (SLID) from 1993 to the most recent available data.

Measurement of earnings differences: mean versus median

There are several other differences in the methods used in earlier studies that may also contribute to different findings. Another potentially important difference is that Burbidge, Magee and Robb (2002) use median earnings of high and low education groups to measure the education wage premium, while Boudarbat, Lemieux and Riddell (2006) follow the more common approach of using mean earnings. We investigate the

importance of this feature by comparing measures of the returns to education based on both median and mean earnings, using Census as well as LFS and SLID data.

A more fundamental question is which of the two measures of central tendency is preferred. A potential problem with the use of the median is that it is relatively unaffected by increases in the returns to education that take place in the top part of the wage distribution. Since highly educated workers are mainly located in the top half of the earnings distribution, this is a potentially important limitation of median-based measures. Furthermore, there is evidence that much of the growth in wage inequality during these two decades occurred in the very top of the earnings distribution (Saez and Veall, 2005). Such changes may have little effect on the median earnings of high and low educated workers.

Burbidge, Magee and Robb (2002) use median earnings to avoid dealing with top-coding problems in U.S. data in arbitrary ways and to reduce the influence of measurement error in the top decile of the SCF data noted by Kuhn and Robb (1998). However, the measurement error issue (division bias) that was raised in the context of a labour supply model by Kuhn and Robb (1998) should not affect measures of the mean earnings gap. Furthermore, there are other ways of dealing with top-coding problems that have been shown to be robust in U.S. data. Thus, in the presence of such problems, one does not have to employ median-based measures.

The role of work experience

Another potentially important difference between the Burbidge, Magee and Robb (2002) and Boudarbat, Lemieux and Riddell (2006) studies is that the former study does not control for experience, and controls only crudely for age, whereas the latter study

regression-controls (separately) for both age and experience. An important advantage of the census data is that it allows the researcher to construct a measure of potential experience. In our previous study we found that controlling for age or experience – especially the latter – makes an important difference to measures of the return to education based on mean earnings. We also explore this issue with median-based measures by using median regressions.

In addition to providing a comprehensive and up-to-date examination of the evolution of the returns to education, we also examine the evolution of the returns to experience. The behaviour of the returns to experience has not been examined in Canada since the study by Beaudry and Green (2000) based on SCF data up to the mid-1990s. We believe that it is important to assess the behaviour of the returns to experience during the latter half of the 1990s, a period that saw a major change in the earnings of younger workers relative to those of older workers. In addition, as mentioned previously, the Census data provide a measure of experience whereas with SCF data one has to rely on age as a proxy for experience.

Empirical analysis of Census data

The analysis in this section employs public use data from the 1981, 1986, 1991, 1996 and 2001 Censuses. Following the existing literature, we focus our analysis on "adults" age 16 to 65 at the time of the Census (June).[3] The census provides detailed information on all degrees, diplomas and certificates obtained. Using this information we classify workers into seven education groups: 0-8 years of elementary schooling, some high school, high school diploma, some post-secondary education, post-secondary degree

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[3] The information on weeks worked and annual wage and salary earnings refer to the previous year. Thus the individuals in our samples were age 15 to 64 during the period to which our wage measures apply.

or diploma below a university bachelor's degree (including trade certificates), university bachelor's degree, and post-graduate degree (Masters, PhD, and professional degrees).

One drawback of the Census for studying the evolution of the wage structure is that it only provides limited information on annual hours of work. As a result, it is not possible to construct a direct measure of average hourly wages by dividing annual earnings by annual hours of work. Following Card and Lemieux (2001), Boudarbat, Lemieux and Riddell (2006) and many U.S. studies such as Katz and Murphy (1992), we use weekly earnings of full-time workers as our main measure of wages. However, we also check the sensitivity of our results to the use of full-time workers, using information such as that on hours of work during the Census reference week.

Following most of the literature, we only use wage and salary earnings for computing weekly earnings of full-time workers. Another common practice in the literature that we do not follow here is to limit the sample to "full-year" workers who worked at least 49 or 50 weeks during the previous year.[4] For the sake of completeness, however, we report some results using all earnings (both wage and salary and positive self-employment earnings), and some results when the sample is limited to full-year workers.

In the public use files of the Census, earnings are top-coded for a small fraction (less than one percent) of individuals with very high earnings. Statistics Canada adjusts

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[4] Prior to 1981, it was not possible to compute average weekly earnings since the Census only reported annual weeks of work in a few intervals. The U.S. Census and Annual Demographic Supplement of the March Current Population Survey also used to follow that practice. Given these data limitations, focusing on "full-time/full-year" workers used to be the most sensible way of obtaining a reasonable proxy for hourly wages of workers. Since the Census has been providing information on weeks of work since 1981, there is no longer a compelling reason for looking at full-year workers only.

the top-code over time to keep it more or less constant in real terms.[5] We also trim all

wage observations with weekly earnings below $75 (in $2000) since they yield

implausibly low values for hourly wages.[6]

Figure 1 presents both unadjusted and regression-adjusted wage differentials

between the different education groups. The wage differentials reported in Figure 1 are

all defined relative to workers with a high school diploma (but without any post-

secondary education, including trade certificates). Unadjusted wage differentials are

simply the difference between the mean log wage of workers in a given education group,

and the mean log wage of high school graduates.[7] The regression-adjusted estimates are

obtained by estimating a standard regression of log wages on a set of six education

dummies (high school is the base case) and a quadratic in potential experience. We use

the standard procedure to compute years of potential experience, defined as age minus

years of schooling minus six. The Census asks detailed questions about years of

schooling completed, and we use this information to compute potential experience.

a. Returns to education

Figure 1a presents the raw education wage differential for men. To simplify the

discussion of the results, we will refer to workers with exactly a bachelor's degree as

"BA" graduates although this group also includes individuals with other types of

bachelor's degrees like a B.Sc. We also interpret differences in log wages as percentage

point differences for presentation purposes.[8]

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[5] The 2001 public use files use the same nominal value for the top code as was used in 1996 ($200,000). Adjusting the top coding to keep the real value the same in 2001 as in 1996 makes almost no difference to our results.

[6] Since full-time workers work at least 30 hours a week, a full-time worker earning $75 a week makes at most $2.50 an hour. This represents less than half of the minimum wage in any province in 2000.

[7] The difference in log wages provides a close approximation to the percentage difference in wages.

[8] For example, we call a 0.10 difference in log wages a "10 percent difference."

The main result in Figure 1a is that the BA-high school wage differential increased sharply between 1995 and 2000.[9] Between 1980 and 1995, the BA-high school differential was relatively stable at around 32 to 33 percentage points, with the exception of a temporary increase in the mid-1980s. The differential then jumped to 38 percentage points in 2000. The wage differential between university post-graduates and high school graduates is much larger – aver 50 percentage points – but relatively stable over time, while that between non-university postsecondary graduates (includes university certificates below a BA, community college or CEGEP diploma, and trade certificates) and high school graduates lies between 15 and 20 percentage points and increased modestly between 1995 and 2000. The wage differentials between the remaining education groups (elementary, less than high school, some postsecondary) and high school graduates are close to zero for all and are very stable over this time period. Taken at face value, Figure 1a suggests that for men returns to high school completion relative to those individuals who only have elementary or some secondary schooling are very small.

Figure 1b shows, however, that adjusting for differences in years of potential experience has important consequences for the pattern of education differentials. For the three low education categories (0-8, Some HS, Some PS), the regression-adjusted wage differentials are systematically larger (in absolute value) than the unadjusted wage differentials. For example, the adjusted wage gap between high school graduates and workers with only elementary schooling (0 to 8 years) is 20 percent in Figure 1b, compared to almost zero in Figure 1a. High school dropouts make about 10 percent less

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[9] A similar increase occurred in the early 1980s, but was reversed during the period 1985 to 1995.

than high school graduates in Figure 1b, while workers with some post-secondary education earn 5 to 10 percent more. The regression-adjusted BA versus high school differential is also larger than the unadjusted difference, while the adjusted and unadjusted university post-graduate – high school gaps are similar in size. Only for the case of the non-university postsecondary – high school gap is the adjusted differential smaller than its unadjusted counterpart.

The discrepancy between the adjusted and unadjusted differentials is due to the fact that the workforce has become increasingly educated over time. For instance, most of the workers with only elementary schooling are older and more experienced. This explains why relative earnings of this group decline substantially when experience is held constant. In other words, secular growth in educational attainment generates a negative correlation between schooling and experience. As a result, returns to education are biased down when experience is not controlled for.

Unlike the unadjusted wage gap that is stable over time, the adjusted wage gap between workers with a non-university post-secondary education and a high school diploma grows steadily over time from 9 percent in 1980 to 16 percent in 2000. Interestingly, the adjusted wage gap between university and high school graduates increases more steadily over time than the unadjusted gap in Figure 1a. For example, the adjusted BA-high school gap increases from 34 percent in 1980 to 40 percent in 1995, while the unadjusted gap remains relatively unchanged (around 32 percent) over the same period. Most of the rise in the adjusted wage gaps took place in the early 1980s and late 1990s. A similar, but less pronounced, pattern is also evident for the other post-secondary categories (non-university postsecondary graduates and university post-graduates).

Figures 1a and 1b show evidence that returns to education – as measured by the skill premium relative to high school graduates -- have been increasing for Canadian men between 1980 and 2000. But while the growth in unadjusted wage differentials is most evident for university graduates between 1995 and 2000, the growth in adjusted wage gaps is more evenly spread out among time periods and education groups.

The results for women reported in Figures 1c and 1d are quite different from those for men. First, returns to education are systematically larger than for men.[10] For instance, the adjusted BA-high school gap for women in 1980 (48 percent) is much larger than the corresponding wage gap for men (34 percent). Second, most education wage differentials among women have been relatively constant over time. For all education categories, the unadjusted wage gaps decline modestly – by 2 to 4 percentage points -- over the 1980-2000 period, suggesting that female wages have become more equally distributed across education groups. In contrast, all of the adjusted wage differentials increase over the sample period. The increases in the adjusted wage gaps, however, are not substantial – growth of 2 to 4 percentage points for most education categories. The smallest increase (1.4 percentage points) is that for the "Some high school" category. Thus the adjusted return to high school completion has remained stable – as was the case for men. Overall, given the modest changes in education wage differentials for females, there has been some convergence between the returns to education of men and women between 1980 and 2000. However, returns to education remain larger for women than men in 2000.

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[10] Other Canadian studies, such as Ferrer and Riddell (2002), also find that returns to education are much higher for women.

The differences between unadjusted and adjusted differentials highlight the importance of controlling for other factors (in this case, experience) when making wage comparisons among education groups.

b. Returns to age/experience

Figures 2a and 2b report the unadjusted and adjusted wage differentials between men age 46-55 and men of other age groups.[11] The adjusted wage gaps are computed from a regression of log wages on a set of age dummies that also control for education (using dummies for the seven education categories). Men age 46-55 are used as the base group since they tend to have the highest earnings of all age groups. Both figures show a large and steady expansion in the wage gap between younger (age 16-25 or 26-35) and older workers between 1980 and 1995. This finding is consistent with other studies such as Morissette (2002), Beaudry and Green (2000), and Picot (1998a, 1998b). Our Census results for the period 1980-95 thus confirm the well-established fact that returns to experience grew significantly while returns to education remained relatively stable over this period.

