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CHANGES TO THE BLS LABOR COMPOSITION INDEX

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June, 2006

Abstract: This paper describes the current BLS methodology for calculating the labor composition index and documents updates that are being proposed to the index. The labor composition index is an adjustment to the labor input that takes into account the varying effectiveness of a man-hour across different types of worker groups, in particular depending upon their education and experience. Until now, experience has been calculated in the BLS labor composition index using an imputation methodology that relies on data from a 1973 match between the CPS and Social Security Administration records. This update would replace that experience measure with one that makes use of more current data on experience from the periodic Survey of Income and Program Participation.

Preliminary and incomplete—not for citation.

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1. Introduction

For many years, BLS measured productivity only as output per unit of labor input. Labor input was measured by the sum of all hours worked at establishments. In 1983, the BLS began to measure multifactor productivity, which incorporated the effects of changes in capital services on output per hour. In 1993, a further refinement was introduced—the labor composition index.

The labor composition index is an adjustment to the measured labor hours that accounts for the different characteristics of the workers who fill those hours. The idea, which derives from Denison (1962), Jorgenson and Griliches (1967), and Chinloy (1980), is that the effectiveness of an hour of labor may vary systematically across workers. Demographic shifts in the compositions of the workforce can then result in increases or decreases in productivity per man-hour. For example, as the baby boom generation nears retirement, more of the economy's hours will come from younger, less experienced workers. These hours may be less effective than hours from the period when baby boomers were in their prime working years.

To see the importance of demographic shifts, Figures 1 and 2 show the composition of total annual hours worked in the economy (in millions), by education and experience, respectively. Total hours worked have increased steadily each year. A simple measure of labor hours captures only this change. However, the composition of this workforce has changed dramatically since the early 1990s. Hours worked by those with more than a high school diploma comprised 44 percent of the total annual man-hours in 1990, but 57 percent by 2004. Similarly, the hours worked by those with more than 25 years of experience increased from 18 percent of the total annual man-hours in 1990 to 39 percent in 2004. Thus, since 1990, there has been a shift in the composition of

man-hours towards more high-skilled workers—ignoring such shifts would lead to an overestimate of multifactor productivity. Even if the number of hours remained constant, the effectiveness of those hours might change. A better measure of labor input reflects both hours worked and also the effectiveness of those hours.

While there are many worker characteristics that might affect the effectiveness of an hour of labor, following BLS (1993), I restrict my attention to those that are consistently measured over time, namely education and experience[1]. I estimate an adjusted labor input separately for men and women because the effect of education and experience on labor effectiveness may be different for the two groups. Thus, rather than measuring the growth in total hours worked, with each hour weighted equally, the change in labor input is measured as the weighted change in the hours of each type of worker. The weights are the workers' shares of labor compensation, according to the relative size and hourly wages of the group of workers, with groups defined by education and experience levels.

Measuring such a weighted labor input requires data on wages, hours worked, education, and experience. Although the primary source of information on hours worked in the economy used in calculating multifactor productivity is the BLS Current Employment Statistics, this source does not contain demographic information on individual workers and therefore cannot be used to calculate an adjusted labor input. Instead, the Current Population Survey (CPS) is used. I calculate both the simple growth in total hours as well as the growth in composition-adjusted hours. The difference

[1] Denison (1962) and Jorgenson and Griliches (1967) use education groups, Chinloy (1980) uses gender, class of worker, age, educational attainment and occupation, and Jorgenson, Gollop and Fraumeni (1987) uses gender, age, educational attainment, class of worker, occupation and industry. Inter-industry and inter-occupation wage differentials may not reflect differences in marginal productivity across types of workers and therefore BLS does not analyze by these characteristics.

between these yields a labor composition index that is used to adjust the hours measure used to determine multifactor productivity.

Unfortunately, the CPS does not ask respondents how many years of experience they have. Many economists have overcome this deficiency by using potential experience (years since leaving school) as a measure of actual work experience, although this measure makes many questionable assumptions about work histories. In 1993, when the labor composition index was introduced, information on experience was obtained from a one time match between the 1973 CPS and Social Security Administration records on the employment history of those workers (BLS, 1993). This one time match was used to model experience in 1973 and predict experience in future CPS data. Over the years, however, this model has become increasingly outdated, as the factors affecting labor force attachment have changed.

This paper describes a proposed new methodology for predicting work experience that relies on data from the Survey of Income and Program Participation (SIPP). The SIPP is a nationally representative survey of individuals that has been conducted periodically from 1984 to the present[2]. It contains questions that measure actual work experience, as well as the demographic variables needed to model experience. Thus, a current model can be estimated in each SIPP year, and predictions based on each model can be made in the CPS.

I show that methods of predicting experience that rely on a model from 1973 underestimate actual experience. This has a cumulative effect over the worker's lifespan, making the understatement quite large for older workers. The effect is largest for women, who have dramatically increased their labor force participation since 1973 (Blau,

[2] The SIPP was conducted in 1984, 1987, 1990, 1993, 1996, 1999, and 2001.

1998; Blau and Kahn, 2006; Goldin, 2006). This has a strong effect on labor composition growth, which increases .5 percent per year more quickly under the proposed methodology.

2. The Labor Composition Model

The labor composition model uses a generalized production function that allows various types of labor to contribute to producing output. It can be written as:

(1) $$Q = A_t f(k_1,...k_n, h_1,...h_m)$$

where output Q is produced by n different types of capital, k_1, …k_n, by m different types of labor hours, h_1, …h_m, and by the technology available at time t, A_t.

By taking the natural logarithm of both sides, differentiating with respect to time, and rearranging terms, equation (1) can be expressed as the relationship between the multifactor productivity and the growth rate of output and the growth rates of the inputs:

(2) $$\frac{\dot{A}}{A} = \frac{\dot{Q}}{Q} - (s_{k_1} k_1 + ... + s_{k_n} k_n + s_{h_1} h_1 + ... + s_{h_m} h_m)$$

where the dot notation indicates the growth rate of that variable. The partial derivatives, s_{ki} and s_{hi} represents output elasticities, or the percent change in output resulting from a one percent increase in the respective input. In practice, these marginal products are unobservable. Under the assumptions of constant returns to scale and perfect competition in product and input markets, each elasticity is equal to the share of total costs paid to that input.

