BLS WORKING PAPERS

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics

OFFICE OF COMPENSATION AND
AND WORKING CONDITIONS

Wage Inflation in the ECI and Across-Group Inequality

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Working Paper 320
January 1999

I thank the members of the Compensation Research and Program Development Group and the Office of Employment Research and Program Development of the U.S. Bureau of Labor Statistics for their comments. The opinions expressed in this paper reflect the views of the authors, and do not necessarily reflect the policies of the U.S. Bureau of Labor Statistics or the views of other staff members.

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Abstract

The U.S. Bureau of Labor Statistic (BLS) introduced the Employment Cost Index (ECI) as a more appropriate measure of wage inflation than existing wage series. Along with the index for all workers, the BLS reports subindices for industry and occupation groups. Although the ECI is a unique measure, variation among its subindices relates to other measures of wage dispersion, which have developed as part of the inequality literature. This paper therefore compares wage inflation in the ECI with average wage rates in the Current Population Survey (CPS) for industry and occupation groups.

During the 1980's, the change in a group's average wage rate in the CPS correlated closely with its wage inflation in the ECI. Since then, however, the ECI shows little difference in compensation growth across industries or occupations, while the CPS has continued to show significant variation.

Many authors document a widening of the wage distribution in the United States over the last 25 years, especially during the 1980's.[1] In measuring inequality, authors often divide the dispersion of wage rates between within-group and across-group variation, where demographic characteristics such as age and education define the skill groups of workers. In the 1980's, the across-group variation increased, which augmented an overall increase in the variance of wages. That is, average wage rates among the various groups of workers diverged during that period.

Average wage rates provide one measure of wage inflation over time. However, the Bureau of Labor Statistics developed the Employment Cost Index (ECI) in the 1970's in response to requests for a wage-inflation measure that is free of changes in the composition of jobs over time. The wage series then available provided little or no control for shifts over time in the mix of workers in the labor market. By following a panel of jobs over three-month periods, the ECI would represent more accurately how much a firm expects to raise its compensation to retain its labor input. Indeed, since the inception of the ECI, the topside indices for all civilian and all private workers have generally grown at different rates than average wage series.[2]

Although the topside indices are the ECI series watched most closely, several subindices are reported also, notably for industry and occupations groups. These subindices provide an opportunity to compare trends in the ECI with trends in average wage rates for the subgroups, thereby linking wage inflation from the ECI with results

[1] For example, see Bound and Johnson (1992), Levy and Murnane (1992), and the symposium on wage inequality in the Spring 1997 issue of the Journal of Economics Perspectives.

from the inequality literature. This paper is therefore organized as follows. The next section describes the calculation of the ECI and presents an equation to document its growth among industry and occupation groups. The section then defines across-group variation from the inequality literature and relates its change over time to wage inflation for the groups in the ECI. Industry and occupation define the skill groups because the ECI does not collect demographic information about workers. Previous studies, which primarily use data from the Current Population Survey (CPS), are not directly comparable because they define skill groups by age, education, and other demographic characteristics. Therefore, the empirical section compares wage growth in the ECI and the CPS when parallel specifications are used. The final section summarizes.

The results suggest that, during the 1980's, the variation in wage growth among industry and occupation groups in the ECI was quite similar to the corresponding change in average wage rates in the CPS. Thus, for those years, average wage rates for the groups accurately represent the variation in wage inflation incurred by employers for the same labor input over time, at least with workers defined by their industry and occupation. Since then, however, the ECI has shown much less systematic variation in wage inflation among the groups, while the CPS has continued to show systematic differences in the growth of average wage rates among the industry and occupation groups.

I. Empirical Specification

A. Calculation of the ECI

[2] See Lettau, Loewenstein, and Cushner (1997b) and results below.

The Employment Cost Index is the aggregation of wage rates for the sample of jobs matched between the current period and the period three months prior. The aggregation occurs in two steps. In the first step, the change in the wage rate is estimated for about 650 categories of labor, which are defined by the intersection of industry and occupation groups. The change equals the average wage rate in the current quarter divided by the average wage rate in the previous quarter among jobs in the category. Each job gets the same sample weight in the two quarters. In the second step, following a Laspeyres index formula, the change in compensation for the categories are combined using fixed employment weights from a base period.[3]

When the ECI micro data from multiple periods are pooled, a natural specification to compare the growth in wage rates among industry/occupation groups is the following.

[1] $$E[\Delta \ln(w)] = q'\gamma + x'\delta$$

The vector q contains dummy variables for each period, while the vector x contains dummy variables for each industry/occupation group. If the log change in the wage rate were regressed on the period dummy variables only, the coefficient estimates would essentially give the three-month change in the ECI for each period.[4] Adding the industry/occupation variables therefore picks up the tendency for the groups' wage rates to grow at different rates in the ECI. Data from multiple periods are pooled because the three-month change in wage rates is quite noisy. Many of the jobs show no change while

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[3] For more information, see BLS Handbook of Methods (1997) and Lettau, Loewenstein, and Cushner (1997a).

[4] There are slight differences. Because of the log functional form, the regression uses differences in geometric means rather than ratios of arithmetic means. Also, the fixed employment weights are not applied. However, the growth in the ECI has been quite invariant to such minor modifications. See Lettau, Loewenstein, and Cushner (1997a).

others show large changes. Pooling the data allows the industry/occupation coefficients to pick up more systematic variation in wage inflation among the groups.

Although the primary purpose of this paper is to estimate the industry/occupation parameters in equation [1] for the ECI, the context in which to consider these estimates is to compare them to trends in average wage rates for the groups, which previous studies on inequality have developed. Therefore, the next subsection puts the parameters from equation [1] into the context of the inequality literature.

