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11 Fringe Benefits in Employee Compensation

Arleen Leibowitz

11.1 Introduction

Although economists generally measure employees' compensation by money wages, money wages account for a shrinking proportion of total employee compensation. In 1977 only 76.7 percent of employee compensation in the private, nonfarm economy was in the form of direct payment for time worked (U.S. Bureau of Labor Statistics 1980*b*, p. 8). Paid leave (vacations and holidays) accounted for 6.1 percent of compensation, employer contributions to social security and other retirement programs for 8.5 percent, employer expenditures for life, accident, and health insurance, for 4 percent, and expenditures for sick leave, unemployment, and bonuses accounted for the remainder. Between 1966 and 1977 nonwage compensation or fringe benefits grew at a faster rate than pay for time worked.

In spite of the importance of fringe benefits, labor supply models typically treat only the wage portion of compensation, while it is clear that total compensation is the relevant variable affecting labor supply. How much does this distort our conclusions? Clearly, if wages are only a part of labor compensation and, in fact, are negatively related to benefits, wages alone may be a very error-prone measure of compensation. This would tend to bias toward zero the measured labor supply elasticities.

We show below that at higher tax rates, employees desire a greater proportion of their total income in the form of nontaxable benefits. Therefore, earnings functions which look at the wage portion of compensation will underestimate the total earnings of employees facing high marginal tax rates. Since more highly educated workers may face higher marginal tax rates, they may take a greater percentage of their remunera-

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tion in the form of benefits. We would therefore underestimate the rate of return to schooling, because we measure a decreasing proportion of total compensation at higher wage levels. Earnings functions often show rates of return at high schooling levels which are low compared to market rates of return on capital (Freeman 1977). This could result from the unobserved returns in the form of benefits. If men and women receive different proportions of compensation in the form of benefits, we will also distort earnings comparisons between these groups.

Clearly, measuring the effect that ignoring fringe benefits has on estimates of labor supply and earnings functions requires data on factors affecting individuals' productivity and personal characteristics as well as on wages and fringe benefits. Some studies have considered how the amounts of fringe benefits supplied by employers vary with industry or employer but not employee characteristics (e.g, Goldstein and Pauly 1976). A recent survey of health care coverage (Taylor and Lawson 1981) does contain the requisite demographic data but does not include information on the employer's payments for health insurance or other fringes. Data sets with both employee characteristics and employer fringe benefit payments can be constructed by linking data from separate employer and employee surveys (e.g., Smeeding, this volume). By using means, however, we lose the data on individual characteristics which would allow us to hold productivity constant.

The present paper, instead of using establishment data, uses data on individuals which is supplemented by employer reports of those individuals' benefits. Data collected as part of the Health Insurance Study (Newhouse 1974) are used to examine how the benefits received vary with *employee* characteristics. The HIS has cost data only for health insurance and vacation pay. It has data on individuals' *receipt* of other benefits, but not their value. These values, conditional on receipt of benefits, are estimated from the 1972 BLS survey of firm compensation practices.

The paper is organized as follows: Section 11.2 presents a simple model of the division of compensation between wages and benefits. Section 11.3 presents findings from the 1972 BLS survey. Section 11.4 describes the HIS data. Section 11.5.1 compares the HIS data with a large national sample. Section 11.5.2 shows how fringe benefits vary with full-time work status, sex, and race, and also presents earnings function estimates. Section 11.6 gives conclusions and data recommendations.

11.2 Trade-offs between Wages and Benefits

11.2.1 Wage Benefit Trade-offs in Theory

Consider a model of the labor market where remuneration for a given worker consists not only of money wages, but also of benefits paid directly by the employer. Employers will be indifferent to the composition of total compensation between money wages and benefits.

Employees have preferences between wages and benefits. Many benefits are characterized by their nonmarketability. They can only be consumed as a tie-in to employment, and they are not transferable—for example, an employee cannot resell his health insurance or accept bids for his sick leave. However, employees are free to choose employers whose benefit mix maxmimizes their utility. Thus, on-the-job benefits can be considered local public goods, and Tiebout-like, employees search out employers who have a benefit mix which "fits" their utility function (see Goldstein and Pauly 1976). Employers, too, will have an incentive to adjust their mix to the expected tastes of their potential employees. Thus, public school systems offer generous sick leave for their largely female work force, while universities offer free tuition to their education-minded employees.

We distinguish three types of benefits from the employee's point of view. First, there are nontaxable substitutes for private consumption expenditures (such as employer-financed health insurance or subsidized lunches in the company cafeteria). Second, there are taxable substitutes for private consumption which the employer can provide at low cost because of quantity discounts (such as life insurance). Third, there are "paid vacations" and sick leave which also are taxable. We assume that the employer is indifferent to the composition of benefits among the three types.