Under the assumption that the labor input is separable from capital, an aggregate labor input equation can be derived:

(3) $$\frac{\dot{L}}{L} = s_{h_1}\frac{\dot{h}_1}{h_1} + \ldots + s_{h_m}\frac{\dot{h}_m}{h_m}$$

To measure equation (3), a specific functional form for the production function must be chosen. The BLS labor composition model assumes a translog production function, which requires less restrictive assumptions. Diewert (1976) shows that changes in input consistent with the translog are exactly measured by changes in Tornqvist indexes. Thus, although $\frac{\dot{L}}{L}$ is the instantaneous rate of change in composition-adjusted labor input, it can be replaced by annual rates of change, measured with a Tornqvist index as the difference in the natural logarithm of successive observations, with the weights equal to the mean of the factor shares in the corresponding pair of years:

(4) $$\Delta \ln L = \sum_j \frac{1}{2}(s_{h_j}(t) + s_{h_j}(t-1))\Delta \ln h_j$$

Under this specification, changes in the index of labor composition, LC, are defined as the difference between the change in composition-adjusted labor input given in (4), and the change in the unadjusted labor input, or the change in the sum of unweighted hours of all workers:

(5) $$\Delta \ln LC = \Delta \ln L - \Delta \ln H = \Delta \ln \frac{L}{H}$$

In practice, estimation of the labor composition index requires a count of the number of hours worked by each type of worker, as well as cost share weights for each type of worker. First, workers are classified according to their education levels, years of experience and gender, and the number of hours in each cell is obtained. There are 72 experience groups, and 7 education groups (0-4 years schooling, 5-8 years schooling, 9-11 years schooling, 12 years schooling, some college, Bachelor's degree, advanced

degree), for a total of 1,008 distinct types of workers. In many cases, those cells are quite small, so that estimates of cost shares, which rely on the mean hourly wage within each cell, are imprecise. To improve the precision of these cost shares, BLS replaces actual wages with predicted wages, where the predictions are obtained from a standard Mincerian wage regression that includes experience, and education as well as other demographic characteristics of the worker (BLS, 1993, Appendix E). Since education and experience determine both the groupings of the worker and the estimates of cost shares, it is essential that they be measured precisely in the data.

3. Measuring Experience

The CPS does not contain information on actual work experience for its respondents. While many economic studies use potential experience (age – years of schooling – 6) as a proxy for actual work experience, this measure is subject to bias. In particular, experience is likely to be overstated for those with weak attachment to the labor market, such as women.

The current labor composition index calculation overcomes this limitation by relying on imputations derived from a one-time match between the 1973 CPS and the Social Security Administration(SSA) records that provided continuous quarterly work histories for all workers covered by the Social Security program (BLS, 1993, Appendix C). Thus, for 1973 only, a worker's demographic characteristics reported to the CPS could be matched to a precise measure of actual work experience.

A regression model was estimated on this match that could then be used to make out of sample predictions of actual experience in future years. Experience was estimated

as a function of potential experience and its square, six education indicators (years of schooling equal 0-4, 5-8, 9-11, 12, 13-15, 16, 17 and up), and potential experience interacted with education indicators. Two variables were included to adjust for limitations in SSA coverage: one for previous experience prior to the beginning of the SSA program in 1937, and an interaction between potential experience and whether the respondent worked in a nonprofit industry (which would not be covered). For women, the model included a married indicator, an interaction between potential experience and married, and interactions between potential experience and three fertility indicators (one child, 2-3 children, 4 or more children, with zero children being the omitted reference group).

There are several potential problems with this experience measure. First, there are several types of workers who were excluded from the initial analysis due to poor Social Security coverage, including African-American and Hispanic workers, and those in non-profit industries, domestic workers and agricultural and rail transportation workers. Additionally, while this measure of experience was useful in the years immediately following 1973, it has become less useful over time. The coefficients are not likely to have remained constant over time, particularly for women, whose labor force participation has increased dramatically.

The proposed new methodology similarly imputes actual experience of CPS respondents by using coefficients obtained from a more recent data source. In this case, however, we use the SIPP, which is a nationally representative survey of all workers, and which has been repeated periodically between 1984 and the present. The SIPP, which includes complete demographic information on respondents, asks workers "in what year

did ___ first work six straight months or longer at a regular job or business?" and "since [that year], has ___ always worked at least six months during the year?" If the respondent has not worked every year since the first one, they are further asked "how many years were there when ___ worked at least six months?"

Although these SIPP experience questions provide the best available information on actual work experience for a large sample of workers, these data are still subject to certain limitations. There are two sources of potential bias. The first is that the questions are retrospective and rely on the worker's ability to recall his complete work history. Short breaks from the labor market may be poorly captured. The second problem is that the questions restrict a working year to one in which at least six straight months were worked. This will result in an understatement of experience for many workers, who may have worked part-year at times during their work histories, such as seasonal workers and college students working while on summer break. This may be partially offset, since a six-month work year will be counted as a full year's experience by this measure.

The proposed new methodology also uses a somewhat different experience model than that used in BLS (1993). Experience is estimated as a linear function of the schooling indicators, age and its square, and black and Hispanic indicators[3]. The women's equation also includes a married indicator, the three fertility indicators, the fertility indicators interacted with age, and the fertility indicators interacted with the schooling indicators. While the current estimation uses potential experience as a determinant of actual experience, the proposed methodology replaces potential experience with age. Since the CPS now codes education by degree obtained rather than

[3] These were not included in the SSA-CPS model, since African-American and Hispanic workers were excluded from the sample due to poor SSA coverage.

by years of education, using potential experience, which requires years of education, adds unnecessary measurement error to the estimation.

3.1. Fertility

For women, the experience equation controls for marital status and the number of children born, since having children often affects a woman's participation in the labor market, and thus her subsequent experience. The CPS does not directly ask women about the number of children they have borne in their lifetimes, however. Instead, it is only possible to observe children under the age of 18 who are living in the household and to determine whether a female respondent is that child's parent. For young women, this is a reasonable estimate of lifetime fertility. For older women, however, this is likely to understate lifetime fertility, as their children may have already moved away from the parental house.

Unlike the CPS, the Census asks women the number of children ever born, providing an alternative source of data on lifetime fertility. The current methodology imputes fertility for women with 26 or more years of potential experience from 1970 Census estimates of fertility rates among older working women of the same marital status and educational attainment. Six categories are used to calculate Census fertility rates: married women with 0-8, 9-11, 12, 13-15 and 16 or more years of schooling, and unmarried women of all education levels. Fertility for women with 25 or fewer years of potential experience is measured from the number of the respondent's children under 18 living in the household.

In order to update these fertility numbers, the proposed methodology uses a weighted average of the 1980 and 1990 Census fertility rates for years prior to 1990, and the 1990 rates for years thereafter. In the most recent 2000 Census, the question was not included in the survey. An alternate source of data will need to be found going forward. Table 1 shows the calculated CPS fertility rates for working women in 2004, under both the current and the proposed measures. The current measure assigns older working women zero children with a higher probability than under the proposed measure. Those women are more likely to be assigned one child or two to three children under the proposed measure. This likely reflects that it is more common today for a woman to continue to work or return to work after having children, relative to 1970.

