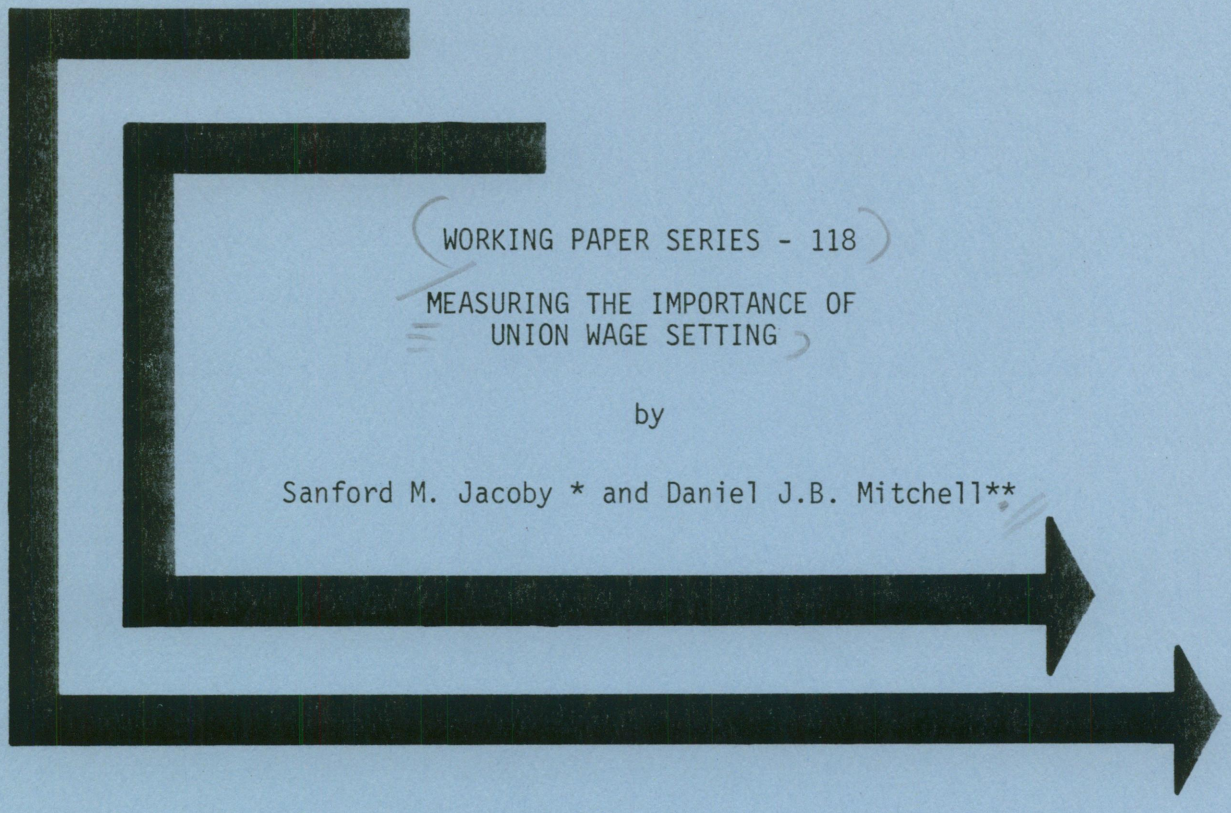

WORKING PAPER SERIES - 118

MEASURING THE IMPORTANCE OF UNION WAGE SETTING

by

Sanford M. Jacoby * and Daniel J.B. Mitchell**

*Sanford M. Jacoby
Associate Professor
Graduate School of Management
U.C.L.A.
Los Angeles, California 90024
(213) 206-6550

**Daniel J.B. Mitchell
Director
Institute of Industrial Relations
U.C.L.A.
Los Angeles, California 90024
(213) 825-4339

and

Professor
Graduate School of Management
U.C.L.A.

Draft: October 1986

INSTITUTE OF INDUSTRIAL RELATIONS (Los Angeles)
UNIVERSITY OF CALIFORNIA
LOS ANGELES 90024

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Sanford M. Jacoby
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Los Angeles, Calif. 90024
(213) 206-6550

Daniel J.B. Mitchell
Director
Institute of Industrial Relations
U.C.L.A.
Los Angeles, Calif. 90024
(213) 825-4339

and

Professor
Graduate School of Management
U.C.L.A.

*The authors would like to thank Maury Pearl, who acted as research assistant on this project, and Al Schwenk and others at the U.S. Bureau of Labor Statistics who assisted in providing necessary data and technical information.