Even from this cursory taxonomy of the on-the-job benefits it is evident why some classes of benefits exist: given positive marginal tax rates, employers can purchase nontaxable benefits which are worth more to their employees than an equivalent expenditure on wages.

It can be shown (see Leibowitz 1982) that the greater the marginal tax rate, the lower the effective price of benefits. Thus, nontaxable benefits are most valuable to the highest wage employees. Further, because of group rates, employers may effect economies of scale in providing even taxable benefits. Sick leave is a kind of disability insurance where the employer self-insures. Typically, for extended sick leave the employer reinsures with a commercial agency or relies on government coverage. Vacation as a fringe benefit is harder to understand since providing "paid vacation" is equivalent to providing a wage increase. Perhaps "paid vacation" is more of a benefit for the employer than the employee since it is a mechanism whereby employers limit the amount of unscheduled unpaid leave employees can take.

11.2.2 Wage-Benefit Trade-offs in Practice

Ceteris paribus, there should be a negative relationship between wages and benefits. The problem for estimation is to hold productivity constant *in practice*. Establishment data, such as have been used in previous studies, have only the crudest indicators of productivity—production or white-collar worker, union status, and type of industry. With such data, one is likely to pick up changes in benefits across levels of worker productivity, rather than trade-offs between wages and benefits for a given employee. For this reason, it is not possible to obtain a meaningful hedonic benefits function from this type of data.

With disaggregated data on individuals, it is possible to control sufficiently for productivity that a wage benefit trade-off could be observed. Then wages and benefits should be negatively related. However, if there are unobserved factors affecting productivity, it is no longer true that observed wages and benefits will be negatively correlated since benefits may be related to the unobserved productivity factors, which shift the entire wage-benefit locus.

If benefits accounted for the same share of remuneration at all productivity levels, rate of return calculations would not be affected by not fully controlling for productivity. Since we expect higher proportions of benefits at higher tax brackets, the expansion path may veer toward benefits as wages increase. However, at some point, the demand for benefits may become saturated, as the marginal utility of benefits falls to zero. Government regulations may also limit the amount of benefits an employee can receive with favored tax treatment.

In this paper we can provide some evidence about the bias resulting from the omission of fringe benefits in computing the increase in earnings due to additional schooling and in comparing earnings of men and women. There are insufficient numbers of blacks in the sample to make meaningful racial comparisons.

In the next section, findings from a 1972 BLS survey are presented. The following two sections describe the HIS data base and present some empirical estimates.

11.3 Fringes and Wages in a National Sample

A 1972 BLS survey of firm compensation practices provides data on employers' expenditures for various categories of benefits and for wages (U.S. Bureau of Labor Statistics 1975). The survey, a stratified probability sample of establishments covered by state employment insurance laws, included 5031 firms. The strata are classified by industry, location, and number of employees, with the probability of inclusion in the sample roughly proportional to employment size.

Table 11.1 presents data on averge hourly wages and benefits for office and nonoffice workers. The data are averages over the 4632 firms who reported complete information and have been weighted to be representative of covered employees in these industries nationwide. The nominal wage for working hours reflects the usual use of the term "wage rate"—

Table 11.1 Hourly Wages and Benefits of Office and Nonoffice Workers—1972

Compensation	Office Workers[a] $/hr	Office Workers[a] %	Nonoffice Workers[b] $/hr	Nonoffice Workers[b] %	Correlation between Nominal Wage and Ratio of Benefit to Nominal Wage
Nominal wage for working hours	4.94	82.9	3.18	84.4	—
Vacation	.46	7.7	.17	4.5	.15
Pension	.16	2.7	.06	1.6	.30
Social security	.20	3.4	.17	4.5	−.59
Unemployment	.08	1.3	.12	3.2	−.22
Insurance	.12	2.0	.07	1.9	.15
Total compensation	5.96	—	3.77	—	.15

Source: Calculated from U.S. Bureau of Labor Statistics (1975).

[a]Office workers are defined as: all employees in executive, administrative, and management positions above the working supervisory level; supervisory and nonsupervisory professional employees and their technical assistants; office clerical workers; salespersons whose sales activities are primarily performed outside the establishment (e.g., real estate salesmen, door-to-door salesmen).

[b]Nonoffice workers are defined as: all employees, except office employees, in nonsupervisory, nonprofessional positions, including employees engaged in fabricating, processing, assembling, building, mining, repairing, warehousing, trucking, retail sales, etc. Proprietors, members of unincorporated firms, and unpaid family workers are excluded from the survey.

that is, direct payments for hours worked. It includes payments for shift differentials but does not include overtime pay. Wage rates were calculated by dividing employer expenditures for time worked by the number of hours worked.