B. Across-Group Variation

The inequality literature uses the analysis-of-variance formula to divide the overall variance in wage rates for a cross-section of workers between within- and across-group variation.

[2] $$V[\ln(w)|Z] = E_x\{V[\ln(w)|X,Z]\} + V_x\{E[\ln(w)|X,Z]\}$$

The vector X defines the groups, while the vector Z represents control variables. The second term on the right-hand side of equation [2] shows the variance in average log wage rates among the groups defined by X, controlling for the variables in Z. Not surprisingly, the parameters in equation [1] relate to the change in the second term over time.

It helps to rewrite equation [1] in its log wage form and to be more explicit about the control variables.

[3] $$E[\ln(w)|x,z,q] = z'\beta + q'\alpha + x'\pi + t\cdot x'\delta$$

The vector q still contains dummy variables for each quarter, although its parameter vector is redefined for levels rather than first differences. The vector of dummy variables for each industry/occupation group is now additionally multiplied by a time trend t, which increments by one for successive three-month periods, starting at zero for three months prior to the first current period. Equation [3] is equivalent to equation [1] when the vector z contains a dummy variable for each job in adjacent periods. But also consider equation [3] as a general specification for the average log wage for the groups defined by x and conditioned on the time period and the variables in z. With this structure and assuming a fixed distribution of X over time, the change in the across-group variance between period t and t-1 equals the following.

$$[4] \qquad \Delta V_x\{E[\ln(w)|X,Z]\} = (2\cdot t\text{-}1)V_x(\delta) + 2\cdot Cov_x(\pi,\delta)$$

The $V(\delta)$ term equals the variance among the parameters in δ, while $Cov(\pi,\delta)$ equals the covariance between the parameters in π and δ.

Previous results from the CPS imply that, in the 1980's, wage rates grew at different rates among age/education groups, and groups with a higher growth rate tended to be the groups with a higher initial wage. Thus, both terms on the right-hand side of equation [4] were positive, which led to increased dispersion. Because industry and occupation defines the skill groups in this paper, results for age/education groups are not strictly comparable. Therefore, the empirical section also reports estimates of the standard deviation among the parameters in δ for the CPS to provide a context for the ECI estimates.

The standard deviation for the ECI, denoted by $\sqrt{V_x(\delta^{ECI})}$, is based on the parameters from equation [1]. The standard deviation for the CPS, denoted by $\sqrt{V_x(\delta^{CPS})}$, is based on the parameters from equation [3], with the control variables in z equal to dummy variables for five age categories, four education categories, and four census region categories, and dummy variables for whether the worker is white, male, married, part-time, and covered by a collective bargaining agreement. Consequently, the CPS parameters show the growth in average wage rates for the industry/occupation groups, adjusted for the change in the distribution of these characteristics over time, while the ECI parameters show wage inflation for the industry/occupation groups within the same job.

Because the ECI is designed to measure wage growth, the empirical section concentrates on the dispersion among the parameters in δ, rather than a complete estimate of the change in across-group variation over time. In fact, the job dummy variables subsume the industry/occupation dummy variables for the ECI in equation [3], so the parameters in π are not identified.[5] Nonetheless, the empirical section does report some information on the across-group variation, using the initial level of wages from the CPS.

II. Data

The paper uses micro data from the Employment Cost Index and the Current Population Survey. The ECI data are available for four months of the year: March, June, September, and December. The CPS data are from outgoing-rotation groups, and they are restricted to March, June, September, and December to match the ECI. The data run from June 1981 through December 1998. As mentioned above, authors using the CPS generally define the skill groups based on demographic information such as age and education, but this paper defines categories of workers by the intersection of nine major industries and nine major occupations. The appendix discusses many further details of the CPS and ECI data.

The nine industries and nine occupations define the industry/occupation groups, so the parameter vector δ contains 81 elements. The first element is defined arbitrarily as zero. The regressions use the sample weights from the CPS and the ECI. Also, the weighted frequency for each industry/occupation group is calculated using data pooled across all the periods. This provides a frequency vector **f**. In addition, variance matrices **V** that correspond to δ are estimated for the CPS and the ECI. The variance matrices are used to adjust the measures of dispersion among the parameters for expected variation due to sampling. The appendix discusses the adjustment in detail.

III. Empirical Results

A. Main Results

Table 1 shows dispersion statistics among the industry/occupation parameters using data for the entire period, June 1981 through December 1998. The table shows the standard deviation both before and after the adjustment for sampling variation. The estimates for the correlation with the CPS parameters use the adjusted standard deviations, so they can be greater than one. The standard deviation and correlation statistics use the frequencies for each industry/occupation group from the CPS. Although not shown, the results are similar when frequencies from the ECI are used.

The top third of Table 1 shows results across the 81 industry/occupation parameters, while the middle and bottom thirds show results across the nine industries and the nine occupations, respectively. The nine industry parameters equal the weighted average of the 81 industry/occupation parameters across occupations. The corresponding

[5] Strictly speaking, it is also contradictory to discuss variation in expected wage growth across industries and occupations conditional on a job, because holding a job constant also holds the industry and occupation

procedure is used to calculate the nine occupation parameters. The final column of the table shows the test statistic for the joint hypothesis that all groups have the same growth rate.

Table 1 includes results for total benefits and total compensation from the ECI for completeness, but the primary comparison is between the CPS and the ECI for wages. As the final column shows, the hypothesis that the wage rate for all industry/occupations groups grew at the same rate is rejected at five percent for both the CPS and the ECI. The adjusted standard deviation among the 81 industry/occupation parameters is virtually the same for the CPS and the ECI for wages at 1.30×10^{-3} and 1.33×10^{-3}, respectively. To give an idea of the magnitude of these values, the average three-month change in the log wage rate for the ECI over the period is 9.40×10^{-3}, which translates into about a 3.8 percent annual growth rate. Therefore, the standard deviation for an industry/occupation group is 14 percent of the overall growth rate. The adjusted correlation between the CPS and ECI parameters is also fairly high at 0.69.