October 1986

SUMMARY

The most commonly used measure of the importance of the union sector is the ratio of union-represented workers to total employment. In this paper, the authors show that the traditional measure of unionization is not appropriate as an index of the importance of the union sector to overall wage determination. A preferable index is the ratio of payrolls (or compensation) in the union sector to total payrolls (or total compensation). Using data from the Current Population Survey and other sources, the authors provide estimates of the union weight in payrolls and compensation at the aggregate level, and for various industrial, occupational, and demographic groupings.

For compensation per hour and average hourly earnings, the traditional unionization rate understates union importance. However, the Employment Cost Index overstates union importance due to its Laspeyres methodology.

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Tables and Figures

Union wage impact research in the U.S. has been conditioned by changes in the proportion of union-represented employees in the employed workforce. From the late 1930s through the mid 1950s, the rapid growth in the proportion of workers organized was accompanied by much public and professional concern about the macroeconomic consequences of union wage settlements. Although there were skeptics in the economics profession, many observers seemed to believe that union wage settlements set patterns which rippled through the entire economy. 1 / Part of the reason for this concentration on union wage setting was the dramatic nature of labor-management confrontations, which inevitably captured the headlines. Only the advent of the 1980s, which brought sharp declines in union membership, unionization rates, and strikes, removed union wage setting from heavy media and public policy attention.

Thus, throughout the post-World War II period, there has been an implicit assumption in the literature that, absent considerations of spillovers and other interactions between the union and nonunion sectors, the union "importance" in aggregate wage setting could be measured by the proportion of workers represented by unions. 2 / It is surprising that this employment-share assumption is rarely questioned, given the energy that has been put into looking for paths (spillovers, threats, displacements) by which the union impact could extend into nonunion wage determination. However, consider the following, simple question:

If union wages were to rise by 1% without affecting nonunion wages, how much would aggregate wages rise?

Surely, this question must be answered before qualifications about union-to-nonunion connections are added to the analysis. A little reflection will demonstrate that the answer cannot be determined simply from knowledge of the employment-based unionization rate.

Aggregate wage indexes are generally calculated by dividing the total wage payroll (or compensation bill) by the number of related employee hours. Such widely used indexes as compensation per hour and average hourly earnings are computed in this fashion. Thus, if union wages were to rise by 1%, the initial impact on the wage index would be determined by the union weight in total payrolls (or total compensation), not the union weight in total employment. The union payroll weight and the union employment weight will be identical only if union workers receive the same mean wage as nonunion workers and if, on average, union and nonunion employees work the same number of hours. In general, neither of these assumptions will hold; union workers tend to earn higher wages than nonunion workers and to work longer hours.

It should be stressed that these empirical generalizations do not involve any complex "standardization" aimed at matching "equivalent" union and nonunion workers. It is the gross (unstandardized) observations which are relevant. Union workers may earn more than nonunion simply because unions originally tended to organize in higher wage industries. But there may also be an independent, union-caused wage differential affecting the

averages. Similarly, unions may have organized in industries which -- purely by chance -- had smaller proportions of part-time workers than other sectors. Alternatively, it may have been easier for unions to organize in industries where workers were more attached to their employers, so that the union propensity for full-time work was no accident.

Why the empirical generalizations about union vs. nonunion workers are true does not matter for the purpose of payroll weight calculations. Thus, the calculation of union payroll weights is a relatively uncomplicated task. However, it is a much neglected task which this essay seeks to remedy.

In what follows, data from the Current Population Survey (CPS) covering 1983-84 are used to calculate union payroll weights for the overall economy and for various industrial, occupational, and demographic classifications. These weights are then compared with corresponding union employment weights. As the discussion above has already suggested, the two weights are not generally the same. Typically, union payroll weights turn out to be larger than employment weights because of the higher wages and longer hours which characterize union-represented workers. By way of preview, the union weight in the average hourly earnings series is estimated to be 28%.

Also included below are estimates of the impact of adding fringe benefits to the calculation and time-series extrapolations back to the mid 1950s. The essay concludes with a discussion of the relevance of these findings for the Employment Cost Index

(ECI). This index is singled out for special attention because it is the one major aggregate wage index which is not based on dividing payroll by hours. The ECI turns out to give excessive weight to the union sector due to its underlying methodology.

I. THE DATA

The Current Population Survey has traditionally been the source for labor market information on unemployment, employment, and labor force participation. Beginning in the 1960s, however, the CPS began to be used sporadically to obtain information on earnings and unionization. During the 1980s, these newer components of the CPS were collected and published on a regular basis, and have been made available to researchers by the Bureau of Labor Statistics (BLS) on computer tapes.