Figures 2a and 2b also show, however, that relative wages of younger workers started improving after 1995. This reversal in earlier trends is sufficiently marked in Figure 2b that in 2000 the wage gap between younger and older workers is back to its mid-1980s level. Clearly, young workers did relatively well in terms of earnings during the economic expansion of the late 1990s.

It is also worth noting that there is substantially less growth in age wage gaps between 1980 and 1995 when adjusted wage gaps are used instead of unadjusted wage

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[11] We employ age categories such as 46-55 years of age as of the survey date so that the age of the respondents during the time period when wages are measured correspond to the standard age groupings used by Statistics Canada (in this case ages 45-54).

gaps. Consider for instance the wage gap between workers age 26-35 and 46-55. In

1995, both the adjusted and unadjusted wage gaps were about 28 percent. The fact that

controlling for education has no impact on the wage gap means that workers age 26-35

and 46-55 have similar levels of education. By contrast, in 1980 the unadjusted gap (12

percent) was substantially smaller than the adjusted gap (19 percent), suggesting that

younger workers were more educated than older workers. This pattern of results is

consistent with Card and Lemieux (2001) who show that, in both Canada and the United

States, there has been stagnation in educational attainment of men born after 1950 (age

30 in 1980). This explains why the unadjusted wage gap grew almost twice as fast as the

adjusted gap between 1980 and 1995, a conclusion that was also reached by Morissette,

Picot, and Kapsalis (1999).

Figure 2d shows that adjusted age wage differentials increase substantially more

for women than men over the period 1980-95. The decline in age wage differentials after

1995 is also generally smaller for women than for men; indeed, for some age groups the

differentials remain stable after 1995. Unlike educational wage differentials, age wage

differentials are also substantially lower for women than men. This is consistent with the

well-known fact that returns to age, or potential experience, are lower for women because

they tend to accumulate less actual experience than do men over the life-cycle (Mincer

and Polachek, 1974). The growth in age wage differentials for women may thus simply

reflect the fact that younger cohorts of women are increasingly attached to the labour

market.

c. Comparing means and medians

As mentioned earlier, an important different between our study and Burbidge, Magee and Robb (2002) is that they look at median wages, whereas we focus on more standard wage differentials based on comparisons of mean wages. While means and medians often yield similar results, some recent evidence by Chung (2006) shows that using medians tends to understate the growth in returns to education in Canada. Using the same Census data as we use here for 1980 and 2000, Chung (2006) finds that mean weekly earnings of full-time men age 35-54 grew by 16.3 percentage points more for men with a university degree than for men with only a high school diploma. In contrast, the median weekly earnings for the same group of university-educated men grew by only 5.0 percent more than for men with only a high school diploma. The results are similar for women. Using means indicates a 1.7 percentage point decline in the university-high school gap for full-time women age 35-54, compared to a 9.3 percentage point decline when using medians. These numbers suggest that using medians as opposed to means makes a large difference, and may explain the difference between our findings and those of Burbidge, Magee and Robb (2002).

It is important to note, however, that Chung (2006) works directly with weekly earnings without taking the log transformation. This is of little consequence for medians, since the log of median earnings is equal to the median of log earnings. For means, however, the log of the mean is not equal to the mean of the logs. Furthermore, there are good reasons to expect that the log of mean earnings has been growing much faster than the mean of log earnings because of the dramatic increase in earnings at the very top end of the distribution (Saez and Veall, 2005). The reason is that taking the log

transformation before averaging out tends to reduce the influence of very high values of earnings.

With these considerations in mind, we now look directly at the gap in median log wages by education group. Figure 3a reproduces the raw education wage differentials for men, except that the median is now used instead of the mean. As in the case of means, we also present estimates of wage gaps in medians adjusted for experience. We do so by running median regressions where the explanatory variables used are education dummies and a quadratic in experience, as in the models for conditional means.[12] The adjusted median gaps for men are reported in Figure 3b. The difference between means and medians is shown more explicitly in Table A1 that compares 1980-2000 and 1995-2000 changes in the wage differentials for the two measures.

Over the 1980 to 2000 period the evolution of wage differentials based on means and medians is generally similar. For example, both the unadjusted and adjusted wage gaps between university BA graduates and high school graduates increase to a similar extent whether the estimates are constructed using means or medians. Only in the case of university post-graduates is the growth in the adjusted wage differential noticeably greater using means than using medians – an increase of 6.6 versus 5.1 percentage points. The estimates for the shorter 1995 – 2000 period are more sensitive to the choice between means and medians, with the increase in the adjusted university BA – high school wage differential being much larger using means (5.0 percentage points) than medians (2.7 percentage points).

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[12] As in the case of the other regressions, we run the median regressions using the median in each age-education cell as dependent variable, and using cells counts as weights. Unlike the case of means, however, running these cell models this does not exactly yield the same result as what would be obtained by running standard median regressions using the micro data. Angrist et al. (2006) show, however, that there exists a set of weights such that the two regression procedures yield the exact same results.

Similar results for women are reported in Figures 3c (unadjusted median gaps) and 3d (experience-adjusted median gaps). The most noteworthy result -- evident in Table A1 -- is that raw wage differentials decline modestly for all education groups, whereas the adjusted differentials increase to an equally modest extent for all groups. Differences between means and medians are generally larger for females than was the case for males. Adjusted median wage gaps increase more than adjusted mean wage gaps for all categories with education above high school. Even so, the differences between measures based on means and those based on medians are not substantial. Generally these differences are 1 to 2 percentage points over the period 1980-2000.

Overall, the summary results on the change in educational wage gaps reported in Table A1 for both men and women tend to suggest that adjusting for experience makes a bigger difference than using means or medians. This is particularly important when looking at changes over the whole 1980-2000 in the case of women. Adjusting for experience and using the consistent and larger samples from the Census thus appear to account for the bulk of the difference between our results and those of Burbidge, Magee and Robb (2002). In contrast, using the means or the medians plays a very modest role when looking at log wages, as is the standard practice in the human capital literature that we follow here.

d. Alternative earnings measures

In this section we investigate the sensitivity of our results to the choice of earnings measures. As discussed previously, we focus principally on the weekly wage and salary earnings of full time workers because this provides the cleanest measure of the "skill premium" associated with higher levels of education and experience. However,

education and experience also influence employment opportunities and the likelihood of experiencing unemployment. The broader measures of earnings that we examine in this section include both quantity dimensions of the return to human capital as well as the price dimension captured in the skill premium. Thus the purpose of this section is to check the robustness of our previous findings to alternative measures, and to see whether use of broader earnings measures results in under-statement or over-statement of the returns to education and experience. To keep the volume of results manageable we focus on the earnings differential between university BA and high school graduates.

Figures 4 and 5 show the evolution of the high school – BA earnings gap using four different earnings measures available in the Census data, together with the benchmark earnings differential used in the previous analysis (based on the weekly wage and salary earnings of full time workers). In Figure 4 we show total earnings (wages, salaries and self-employment earnings) instead of wage and salary earnings alone. Also shown are results for full-year full-time workers (FYFT) in addition to those for full-time workers.[13] For women the four measures are very similar in magnitude and move closely together over the sample period. For men the inclusion of self-employment income makes little difference to the earnings gap and to its evolution over time. However, the restriction to FYFT workers does result in somewhat larger earnings differentials at each point in time and greater growth in the earnings differential over the 1980-2000 period.

In Figure 5 we broaden the earnings measure further by including earnings of all workers, rather than restricting the sample to full-time workers. These measures thus include those who work part-time as well as those who work part-year. Thus here we are including the effect of education on weekly hours of work as well as the "skill price" of

[13] We use the conventional definition of full-year of working at least 49 weeks during the year.

labour. The inclusion of all workers results in much higher returns to education for both men and women, and for greater growth in the earnings differentials over the 1980-2000 period, especially for women. As before, inclusion of self-employment earnings makes very little difference for females and a small difference for males. However, inclusion of part-time workers makes a big difference to both the magnitude of the earnings differential and to its growth over time. Those with higher education work more hours per week in addition to earning more conditional on working full-time.

In Figure 6 we broaden the analysis further by examining four annual measures: wage and salary earnings, total earnings (wages, salaries and self-employment earnings), weeks worked, and an indicator variable for whether or not the individual worked during the previous year (i.e. had positive weeks of work). For both men and women the use of annual earnings rather than weekly earnings results in larger differentials between the two education groups. For example, in 1980 the weekly wage and salary earnings differential is 34 percent for full-time workers and 38 percent for all workers, as shown in Figure 5a). The gap based on annual earnings is much larger – a premium of 47 percent. There is also substantial growth in the annual earnings differential over the period 1980-2000 for both genders, despite a decline in the gap between 1995 and 2000. For women the adjusted annual earnings differential increases from about 62 percent to about 70 percent, while for men the gap rises from 47 percent to approximately 53 percent. Thus the return to higher education consists not only of a weekly earnings premium, but also increased amount of work during the year.[14]

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[14] The LFS results in the next section suggest that the greater amount of work primarily takes the form of increased weeks worked during the year rather than increased hours of work per week.

The measures of the return to education based on annual earnings are also more sensitive to the business cycle. In periods during which the economy is weak, such as 1985 (when the Canadian economy was recovering from the 1981-82 recession) and 1995 (when the economy was recovering from the 1990-92 recession) the earnings differential widens, reflecting the fact that weak economic conditions exert a greater adverse effect on those with less education. Similarly, when economic conditions are buoyant – such as in 1980 and, especially, in 2000 when the Canadian economy reached a cyclical peak -- the earnings differential narrows, reflecting the fact that lower skilled workers benefit relatively more from strong economic conditions.

The gaps in weeks worked and in whether or not one worked during the year are positive for both men and women and much larger for women than for men. These differentials also display sensitivity to cyclical conditions.

In summary, the use of broader measures of the return to education does not alter the principal results from our benchmark analysis based on weekly wage and salary earnings of full-time workers. However, the use of broader measures of the impact of education does increase the magnitudes of the estimated returns, in some cases quite substantially. These increases in the magnitudes of the returns arise because higher education is associated with increased employment – in the form of hours of work and weeks of work over the year – as well as a "skill premium" in the form of higher weekly earnings. The use of broader measures also tends to result in greater growth in the return to education over the period 1980-2000.

Alternative data sources

Although the Census is our preferred data source for measuring the returns to human capital, it is worthwhile checking the consistency of our findings with alternative data sources. This section provides results using the two principal alternatives – the Labour Force Survey (LFS) and the Survey of Labour and Income dynamics (SLID). Both surveys have the advantage of providing more recent data than that available with the Census. However, neither the LFS or SLID allow the long time perspective that is possible with Census data, as the SLID began in the 1990s and the LFS has provided information on wage rates and earnings only since 1997.