3.2. Comparing Experience Measures

Tables 2A and 2B show the parameters of the experience models for SIPP years 1984, 1993, and 2001[4]. Aside from the obvious increase in experience with age, advanced schooling reduces experience for men, as does being in a minority group. For women, the effects are somewhat more difficult to interpret due to the numerous interactions. A few examples show interesting relationships between fertility, education and experience for women. A 45 year-old white married woman with a Bachelor's degree who is working in 2001 has an estimated 24.3 years of experience if she has no children. A similar woman with one child has less experience--16.6 years. However, if she were to have two to three children, her experience would be higher--26.0 years--while with four or more children she would only have 19.5 years. Among 45 year old

[4] For comparison, the original 1973 CPS-SSA experience models are included in Appendix Table 1A. Since the sets of variables included are slightly different, it is somewhat difficult to directly compare coefficient estimates.

high school educated women working in 2001, the estimated experience is 25.0 (no kids), 11.7 (1 kid), 24.4 (2-3 kids) and 30.7 (4 or more kids)[5]. While a few of these predictions are inordinately large, the estimates are imprecise at the extreme values. Thus while it is unlikely that a 45 year old woman with high school education and 4 or more kids has worked for 31 years, it is also unlikely that the sample of women observed working in 2001 would contain many such women; despite the fact that many such women exist in the population of individuals in the U.S., they are much less likely to exist in the workforce. As a result, many of the coefficients on the fertility indicators have high standard errors, and predicted differences such as these, while large, are not statistically significant.

One way to gauge the performance of the proposed experience prediction model is to compare the actual age-experience profiles for workers in the SIPP to the predicted age-experience profiles for CPS workers under both the current and proposed imputation methodologies. Figure 2A and 2B show these profiles, for men and women respectively. For both men and women, predictions of experience based on the 1973 SSA-CPS match model result in much lower predicted experience for workers ages 35 and above, with the gap increasing with age. The effect is larger for women than for men. Figure 3 separates female workers by education level and compares the imputed experience under the proposed methodology relative to the current one (a value of one indicates that both predict the same experience level). The gap is widest for women with at least some college. The two figures indicate that it is quite important to update the model used to predict experience.

[5] Using the coefficients of the 1973 model, the comparable numbers are: 16.7 (BA 0 kids), 14.9 (BA 1 kid), 11.9 (BA 2-3 kids), 10.1 (BA 4+kids), 20.2 (HS 0 kids), 18.2 (HS 1 kid), 14.6 (HS 2-3 kids), 12.5 (HS 4+kids)

4. Effects of Proposed Experience Measure on the Labor Composition Index

The experience measure affects the labor composition index in two ways. First, experience is an important determinant of wages, which are used in calculating the shares of labor compensation that are used as weights to the labor inputs. Second, experience is one of the characteristics that define the groups of labor inputs. Thus, if experience is understated, it will affect both the relative wages of groups and the division of hours into groups as well.

4.1. The Effect of the Proposed Experience Measure on Wage Regressions

The labor composition index weights changes to each group's hours by its average share of labor compensation. Since some groups are quite small, mean wages will be imprecise for those groups. To improve the precision of the estimated cost shares, compensation is obtained from wage regressions, using the CPS. The dependent variable is the natural logarithm of an hourly wage rate, obtained by dividing the previous year's total annual wages and salaries by the number of hours worked last year (measured as the number of weeks worked multiplied by the usual weekly hours worked). Thus, the 2005 CPS provides information on the 2004 sample of workers. Following the standard Mincer human capital model, education, experience and experience squared are included in the set of independent variables. In addition, other demographic features of the worker, such as whether a part-time worker, veteran status, region of residence and whether in a central city or balance of SMSA, are included as explanatory variables.

The coefficients from the wage regression for the 2005 Current Population Survey, referring to 2004 employment and earnings, are shown in Table 3. Men and women are estimated separately. In columns 1 and 3, the experience variable is imputed using the latest SIPP model (2001), while in columns 2 and 4 it is imputed from the 1973 SSA-CPS model. The experience variable appears to have a larger effect on wages when measured by the current methodology. This makes sense, since the current methodology undercounts experience for the more highly experienced (and higher paid) workers. The remaining coefficients do not vary significantly across the two experience imputation methodologies. The explanatory power is approximately the same under the two methodologies, with the men's models having a higher R-squared than the women's.

4.2 The Effect of Proposed Experience Measure on Labor Composition

To show the importance of the method used to impute experience, in this section I give a compressed example of the complete labor composition index calculation. The full labor composition index uses 72 experience groups, 7 education groups and 2 genders, for a total of 1,008 distinct types of workers. Here, these groups will be aggregated to four experience groups (0-9 years, 10-19 years, 20-29 years, and more than 30 years), three education groups (less than high school graduate, high school graduate only, and at least some college), and two genders, for a compressed set of 24 types of workers. Table 4 shows the number of hours worked by all workers in each group, and the average predicted wages for workers in each group, estimated by the models in Table 3. The top number in each cell represents the calculation using the proposed experience

imputation, while the number below in parentheses indicates the same calculation using the current experience imputation.

As shown in Figures 2 and 3, imputing experience from the 1973 SSA-CPS match results in dramatically undercounting experience, especially for women. For the highest experience group, the count of hours is much smaller and one cell—the one for the most educated and most experienced women—drops out completely. As these highly experience workers are also those with the highest wages, particularly for men, this indicates that the cost shares attributed to these groups will be much different when the experience measure is adjusted.

Hours grew between 2003 and 2004 for men with less education, especially those with more experience. Among men with less than a high school education, those with 30 or more years of experience had 5.75 percent higher hours in 2004; among those with only a high school education, hours for those in the highest experience group grew 7.7 percent. For women, hours grew for the least educated and most educated groups, but fell for those with just a high school education. Most of the female education and experience groups experienced a small wage increase.

Table 5 shows the average labor cost shares for each group, as well as the percent change in hours between 2003 and 2004. These two components are used to calculate the weighted labor input—the cost shares being the weights. The highest weights for the men, which are not in the cells with the highest change in hours, are for those with at least some college, and 10 or more years experience. For women, the highest weights are for those with some college, but 10-29 years experience; again, not the cells with the greatest hours growth.

The percent change in weighted labor input is the sum of the products of the labor cost share and hours. In this example, the percent change in labor input measured using the proposed experience imputation is 1.34, while the same number using the current experience imputation is 1.39. This means that regardless of the total growth in hours, the proposed methodology shows slower growth in the composition-adjusted labor input than the current methodology over this time period. The labor composition index is the difference between the composition-adjusted labor input growth and the unweighted hours growth. Hours grew by 1.3 percent[6] between 2003 and 2004, resulting in a -.044 (+.011) percent change in the labor composition index, using the proposed (current) methodology.

Table 6 shows composition-adjusted labor input, hours and the labor composition index for the full matrix of 1,008 types of workers, under both the proposed methodology and the BLS published results. Published labor input and hours growth figures were only available from 1988 forward. Labor input grew 2.4 percent annually between 1987 and 2004, using the proposed methodology, and 1.6 percent annually according to published results. This increase in labor input was due partly to an increase in total hours worked—1.3 (1.0) percent annual growth under the proposed (published) methodology, which accounted for 54 (63) percent of the growth in labor input. The remainder was due to growth in the composition of labor—1.1 (0.6) percent annually under the proposed (published) methodology. Calculating experience from the more current SIPP dataset

[6] In this example, the growth in unweighted aggregate hours is 1.338 when the groups are defined under the proposed experience measure. This aggregate number is slightly different under the current measurement, because when a cell contains hours for only one of the two years, it must be dropped from the estimation of labor composition; as a result, aggregate hours growth is 1.393 using the current experience imputation.

results in a much higher labor input growth, largely due to the much greater importance of labor composition.