Calculations made for this study combine data from the CPS Earnings Files for 1983 and for 1984. These files were compiled by BLS from the outgoing rotation groups of the CPS, the groups which are used to obtain information about the usual weekly earnings of household members and about their union status. The widely-cited BLS annual tables showing earnings differences between union and nonunion workers are drawn from these same tapes (BLS, 1982; Flaim, 1985; Adams, 1986).

Data reported below have been restricted to private, nonagricultural employees. All self-employed persons have been removed. In order to emulate the establishment-based data reported in the average hourly earnings (AHE) series, however, 14

and 15 year-olds are included. Part-time workers are also included except where indicated. Neither 14-15 year olds nor part-timers appear in the published BLS tables on union/nonunion earnings differences. Thus, the definitions adopted in this paper are better suited for calculating union payroll or compensation weights than those tables. Finally, for purposes of the computations described below, unionized employees are defined as those workers represented by unions. That is, non-members in collective bargaining units are included (along with members) as unionized employees.

In the discussion that follows, reference is made to two samples drawn from the CPS tapes: the "global" sample and the "AHE" sample. All wage and salary earners remaining after application of the above-mentioned restrictions and definitions were included in the global sample. In contrast, the AHE sample was derived by taking the global sample and excluding from it those occupations which are not included in the payroll data used to generate BLS's average hourly earnings series. The AHE series includes only production workers in mining and manufacturing, construction workers in the construction industry, and nonsupervisory workers in all other industries. (U.S. Bureau of Labor Statistics, 1986) Thus, managers, supervisors, and certain other classifications are omitted from average hourly earnings and from the AHE sample. For 1983-84, there were 283,989 observations in the global sample, and 206,316 in the AHE sample.

When the BLS codes the CPS, it censors some data values. In

particular, wage and salary workers reporting weekly earnings of $1,000 or more are assigned a value of $999. Because the BLS only reports median figures for usual weekly earnings, its published tables are unaffected by this censoring of the upper tail of the earnings distribution. However, since it is essential to use means rather than medians to calculate payroll weights, estimates of the upper tails had to be reconstructed. As is a common procedure in research on income inequality, the tails were assumed to follow the form of a Pareto distribution. 3 / Methodology following BLS practice was used for the estimations of the upper tails. Pareto factors were calculated for each industry/union-status distribution presented below, and these factors were used to compute the needed earnings means and payroll weights. 4 /

II. DEPARTURES FROM BLS MEDIAN EARNINGS FIGURES

The upper panel of Table 1 compares the median weekly earnings figures published by the BLS with the median and mean earnings figures computed directly from the merged 1983-84 files. 5 / There is a noteworthy discrepancy between mean and median earnings, especially for nonunion workers. A number of high earning employees fall into the nonunion category. Not surprisingly, a lesser proportion of unionized workers are very high earners. The extreme nonunion values have little impact on medians but carry larger weight in means.

Labor market analysts who have been relying on the published BLS tables for estimates of union/nonunion wage differentials must

TABLE 1. MEAN AND MEDIAN WEEKLY EARNINGS FOR PRIVATE, NONAGRICULTURAL WAGE & SALARY EARNERS, 1983-1984

	Full-Time Employees					
	BLS-Published Medians		Medians and Means Calculated from 1983-84 CPS Earnings Files			
			Global Sample		AHE Sample	
	1983	1984	Median	Mean	Median	Mean
Union	$391	$404	$400	$410	$390	$399
Nonunion	287	302	290	367	250	310
Ratio: Union/ Nonunion	1.36	1.34	1.38	1.12	1.56	1.29

	Full-Time and Part-Time Employees Combined 1983-84			
	Global Sample		AHE Sample	
	Median	Mean	Median	Mean
Union	$380	$391	$365	$378
Nonunion	236	304	200	252
Ratio: Union/ Nonunion	1.61	1.28	1.83	1.50

Source: BLS-published data from Employment and Earnings, 32 (January 1985), p. 211; other data from 1983-84 earnings files from the Current Population Survey as described in text.

henceforth be cautious. The median differential is substantially larger than the estimated mean differential (38% vs. 12%). Thus, users cannot assume that calculated union/nonunion differentials are insensitive to the measure of central tendency employed. To the contrary, Table 1 demonstrates that medians and means are not interchangeable.

Table 1 also shows that the union/nonunion wage differential is quite sensitive to the sample's occupational specifications. When occupational definitions are changed to match those used in the AHE series -- chiefly by eliminating managers and supervisors -- the median earnings differential is raised to 56%, and the mean is boosted to 29%. It could be argued that the AHE figures of Table 1 are derived from a sample that approximates the potential union membership base and thus constitutes a more realistic measure of union/nonunion earnings differences. However, even for this restricted sample, a significant mean/median gap remains for nonunion workers, a discrepancy which again reflects the weight of the upper tail of the nonunion earnings distribution.