Figure 7 shows results from the LFS over the period 1997-2006. For comparability with our benchmark Census estimates, reported weekly earnings estimates are for full time workers. However, hourly wages are not restricted to full-time workers. In order to keep the volume of results manageable we focus on the earnings differential between high school graduates and university BA graduates. Two measures of earnings are shown in each panel of Figure 7: the hourly wage rate of all workers and the weekly wage of full-time workers. The latter is most directly comparable to our Census-based measures. Figure 7a contains the raw mean differentials for men and women, while Figure 7b contains the adjusted mean earnings gaps.[15] Figure 7c contains the unadjusted differences based on median earnings rather than mean earnings.

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[15] The LFS does not contain direct information on years of schooling (only highest degree completed is available) and age (only five years categories available in the public use files). We nonetheless construct a proxy for years of potential experience using average years of schooling for each education category and the mid-points of the age intervals. While the resulting measure of experience is not as accurate as the one from the Census, we nonetheless prefer to control for experience than age for the sake of comparability with the rest of the paper.

In all three panels of Figure 7 the estimated earnings gaps based on weekly earnings are broadly similar to those obtained with Census data. Returns to education are substantially greater for women than for men, especially after we control for potential experience. The magnitudes of the earnings differentials for women are very close to those estimated with Census data. For example, in 2000 the unadjusted mean weekly wage differentials are approximately 40 percent according to both the Census and LFS and the adjusted gaps are 46 to 50 percent. For men the LFS gives somewhat lower estimates than the Census, but the two sets of estimates are nonetheless in the same ballpark.

There is also evidence of a modest upward trend in the mean weekly earnings differentials over the period 1997-2002, similar to what was observed for the 1995-2000 period with Census data. Interestingly, this upward trend has recently been reversed, and in 2006 the adjusted mean earnings gaps for men are actually below their levels at the beginning of the LFS sample in 1997, while those for women are back to their 1997 levels. Although it is beyond the scope of this paper to investigate this phenomenon, it is possible that the very strong labour market – especially in western Canada – for those with low levels of education has narrowed the earnings gaps and reduced the return to higher education.

Figure 7c supports the conclusion reached with Census data that the use of median earnings rather than mean earnings does not substantially alter estimates of education earnings premia. For both men and women, the magnitudes of the estimated earnings differentials are somewhat larger when medians are used, while the movements over time are very similar to those based on mean earnings.

A weakness of the Census is that it does not provide information on average hours worked per week over the previous year. Thus it is not possible with Census data to construct a measure of hourly earnings. However, with the LFS and SLID it is possible to compare the hourly earnings to our benchmark measure of weekly earnings of full-time workers employed with Census data. Inspection of figures 7a – 7c reveals that for men and women the wage gap measures based on weekly earnings are systematically smaller than those based on hourly earnings, whether we use unadjusted or adjusted measures or means or medians. This indicates that among full-time workers those with lower education tend to work more hours than those with higher levels of education. However, the movements over time in the hourly and weekly based measures are very similar. Thus use of the weekly earnings of full-time workers does not bias evidence from Census data about the evolution of education-earnings gaps over time, but it does result in a small (in the order of 2 percent) understatement of the level of the returns to university education.

The equivalent results based on data from the SLID over the period 1996-2004 are shown in Figure 8. Because of the smaller sample sizes in the SLID, the estimates are noisier than those obtained using the LFS and Census. However, the estimates are generally consistent with those based on the LFS and Census, showing growth in the returns to education from 1996 to the early 2000s, but a fairly flat or even modestly declining pattern since then. The magnitudes of the estimated earnings gaps, the differences between men and women, and the relatively small differences between hourly earnings-based and weekly earning-based measures are all similar to those found using the LFS data.

Conclusion

This paper examines the evolution of the returns to human capital in Canada over the period 1980-2006. While particular emphasis is given to the returns to education, we also examine the evolution of the returns to experience. Most of our analysis is based on the Census because it allows a long time perspective, and provides consistent information on educational attainment, as well as labour market outcomes. However, available data cover the 1980-2000 period only. To obtain recent information and, at the same time, to check the consistency of the findings from the Census, we also use data from the Labour Force Survey (LFS) from 1997 to 2006, and from the Survey of Labour and Income Dynamics (SLID) from 1996 to 2004. In addition, we focus on "adults" age 16 to 65 and use weekly wage and salary earnings of full-time workers as our main measure of wages. However, we also examine the impact of using broader earnings measures on results.

Our investigation with Census data yields several conclusions. For men, returns to education – as measured by the skill premium relative to high school graduates -- have been increasing between 1980 and 2000. For example, we find that the raw BA-high school differential rose from 32 percentage points in 1980 to 38 percentage points in 2000. Most of this rise took place in the early 1980s and late 1990s. The BA-high school differential expands when we control for differences in years of potential experience, and, unlike the unadjusted wage gap, it shows an overall positive trend over the period, going from 34 percent in 1980 to 43 percent in 2000. The growth in (adjusted) wage differentials occurs steadily throughout the period and among all education groups above high school graduates.

This finding contrasts with conclusions of studies based on SCF data that show little change in returns to education for men during the 1980s and 1990s. The rise in the return to education among Canadian men, while significant, is, however, much less dramatic than that experienced in the U.S.

The results for women are quite different from those for men. First, returns to education are systematically larger than for men. Second, most education wage differentials among women have been relatively constant over time. The adjusted wage differentials increase over the period 1980-2000, but the increases are not substantial – growth of 2 to 4 percentage points for most education categories. Given the modest changes in education wage differentials for females, there has been some convergence between the returns to education of men and women. However, returns to education remain larger for women than men.

Regarding returns to work experience, our results show that the wage gap between younger (age 16-25 or 26-35) and older (age 46-55) men expanded between 1980 and 1995. During the subsequent period 1995-2000 young workers did relatively well in terms of earnings, and the gap narrowed. Results for women show similar trends over the period. In contrast to the case of education, the returns to experience are lower for women than for men.

Adjusting for experience and using the consistent and larger samples from the Census appear to account for the bulk of the difference between our results and those of Burbidge, Magee and Robb (2002). In contrast, using means or medians plays a very modest role.

The use of broader earnings measures – such as including self-employment earnings, using weekly earnings of all workers, or using annual earnings of full-time workers -- does not alter the principal findings from our benchmark analysis based on weekly wage and salary earnings of full-time workers. However, the use of broader measures of the impact of education does increase the magnitudes of the estimated returns, in some cases quite substantially. These increases in the magnitudes of the returns arise because higher education is associated with a larger amount of work – as well as a "skill premium." The use of broader measures also tends to result in greater growth in the return to education over the period 1980-2000.

Finally, results from the two alternative data sources (LFS and SLID) support our findings based on the Census data. Indeed, estimated returns to education based on weekly earnings of full-time workers from the LFS are broadly similar to those obtained with Census data. The equivalent results based on data from the SLID are also generally consistent with those based on the Census, showing growth in the returns to education from 1996 to the early 2000s. Interestingly, results for the post 2000 period, which is not covered by Census data, show a downward trend in the BA-high school wage gap starting in 2003. Thus some of the growth in the return to education over the period 1980-2000 appears to have recently been reversed. The causes of this reversed trend and its impacts on university participation, are interesting subjects for future research.