Hourly benefits were calculated by dividing each employer's expenditures on benefits by the number of hours worked. Employer payments for health, life, and accident insurance accounted for 2.0 percent of office employees' total compensation, and 1.9 percent for nonoffice employees. Including vacation pay, pensions, insurance, and social security payments, office workers gained, on average, $1.02 per hour and nonoffice workers, $.59 per hour from the various fringe benefits.

In spite of the substantial increase in compensation per hour represented by fringe benefits, the correlation of total compensation (wages plus fringes) with base wage rate is 0.98. However, as wages increase, fringe benefits grow as a fraction of total compensation, as seen by the positive correlation between wages and percentage of compensation accounted for by fringe benefits. The last column shows the correlation across firms in the 1972 BLS survey of nominal wages with the ratio of fringe benefits to nominal wages. Over all, there is a low positive correlation (0.15) between base wage rates and the share of fringe benefits in wage rates.

As postulated above, benefits increase as a share of total compensation at higher productivity levels. However, it appears that nontaxable as well as taxable benefits increase with productivity. The share of nontaxable, private pensions, in total compensation, is more highly correlated with wages (0.30) than the share of taxable leave time (vacation, holidays, sick leave, and personal leave). Both leave time's share and that of insurance benefits are correlated 0.15 with nominal wages. Benefits mandated by law, such as employer contributions to social security and unemployment insurance, account for a smaller share of wages at higher compensation levels, largely because there is a ceiling on the income subject to employer and employee taxes. In general, however, benefits represent a larger share of compensation at higher wage levels. To see whether this leads to underestimates of rates of return, we turn to data from the Health Insurance Study.

11.4 The Health Insurance Study

Data for this section were collected by the Health Insurance Study (HIS) which is being carried out under a grant from the Department of Health and Human Services (previously Health, Education, and Welfare) to The Rand Corporation. The purpose of the HIS is to address questions of health care financing by experimentally enrolling families in a variety of health insurance plans which vary in the amount they reimburse families for medical expenditures, and monitoring their subsequent health and health-care expenditures. (The study design is described in Newhouse [1974].) As part of this effort, data on wages, income, and fringe benefits were also collected. Beginning in 1974, a total sample of 7706 individuals in 2756 families have been enrolled at six sites: Dayton, Ohio; Seattle, Washington; Fitchburg, Massachusetts; Franklin County, Massachusetts; Charleston, South Carolina; and Georgetown County, South Carolina. Participants were enrolled for a period of either three years or five years. Early results on the response of medical expenditures to variation in reimbursement are reported in Newhouse et al. (1981).

Eligibility for participants is quite broad. The only ineligible people are those 62 years of age and older at the time of enrollment, and persons with special health-care options such as members of the military, persons in prisons, recipients of disability medicare or veterans with service connected disabilities. In addition, low-income families were slightly oversampled, and those with incomes in excess of $25,000 (in 1973 dollars) were not eligible. Families in the experiment are representative of families in their site, although because of the income restriction, they do not represent a random sample. The sample as a whole is not a random sample of the U.S. population, but the sites do cover a mix of urban and rural northern, southern, and western sites. This allows estimation of regional and city-size effects.

Over the life of the study, data are collected on demographic and economic variables, health status, utilization of health services, type of health services received, and type of providers utilized. Demographic and economic data are elicited at baseline interviews prior to actual enrollment.

Income data are updated annually, when respondents are asked to copy from their income tax forms information on earnings, interest, dividends, federal, state, and local taxes paid, tax credits, and nontaxable income. From these data, marginal tax rates are calculated. Wage and labor supply data are updated at four- to six-month intervals. Each person over age 16 fills in a mailed questionnaire with employment data. A flexible format allows respondents to report hourly, daily, weekly, biweekly, monthly, or annual earnings. For this study all earnings were reduced to an hourly basis using data supplied in the same questionnaire on weekly hours of work and weeks worked per year. Wage data were obtained for a primary and secondary job, but only the wage data for the first job are used in this paper. The periodic employment report also asked whether the respondent was eligible at his first job for "employer-paid accident insurance" and "employer-paid life insurance." "Employer-paid" was defined as insurance for which the employer paid any part. The amount of the premium paid on behalf of the employee is not known.

Vacation and sick leave data were obtained directly from employers by means of the sick leave abstraction form. Employers were identified from the preceding periodic employment report. Employers reported the number of hours, days, or weeks of vacation for which each of their employees in the HIS was eligible. Employers supplied a great deal of detail about sick leave: whether it accrued with length of service, or was a fixed amount per illness or per period of time, or was given at the employer's discretion. Whether the employee received full or partial pay for sick days, whether benefits began on the first day of illness, and whether sick leave could be accumulated were also determined. Sick leave data were not obtained for persons who were self-employed, so they have been eliminated from this analysis.