The lower panel of Table 1 includes part-time workers in both the global and AHE samples. Thus, the lower panel is more comprehensive than the tables on union vs. nonunion earnings published by BLS. Part timers are paid less than full-time workers, often on an hourly, and certainly on a weekly, basis. They are also heavily nonunion.

As a result of these differences, absolute earnings are reduced for both the union and nonunion groups (relative to the

upper panel), but the reduction is comparatively greater for nonunion workers. This comparative effect raises the weekly union/nonunion earnings differential. For example, the global median differential increases from 38% for full-time workers to 61% for full- and part-time workers combined. The same type of mean/median discrepancies that characterized full-time workers are again observed when part timers are included in the analysis.

III. PAYROLL WEIGHTS

Table 2 presents employment and payroll weights for full- and part-time workers. Aggregate weights are shown together with weights for industrial, occupational, and demographic groups. The reported payroll weights were calculated by multiplying the estimated mean weekly earnings figures by their corresponding employment levels and then dividing the union payroll by the total (union plus nonunion) payroll for each classification shown. Employment weights are simply the proportion of individuals in a specific category who were represented by unions.

The top line of Table 2 shows that unions represented 18% of private, nonagricultural wage and salary workers in 1983-84, but that these unionized workers earned about 22 percent of total payrolls in those years. The discrepancy between employment weights and payroll weights reflects the earnings differential between unionized and nonunion workers. As could be anticipated from the exclusion of higher earning occupations, the gap between employment and payroll weights is larger for the AHE than for the

Table 2: EMPLOYMENT, PAYROLL, AND COMPENSATION WEIGHTS FOR 1983-84, PRIVATE, NONAGRICULTURAL WAGE & SALARY WORKERS

	Employment Weight		Payroll Weight		Global Compensation Weight
	Global	AHE	Global	AHE	
All Industries	18%	20%	22%	28%	25%
Full-time only	21	24	22	29	--
Industry Sector					
Construction	27	30	37	43	41
Finance, insurance, real estate	4	4	3	4	4
Manufacturing	29	42	30	50	34
Mining	21	26	18	24	20
Services	9	10	11	12	13
Transportation & public utilities	44	49	47	56	52
Wholesale & retail	9	10	12	14	14
Occupation Group					
Managers & professionals	8	11	7	12	8
Operators, fabricators, & laborers	36	35	47	46	51
Precision production, craft & repair	33	35	40	44	44
Service workers	10	11	17	18	20
Technical, sales, administrative	10	10	12	12	13
Age					
Under 40 years	15	17	19	24	22
40 and over	23	27	23	34	26
Race					
Black	26	28	34	37	38
White	18	20	21	27	24
Other	17	21	19	26	22
Sex					
Female	11	13	14	17	17
Full-time only	13	16	15	19	--
Male	23	27	24	33	27
Full-time only	25	30	24	34	--

Note: "--" = not calculated.
Source: See Table 1.

global sample, i.e., 28% vs. 20% for the former and 22% vs. 18% for the latter.

i. Disaggregated Weights and Reverse Differentials.

When finer breakdowns are examined, it can be seen that the employment weight is usually less than the payroll weight. Reverse cases occur only when mean earnings for nonunion workers in a grouping exceed mean union earnings. The reader is reminded that the earnings data are gross, i.e., not standardized for employee characteristics, so that such reverse differentials can occur even if unions raise the wages of their members. Cases in which the union payroll weight is <u>smaller</u> than the employment weight can be found among workers in the finance, insurance and real estate industry, the mining industry, and among the managers and professionals. In the last case, for example, unionized workers might be nurses and engineers, while nonunion workers might be highly-paid doctors, lawyers, and executives.

ii. The Demographic Profile of Union Payroll Weights.

Table 2 indicates that the gap between global employment and payroll weights for males is relatively small when compared with the corresponding gap for females. In fact, for full-time workers only, the male gap is negative in the global sample. This finding for males is a case of the "tail wagging the distribution"; large numbers of well-paid, unorganized male managers and supervisors dominate the global male payroll weights. When these workers are

removed, as in the AHE sample, a positive gap appears.

The female earnings distribution is less skewed; there are proportionately fewer highly paid nonunion women than men. But despite this fact, it is not the case that the global union/nonunion wage differential exists only because of the union/nonunion wage gap among female workers. At the aggregate level, unionized men count heavily in total payroll weights; there are more of them, and they earn more (on average), than unionized women. Thus, the aggregate union/nonunion wage gap reflects male/female wage differentials as well as union/nonunion differences within the two sex groups.