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Figure 1a: Unadjusted Wage Gap in Log Weekly Earnings of Full-time Men (Relative to High School Graduates)
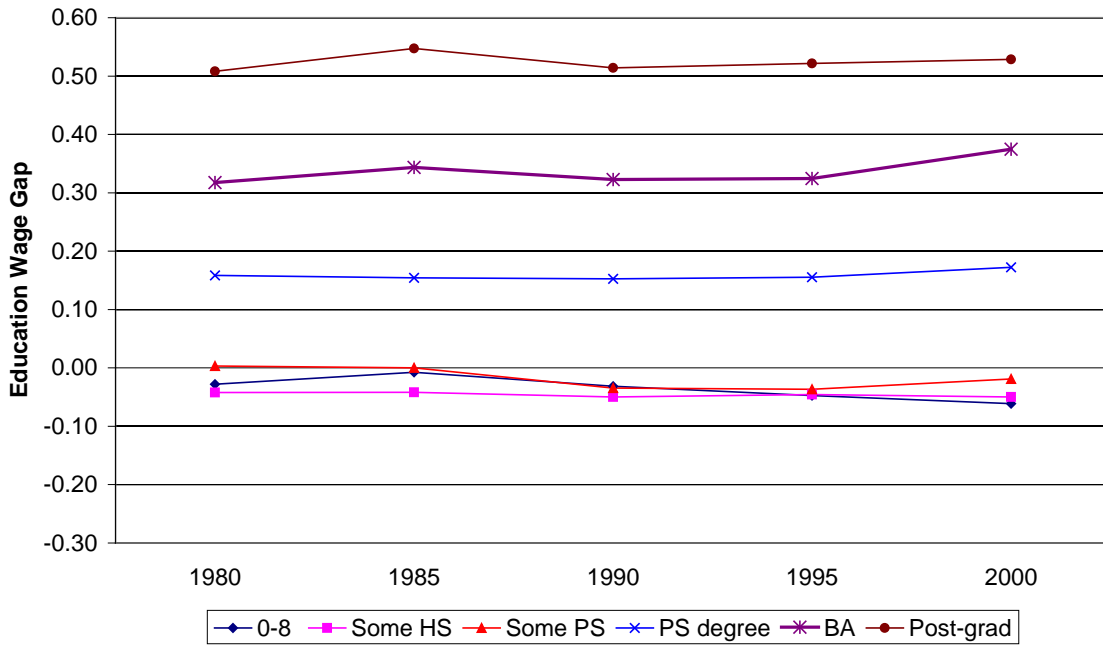
Figure 1b: Regression-Adjusted Wage Gap in Log Weekly Earnings of Full-time Men (Relative to High School Graduates)
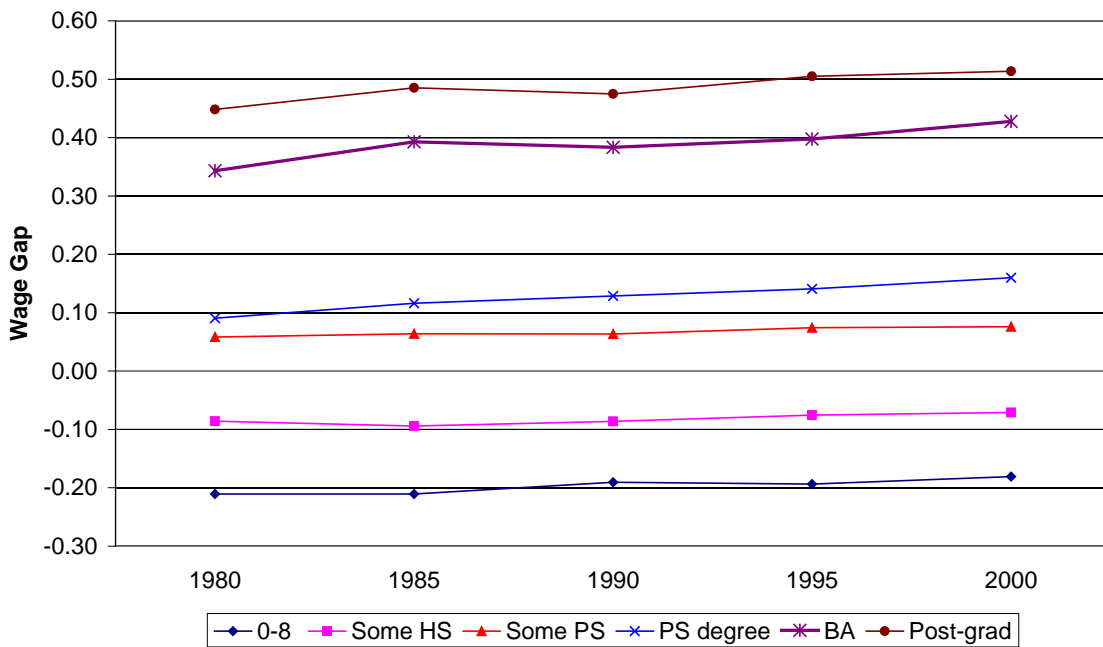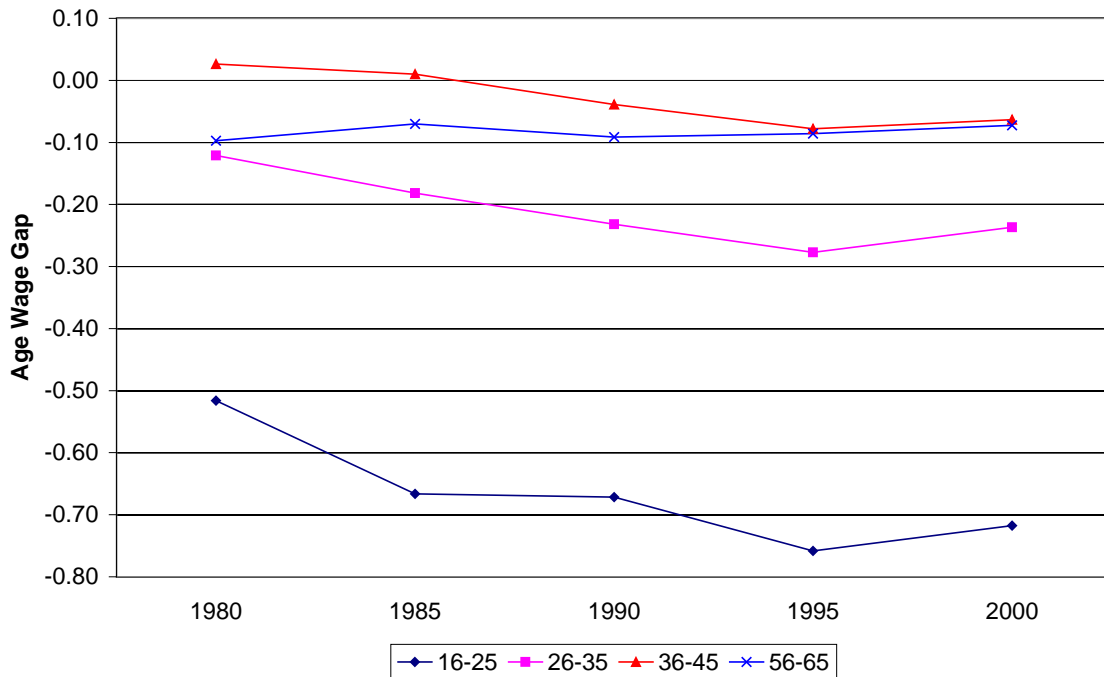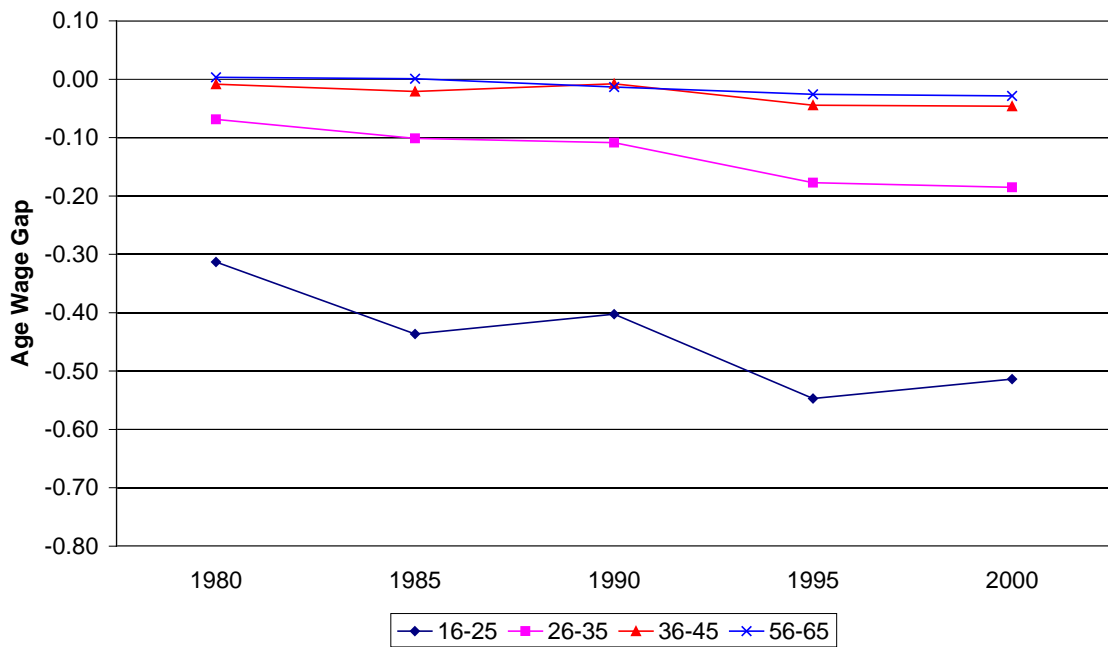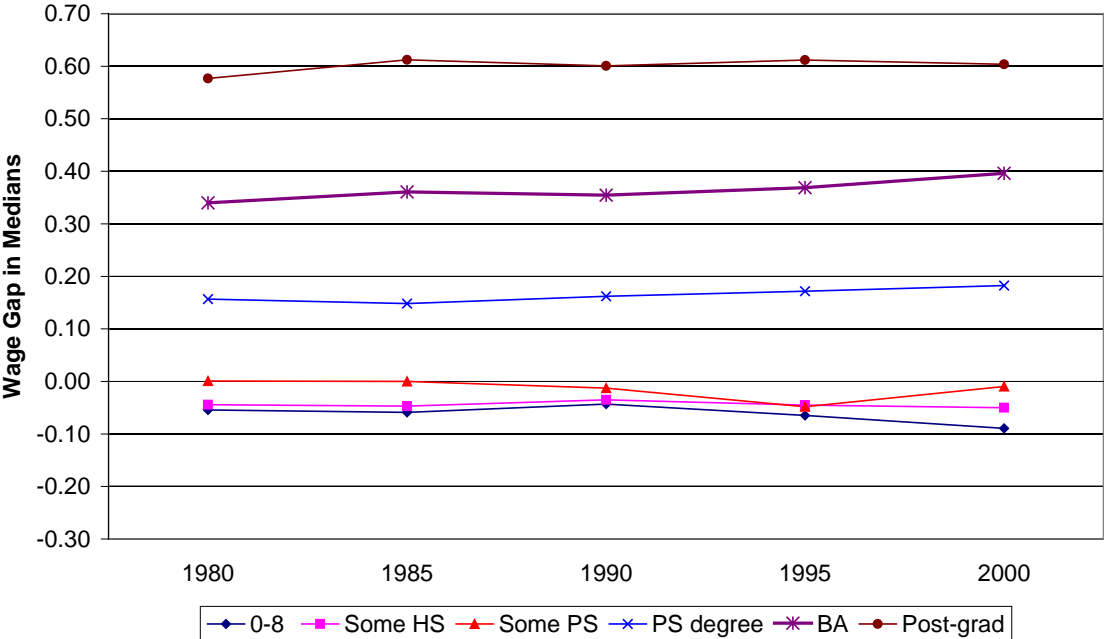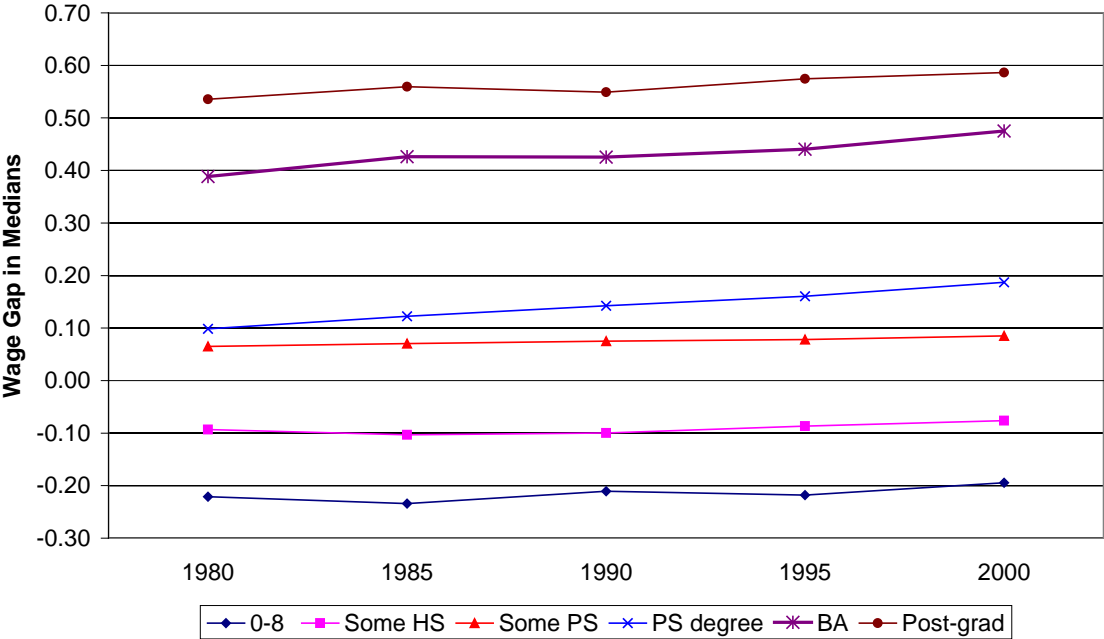
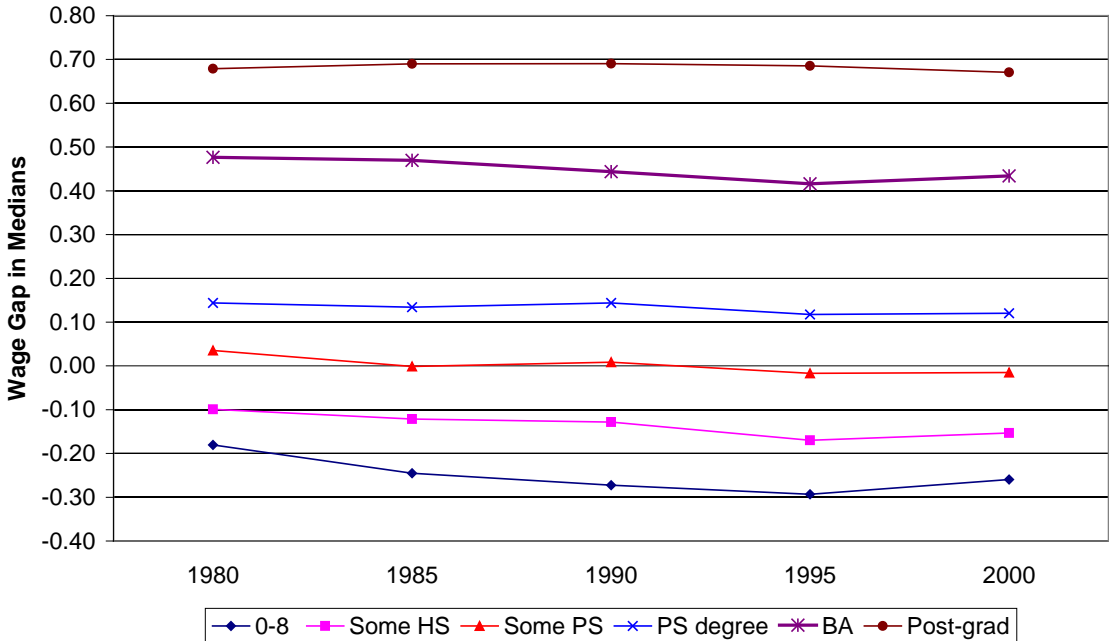**Figure 1c: Unadjusted Wage Gap in Log Weekly Earnings of Full-time Women (Relative to High School Graduates)**
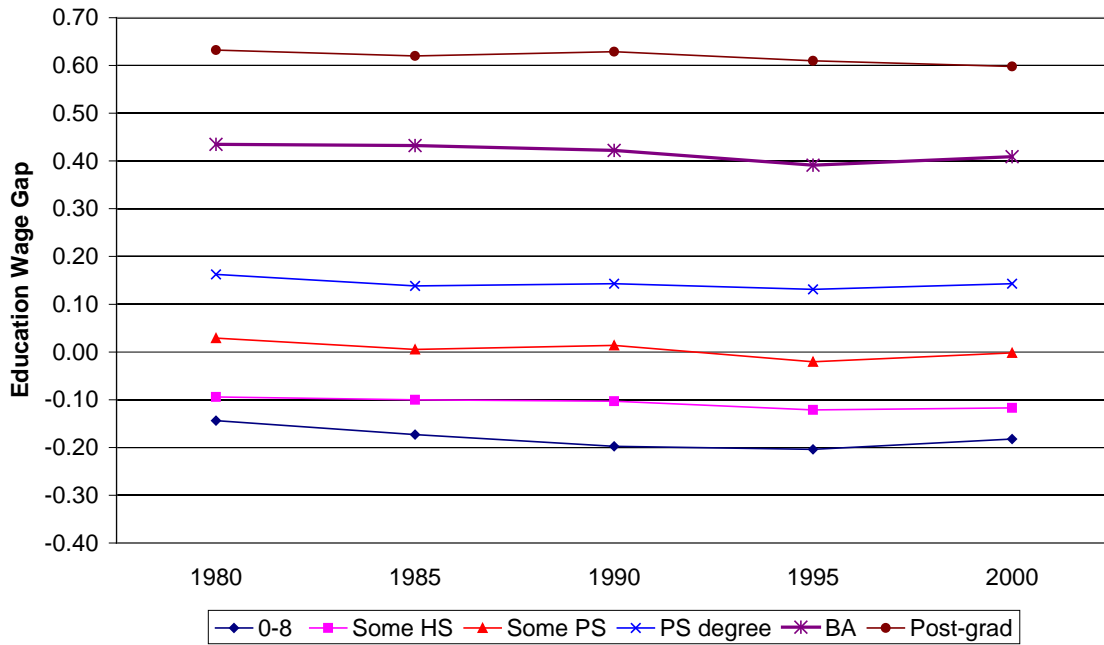
Figure 1d: Regression-adjusted Wage Gap in Log Weekly Earnings of Full-time Women (Relative to High School Graduates)
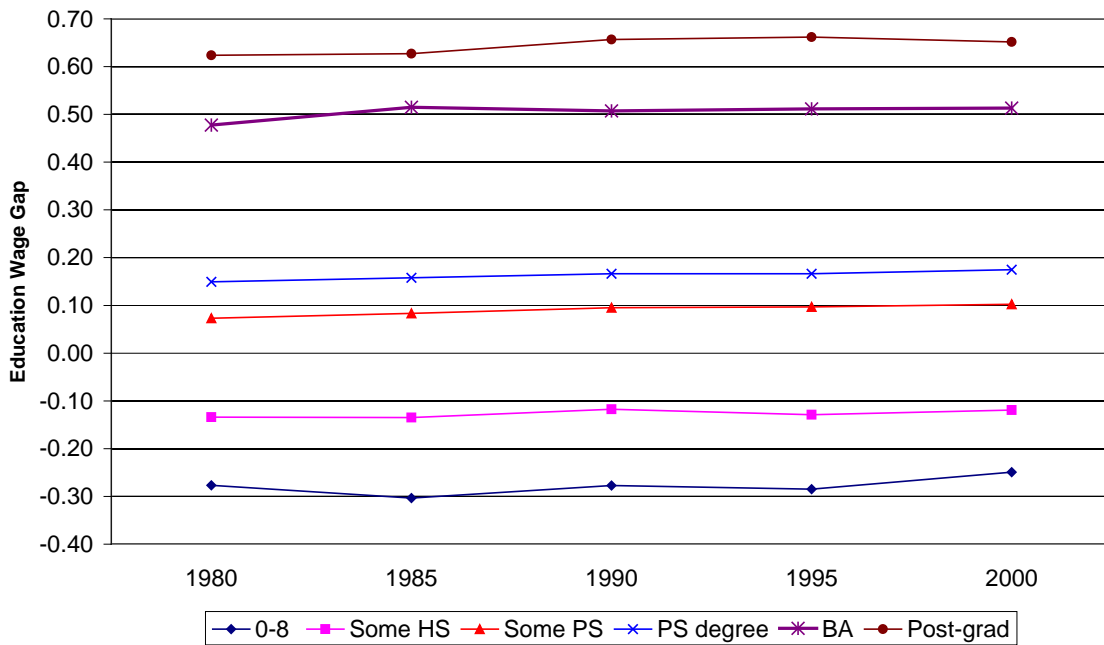
Figure 2a: Unadjusted Age Wage Gaps Relative to Age 46-55, Men