Vacation and sick leave plans were obtained from employers in 1978. Wage data corresponding to the same time period were obtained from periodic employment reports administered in March 1978 for Dayton and in September 1978 for the Seattle, Massachusetts, and South Carolina sites.

Health insurance benefits could not be obtained for the identical time period because after enrollment all HIS subjects received their HISassigned insurance package. Therefore, the health insurance measure relates to the benefits workers received before enrollment in the HIS. Because many workers had changed jobs in the several years between enrollment in the study and the time at which we obtained wage data, the available sample size was smaller for analyses using health insurance data. The sample was further reduced because data were only available for a subsample of employees. For those with data, the measure is the annual employer contribution to health insurance premiums, as reported by the employer. The HIS data base also contains detailed information on the provisions of health insurance held by employees in our study prior to their enrollment in the experimental HIS plans. Marquis (1981) describes how these data were obtained by abstracting descriptive booklets provided by employers. She also finds that most families were well informed about some aspects of their health insurance coverage, but many lacked detailed knowledge of benefits covered. Some knowledge about the generosity of health insurance coverage (and other fringe benefits) is essential if employees are to effectively trade off benefits for money wages.

11.5 Empirical Estimates

11.5.1 Characteristics of Fringe Benefits Data

In order to assess the quality of the HIS fringe benefits data, we begin by comparing fringe benefits data collected by the HIS in 1978 with the 1979 Level of Benefits (LOB) Survey (U.S. Bureau of Labor Statistics 1980*a*). The LOB data were collected by the Bureau of Labor Statistics in 1979 as a pilot survey. The survey, conducted for the Office of Personnel Management, will be used to develop cost estimates for providing federal employees' benefits comparable to those in private industry.

While the LOB and HIS fringe benefits surveys occurred within a relatively short time span, the LOB sample differs in several ways from the HIS sample. The LOB obtained information from 1253 large establishments in the continental United States. Establishments with few employees (the minimum number of employees varied between 50 and 250, depending on the industry) were not surveyed. Responding establishments were asked to provide benefits data for three classes of workers: professional-administrative, technical-clerical, and production. The LOB survey excluded executive management employees and part-time, seasonal, and temporary employees.

The HIS sample, by contrast, was defined as including employed individuals who were enrolled in the HIS, and therefore subject to its sampling rules. The data represent plans applicable for a given individual. No exclusions were made on the basis of occupation, part-time employment, or establishment size. The HIS data can be aggregated to the occupation categories in the LOB for comparison. However, because of the noted differences between the two samples, the data obtained from the two sources may not correspond exactly.

The benefit rates reported in the LOB tend to exceed the rates in the HIS because LOB excludes seasonal and temporary workers and smaller employers. The percentage of employees covered by life insurance is similar in the two surveys, but the percentage covered by health insurance is lower in the HIS. While LOB reports that 96 percent of full-time employees receive health insurance benefits, HIS data indicate 87 percent do so. The HIS number matches well with National Center for Health Statistics (NCHS) data which show 86–91 percent of workers in firms with health insurance plans. The same document shows that over 90 percent of employees in firms with more than twenty-five workers have health insurance plans available, while only 55 percent of workers in firms with twenty-five or fewer employees do (Taylor and Lawson 1981, p. 4). The exclusion of smaller employers and part-time workers causes the LOB estimates to exceed the average for all firms and workers. This is a probable explanation for the reported differences in paid vacation and sick leave. The HIS data seem to correspond well to national data, where the comparison group is similar, as in the NCHS survey.

The multivariate analysis will use only data on full-time workers, but we can use the HIS data to determine how the various benefits vary with part-time/full-time status. Table 11.2 shows that fewer than half of the HIS sample part-time employees receive each of the benefit types, except health insurance. The percent of the HIS sample of full-time employees

Table 11.2 Benefits of Part-Time and Full-Time Employees

	Percent Receiving Benefit		
	Part-Time	Full-Time	
Benefit	HIS[a]	HIS[a]	LOB[b]
Sick leave	36%*	47%	56%
Paid vacation	30%*	56%	100%
Accident insurance (noncontributory)	43%*	79%	55%[c]
Life insurance	31%*	73%	77%
Health insurance[d]	75%*	87%	96%

[a]HIS data from 1978 Sick leave Abstraction and Periodic Employment Reports (III for Dayton, IV for other sites), see Leibowitz (1982).

[b]U.S. Bureau of Labor Statistics (1980*a*), table 1, p. 4.

[c]Accident and sickness insurance, noncontributory.

[d]HIS data based on a subsample at baseline.

*Differences between HIS full- and part-time employees significant at the 0.001 level.

receiving benefits is nearly twice as high as for part-time in each category except sick leave and health insurance.