There is a parallel situation with regard to the two age groups presented on Table 2. Taken separately, the gap between the employment weight and the payroll weight for the global sample is evident only for younger workers (those less than 40 years old). But younger workers earn substantially less than older workers on average and are less likely to be unionized. The gap between employment weights and payroll weights for the overall global sample reflects both union/nonunion wage differentials across age groups as well as age-related wage differences.

With regard to race, the most striking feature is the high proportion of black pay which comes from the union sector. Over a third of the black payroll in 1983-84, even for the global sample, was set by collective bargaining, according to Table 2. For total compensation (to be discussed below) the proportion for blacks was even higher.

iii. The Impact of Part-Time Workers on Payroll Weights.

The second row of Table 2 shows that adding part-time workers to the sample has little effect on union payroll weights. This result may seem surprising because Table 1 has already demonstrated that adding part-time workers raises the union/nonunion earnings differential substantially. Why isn't this boost in earnings differentials reflected in the payroll weights?

This seeming paradox is easily explained. When payroll weights are calculated, the addition of part-time workers greatly increases the total number of nonunion individuals in the denominator of the weight. The "body count" effect of part-timers on nonunion payrolls offsets their wage depressing effect, and this reduces the union weight. A further reduction in the union weight occurs because, within the union sector, part timers add few bodies but have a sufficient wage depressing effect to drag down the union payroll relative to the nonunion.

IV. FRINGE BENEFITS

Previous studies have found that, in addition to raising wages, unions increase expenditures on most kinds of fringe benefits. The union "fringe effect" often is larger than the union wage effect (Freeman and Medoff, 1984). Fringe benefits include pensions, insurance, and various forms of pay for time not worked. Today, these benefits account for an important share of

total compensation, particularly in larger firms.

Unfortunately, fringe benefits such as pension plans, health and life insurance, and similar programs are not included in the CPS data on usual weekly earnings. Employer-paid payroll taxes, e.g., for Social Security, are also omitted. Yet, a complete accounting for the union weight in total compensation must include fringe benefits and payroll taxes. Given the limitations of the CPS as a data source, however, only an estimate of the fringe impact can be provided.

The national income accounts include data on wages and salaries (corresponding roughly to earnings in the CPS) and total compensation on a detailed industry basis. Thus, it is possible to calculate the ratio of total annual employee compensation to total annual payrolls for each two-digit industry in 1983-84. 6 / A regression technique was applied to discern the ratio's union and nonunion components.

Specifically, the natural log of the industry compensation/wage ratios were regressed against industry union payroll weights estimated from the CPS [W_1]. Under certain assumptions, the antilog of the resulting regression coefficient of W_1 can be taken as an estimate of the compensation/payroll ratio for unionized workers. Similarly, the antilog of the regression's constant term represents the ratio for nonunion workers. 7 /

Using the regression estimates for union and nonunion sectors, it was a simple matter to adjust the CPS payroll

estimates to reflect fringes and payroll taxes as well as wages. Union compensation weights could then be computed. Results of these calculations (for full- and part-time workers) are presented on Table 2.

The union weight in total compensation is uniformly greater than the union weight in payrolls. This unsurprising result is due to the large estimated fringe benefit advantage enjoyed by union workers relative to nonunion. For example, in the global sample, the aggregate payroll weight is 22% while the corresponding compensation weight is estimated to be 25%. Thus, even in their concession-prone weakened state, unions negotiated about one fourth of total private nonfarm labor costs in 1983-84, although only 18% of the corresponding workforce was union-represented.

V. A TIME SERIES PERSPECTIVE

Data from the CPS on union vs. nonunion wages were not collected during much of the period of declining unionization, i.e., the period from the mid 1950s to the present. However, it is possible to use alternative data sources benchmarked to the 1983-84 CPS-based figures already presented to illustrate the likely path of the union weight in payrolls and compensation. To make such estimates, national income account data on wages and salaries per employee and compensation per employee were obtained for industries with above average and below average unionization rates. Pay trends for these two industry groupings were assumed

to track general union and nonunion pay trends, respectively. These data were benchmarked to the 1983-84 CPS-based payroll and compensation figures already discussed to produce comparable estimates for selected earlier two-year periods beginning in the mid 1950s. 8 /