5. Separating the Effects of Education and Experience on Labor Composition

This aggregate change in labor composition can be decomposed into its two sources—education and experience—by the use of partial indices of labor composition, as derived in Chinloy (1980). To determine the main effect of education on labor composition growth, the experience cells are combined, thereby treating workers as homogeneous across experience levels. This results in only fourteen types of labor (seven education groups and two genders), which are weighted according to their average cost shares. Similarly, to determine the main effect of experience on labor composition growth, the education cells are combined, resulting in 144 types of labor (72 experience groups and two genders). In addition to these two main effects, there is a first-order interactive effect for the two factors, which "explains" the remaining difference between the full labor composition growth and the two partial labor composition growths.

Table 7 presents the decomposition of labor composition into its two sources, plus the remaining interaction effect. Using only education and gender groups, labor composition grew at a rate of .26 percent per year from 1987 to 2004. This is 24 percent of the full labor composition growth, which is attributed directly to changes in the education of the workforce over the time period. The partial index for experience grew at a rate of .64 percent per year, indicating that 58 percent of the growth in labor composition is due to the increasing experience of the workforce. The remaining 18 percent is attributed to the interactive effect of both education and experience. This is

quite different from BLS (1993), which found that 78 percent of the growth in labor composition between 1979 and 1990 was attributed to changes in education, while 20% was attributed to changes in experience. Clearly, capturing the higher experience levels of prime age and older workers has a strong effect on the labor composition index.

6. Conclusions

This paper proposes a change in the calculation of the BLS labor composition index. While the current methodology uses a one-time match in 1973 between the CPS and the SSA records to model experience, and predicts experience to future CPS populations using this model, the proposed new methodology uses periodically conducted SIPP surveys to model experience and predict to CPS population. The advantage of making this improvement is that it will better capture the changing relationship between a worker's experience and demographic characteristics—ignoring such changes results in a downward bias in predictions of experience. Age-experience profiles show that the current model severely understates the true experience levels of prime age and older workers, especially women.

Using the proposed experience imputation methodology, I estimate new labor composition indices for 1984 through 2004. I find higher annual growth rates of labor composition under the new methodology--.5 percent per year. In particular, partial indices indicate that the growth in labor composition that is due to experience is much larger under the proposed estimates. Previous calculations using the current methodology suggested that only 20 percent of labor composition growth is due to changes in the experience level of the workforce, while the proposed estimation shows 58 percent. As

demographic changes occur in the workforce, such as the aging and retirement of the baby boom generation, it will be important to measure as well as possible the experience of the workforce.

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Figure 1A. 1984-2004 Employment, by Education