Figure 2b: Regression-adjusted Age Wage Gaps Relative to Age 46-55, Men
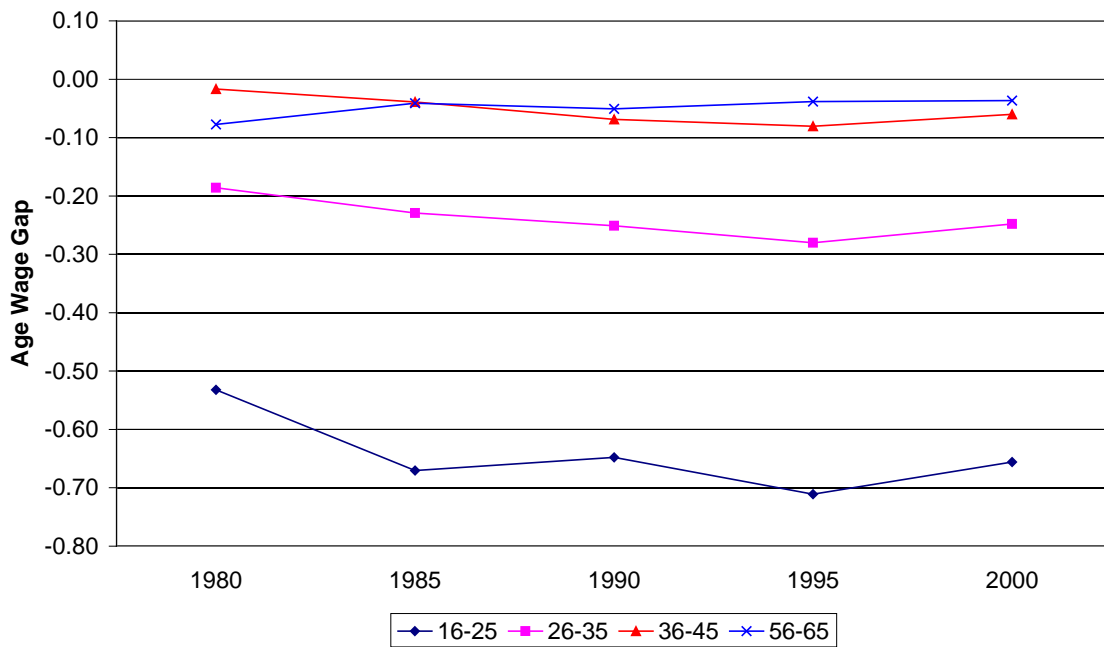
Figure 2c: Unadjusted Age Wage Gaps Relative to Age 46-55, Women
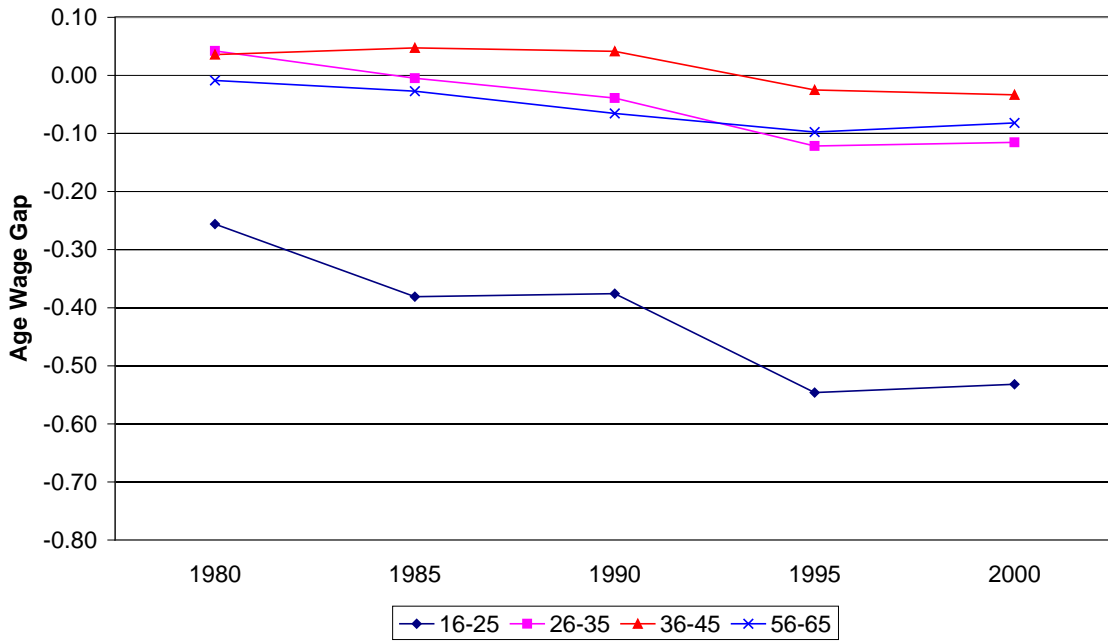
Figure 2d: Regression-adjusted Age Wage Gaps Relative to Age 46-55, Women