The results for the nine industries and nine occupations in the middle and bottom of Table 1 are also quite similar between the CPS and the ECI for wages. The adjusted standard deviation across the industries is the same within rounding. Moreover, while the adjusted standard deviation across the occupations is slightly lower for the ECI than the CPS, their difference is small in magnitude and the correlation between the two is quite high at 0.79.

Table 1 gives only measures of dispersion among the parameter estimates for the groups, so Chart 1 shows the individual estimates for the nine occupations to illustrate their magnitude more clearly. The parameter estimates are differenced from their

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constant. Any illogic here is ignored.

weighted average to set the mean to zero. The chart makes apparent the similar variance and the high correlation between the ECI and the CPS parameter estimates. Only the estimates for sales and service occupations differ in sign. In fact, the results are close enough that it is worth reiterating that the ECI and CPS parameters for the industry/occupation groups are not hypothesized to be the same. The CPS shows trends in average wages controlling for broad changes in the demographic characteristics of workforce, while the ECI measures the wage inflation an employer expects to incur for its labor input. Indeed, breaking the entire sample period into subperiods reveals more substantive differences between the estimates for the ECI and CPS.

As mentioned above, the ECI micro data on the change in the wage rate are quite noisy. In terms of a coefficient of variation, the standard deviation of the three-month log change ranges from five to eleven times the sample mean for the periods between March 1986 and December 1996. Pooling the data from multiple periods helps counterbalance the noise to find systematic differences in wage growth among the industry/occupation groups. The drawback, of course, is that the differentials are constrained to be constant across the periods. Therefore, the next set of tables reports results for subperiods, through incorporating dummy variables into equations [1] and [3].

Equation [5] shows the specification used for the ECI, where j is the index for the subperiods, t_j equals the period three months prior to first current period in the subperiod, and the indicator function $1[t>t_j]$ equals one if the current period is later than t_j, zero otherwise.

[5] $$E[\Delta\ln(w)] = q'\boldsymbol{\gamma} + \boldsymbol{\Sigma}_j 1[t>t_j]\cdot x'\boldsymbol{\delta}_j$$

For example, the expected change for an industry/occupation group in a period from the subperiod j equals the period's coefficient in γ plus the sum of the group's coefficients in δ_1 through δ_j. Equation [5] uses the accumulation of coefficients for the previous subperiods, rather than a separate coefficient for each subperiod, because it makes the mapping to the log-wage specification easier. The first difference in equation [5] translates into a spline function for the expected log wage.

$$[6] \qquad E[\ln(w)] = z'\beta + q'\alpha + x'\pi + \Sigma_j 1[t>t_j]\cdot(t-t_j)\cdot x'\delta_j$$

Equation [6] is used for the CPS.

Tables 2 and 3 show results for two subperiods, with March 1990 used as the break. March 1990 was chosen for two reasons. First, many of the CPS results from previous studies refer to the 1980's, so they provide a more appropriate context for ECI results that are likewise restricted to the 1980's. Second, the two periods correspond roughly in terms of the business cycle. Both begin with recessionary periods followed by a longer period of expansion.

Table 2 shows dispersion statistics for the earlier subperiod, June 1981 through March 1990. The hypothesis that wage rates grew at the same rate for all the industry/occupations groups is again rejected at five percent for both the CPS and the ECI for wages, as are the corresponding hypotheses for the industry and occupation groups. The standard deviations are larger in magnitude than for the entire period, but nominal wage rates grew at a higher rate during the subperiod also. The average three-month change in the log wage rate for the ECI translates into a 4.5 percent annual growth rate, so the deviation around the growth rate might be expected to be higher also.

Of the results in Table 2, the dispersion measures for the nine occupations probably fit the expected relationship between the ECI and CPS. Previous studies suggest that skill-biased demand shifts explain the stronger growth in average wage rates for some groups relative to others. The growth in average wage rates likely occurred not just through stronger wage growth within jobs, but also through the creation of and movement toward higher-paying jobs within the group. Under this scenario, the ECI will show less variation because it picks up only the wage growth within jobs. However, for the industry/occupation and the industry groups, the standard deviation estimates are actually higher for the ECI than the CPS, not lower.

Thus, for the 1980's, the variation in the growth of average wage rates among the groups from the CPS does not substantially overstate nor misrepresent the variation in wage inflation incurred by employers to retain their labor input. The same is not true for the years since then, however. Table 3 shows results for the second subperiod, March 1990 through December 1998. The standard deviation estimates for the ECI are small in magnitude, both relative to the CPS in the same period and the ECI in the earlier period. Moreover, while the growth rates for the various groups continue to be jointly significant for the CPS, the hypothesis that the wage rates for various groups all grew at the same rate cannot be rejected at five percent for the ECI. In fact, for the industry/occupations groups, the expected variation due to sampling error is large enough that the adjusted standard deviation estimate becomes negative. Therefore, since 1990, employers have not incurred substantially different rates for wage inflation for some workers relative to others, at least with the workers defined by industry and occupation groups.

The difference in the results for the two subperiods leads to the question of how the results vary over time under a less structured specification, which does not force the differentials in wage growth for the groups to be constant within the subperiods nor chooses a break period arbitrarily. Equations [7] and [8] show general specifications for the ECI and CPS regressions.

[7] $E[\Delta \ln(w)] = q'\gamma + \Sigma_k 1[t=t_k] \cdot x'\delta_k$

[8] $E[\ln(w)] = z'\beta + q'\alpha + \Sigma_k 1[t=t_k] \cdot x'\pi_k$

The ECI specification has a separate change parameter for each group in each period, while the CPS specification has a separate level parameter for each group in each period.