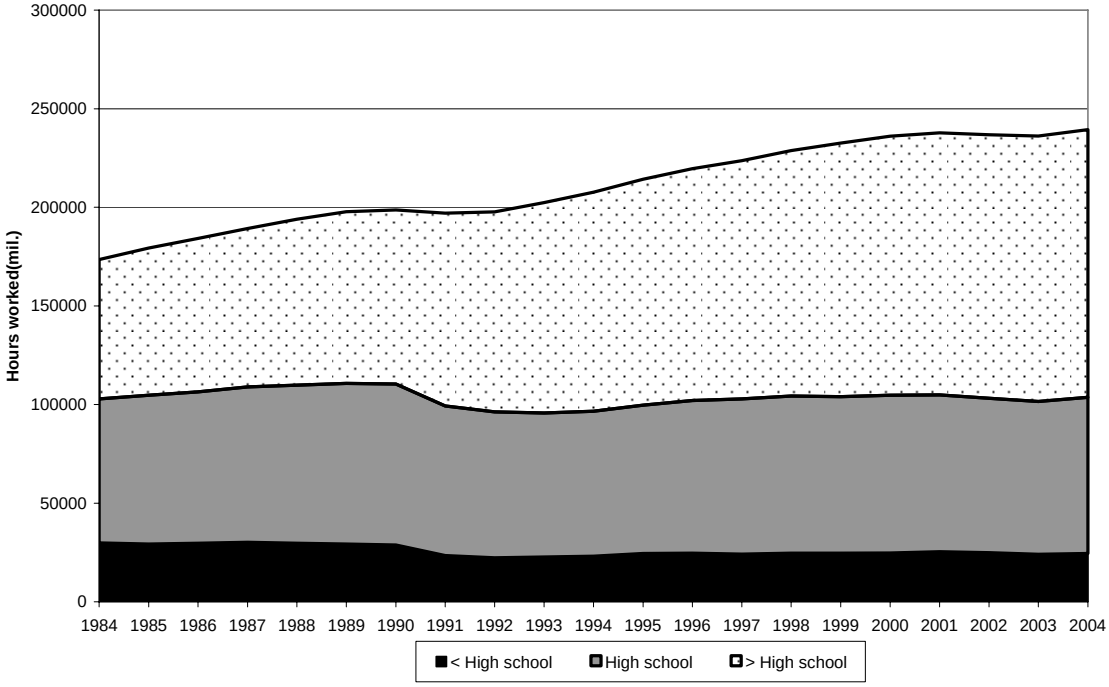

Figure 1B. 1984-2004 Employment, by experience

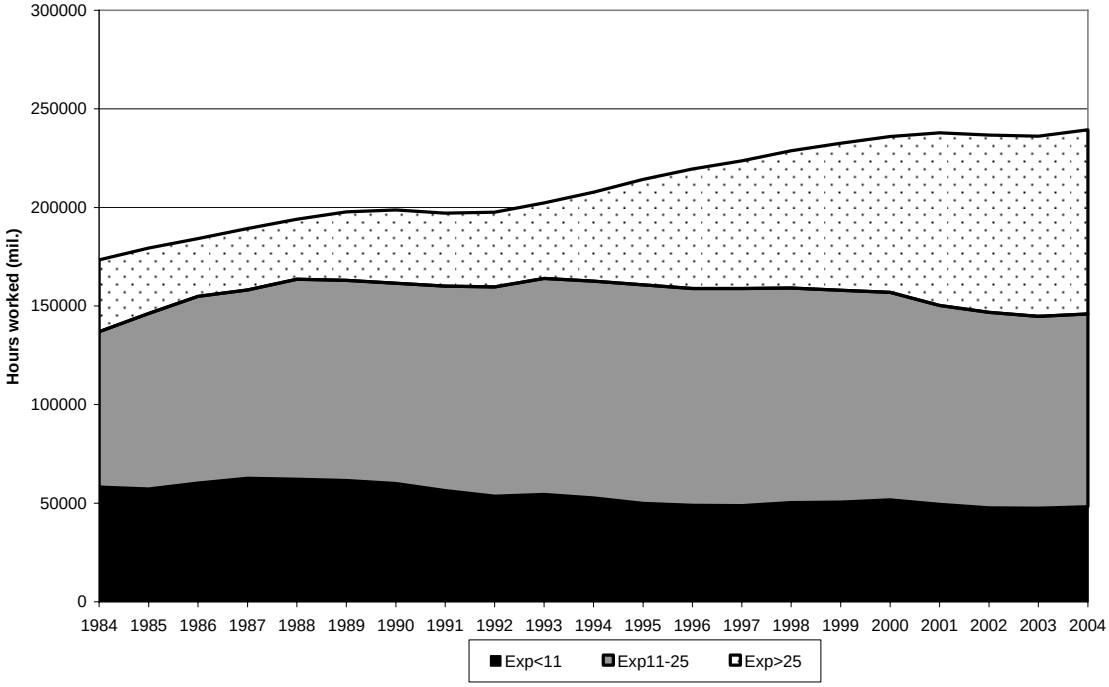

Figure 2A. Imputed and Actual Age-Experience Profiles for Working Men

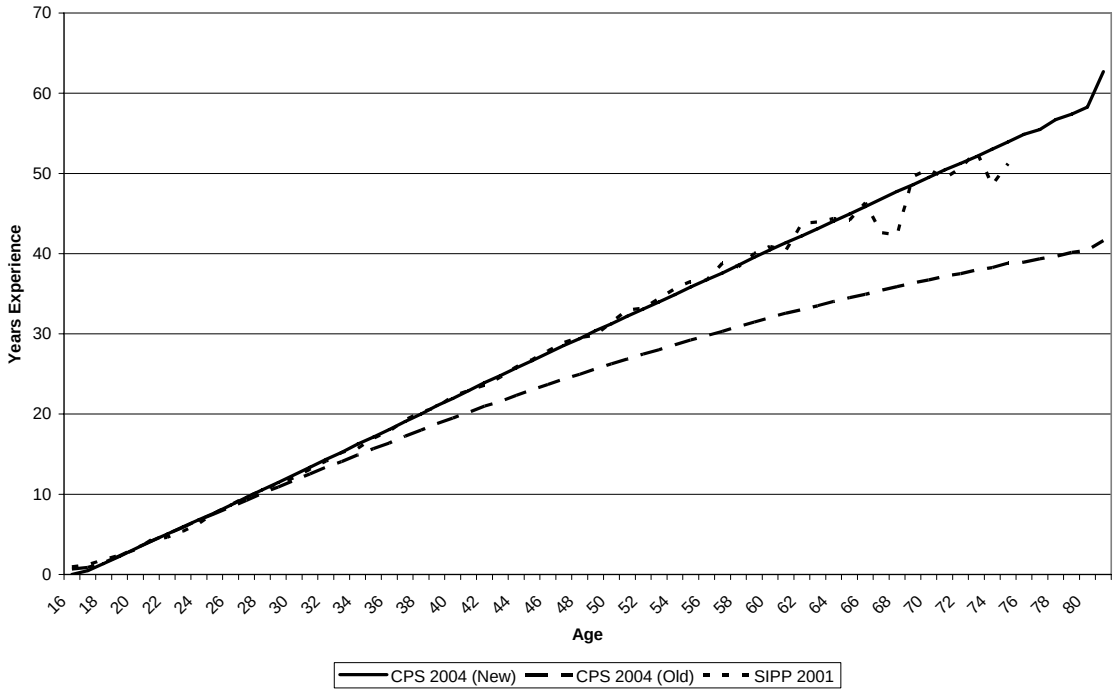

Figure 2B. Imputed and Actual Age-Experience Profiles for Working Women

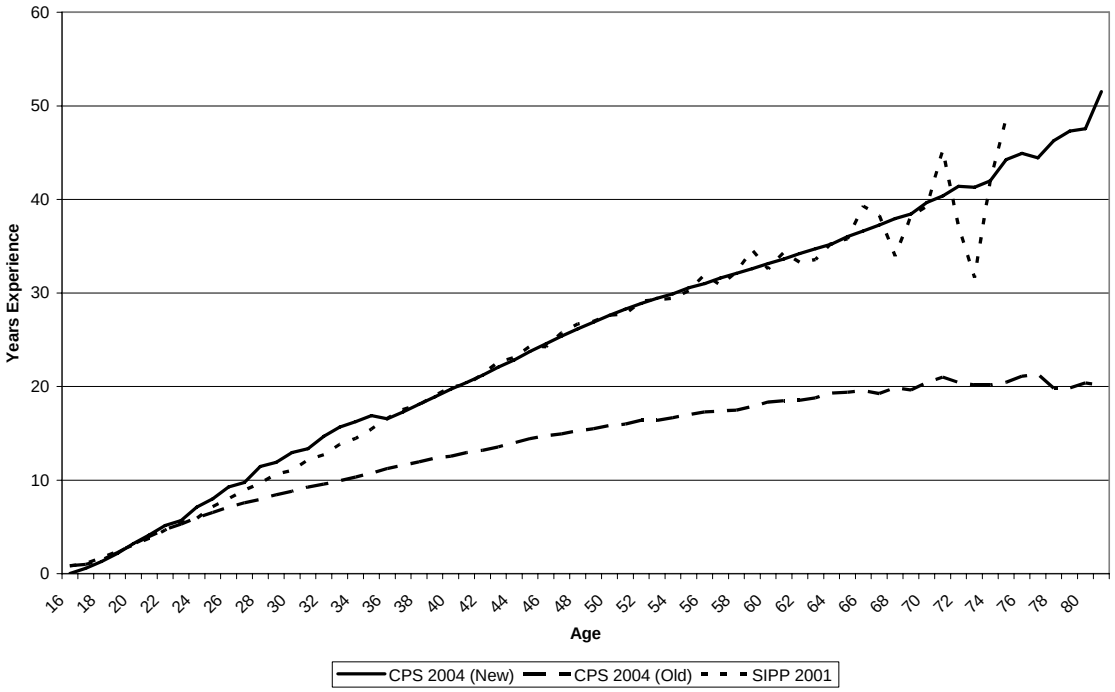

Figure 3. Imputed Age-Experience for 2004 CPS Working Women, (Proposed Method Relative to Current), by Education