Table 11.3 shows that even among full-time employees, benefits vary by race and sex. The top panel shows what percentage of employees received benefits of various types. The bottom panel shows the wage increase implied by two types of benefits. These two fringe benefits are the only ones where the HIS data have actual employer expenditures. Female employees were significantly more likely to receive paid sick leave and vacation than male employees, while men were more likely to receive both accident and life insurance. Male and female workers were equally likely to receive health insurance through their employment. Black-white differences should be interpreted with caution, since blacks accounted for only 4 percent of the sample. Further, a majority of the blacks resided in South Carolina, where all workers have lower benefit levels. Given these interpretive caveats, the data show that white workers were more likely to receive sick leave, accident and life insurance, but no more likely to receive health insurance or paid vacation.

The bottom panel of table 11.3 shows the percentage increase in compensation due to employer-paid health insurance premiums and due

Table 11.3 Benefits of Full-Time Employees by Race and Sex

Benefit	White	Black	Male	Female
	Percent Receiving Benefits			
Sick leave	47[b]	34	40[c]	60
Paid vacation	57	44	53[d]	62
Accident insurance	81[a]	47	84[c]	70
Life insurance	73[a]	53	75[d]	68
Health insurance	87	85	87	86
Number of observations (first four benefits)	856	32	587	301
Number of observations (health insurance)	443	21	165	299
	Percentage Increase in Compensation due to Benefit			
Employer-paid health insurance	*	*	4.4%	4.5%
Paid vacation	3.4	2.5	3.0%[c]	4.0%
Paid vacation plus holidays	6.1[a]	5.0	5.5%[c]	7.2%

[a]Difference between whites and blacks is significantly different at 1% level; however, these differences may be peculiar to our sample.

[b]Difference between whites and blacks is significantly different at 10% level; however, these differences may be peculiar to our sample.

[c]Difference between males and females is significantly different at 1% level.

[d]Difference between males and females is significantly different at 5% level.

*Insufficient observations to compute.

to paid vacation and holidays.[1] For full-time workers in this sample, paid vacation added 3 percent to men's salaries and 4 percent to women's. Thus women were not only more likely to receive vacation, but also had a significantly greater share of compensation as vacation benefits. Including paid holidays makes the differences appear even larger, since even among full-time workers, men have longer average workweeks than women. These numbers correspond well to the 6.1 percent of compensation attributable to vacations and holidays in 1977 reported by the BLS (1980*b*). The percentage increase in wages attributable to health insurance, for those who had health insurance, is 4.4 percent for men and 4.5 percent for women. When we allow for the fact that not all workers have health insurance benefits and that life and accident insurance premiums are likely to be small, this number is quite consistent with the 4 percent of employers' expenditures for life, accident, and health insurance (U.S. Bureau of Labor Statistics 1980*b*). Thus the HIS data are quite comparable to national averages.

The differences by sex indicate that significant variation exists within the group of full-time employees. Table 11.3 shows that at least in terms of sick leave and vacation, women are more likely to receive benefits than men. To see whether this offsets some of the male-female differential in direct monetary compensation, we must use multivariate methods to control for productivity differences. Because of the richness of complementary data on wages and demographic characteristics, we should be able to determine to what extent employees trade off wages and benefits.

11.5.2 Multivariate Analyses

In this section hedonic wage functions are estimated. We expect a negative relationship between wages and benefits if productivity is effectively held constant. A single method such as this does not capture the simultaneous nature of the wage-benefit trade-off. However, it does solve a data problem posed by having employer costs for some benefits, but only a dichotomous indicator of whether benefits were received for others.

Table 11.4 presents regressions for the entire sample of full-time workers (those who worked thirty-five hours or more a week) for whom wage and fringe benefits data referred to the same employer. Regressing the log of hourly earnings on the usual productivity measures, we find that the implied rate of return to schooling is 4.1 percent. The rate of return estimate falls in the low end of the range reported in the literature. A consumer price index[2] as well as dummy variables for the sites are included in the regression, but not shown. This regression accounts for one-quarter of the variance in log hourly earnings.

Men's median earnings were estimated to be 49 percent greater than women's, and union workers earn 17 percent greater wages. Separate

Table 11.4 **Wage Regressions for Full-Time Workers (*t*-values in parentheses)**