Defining the groups by industries and occupations leads to a prohibitive number of parameters, but consider results with the groups defined by the nine occupations. Chart 2 shows the standard deviations for the ECI and the CPS using the following procedure. For the ECI, the entire period gives 70 times 9 change parameters for the period/occupation combinations. The estimates for these parameters are then regressed on period dummy variables, and the residuals are smoothed separately for each occupation using a kernel estimator. The same procedure is used for the CPS, although the CPS regression gives 71 times 9 level parameters for the period/occupation combinations, so the level estimates are differenced by occupation before they are regressed on the period dummy variables.[6]

The specification in equation [1] used earlier assumes that the expected wage growth for the group, apart from the period coefficient, is constant for each period. Equation [5] allows the group's expected wage growth to be discontinuous at the break period but otherwise constant within the subperiod, apart from the period coefficient. In contrast, the kernel estimator assumes only that the group's expected wage growth, again apart from the period coefficient, is a smooth function over time. Chart 2 shows the standard deviation estimates among the nine occupations, both before and after the adjustment for sampling variation. The kernel estimates use the normal density function and a bandwidth of eight periods (two years). Like many kernel estimates, the results are sensitive to the choice of bandwidth. Also, even though Chart 2 shows the variation among nine kernel estimates, not the individual estimates themselves, the standard deviations still undulate over time, as can be typical of moving averages of noisy data.

Chart 2 is reported because the results for the subperiods in Tables 2 and 3 may misrepresent the decline in the variance of wage inflation among the occupations, due to the arbitrary choice of the break period. The kernel estimates do suggest some fluctuation within the 1980's. For the CPS, the variation was quite high in the early 1980's, but it declined precipitously to where its standard deviation was lower than the corresponding estimate for the ECI by the late 1980's. The standard deviation for the ECI also declined during the 1980's, but its decline was steadier. For the 1990's, in Table 3, the unadjusted standard deviation for the ECI was only 52 percent of the magnitude of the CPS, and the hypothesis that wage inflation for all occupation groups was the same cannot be rejected. In chart 2, except for the upturn of the CPS in the last several periods, the differential between the ECI and the CPS is never quite that large. This is due in part to the forced smoothness in the kernel estimates. When the kernel estimates are allowed to be discontinuous between the 1980's and 1990's, the ECI

[6] When the residuals for the ECI and CPS are regressed on a specification that corresponds to equations [1] and [3], rather than smoothed using a kernel estimator, the results are essentially the same as in the bottom

variation is a smaller fraction of the CPS variation. The correlation and adjusted correlation between the ECI and CPS are superimposed in Chart 2 on the right-hand axis. When the systematic variation is large in magnitude during the 1980's, the correlation nears one. But when the systematic variation is smaller in magnitude during the 1990's, the correlation is much more erratic and actually becomes negative for several periods.

Taken as a whole, the subperiod results and the kernel estimates imply that, during the 1980's, wage inflation in the ECI was highly correlated with the change in average wage rates in the CPS for the industry and occupation groups. The magnitude of their variation also nets out to be roughly the same, although the change in average wage rates seems first to overstate then to understate the variation in wage inflation. The high correlation breaks down for the 1990's, however, and wage inflation from the ECI no longer seems to differ substantially among the groups, particularly in the most recent periods.

B. Related Issues

The results presented so far are the main results for the paper. However, to relate wage inflation from the ECI to previous results from the CPS more fully, a few additional issues must be addressed. Foremost is the link between wage inflation and across-group variation from the inequality literature. Also related is the mean wage inflation in the ECI compared with the mean wage growth in the CPS. These final results are based on the kernel estimates for the occupation groups.

1. Across-Group Variation

Different rates of wage growth for the various groups are generally not sufficient to increase the across-group variance in wage rates. As equation [4] shows, the rates of

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of Table 1.

growth must also correlate positively with the group's initial wage level. Chart 3 shows the across-group variation for the nine occupation groups. The series labeled "CPS" equals the adjusted standard deviation among the level parameters in equation [8] by period. For the "CPS kernel" series, each occupation's level parameter for the initial period is multiplied by the accumulated sum of the kernel estimates for the log change, which gives a simulated series for the occupation's expected log wage. The chart then shows the adjusted standard deviation among the nine occupations. Not surprisingly, the kernel series is a smoothed version of the across-occupation variation under the general specification. Both suggest that the variation among the occupations increased during the 1980's but leveled off and actually decreased since then, although the decline results from the last four periods so it not yet apparent whether the decline will persist. The ECI kernel uses the same procedure as the CPS kernel, but because the level parameters are not identified in the ECI regression, the CPS estimates for the initial period are used instead. In contrast to the CPS, the ECI variation increased more steadily throughout the period.

It is important to consider Chart 3 in light of the results already discussed, as it leads to the question of whether the trends in average wage rates for occupations continued into the 1990's. Chart 4 shows estimates for the individual occupations using equation [5] and a modified version of equation [6]. Recall that the specifications in [5] and [6] allow the growth parameters to differ between the earlier period, June 1981 to March 1990, and the later period, March 1990 to December 1998, but restrict them to be constant within the subperiod. The modification to equation [6] adds interactions of the industry/occupation variables and the demographic variables with a dummy variable for the later period, which allows for a more discontinuous break between the subperiods.[7] In Chart 4, the two leftmost bars for each occupation show the wage growth in the earlier period for the CPS and ECI, respectively, while the third and fourth bars show the corresponding growth parameters for the later period. As in Chart 1, each of the four series has its weighted mean set to zero.