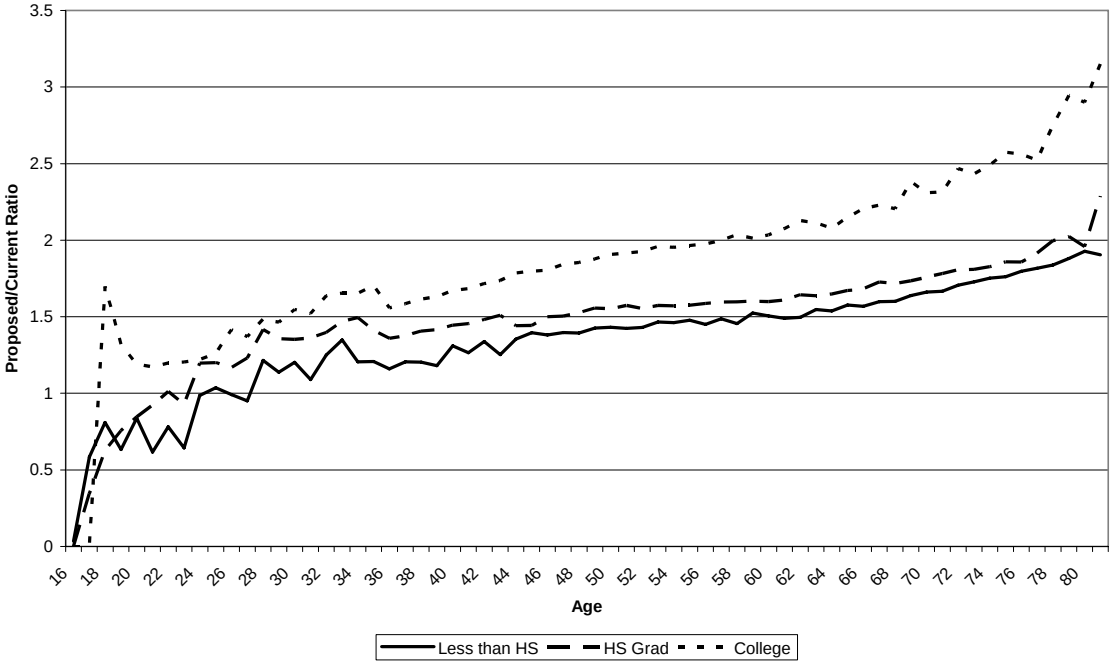

TABLE 1. Estimates of fertility in 2004 CPS working women, under proposed and current imputation methods

Age	0 kids	1 kid	2-3 kids	4+ kids
15	1	0	0	0
20	.854	.101	.038	.007
25	.570	.208	.178	.044
30	.314	.197	.396	.094
35	.233	.170	.452	.145

	Prop.	*Curr.*	*Prop.*	*Curr.*	*Prop.*	*Curr.*	*Prop.*	*Curr.*
40	.178	.180	.178	.179	.552	.550	.093	.093
45	.158	.222	.144	.157	.561	.497	.137	.137
50	.122	.236	.107	.162	.538	.455	.233	.233
55	.120	.241	.093	.162	.478	.451	.310	.310
60	.121	.233	.101	.164	.450	.452	.328	.328
65	.122	.212	.114	.168	.460	.459	.304	.304
70	.148	.211	.153	.169	.468	.458	.231	.231
75	.212	.248	.177	.161	.439	.438	.173	.173

Notes: For age groups 40+, number of children borne is derived from decennial Census estimates for working women, by age, marital status and educational attainment. Proposed uses 1990 Census estimates, current uses 1970 estimates.

TABLE 2A. Men's experience model, selected SIPP years.

	1984	*1993*	*2001*
Constant	-15.39***	-15.15***	-16.51***
	(.589)	(.624)	(.351)
Age	.9104***	.8915***	1.021***
	(.033)	(.040)	(.023)
Age^2	.0004	-.0001	-.0009***
	(.0004)	(.001)	(.0003)
0-4 yrs. schooling	-3.659***	-2.382***	-1.632**
	(.765)	(.864)	(.751)
5-8 yrs. schooling	-.4608	-.9049**	-.1888
	(.332)	(.458)	(.324)
12 yrs. schooling	-.1032	.2005	-.1486
	(.191)	(.199)	(.160)
Some college	-.3114	.1737	-.0529
	(.207)	(.207)	(.160)
BA degree	-2.003***	-1.416***	-1.616***
	(.230)	(.242)	(.185)
Advanced degree	-2.516***	-2.194***	-2.785***
	(.233)	(.263)	(.213)
Black	-1.747***	-1.196**	-1.080***
	(.483)	(.574)	(.174)
Hispanic	-.2585	-.0134	-.6534***
	(.508)	(.606)	(.139)
R-squared	.8469	.7876	.8709
Number of observations	10,804	8,195	13,744

Notes: Dependent variable is years experience. *** = p<.01, ** = p<.05 * = p<.10.

TABLE 2B. Women's experience equation, selected SIPP years

	1984	*1993*	*2001*
Constant	-13.68***	-12.47***	-12.83***
	(1.89)	(2.28)	(1.37)
Age	.8222***	.6882***	.7531***
	(.120)	(.155)	(.098)
Age^2	.0006	.0011	.0024**
	(.001)	(.002)	(.001)
0-4 yrs. schooling	-4.149	-4.635	-3.045
	(4.91)	(3.79)	(2.80)
5-8 yrs. schooling	-1.487	-1.605	.6008
	(1.63)	(1.49)	(.753)
12 yrs. schooling	.3954	1.643***	-.5172
	(.794)	(.407)	(.469)
Some college	-.4508	1.857***	.0193
	(.813)	(.481)	(.320)
BA degree	-1.684*	.5593	-1.251**
	(.890)	(.779)	(.556)
Advanced degree	-1.677	1.426	-.6079
	(1.20)	(.934)	(.855)
Married	.9287	.5485	-.3817
	(.710)	(.499)	(.241)
1 kid	-8.428	-5.861	10.83*
	(11.5)	(12.3)	(6.32)
2-3 kids	13.15**	6.113	-1.881
	(5.94)	(3.85)	(2.85)
4+ kids	2.319	40.45**	52.34***
	(11.9)	(21.0)	(16.7)
Age * 1 kid	.0983	.3509	-.5678
	(.485)	(.664)	(.358)
Age * 2-3 kids	-.6536***	-.4642***	-.1299**
	(.221)	(.095)	(.059)
Age * 4+ kids	-.1240	-.7090*	-1.030***
	(.215)	(.370)	(.270)
Black	-.7993	-.8506*	.2862*
	(.632)	(.487)	(.168)
Hispanic	1.193*	.2108	-.9403***
	(.666)	(.494)	(.205)
R-squared	.5105	.5409	.6948
Number of observations	9,269	8,101	13,430

Notes: Dependent variable is years experience. *** = p<.01, ** = p<.05
* = p<.10.

TABLE 2B (cont'd)

	1984	*1993*	*2001*
1 kid * 0-4 yrs. school	6.819	49.05	12.27
	(32.3)	(37.8)	(15.9)
1 kid * 5-8 yrs. school	-2.629	7.603	-9.036
	(12.2)	(1.26)	(8.97)
1 kid * 12 yrs. school	-.7572	-5.349**	1.438
	(3.93)	(2.71)	(2.87)
1 kid * some college	.7698	-8.425**	3.487
	(4.96)	(3.66)	(3.14)
1 kid * BA degree	.1294	-5.104	7.071
	(7.06)	(6.72)	(4.59)
1 kid * advanced degree	.8952	-15.19**	.3220
	(8.09)	(7.25)	(5.54)
2-3 kids * 0-4 yrs. school	10.28	-13.53	-7.237
	(14.2)	(12.9)	(10.3)
2-3 kids * 5-8 yrs. school	2.001	-5.880	-.3607
	(5.49)	(5.10)	(4.99)
2-3 kids * 12 yrs. school	3.463*	5.265***	7.118***
	(2.10)	(1.91)	(1.98)
2-3 kids * some college	5.111**	8.164***	8.127***
	(2.36)	(2.14)	(2.03)
2-3 kids * BA degree	5.361*	6.974***	9.416***
	(3.22)	(2.53)	(2.30)
2-3 kids * advanced degree	5.141*	10.93***	8.133***
	(3.12)	(2.70)	(2.44)
4+ kids * 0-4 yrs. school	-6.728	3.746	8.261
	(12.6)	(15.0)	(12.6)
4+ kids * 5-8 yrs. school	-1.517	.5133	-1.635
	(5.29)	(6.40)	(5.98)
4+ kids * 12 yrs. school	-.4648	-2.954	-.3518
	(3.91)	(4.48)	(3.47)
4+ kids * some college	-3.860	-5.185	-1.944
	(4.83)	(6.02)	(3.74)
4+ kids * BA degree	-3.195	6.300	-10.80
	(7.92)	(7.97)	(5.30)
4+ kids * advanced degree	10.50	-6.943	1.083
	(7.54)	(9.46)	(5.37)

Notes: Dependent variable is years experience. *** = p<.01, ** = p<.05 * = p<.10.