Dependent Variable:	Log Hourly Wage			Log Vacation Days	Log Hourly Wage Plus Benefits	Log of after Tax Wages Plus Benefits	Log of Ratio before and after Tax Wages Plus Benefits
Sample:	All Full Time (1)	Males (2)	Females (3)	All Full Time (4)	All Full Time (5)	All Full Time[b] (6)	All Full Time[b] (7)
Independent Variables:[a]							
Intercept	1.098	1.482	.997	−.330	1.114	1.004	.110
	(7.94)	(9.35)	(4.59)	(−.96)	(10.3)	(9.61)	(5.17)
Education (years)	.041	.041	.043	.067	.043	.038	.005
	(6.67)	(5.33)	(4.31)	(4.24)	(8.79)	(7.99)	(5.41)
Experience (years)	.009	.0154	−.003	.022	.021	.018	.003
	(1.48)	(2.07)	(−.31)	(1.50)	(4.44)	(3.95)	(3.15)
Experience squared	−.006	−.017	.012	−.023	−.036	−.033	−.003
(years × 10^{-2})	(−.42)	(−.99)	(.57)	(−.66)	(−3.42)	(−3.20)	(−1.54)
Sex	.399			−.081	.367	.370	−.003
	(9.29)			(−.74)	(11.1)	(11.60)	(−.44)
Union	.127	.151	.058	−.272	.146	.133	−.013
	(2.73)	(2.65)	(.73)	(−2.27)	(4.18)	(3.93)	(−1.92)
R^2	.25	.17	.16	.07	.38	.36	.14
Number of observations	595	389	206	595	595	515	515

[a]Prices and sites were also controlled in the regressions.

[b]After tax regression has smaller sample because of missing income tax forms.

regressions for men and women had significantly different sets of coefficients. ($F = 24.5$ with 14 and 580 degrees of freedom.) While the rates of return were similar, men's wages increased more with experience and were positively related to union membership, while women's wages were not.

A significant share of employees' fringe benefits is in the form of paid vacation. What does "vacation earnings function" look like? Column (4) in table 11.4 shows how the log of vacation days is related to productivity determinants, just as wages are. Vacation days increase significantly more rapidly with education than do money wages,[3] even though there is no tax advantage in receiving vacation pay. This result is consistent with the finding from the 1972 data reported in table 11.1. Union status is associated with shorter paid vacations, but higher wages. In contrast to the results for money wages, sex does not affect vacation benefits significantly, once experience and other factors are accounted for.

How would the rate of return to schooling be affected by including compensation in the form of fringe benefits in total compensation? The wage data used in columns (1)–(3) were augmented to account for the implicit increase due to vacation pay, for sick leave (based on the sex-adjusted average number of days lost from work due to sickness by men and women), and on price-adjusted, occupation-specific expenditures for health, life, and accident insurance, given that an individual received insurance.[4] Hourly wages, including vacation pay, sick leave, and insurance, averaged $6.70 compared to $6.25 before benefits were added, an increase of 7 percent. This increase falls within the range reported above for office and nonoffice workers. The earnings function explains a substantially greater percent of the variance of wages plus benefits than of wages alone.

If a greater percentage of compensation is given in the form of benefits to workers with certain characteristics (those with more education or experience, for example), then earnings functions which excluded benefits would bias the coefficients of these variables. To see which characteristics would be significantly biased by omitting benefits, the ratio of full compensation to wage compensation was regressed on the independent variables included in table 11.4. The results show that there is no systematic relationship between the independent variables and the ratio of wage to wages plus benefits. This is equivalent to stating that the sets of coefficients in columns 1 and 5 in table 11.4 differ only in the intercept.[5]

The benefits accounted for here are largely taxable, and the correlations using BLS data show these rise less rapidly with productivity than nontaxable benefits. However, it is clear that the omission of taxable benefits from earnings functions does not lead to significant bias in rate of return to schooling estimates, or to male-female or union-nonunion comparisons. In column (6) of table 11.4 the family marginal tax rate (derived from data on actual income taxes paid) and social security tax rate are applied to wages to obtain an earnings function for after-tax wages plus benefits.

The regression shows that accounting for taxes has a greater effect on the coefficients than including benefits. The ratio of before-tax wage plus benefits to after-tax wage plus benefits is significantly related to both education and labor market experience, as the last column shows, while we found no significant change in coefficients due to adding benefits to raw wages. The positive coefficients in column (7) indicate that the rate of return to schooling and experience appear to be significantly more positive when marginal tax rates are ignored. The bias amounted to a difference in the rate of return of 0.5 percent. The ratio of after-tax wage plus benefit to hourly wages (e.g., comparing columns 7 and 1) is not significantly related to either education or experience, since the positive effect of schooling on benefits is counterbalanced by the positive relationship of schooling and marginal tax rates.

Using this basic earnings function framework, we next estimate an hedonic wage function to determine in what way employees trade off wages for benefits. Table 11.5 presents hedonic wage equations in which benefits are added to the basic earnings function. If employees are trading off wages for benefits, we expect these benefit variables to have negative signs. There are four dummy variables indicating whether or not benefits are received. Receipt of paid vacation, sick leave, and accident insurance is associated with lower wages, but only vacation benefits lower wages significantly. However, the receipt of life insurance is positively related to wages. While not receiving any vacation or sick leave is compensated by higher wages, among those who do receive the benefit, wages are positively related to the amount of benefit received.