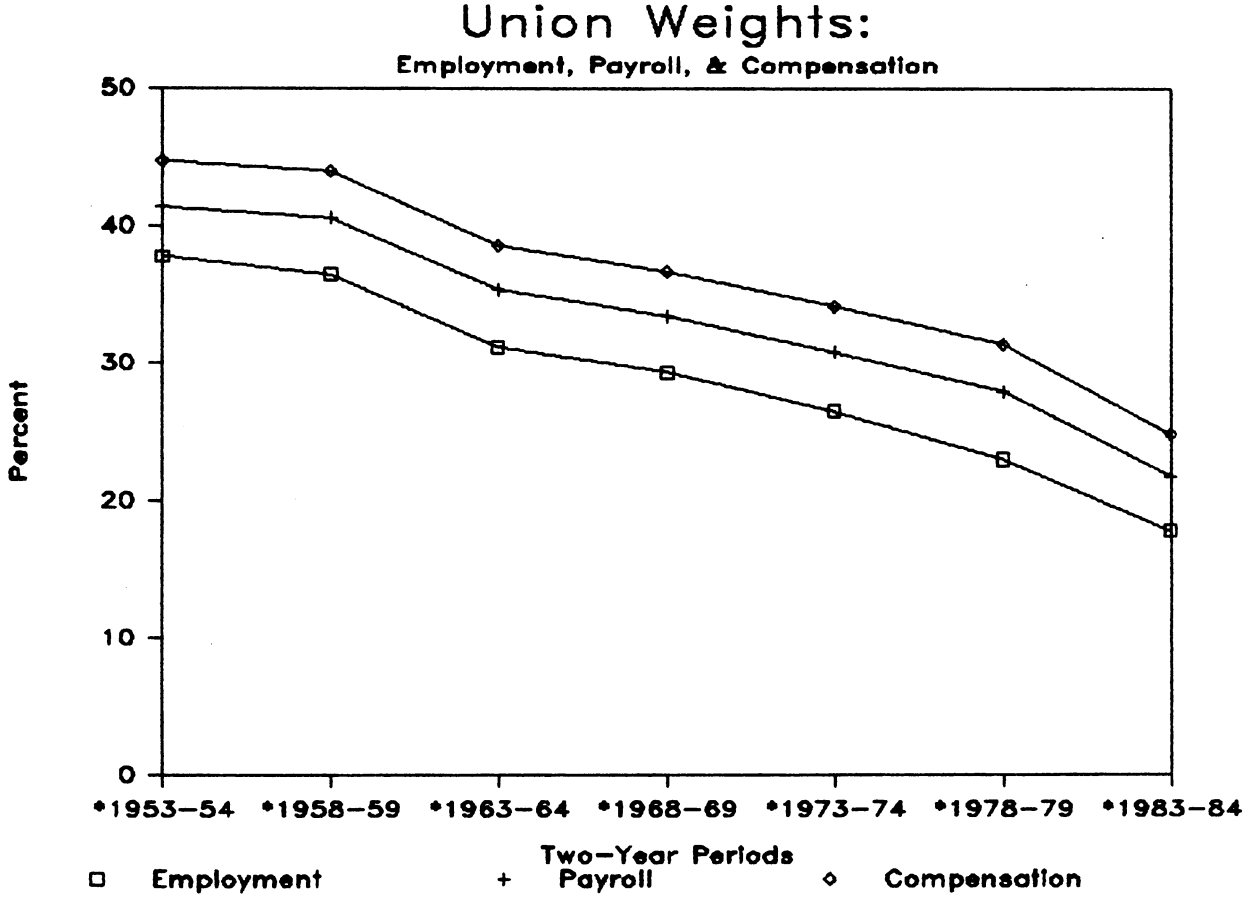
Figure 1 compares the union employment, payroll, and compensation weights over the estimation period. As can be seen from the figure, union payroll weights have typically been 3-5 percentage points above employment weights. Similarly, union compensation weights have been 7-9 percentage points higher than employment weights. Thus, the importance of the union sector in aggregate pay setting has been chronically understated by the traditional employment-based unionization rate.

On the other hand, although union wages generally rose relative to nonunion during the period from the mid 1950s through the 1970s, the widening union pay advantage only partially offset the downward pull of the declining unionization rate. And in the 1980s, the widening union/nonunion pay trend reflected in the national income account data reversed, intensifying the decline of the union payroll and compensation weights.

VI. THE EMPLOYMENT COST INDEX

Until the mid 1970s, an important gap in labor market statistics was the unavailability of data on union vs. nonunion pay trends. Researchers could obtain some information on union wage trends from the BLS series on major contract pay adjustments

Figure 1


Union Weights:
Employment, Payroll, & Compensation
50
40
30
20
10
0
Percent
1953–54
1958–59
1963–64
1968–69
1973–74
1978–79
1983–84
Two–Year Periods
Employment
Payroll
Compensation

but nonunion pay information was either unavailable or badly flawed. 9 / In 1975, however, the BLS introduced its Employment Cost Index which incorporated separate union and nonunion components. Subsequently, the ECI was expanded to include fringes as well as wages.

i. Union Weights in the ECI.