TABLE 3. Log hourly wage estimations in 2005 CPS with proposed and current experience imputation methods

	Men		Women	
	Proposed	*Current*	*Proposed*	*Current*
Experience	.0458***	.0623***	.0410***	.0759***
	(.001)	(.002)	(.001)	(.003)
Experience^2/100	-.0678***	-.1172***	-.0754***	-.2108***
	(.0030)	(.0055)	(.0037)	(.0108)
0-4 yrs. schooling	-.2493***	-.3180***	-.2283***	-.2779***
	(.047)	(.047)	(.060)	(.063)
5-8 yrs. schooling	-.1259***	-.1461***	-.1052***	-.1227***
	(.027)	(.026)	(.025)	(.025)
12 yrs. schooling	.1692***	.1514***	.1803***	.1805***
	(.015)	(.015)	(.015)	(.015)
13-15 yrs. schooling	.3430***	.3394***	.3564***	.3874***
	(.015)	(.015)	(.015)	(.015)
16 yrs. schooling	.6866***	.6725***	.6713***	.7029***
	(.017)	(.017)	(.017)	(.017)
17+ yrs. schooling	.9757***	.9713***	.9290***	.9794***
	(.021)	(.021)	(.023)	(.023)
Part-timer	-.2258***	-.2057***	-.1238***	-.1136***
	(.019)	(.019)	(.010)	(.010)
Veteran	-.0023	-.0001	.0592*	.0661**
	(.015)	(.013)	(.033)	(.034)
New England	.0555***	.0561***	.0600***	.0611***
	(.017)	(.017)	(.017)	(.018)
Mid-Atlantic	-.0026	-.0003	-.0232*	-.0205
	(.015)	(.015)	(.014)	(.014)
East North Central	-.0156	-.0119	-.0347***	-.0272**
	(.014)	(.014)	(.013)	(.013)
South Atlantic	-.0500***	-.0526***	-.0501***	-.0475***
	(.013)	(.013)	(.012)	(.012)
East South Central	-.0361**	-.0325*	-.1140***	-.1057***
	(.018)	(.018)	(.018)	(.018)
West South Central	-.0526***	-.0550***	-.0954***	-.0932***
	(.016)	(.016)	(.015)	(.015)
Mountain	-.0140	-.0129	-.0386***	-.0341**
	(.015)	(.015)	(.015)	(.015)
Central city	.0122	.0062	.0906***	.0798***
	(.011)	(.011)	(.011)	(.011)
Remainder of SMSA	.1129***	.1108***	.1515***	.1488***
	(.009)	(.009)	(.009)	(.009)
Constant	1.826***	1.758***	1.709***	1.565***
	(.020)	(.021)	(.018)	(.020)
R-squared	.6745	.6757	.6399	.6405
Number of observations	40,272	40,493	37,781	37,781

Notes: Dependent variable is log hourly wage. *** = p<.01, ** = p<.05 * = p<.10.

TABLE 4. Compressed hours and wage matrices for 2003 and 2004: proposed imputation (current imputation)

	<12 yrs. schooling	**12 yrs. schooling**	**>12 yrs. schooling**	**<12 yrs. schooling**	**12 yrs. schooling**	**>12 yrs. schooling**
		2003 Hours-Men			*2003 Wages-Men*	
<10 yrs.	3838	8065	9865	6.91	9.15	12.32
experience	(3603)	(7969)	(11466)	(6.71)	(9.14)	(12.64)
10-19 yrs.	3903	10947	20247	9.66	12.45	18.71
experience	(4630)	(14176)	(23521)	(10.11)	(13.14)	(19.74)
20-29 yrs.	3706	13270	22049	11.85	15.15	22.77
experience	(4816)	(16320)	(30951)	(11.99)	(15.43)	(23.36)
≥ 30 yrs.	3762	12129	23661	11.91	15.57	23.59
experience	(2160)	(5947)	(9884)	(11.51)	(14.82)	(22.98)
		2003 Hours-Women			*2003 Wages-Women*	
<10 yrs.	2531	6206	10759	5.92	7.94	11.06
experience	(2339)	(7128)	(17790)	(5.98)	(8.39)	(12.40)
10-19 yrs.	1561	6600	15161	8.53	10.59	15.66
experience	(4154)	(19518)	(37788)	(8.86)	(11.24)	(16.56)
20-29 yrs.	2303	11371	20278	9.18	11.64	16.99
experience	(981)	(4613)	(1584)	(8.65)	(10.94)	(15.90)
≥ 30 yrs.	1119	7154	10963	8.92	11.04	15.60
experience	(40)	(71)	(0)	(5.58)	(7.29)	(--)
		2004 Hours – Men			*2004 Wages – Men*	
<10 yrs.	3762	8282	9705	7.02	9.18	12.80
experience	(3546)	(8165)	(11348)	(6.87)	(9.16)	(13.12)
10-19 yrs.	3927	11508	20248	9.82	12.39	19.26
experience	(4661)	(14768)	(23361)	(10.34)	(13.07)	(20.46)
20-29 yrs.	3766	13700	21940	11.94	15.08	23.62
experience	(4997)	(17485)	(30618)	(12.07)	(15.33)	(24.13)
≥ 30 yrs.	4019	13118	23938	11.98	15.44	24.35
experience	(2270)	(6191)	(10505)	(11.61)	(14.63)	(23.66)
		2004 Hours –Women			*2004 Wages – Women*	
<10 yrs.	2650	6072	11296	6.04	8.03	11.24
experience	(2392)	(6918)	(18036)	(6.08)	(8.44)	(12.51)
10-19 yrs.	1562	6443	15227	8.46	10.54	15.65
experience	(4333)	(18976)	(38553)	(8.82)	(11.23)	(16.57)
20-29 yrs.	2409	11238	20593	9.27	11.64	16.93
experience	(902)	(4703)	(1719)	(8.85)	(11.22)	(16.43)
≥ 30 yrs.	1051	6953	11192	9.08	11.31	16.07
experience	(45)	(108)	(0)	(6.54)	(8.23)	(--)

Notes: Data are from 2004 and 2005 CPS, which yield wage and employment information for 2003 and 2004, respectively. The results under the current imputation methodology appear in parentheses.