Chart 4 reiterates several results from previous charts and tables. But most relevant to across-group variation, it demonstrates the extent to which wage inflation in the ECI and average wage rates in the CPS have diverged from their very similar pattern in the 1980's. For the ECI, the pattern among the occupations more or less continues into the 1990's, but the estimated variance among them diminishes to the point where it is no longer statistically significant. In contrast, the variation among the occupations continues to be significant for the CPS into the 1990's. However, the pattern among them changed to the point where the growth in across-group variation began to reverse.

2. Mean Wage Growth

The results so far are standard deviations of growth rates among the industry and occupation groups. The mean growth of wages has been largely ignored. Chart 5 shows the three-month change in expected log wage rates. For the ECI, the change for each period equals the average of the occupations' change parameters from equation [7] plus the average of the occupations' kernel estimates. For the CPS, the change equals the average of the first difference in the occupations' level parameters from equation [8] plus the average of the occupations' kernel estimates. Thus, both allow the period effect to be discontinuous but the deviation from the period effect for each occupation is smoothed over time.

[7] None of the results in Tables 2 and 3 change much when the interactions are added.

Over the entire period, the average three-month change translates into a 3.8 percent annual growth rate for the ECI and a 3.1 percent annual growth rate for the CPS. For the subperiods, with March 1990 as the break, the annual growth rates for the earlier period equal 4.5 and 3.3 percent for the ECI and CPS, respectively, and 3.4 and 2.9 percent, respectively, for the later period. Again, for the reasons cited above, these growth rates are not hypothesized to be the same, and to some extent their difference distinguishes the ECI as a measure of wage inflation. Nonetheless, the lower rate for the CPS does recast the extreme similarity of the variation in wage growth between the CPS and the ECI for the 1980's. If the variation around the mean is expected to increase with the mean, then the CPS variation in wage growth among the groups is relatively larger than the ECI variation in wage inflation, even though their standard deviations are nearly identical in magnitude.

IV. Summary

The Bureau of Labor Statistics introduced the Employment Cost Index as a unique measure of the change in compensation over time. The ECI provides a purer measure of wage inflation than other wage series because it is based on a panel survey of jobs. The BLS introduced subindices for various groups of workers. The movement of these indices fits readily with previous results from the inequality literature. Moreover, their variation over time describes differences in wage inflation among the groups, which provides a distinct measure for the distribution of wages, one that may be appropriate for some purposes, particularly for issues involving employer behavior.

The empirical results summarize wage inflation in the ECI for industry and occupation groups, with parallel results from the CPS presented for comparison. During the 1980's, when across-group variation in wage rates increased dramatically, the CPS and ECI results align closely. They are enough alike that it is probably valid to conclude that changes in average wage rates for groups defined by age, education, and other demographic characteristics similarly represent differences in the wage inflation that employers faced. More recently, however, when the trend in across-group variation has been less dramatic, wage inflation from the ECI does not differ significantly among the groups, and to the extent that the point estimates do differ, they do not particularly align with the change in average wage rates from the CPS.

Table 1
Summary of Dispersion among Growth Rates for ECI and CPS
June 1981-December 1998

	standard deviation	adjusted standard deviation	adjusted correlation w/ CPS	joint test statistic
Industries/Occupations:				
CPS	1.32	1.30	---	2,762.6*
ECI wages	1.55	1.33	0.69	231.7*
ECI benefits	1.58	1.13	0.52	137.9*
ECI compensation	1.42	1.12	0.63	206.6*
Industries:				
CPS	1.10	1.10	---	1,910.3*
ECI wages	1.14	1.10	0.67	112.3*
ECI benefits	1.13	1.06	0.50	56.6*
ECI compensation	1.07	1.04	0.59	104.0*
Occupations:				
CPS	1.02	1.02	---	1,648.3*
ECI wages	1.04	0.99	0.79	104.5*
ECI benefits	0.77	0.66	0.74	31.9*
ECI compensation	0.91	0.87	0.76	86.5*

Notes: The estimates for the standard deviation and adjusted standard deviation are multiplied by 10^3. An asterisk indicates statistical significance at five percent.

Table 2

Summary of Dispersion among Growth Rates for ECI and CPS
June 1981-March 1990

	standard deviation	adjusted standard deviation	adjusted correlation w/ CPS	joint test statistic
Industries/Occupations:				
CPS	2.41	2.36	---	1,871.6*
ECI wages	2.73	2.48	0.81	316.1*
ECI benefits	2.49	1.94	0.54	180.2*
ECI compensation	2.45	2.20	0.76	271.6*
Industries:				
CPS	1.60	1.59	---	820.5*
ECI wages	1.99	1.95	0.87	152.3*
ECI benefits	1.68	1.59	0.72	54.7*
ECI compensation	1.84	1.80	0.82	136.1*
Occupations:				
CPS	2.05	2.05	---	1,353.9*
ECI wages	1.81	1.77	0.88	144.4*
ECI benefits	1.07	0.90	0.47	26.6*
ECI compensation	1.51	1.45	0.82	104.0*

Notes: The estimates for the standard deviation and adjusted standard deviation are multiplied by 10^3. An asterisk indicates statistical significance at five percent.

Table 3
Summary of Dispersion among Growth Rates for ECI and CPS
March 1990-December 1998

	standard deviation	adjusted standard deviation	adjusted correlation w/ CPS	joint test statistic
Industries/Occupations:				
CPS	1.44	1.35	---	640.1*
ECI wages	0.79	---	---	46.2
ECI benefits	1.74	0.86	-0.63	125.2*
ECI compensation	0.89	---	---	65.7
Industries:				
CPS	1.12	1.11	---	384.2*
ECI wages	0.44	0.25	-0.03	12.0
ECI benefits	0.91	0.76	-0.48	27.1*
ECI compensation	0.52	0.38	-0.31	18.2*
Occupations:				
CPS	0.82	0.81	---	212.5*
ECI wages	0.43	0.18	-0.90	11.2
ECI benefits	0.90	0.72	-0.63	24.9*
ECI compensation	0.51	0.35	-0.60	17.0*

Notes: The estimates for the standard deviation and adjusted standard deviation are multiplied by 10^3. An asterisk indicates statistical significance at five percent.