Because of the importance of the ECI as an analytical tool, the weights it gives to the union sector are of special interest. For reasons discussed below, the ECI's union weight is higher than the CPS-based estimates presented in this paper. Obviously, for purposes of understanding the wage changes indicated by the ECI, its own weights must be utilized. However, the ECI's union weights should not be taken as indicative of the actual importance of the union sector in U.S. payrolls or total compensation bills.

ii. ECI Methodology.

Unlike the CPS, the ECI does not present absolute wage information; it is an index number showing rates of pay change on a quarterly basis. To obtain this information, the BLS surveys pay changes in a sample of establishments. The index uses a Laspeyres formula, so that it is based on employment weights from a designated historical period. Until the mid 1980s, this base period was 1970. Also, information was obtained from a constant set of establishments until 1985. 10 /

These two elements of constancy gave undue weight to the

union sector. First, the pattern of employment in the U.S. generally shifted toward industries with low unionization rates after 1970. So the 1970-based index overweighted unionized industries. Second, within industries, there was a shift toward nonunion operations after 1970. While the BLS methodology did take account of the changes in union status of the surveyed establishments, much of the nonunion growth within industries occurred through the opening of new, nonunion facilities. These changes were not reflected in an index which tracked a fixed sample of establishments.

The employment-based unionization rate in the BLS sample was about one third during the late 1970s, and showed little downward trend until the early 1980s. Since the union weight in the index reflected both the unionization rate and the (rising) trend in union/nonunion pay differentials, the importance of the union sector in the index was somewhat higher. In 1985, BLS adopted a new sample of establishments (which reflected the shift to nonunion facilities) and in 1986, the ECI was re-based on the employment patterns of 1980. The combination of these two changes reduced the employment-based unionization rate in the index to about one fourth.

Even with these two modifications, the index still reflected an historical base period (1980) in which heavily unionized industries accounted for a greater share of employment than they did by the mid 1980s. Thus, the ECI still overweights the union sector, although by less than it did prior to the sample and base

year changes. It is inevitable that a fixed weight Laspeyres index will lag current reality in a world in which a consistent trend (declining unionization) away from base year circumstance is occurring.

Despite this difficulty, the ECI is still an excellent index of pay trends. The impact of the extra weight given the union sector on the overall movements of the index is relatively slight. For example, if union wages rose 10% relative to nonunion over the course of a decade, and if union wages were given a weight of 40% when the true weight was 20%, a wage index such as the ECI would be about 2% too high at the end of the period. Thus, the error per year would be an overestimate of wage inflation of only 0.2 percent. And, of course, there is no inherent bias in the separate union and nonunion ECI estimates of wage change.

VII. CONCLUSIONS

The proportion of workers represented by unions has traditionally been used as a measure of the importance of unions in wage setting. However, a preferable measure is the percentage of the total national payroll (or -- still better -- the compensation bill) located in the union sector. If union workers received identical rates of pay and worked the same number of hours, there would be no discrepancy between these measures. But in fact, the pay and hours differences produce payroll or compensation weights for union workers which are higher than their employment weights.

Since relatively high paid nonunion workers are often managers and supervisors, wage indexes which exclude such workers will have particularly high union payroll weights. Thus, the estimates presented above for average hourly earnings suggested a union weight of 28% in 1983-84, with weights of 50% or more in the relative highly unionized manufacturing and transportation/public utilities sectors.

Union workers tend to earn more fringe benefits than nonunion, so that indexes which include fringes -- other things equal -- will have higher union weights than those that do not. The widely-used compensation per hour index, which includes fringes and payroll taxes (but also includes managers and supervisors), had an estimated union weight of 25%. These estimates apply to a period in which the private, nonfarm (employment-based) unionization rate was only 18%.

Labor market analysts may well have underestimated the true importance of union wage determination in average hourly earnings and compensation per hour. Regarding the Employment Cost Index, however, such an underestimate would have been more understandable. The ECI's Laspeyres methodology -- and its fixed sample of establishments -- has caused excessive weight to be given to union wage setting during an era of declining unionization. However, the impact of this bias on the overall movements of the ECI is relative small.

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FOOTNOTES

1. The operators of wage controls and guidelines programs--even as late as the Carter administration -- put great stress on the impact of a few "key" union settlements. See Mitchell (1980), chapter 5, for a review of the wage spillover literature and the history of public policy regarding spillover theory.

2. Estimates of the overall proportion of unionized workers based on membership surveys were available from the U.S. Bureau of Labor Statistics until the early 1980s; thereafter, such estimates have been made available by private vendors. Other estimates from alternative sources were made by Freeman and Medoff (1979) and have been widely cited by other researchers. For certain purposes, it is important to note, employment-based unionization rates <u>are</u> the appropriate measure. These include estimating union/nonunion wage differentials from cross-industry earnings data, as discussed in Lewis (1963) and Mitchell (1980) and measuring union political strength.