TABLE 5. Components of 2004 labor composition index using compressed matrix: proposed imputation (current imputation)

	<12 yrs. schooling	**12 yrs. schooling**	**>12 yrs. schooling**	**<12 yrs. schooling**	**12 yrs. schooling**	**>12 yrs. schooling**
	Δ ln(hours) – Men			*Average cost share – Men*		
<10 yrs.	-.0132	.0279	-.0174	.0075	.0206	.0336
experience	(-.0125)	(.0258)	(-.0113)	(.0069)	(.0204)	(.0402)
10-19 yrs.	.0113	.0515	.0023	.0111	.0386	.1050
experience	(.0126)	(.0431)	(-.0043)	(.0137)	(.0526)	(.1290)
20-29 yrs.	.0170	.0376	-.0056	.0128	.0570	.1400
experience	(.0373)	(.0736)	(-.0115)	(.0172)	(.0728)	(.2009)
≥ 30 yrs.	.0592	.0758	.0122	.0137	.0555	.1577
experience	(.0417)	(.0333)	(.0607)	(.0075)	(.0258)	(.0662)
	Δ ln(hours) – Women			*Average cost share – Women*		
<10 yrs.	.0395	-.0229	.0460	.0043	.0133	.0334
experience	(.0187)	(-.0321)	(.0123)	(.0040)	(.0161)	(.0606)
10-19 yrs.	.0007	-.0255	.0036	.0037	.0188	.0646
experience	(.0351)	(-.0272)	(.0205)	(.0104)	(.0592)	(.1724)
20-29 yrs.	.0362	-.0107	.0169	.0060	.0360	.0944
experience	(-.0873)	(.0044)	(.0867)	(.0023)	(.0143)	(.0073)
≥ 30 yrs.	-.0681	-.0373	.0215	.0027	.0216	.0480
experience	(.0916)	(.4095)	(--)	(.0001)	(.0002)	(--)

Notes: Data are from 2004 and 2005 CPS, which yield wage and employment information for 2003 and 2004, respectively. The results under the current imputation methodology appear in parentheses. Δ ln(hours) is measured as $\ln(\text{hours}_{2004}/\text{hours}_{2003})$. Average cost share is measured using the arithmetic average.

TABLE 6. Labor composition and related measures, using proposed imputation and BLS published statistics

	Proposed methodology			BLS published		
	% chg. hours	% chg. labor input	% chg. composition	% chg. hours	% chg. labor input	% chg. composition
1985	3.43	3.47	.035			0.3
1986	2.79	2.42	-.368			0.5
1987	2.74	3.41	.674			0.3
1988	2.49	3.16	.672	2.7	3.5	0.8
1989	1.75	2.81	1.06	2.7	3.1	0.4
1990	0.34	0.32	-.027	-0.5	0.0	0.5
1991	-0.76	0.73	1.49	-2.3	-1.2	1.1
1992	0.31	1.67	1.36	-0.2	-0.8	1.2
1993	2.31	2.75	.441	2.7	2.9	0.2
1994	2.66	3.80	1.15	4.0	4.5	0.5
1995	3.05	3.74	.686	2.8	2.9	0.1
1996	2.42	3.49	1.07	1.6	2.0	0.4
1997	1.84	2.59	.752	3.4	4.0	0.6
1998	2.26	2.63	.377	2.0	2.3	0.3
1999	1.59	2.38	.793	2.1	2.7	0.6
2000	1.49	1.59	.106	1.1	1.2	0.1
2001	.776	1.81	1.03	-2.2	-1.3	0.9
2002	-.450	.237	.687	-2.4	-1.2	1.2
2003	-.282	.109	.391	-0.5	-0.1	0.5
2004	1.36	1.32	-.033	1.3	1.5	0.2
1984-2004	1.5	2.4	.9			
1987-2004	1.2	2.3	1.1	1.0	1.6	0.6

Notes: Growth is measured as $\ln(X_t/X_{t-1})$. Source for published figures: http://www.bls.gov/web/mprlabor.pdf

TABLE 7. Decomposition of labor composition growth into partial education and experience indices

	Education	Experience	Interaction
1985	.35	-.60	.29
1986	.21	-.62	.04
1987	.03	-.11	.75
1988	.39	.09	.19
1989	.10	.90	.06
1990	.12	.85	-1.0
1991	.69	.68	.12
1992	.87	.68	-.19
1993	.20	.17	.07
1994	.54	.85	-.24
1995	-.20	.81	.08
1996	.13	.58	.36
1997	.29	.34	.12
1998	.19	.09	.10
1999	.44	.17	.18
2000	.03	.02	.06
2001	.51	.44	.08
2002	.40	.37	-.08
2003	.37	.05	-.03
2004	-.11	.15	-.07
1987-2004	.26	.64	.10

Notes: data are from 1985-2005 March CPS, which yield wage and employment data for 1984-2004. First two columns show labor composition indices calculated with only separate gender and education/experience groups. The third column is derived by subtracting the first two columns from the corresponding total labor composition index.

TABLE A1. 1973 CPS-SSA experience models		
	Men	**Women**
Constant	.750*** (.106)	.550** (.229)
Potential experience	.963*** (.011)	1.065*** (.030)
Potential experience^2	-.005*** (.000)	-.009*** (.001)
Ever married		.500* (.250)
Potential experience * ever married		-.255*** (.038)
Pot. exper.^{2} * ever married		.004*** (.001)
Pot. exper. * 1 kid		-.075*** (.020)
Pot. exper. * 2-3 kids		-.208*** (.017)
Pot. exper. * 4+ kids		-.285*** (.022)
0-4 yrs. schooling	4.808*** (.925)	-4.583*** (.992)
5-8 yrs. schooling	3.288*** (.274)	-2.783*** (.647)
12 yrs. schooling	1.248*** (.089)	.995*** (.262)
Some college	2.475*** (.155)	2.210*** (.307)
BA degree	3.595*** (.200)	2.868*** (.434)
Advanced degree	3.973*** (.284)	4.098*** (.872)
Pot. exper. * 0-4 yrs. school	-.015 (.250)	.048 (.053)
Pot. exper. * 5-8 yrs. school	.038*** (.008)	.035** (.018)
Pot. exper. * 12 yrs. school	--	-.015 (.011)
Pot. exper. * some college	-.013 (.007)	-.113*** (.014)
Pot. exper. * BA degree	-.038*** (.009)	-.153*** (.023)
Pot. exper. * advanced degree	-.113*** (.014)	-.268*** (.037)
Previous exper.	-.093*** (.006)	--
Pot. exper. * nonprofit industries	-.083*** (.006)	-.070*** (.010)
Number of observations	17,120	8,663
R-squared	.84	.60
Source: BLS Bulletin 2426, Table C-2 and C-3. Estimates divided by 4 to translate to annual experience measure. Standard errors in parentheses calculated from t-statistics reported in tables.		