The LOB study gives a clue as to why this happens. Their data show that within occupation types, the number of vacation days and sick leave days increase with years of service (U.S. Bureau of Labor Statistics 1980*a*, pp. 5 and 6). But wages also increase with years of service or experience. Borjas (1981) found that workers with greater employer-specific tenure had significantly higher wages at later ages. While the regression controls for labor market experience, it does not perfectly control for years of service with a given employer. Thus the unobserved variable, years of employer-specific experience, which is positively related to both wages and vacation and sick leave benefits, biases the continuous benefit coefficients.

Separate regressions for men and women were found to differ significantly from each other.[6] Both men's and women's wages react similarly to vacation benefits, but they differ in the response to sick leave. Sick leave has little effect on men's wages. For women, however, receiving any sick leave is compensated by lower wages, but among women who

Table 11.5 Hedonic Wage Equations for Full-Time Workers (*t*-values in parentheses)

	Dependent Variable: Log Hourly Wage			
Independent Variables[a]	All Full-Time	Full-Time Males	Full-Time Females	Sample with Health Insurance
Education	.04	.04	.04	.07
	(5.60)	(4.49)	(3.48)	(2.90)
Receives vacation	−.34	−.44	−.34	.19
	(−1.97)	(−1.78)	(−1.46)	(.26)
Receives sick leave	−.12	.01	−.31	.31
	(−.80)	(.06)	(−1.29)	(.59)
Receives accident insurance	−.04	−.05	−.07	.02
	(−.72)	(−.54)	(−.89)	(.09)
Receives life insurance	.15	.19	.10	.10
	(2.66)	(2.61)	(1.29)	(.56)
Log of annual vacation days	.15	.18	.11	−.05
	(2.22)	(1.95)	(1.26)	(−.18)
Log of annual sick leave	.04	−.03	.19	−.22
	(.73)	(−.40)	(1.87)	(−1.03)
Log of health insurance premium	—	—	—	.14
				(1.50)
R^2	.26	.17	.15	.12
Number of observations	595	389	206	136

Source: HIS data.

[a]Prices, sites, experience, experience squared, and union status were also controlled for.

receive sick leave, higher-wage women receive more. Sick leave may have greater importance for women because of greater sickliness or because of their responsibilities for sick children. Whereas 5.1 percent of women employed full-time lost time from work due to illness in May 1978, only 3.4 percent of men employed fully were absent from work in that month. This represented a loss of 2.8 percent of working time for women and 2.1 percent for men, since men had lengthier absences for each incidence (Taylor 1979, p. 57). Table 11.3 also showed that women were significantly more likely than men to receive any sick leave.

What the regressions suggest is that full-time employees can choose jobs with benefits or jobs without benefits, which are compensated at a higher rate. Thus workers can be thought of as regular employees receiving benefits or as working on contract to provide certain services, without receiving benefits. However, among employees who receive benefits, the amount of these benefits is positively related to wages. This may occur because an unobserved job tenure variable relates wages and benefits indirectly, or because the benefit is tied directly to wage levels. The LOB reports, for example, that 63 percent of the job-related life insurance plans insure employees for a multiple of their earnings rather than for a flat amount or one based on years of service (U.S. Bureau of Labor Statistics 1980*a*, p. 14).

One of the most costly benefits is health insurance. The last column of table 11.5 presents some results using the smaller sample on which health insurance benefits are available in the HIS sample. The health insurance variable is a measure of the amount the employer paid for health insurance. There are only 136 observations for this regression because data were only available for a subsample of HIS participants, and because workers who had changed jobs in the interval between the collection of health insurance data at baseline and the collection of wage data in 1978 were eliminated from the sample. Although the coefficients lack precision due to the small sample size, it is clear that employer-paid premiums are positively rather than negatively related to wages.

The rate of return to schooling for this subsample is 0.052 when benefits variables are not included in the regression, but increases to 0.07 when benefits are included. However, the small sample size prevents any firm conclusions about bias.

11.6 Conclusions

Fringe benefits data from the HIS showed that there are significant differences by sex and race in the probability of receiving benefits. However, there was little evidence in the multivariate analyses that omitting benefits from earnings functions would systematically affect comparisons among sex or union groups.

Hedonic wage equations showed that employees earned compensating differentials when benefits were not provided on the job. However, among those receiving any benefits, the level of benefits was positively related to wage rates. While both men and women who did not receive paid vacations have higher wages, men seem not to pay any significant price in terms of lost earnings for receiving sick leave. Accident insurance affected wages insignificantly for both groups, perhaps because the total expenditure is small. Life insurance was positively related to wages. In the subsample for whom health insurance data were available, the amount of employer-paid premiums was positively related to wages.