Chart 1
Occupation Growth Rate Parameters for ECI and CPS
June 1981-December 1998

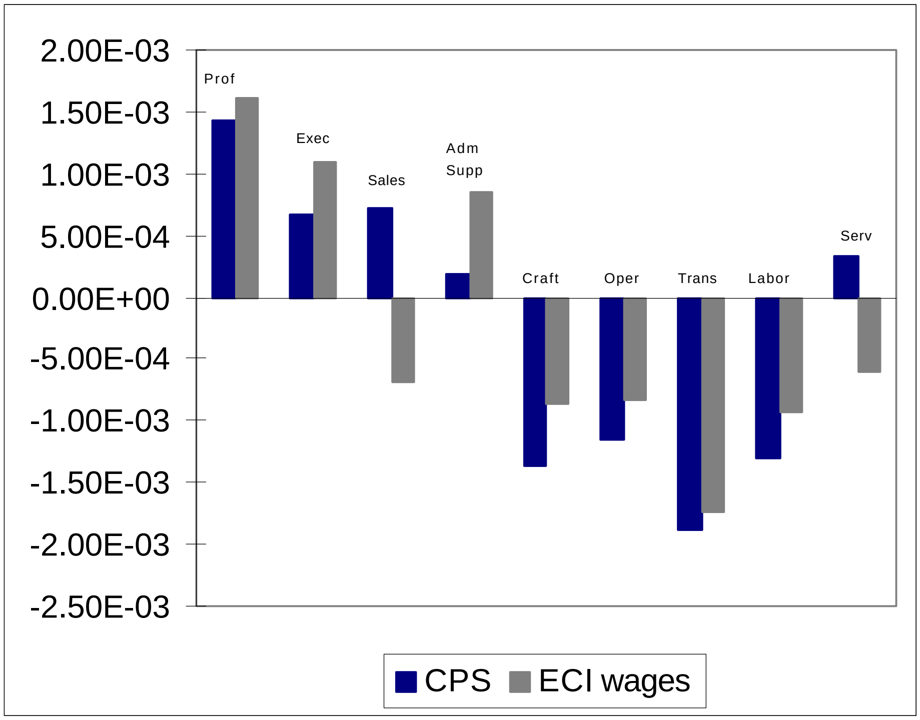


Chart 2
Dispersion among Occupation Growth Rates for ECI and CPS
June 1981-December 1998