Figure 3a: Unadjusted Median Wage Gap in Log Weekly Earnings of Full-time Men (Relative to High School Graduates)

Figure 3b: Regression-Adjusted Median Wage Gap in Log Weekly Earnings of Full-time Men (Relative to High School Graduates)

Figure 3c: Unadjusted Median Wage Gap in Log Weekly Earnings of Full-time Women (Relative to High School Graduates)

Figure 3d: Regression-adjusted Median Wage Gap in Log Weekly Earnings of Full-time Women (Relative to High School Graduates)
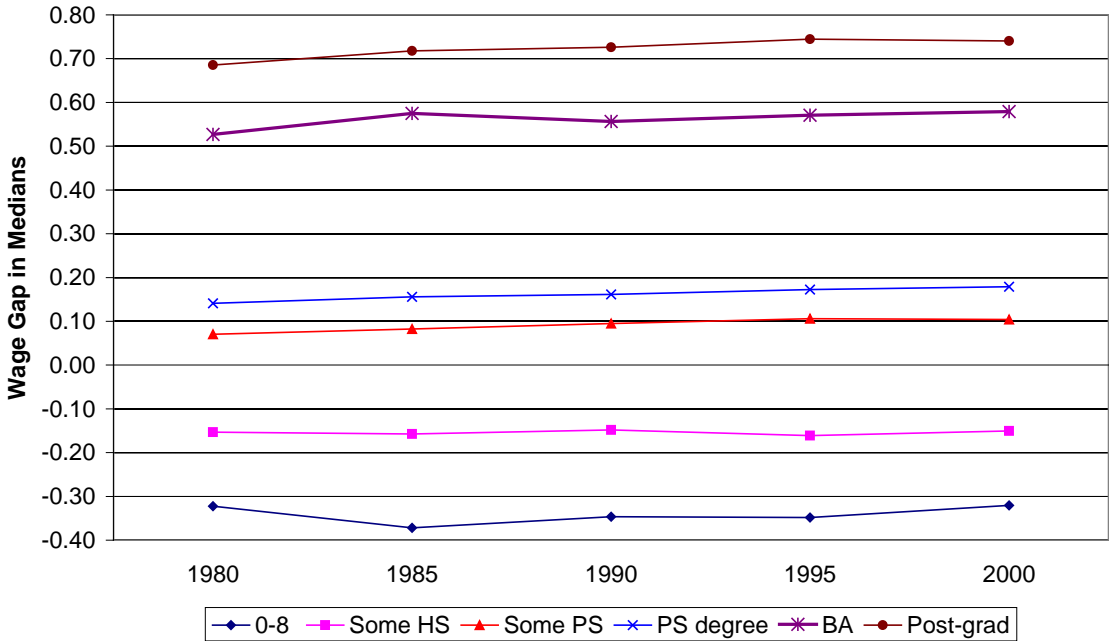
Figure 4a: Alternative Measures of the Adjusted BA-HS Wage Gap from the Census, Men
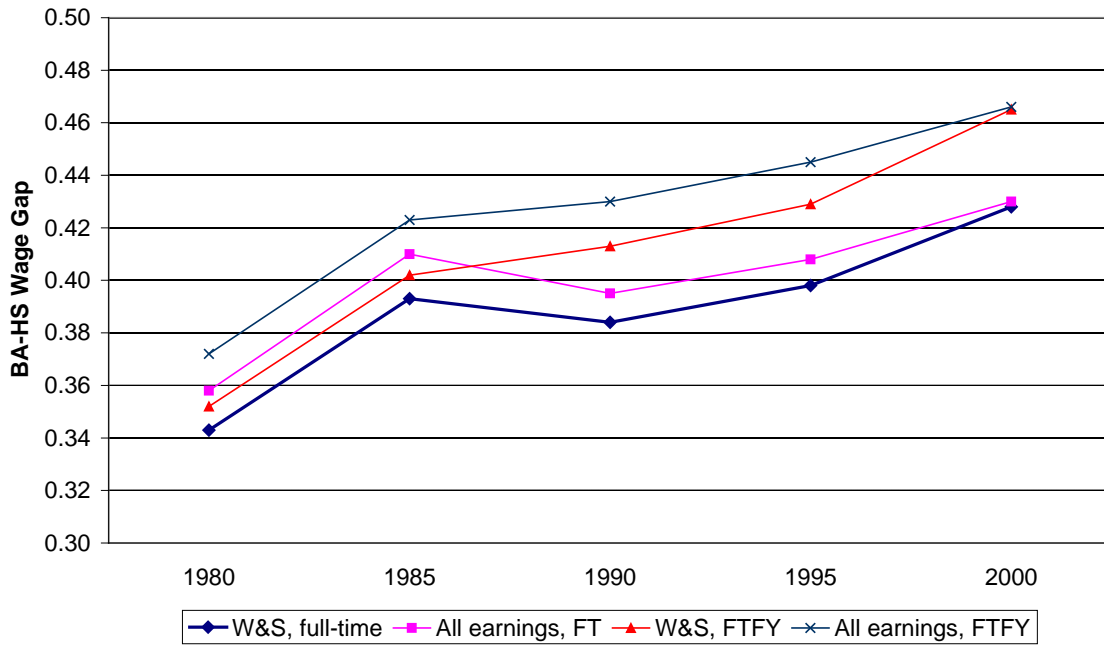
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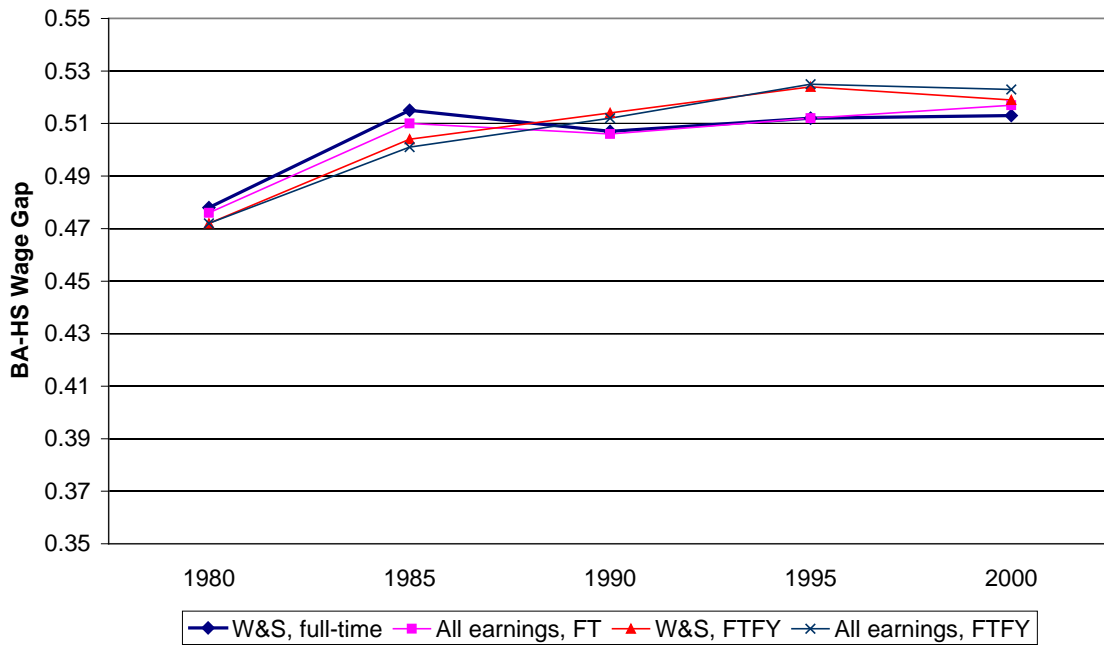
Figure 5a: Adjusted BA-HS Wage Gap from the Census using Weekly Earnings for all Workers, Men
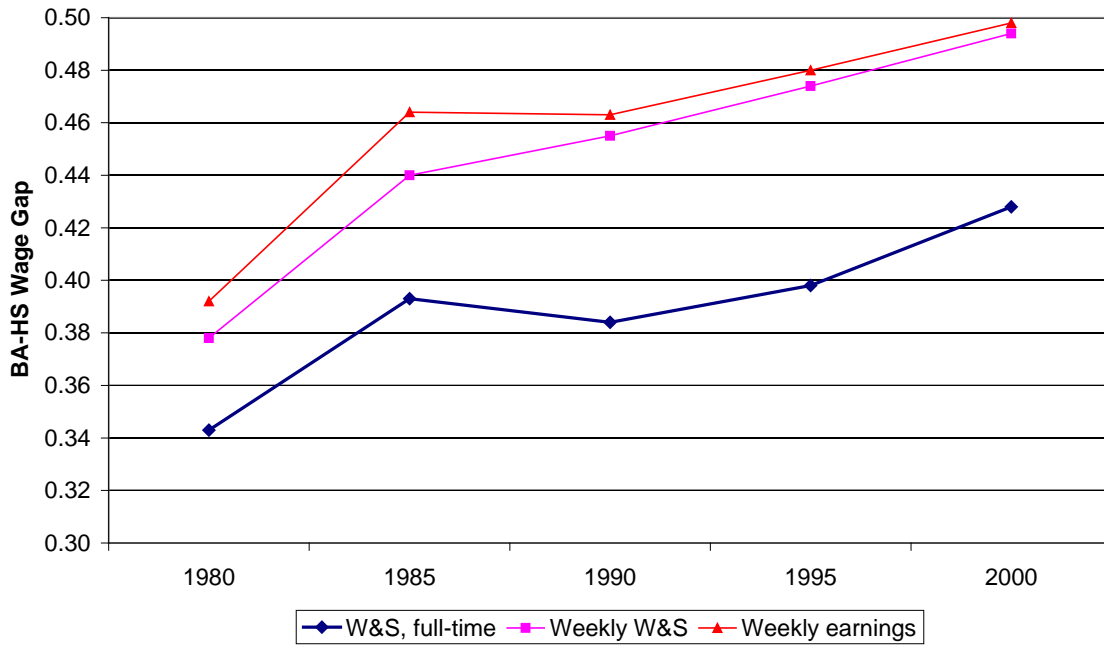
Figure 5b: Adjusted BA-HS Wage Gap from the Census using Weekly Earnings for all Workers, Women
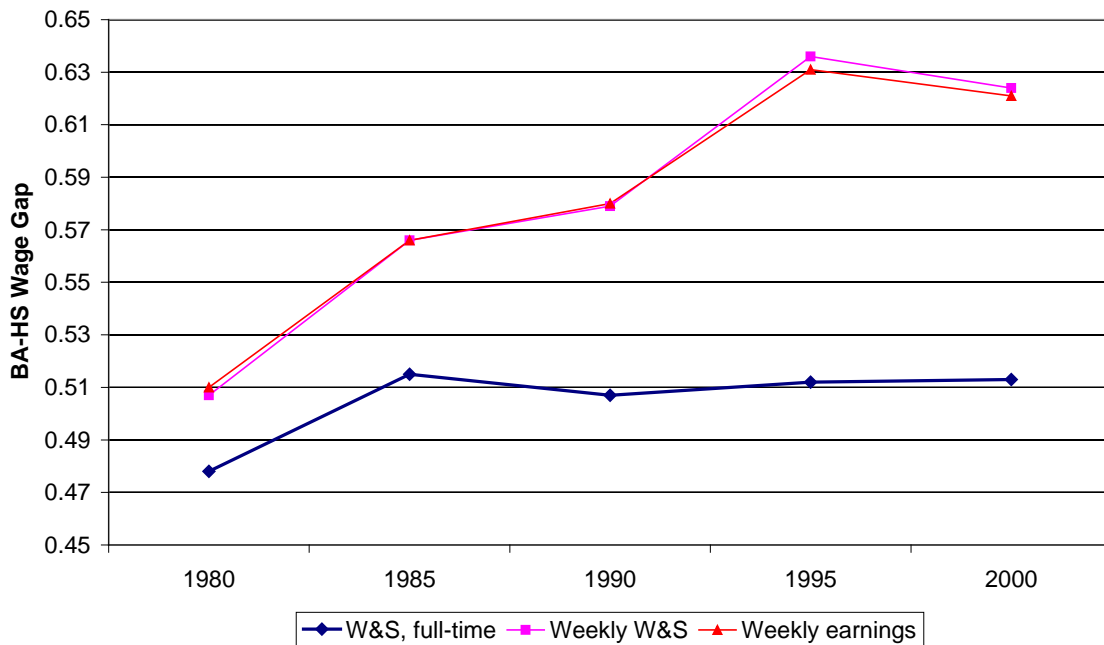
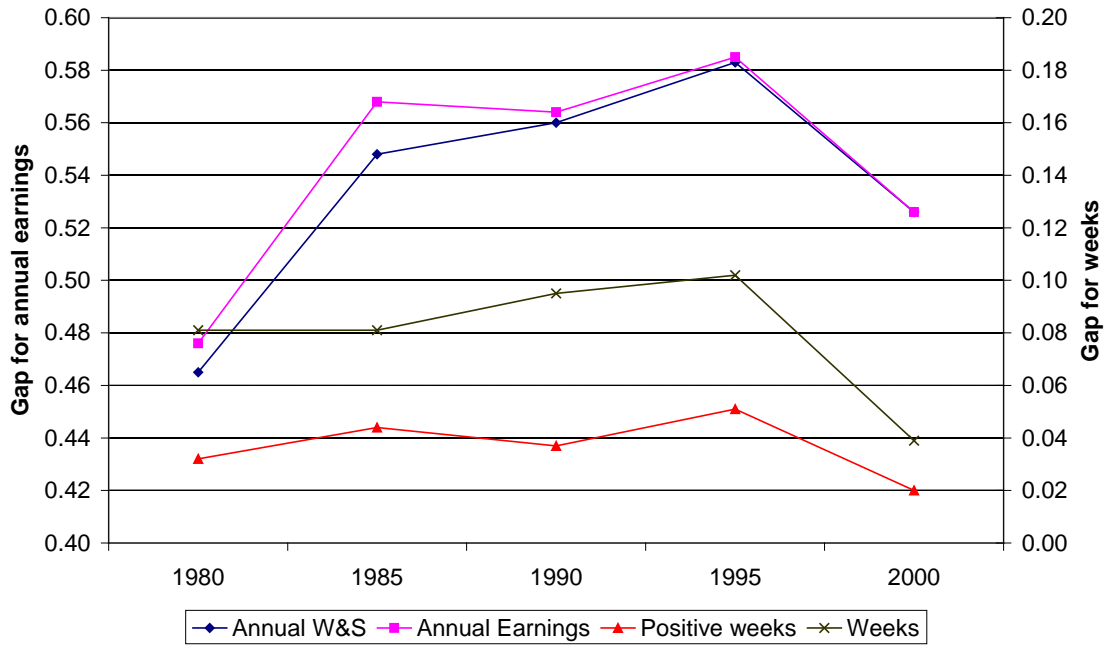**Figure 6a: Adjusted BA-HS Gap from the Census using Annual Earnings and Employment, Men**