3. In a Pareto distribution, the probability of finding an individual whose income exceeds x is $(x/d)^{-A}$, where A is the Pareto constant and d is the lower limit of the interval to which the Pareto distribution is assumed valid. When x is not less than d, a conditional mean -- the Pareto factor -- of A/(A-1) emerges. See Theil (1967).

4. The BLS has developed a maximum likelihood estimator for A (defined in the previous footnote) which was applied in this study. See West (n.d.).

5. The BLS divides the earnings distribution into ranges and applies an interpolation technique in the range in which the median is located to produce its median estimate. In contrast, the 1983-84 estimates of the median presented on Table 1 are calculated directly from the two-year distribution without application of an interpolation technique. There appears to be little practical difference between direct estimation and estimation by interpolation.

6. National income data on compensation, wages and salaries, and employment, appear annually in the <u>Survey of Current Business</u>, typically in the July issue, and in various supplements.

7. The regression technique is analogous to the estimation of union/nonunion wage differentials from cross-industry data on average earnings. Similar problems of bias arise if the union effect on compensation affects nonunion compensation. In the simplest case, suppose that there is a ratio (RU) of compensation to wages for all union workers and another (RN) for nonunion workers. In an industry with no union workers, the industry's compensation to wage ratio (R_s) will be equal to RN. Similarly,

in an industry composed entirely of union workers R_1 = RU. In partially unionized industries, RN < R_1 < RU, assuming (as is empirically the case) that RN < RU. Consider now the intermediate case in which half of an industry's workforce is unionized. For purposes of illustration, assume that the wage of nonunion workers is $5/hour and the wage of union workers is $10. Further, assume that RN = 1.5 and RU = 2. The union weight in the hourly payroll will be two thirds [$10/($5 + $10)]. Total hourly compensation for union workers will be 2 x $10 = $20 and total hourly compensation for nonunion workers will be 1.5 x $5 = $7.50. Thus, R_1 = ($20 + $7.50)/($10 + $5) = 1.83, which is two thirds of the way between 1.5 and 2. Note that this example illustrates a case in which using the employment-based unionization rate (rather than the payroll weight) would provide a biased estimate. In this example, the unionization rate is 50%, not two thirds. Therefore, in a cross-industry regression, use of the unionization rate would provide an upward biased estimate of RU.

For the regression discussed in the text, 57 industries representing a matching of national income and CPS data were used. Industries used were mainly those appearing annually in the national income accounts tables relating to compensation. See, for example, Survey of Current Business, vol. 66 (July 1986), p. 65. Private households and farms were excluded from the regression. The security and commodity broker and related service industry was combined with holding and other investment companies to follow the CPS.

8. Unionization rates used to divide industries into the two groupings were taken from U.S. Bureau of Labor Statistics (1972), Table 2, and apply to 1970. Forty-one industries were used. See Appendix A for a listing.

9. The BLS collected data on union and nonunion wage adjustments in manufacturing from the late 1950s until the late 1970s. However, this survey omitted merit adjustments, producing a substantial (and, apparently, variable) bias in its nonunion estimates.

10. For information on the ECI, see Wood (1982) and U.S. Bureau of Labor Statistics (1986).

APPENDIX A

Industries Used to Calculate Pay Trends in Sectors with Above- and Below Average Unionization Rates

Industries with below-average unionization had unionization rates (union members as a percentage of wage and salary workers) ≤ 20.8%, where 20.8% is the private, nonagricultural average unionization rate in 1970. These industries are marked with a "(B)" in the listing below. All other industries had above-above average unionization.

Forestry and fishing (B)
Mining
Construction
Lumber and wood products
Furniture and fixtures
Stone, clay, and glass products
Primary metals
Fabricated metals
Machinery except electrical
Electrical equipment
Motor vehicles and parts
Other transportation equipment
Instruments (B)
Miscellaneous manufacturing industries
Food and kindred products
Tobacco manufactures
Textile mill products (B)
Apparel and other textile products
Paper and allied products
Printing and publishing
Chemicals and allied products
Petroleum and coal products
Rubber and miscellaneous plastics products
Leather and leather products
Railroad transportation
Other transportation
Telephone communications
Other public utilities
Wholesale trade (B)
Retail trade (B)
Banking and other financial services (B)
Insurance and real estate (B)
Private households (B)
Business services (B)
Repair services (B)
Personal services (B)
Entertainment (B)
Health services (B)
Welfare and religious services (B)
Educational services (B)
Other professional services (B)