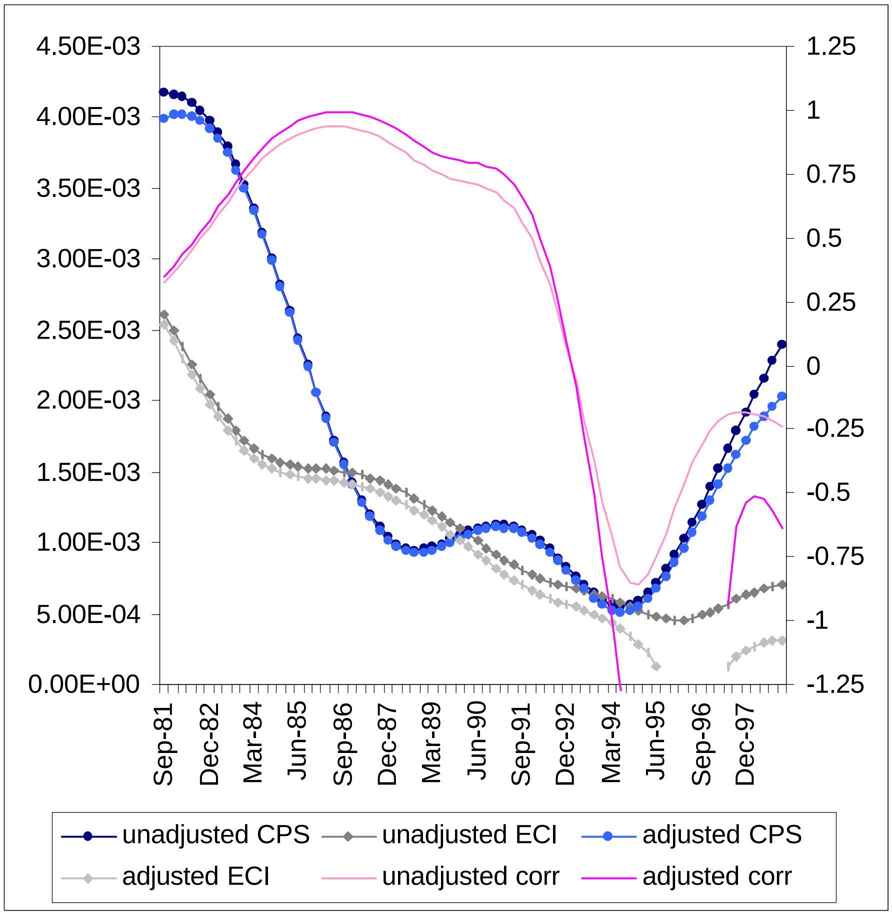


Chart 3
Across-Occupation Variation for ECI and CPS
June 1981-December 1998

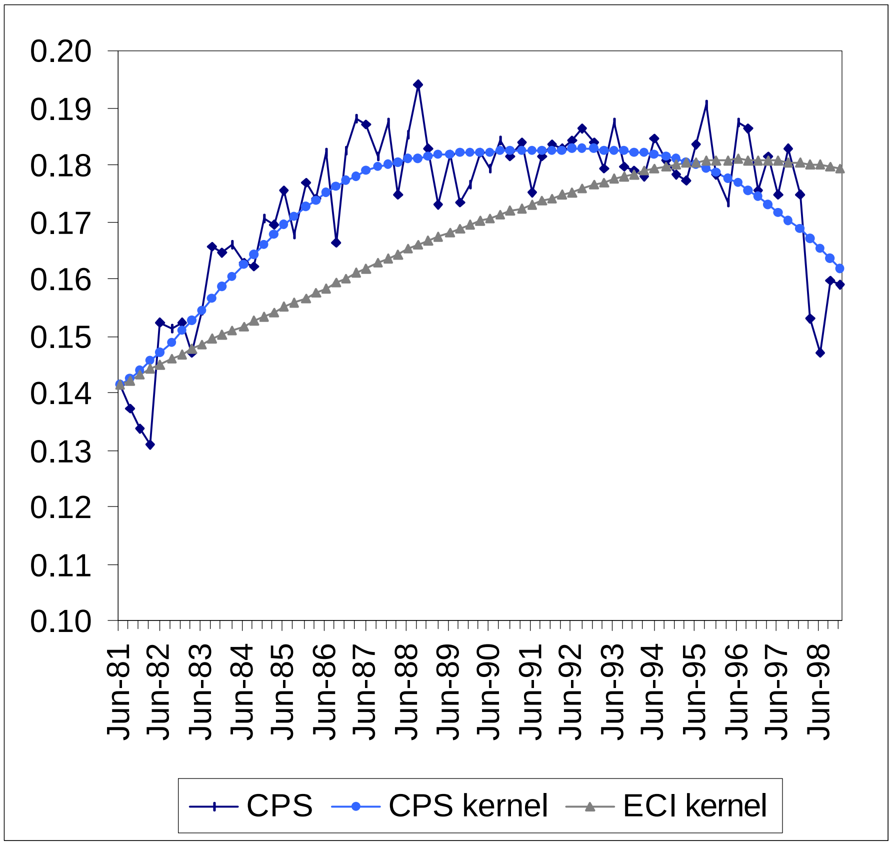


Chart 4
Occupation Growth Rate Parameters for ECI and CPS
June 1981-March 1990 and March 1990-December 1998

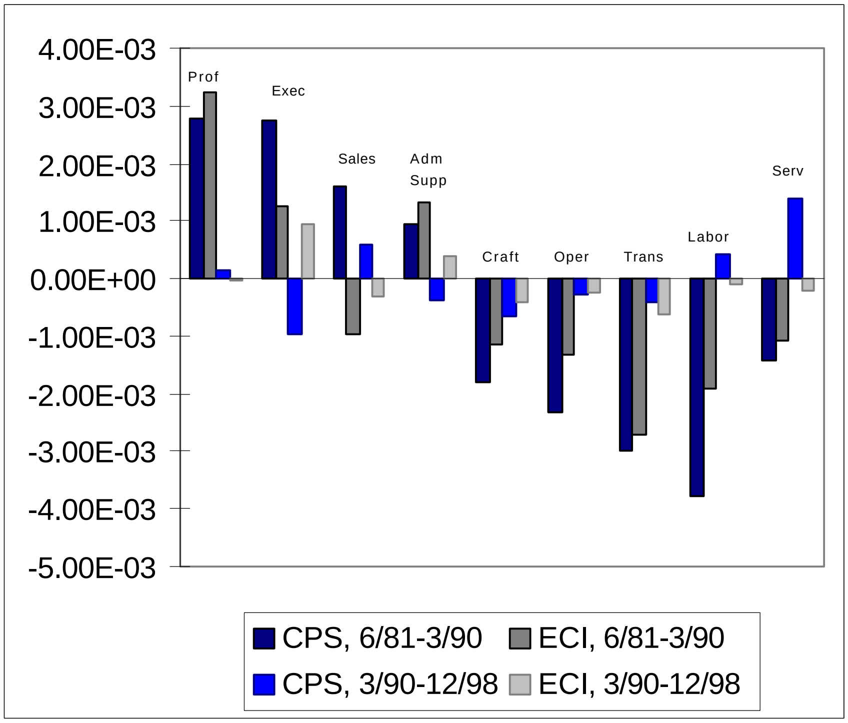
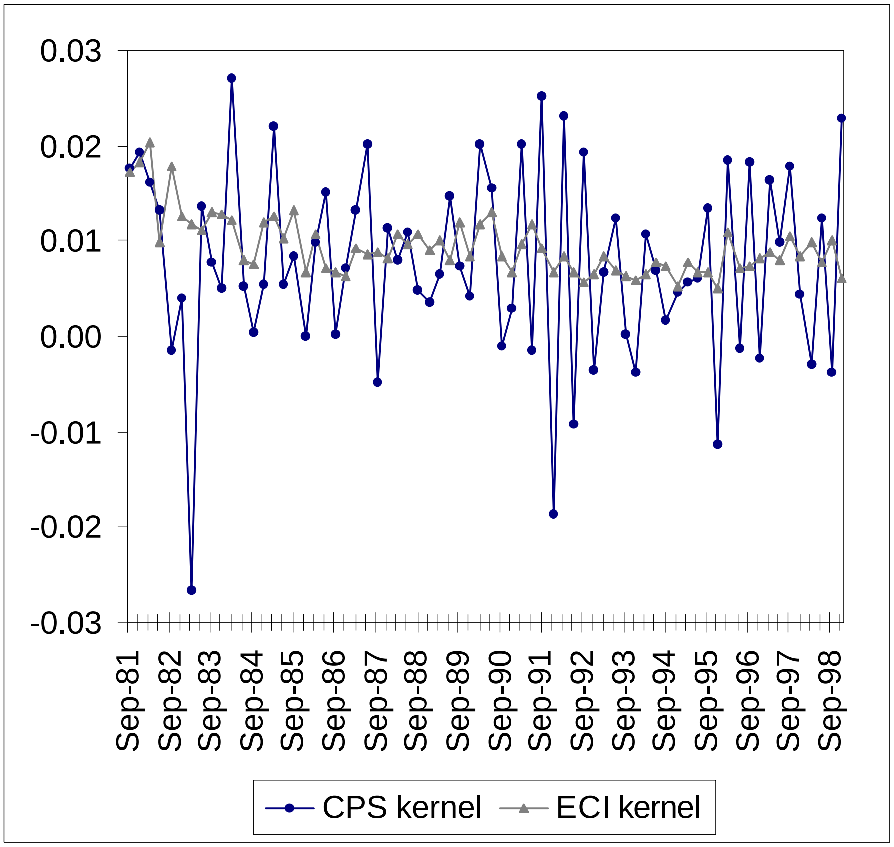