Figure 6b: Adjusted BA-HS Gap from the Census using Annual Earnings and Employment, Women
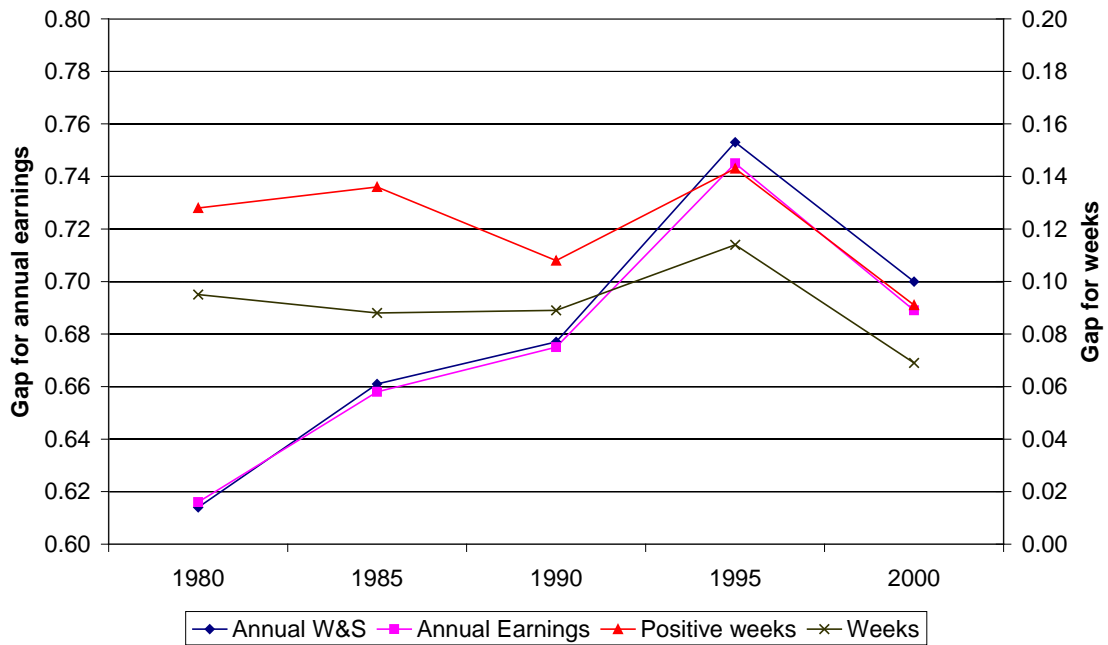

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Figure 7a: Unadjusted BA-HS Wage Gap Based on Mean Hourly Wage Rates and Mean Weekly Earnings, LFS
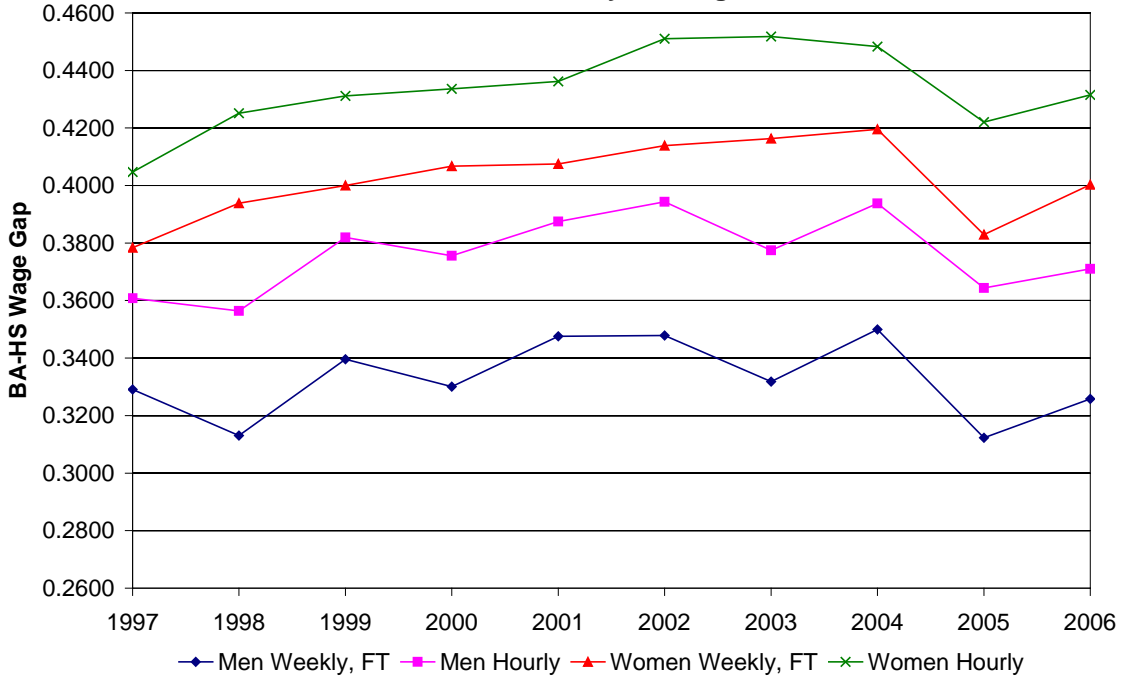