Chart 5
Mean Wage Growth for ECI and CPS
June 1981-December 1998



Appendix

A.I. CPS and ECI Data

The ECI is a survey of jobs within establishments. For each establishment in the survey, a small number jobs are sampled randomly, usually between four and eight. Because the unit of observation is a job, the micro data equal the average value of compensation per hour among the workers in the job.

The CPS and the ECI samples are restricted to workers and jobs in private, nonagricultural industries. To match the ECI, the CPS sample is restricted to wage and salaries workers and excludes workers in private household occupations. The regressions use the CPS earnings weights and the ECI sample weights. The weights are normalized to one for each period.

The nine industries are mining; construction; durable manufacturing; nondurable manufacturing; transportation, communication, and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services. The nine occupations are professional and technical; executive and managerial; sales occupations; administrative support occupations; precision and craft occupations; operators and assemblers; transportation occupations; handlers and laborers; and service occupations.

For the CPS, the four education categories are less than high school, high school, some college, and at least a college degree. The five age categories are 16 to 24, 25 to 34, 35 to 44, 45 to 54, and 55 or older. Although the ECI imposes no age restriction for the jobs in its sample, the CPS data are restricted to workers at least 16 years old. The dummy variable for whether a worker is covered by a collective bargaining agreement is not available before 1983, so it is set to zero for all workers in years prior to then. This is arbitrary because the period dummy variables would subsume an additional dummy variable for whether the collective bargaining information is missing.

For years prior to the CPS redesign in 1994, the wage rate in the CPS equals usual hourly earnings for workers paid hourly and usual weekly earnings divided by usual weekly hours for other workers. I use the same procedure for 1994 and subsequent years, although I follow Polivka (1997) for workers who report that their hours vary. I also use her procedure to account for the topcoding of earnings. Details on this procedure are available from the author upon request. Results reported in the paper are similar when I use usual weekly earnings divided by usual weekly hours for all workers, which is generally interpreted as including overtime pay in wage rates.

Workers in the CPS and jobs in the ECI with a wage rate below $1 per hour or above $200 per hour in March 1979 dollars are excluded as outliers. The ECI for wages and salaries for workers in private industries is used as the index for the outlier threshold. For both the CPS and the ECI, the weighted proportion of outliers stays below one percent.

Prior to 1986, the ECI data are only available as averages for the current and previous quarter by month/industry/occupation cells. This presents three complications. First, for each cell, the log difference between the average wage rates for the current and previous periods replaces for the average log difference between the current and previous wage rates. The regression results do not change much, however, when the same replacement is made for periods in which the micro data are available. Second, the sum of the sample weights for each cell is not available. Therefore, the cells' relative frequencies from the CPS are used. Third, the weighted sum of the squared residuals, the sum of the weights, and the sum of the squared weights for each cell are all needed to calculate the standard errors. Because the residual is assumed homoskedastic across all periods, the estimated residual variance from periods in which the micro data are available is applied to all periods. Further, the sum of the weights and the sum of the squared weights for the cells are assumed to be the same for periods in which the micro data are and are not available, so their values from periods in which they are available are inflated accordingly.

A.II. Standard Deviation Estimates

The wage growth parameters in vector δ are estimated by weighted least-squares. The variance matrix **V** is estimated under the assumption of homoskedasticity, although the results do not change much when the ECI regressions use a block form of White's (1980) procedure, which allows for heteroskedasticity and general forms of covariation among jobs from the same establishment in the same period.

The standard deviation among the parameters in δ is calculated as follows. Define an 81×81 matrix H as follows.

$$[\text{A1}] \quad \mathrm{H} = \mathbf{F}^{\frac{1}{2}}[\mathrm{I} - \mathrm{u}(\mathrm{u}'\mathbf{F}\mathrm{u})^{-1}\mathrm{u}'\mathbf{F}]$$

The matrix **F** is an 81×81 diagonal matrix with the frequency vector **f** on its main diagonal. The matrix I is an 81×81 identity matrix. The vector u is an 81×1 vector of ones.

Define the first element of δ equal to zero, and define the first row and column of **V** equal to zero. The following holds.

$$[\text{A2}] \quad \mathrm{E}(\hat{\delta}'\mathrm{H}'\mathrm{H}\hat{\delta}) = \delta'\mathrm{H}'\mathrm{H}\delta + \mathrm{trace}(\mathrm{H}\mathbf{V}\mathrm{H}')$$

The first term on the right-hand side of [A2] equals the variance among the parameters in δ, so the second term on the right-hand side is the adjustment to the variance estimate due to sampling variation.

The standard deviation across occupations is calculated using a similar procedure, although H is more complicated because the δ parameters must first be averaged across industries. The same procedure is used for industries.

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