Figure 7b: Adjusted BA-HS Wage Gap Based on Hourly Wage Rates and Weekly Earnings, LFS
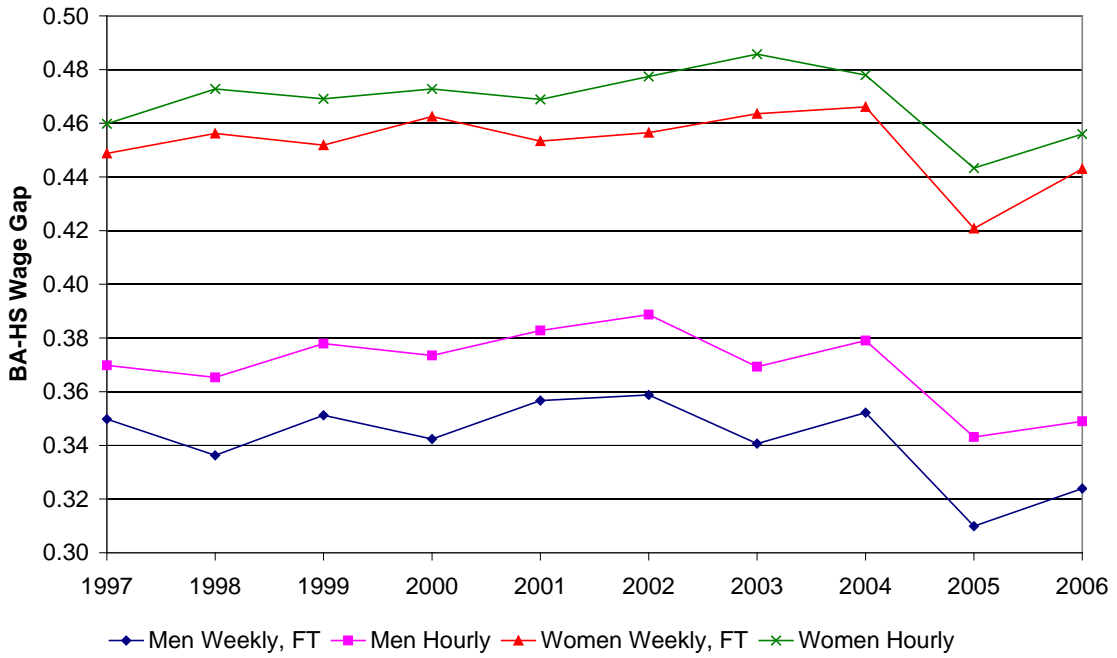
Figure 7c: Unadjusted BA-HS Wage Gap Based on Median Hourly Wage Rates and Median Weekly Earnings, LFS
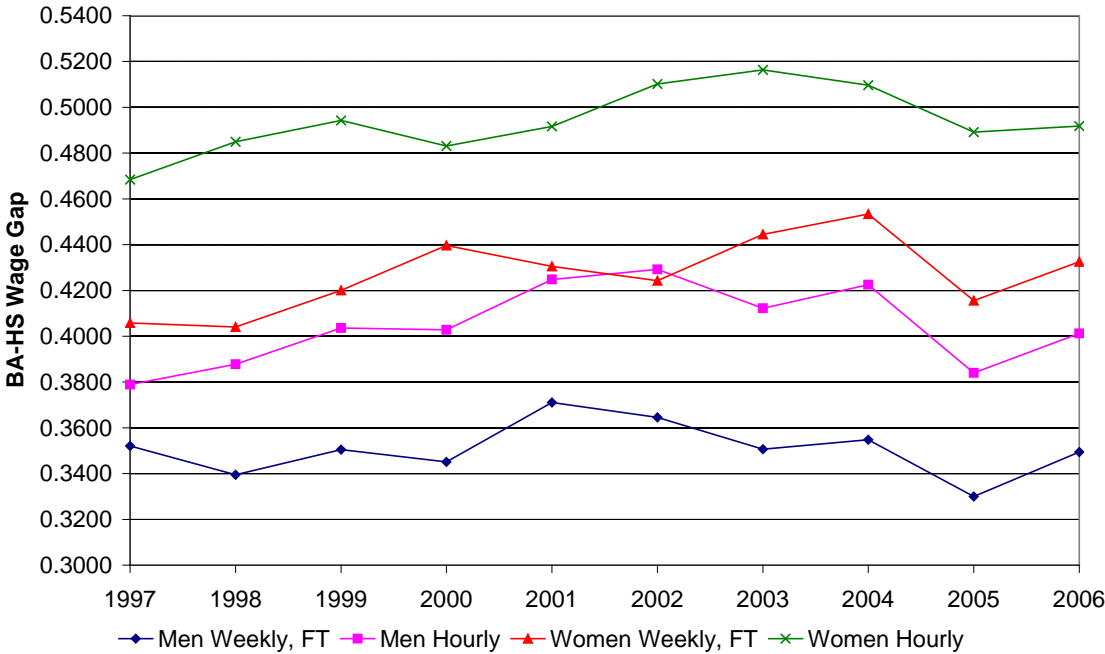
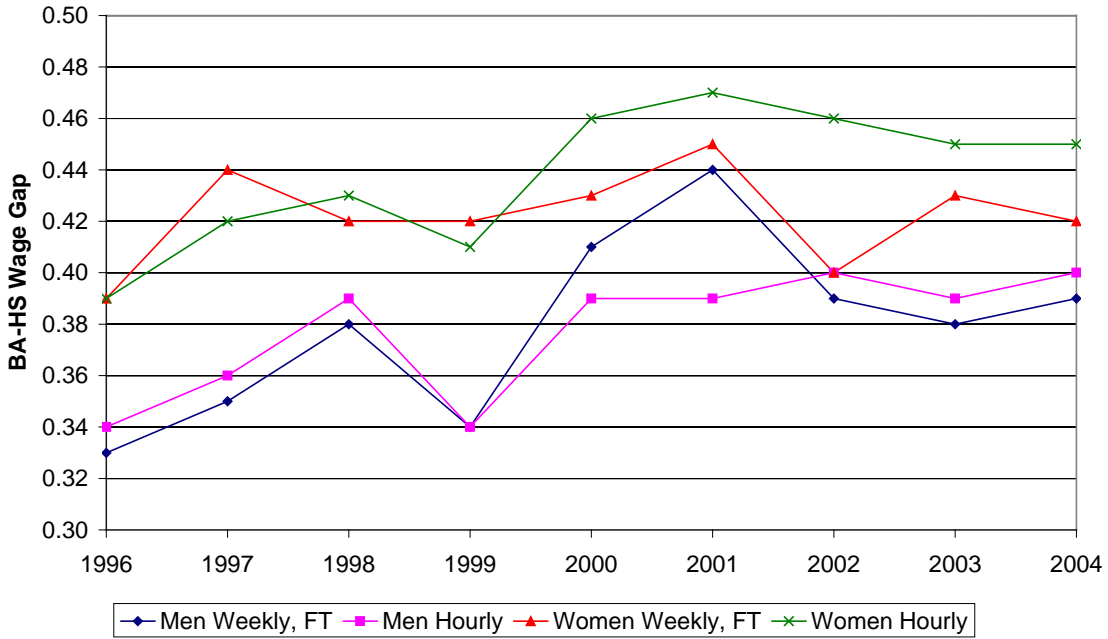**Figure 8a: Unadjusted BA-HS Mean Wage Gap Based on Hourly Wage Rates and Weekly Earnings, SLID**

Figure 8b: Adjusted BA-HS Wage Gap Based on Hourly Wage Rates and Weekly Earnings, SLID
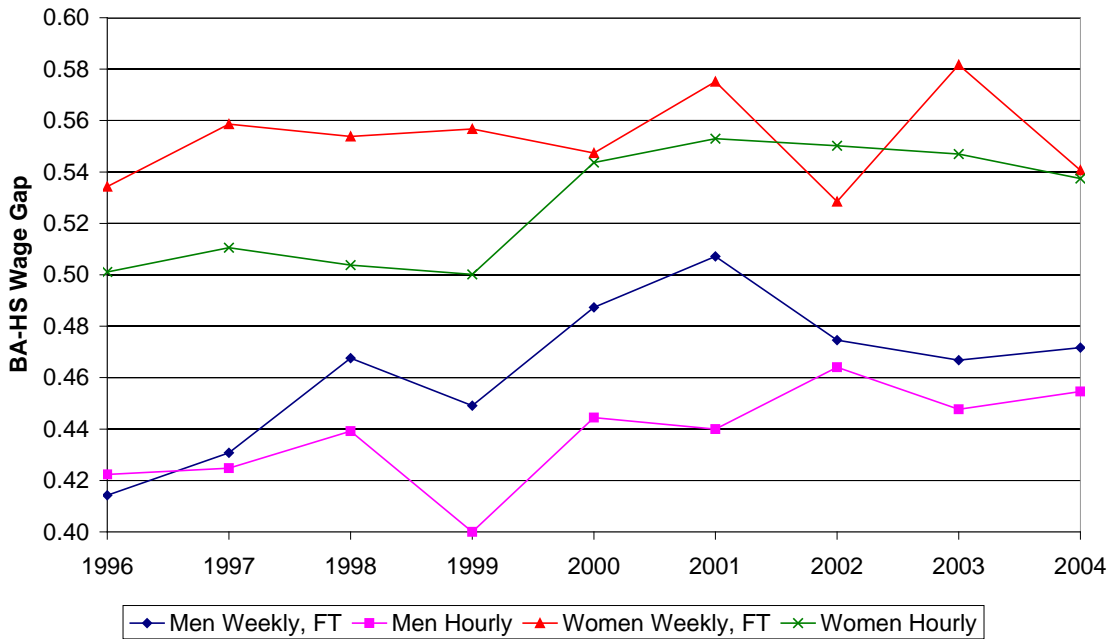
**Figure 8c: Unadjusted BA-HS Median Wage Gap Based on Hourly
Wage Rates and Weekly Earnings, SLID**

Table A1: Comparison of results for means and medians

A. Unadjusted, Men

	1980-2000		1995-2000	
	Mean	Median	Mean	Median
0-8	-0.034	-0.035	-0.014	-0.025
Some HS	-0.007	-0.006	-0.004	-0.005
Some PS	-0.022	-0.010	0.018	0.039
PS degree	0.014	0.026	0.017	0.011
BA	0.057	0.056	0.050	0.027
Post-grad	0.020	0.027	0.007	-0.008

B. Regression adjusted, Men

	1980-2000		1995-2000	
	Mean	Median	Mean	Median
0-8	0.030	0.026	0.013	0.024
Some HS	0.015	0.017	0.004	0.010
Some PS	0.018	0.020	0.002	0.007
PS degree	0.069	0.088	0.019	0.027
BA	0.084	0.087	0.030	0.035
Post-grad	0.066	0.051	0.009	0.012

C. Unadjusted, Women

	1980-2000		1995-2000	
	Mean	Median	Mean	Median
0-8	-0.038	-0.079	0.022	0.034
Some HS	-0.023	-0.054	0.004	0.017
Some PS	-0.031	-0.050	0.018	0.002
PS degree	-0.019	-0.023	0.012	0.003
BA	-0.026	-0.042	0.018	0.018
Post-grad	-0.034	-0.008	-0.012	-0.015

D. Regression adjusted, Women

	1980-2000		1995-2000	
	Mean	Median	Mean	Median
0-8	0.028	0.002	0.036	0.028
Some HS	0.014	0.003	0.010	0.010
Some PS	0.029	0.034	0.005	-0.002
PS degree	0.025	0.038	0.009	0.007
BA	0.036	0.052	0.001	0.008
Post-grad	0.028	0.055	-0.010	-0.004