These results indicate that lack of data on employee-specific taxable benefits does not greatly bias either rate of return estimates or earnings comparisons between men and women. Accounting for marginal tax rates had a greater effect on rates of return than accounting for fringe benefits. However, comparisons with LOB employer supplied data show that it is nonetheless true that benefits vary with employee characteristics. For comparisons of relative earnings, lack of benefits data does not seem crucial. However, the exclusion of nontaxable benefits, such as pensions, which rise more rapidly than taxable benefits with earnings, may pose a problem for relative earnings comparisons. While for relative wage comparisons taxable fringe benefits have little effect, for comparison of absolute total compensation, ignoring benefits would lead to underestimates.

The exclusion of part-time and seasonal employees from national benefits surveys may result in overestimates of fringe benefits coverage among workers. One way employees may choose a package of low benefits is to choose to work part-time, since many employers pay benefits only to full-time employees. Thus, total compensation may have a discontinuity at the number of hours at which employees become eligible for benefits.

More realistic models of labor supply should incorporate fringe benefits as part of the compensation for work and acknowledge explicitly that hours worked respond to the discontinuity in compensation schedules due to providing fringe benefits only for full-time employees. The results presented here indicate that employees do trade off wages for the option to receive benefits. Surely this option affects hours of work as well.

Notes

1. We assume six paid holidays per year, in order to compare HIS data to data in BLS (1980*b*).

2. The price index used is based on BLS data (U.S. Bureau of Labor Statistics 1978) on the autumn cost of living for an urban intermediate family of four in 1975–78, and on price data collected by the HIS. It is fully documented in Manning and Duan (1981). Only two of our sites (Dayton and Seattle) coincided with sites used by BLS. Because the remaining sites were not specifically reported in BLS data, in all sites we sampled prices for a subset of thirty-three items in the BLS list of more than four hundred items. The data for Dayton and Seattle, where both sets of estimates were available, were used to calibrate HIS cost-of-living to BLS cost-of-living estimates. The constructed indices were validated by comparing the HIS price index with data for available BLS sites (comparing Fitchburg, Massachusetts, site with Boston; Franklin County, Massachusetts, with Northeast Nonmetropolitan; Charleston with Atlanta; Georgetown County, South Carolina, with Southern Nonmetropolitan).

3. Since the two dependent variables are regressed on the same set of independent variables, the appropriate test involves restricting some or all of the two sets of coefficients to be identical in the two regressions. The F value is 4.12 for the education variable, with 1 and 586 degrees of freedom, which is significantly different from zero at better than the 5 percent level. An equivalent test involves regressing the differences between the two dependent variables on the set of independent variables. Since the dependent variables are in logs, this is equivalent to the log of the ratio

$$\ln W - \ln V = \ln\left(\frac{W}{V}\right) = f(X_i),$$

where W and V are the wage rates and vacation days, respectively, and X_i are the independent variables. A significant education coefficient indicates the ratio of wages to vacation falls with education, implying vacation rises more rapidly with education than wages do.

4. To estimate sick leave taken, as contrasted with the maximum entitlement reported in the HIS data, the mean number of days of sick leave taken by male and female workers nationally was used (Taylor 1979, p. 51). Price adjustment was by means of the price index described in note 1. Mean expenditures for life, health, and accident insurance in occupations were calculated from BLS (1975) and matched by occupation to the sample data if the individual received such employer-paid insurance.

5. The test described in note 2 was used. The F value was 0.71, with 8 and 586 degrees of freedom, which is not significant at the 5 percent level. It is, however, difficult to find significant differences when comparing to the raw wage rate equation, which lacks statistical precision.

6. The F value was 12.5 with 26 and 502 degrees of freedom.

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Comment B. K. Atrostic

The other papers presented in this session (Burkhauser and Quinn, and Smith and Ehrenberg) show that estimation of labor cost and trade-offs among wages, fringe benefits, and employment characteristics requires data on employer and employee characteristics, as well as detailed data on fringe benefit plans and expenditures, and information on personnel policies, such as mandatory retirement. Leibowitz appears to have, in the Health Insurance Survey (HIS), just such data. Demographic and economic data collected from households are matched with employer records of fringe benefit expenditures. The importance of having fairly complete measures of labor cost and worker characteristics can be highlighted by laying out clearly the model whose hypotheses Leibowitz tests, and comparing her results with those obtained by estimating the same model with a data set which permits a more complete measure of labor cost.

The wage and compensation equations relevant to Leibowitz's investigation can be stated formally as:

$$\ln(W) = A_1X + e_1, \quad (1)$$

$$\ln(W + B_T) = A_2X + e_2, \quad (2)$$

$$\ln(W + B_T + B_{NT}) = A_3X + e_3, \quad (3)$$

where B_T and B_{NT} are taxable and nontaxable benefits, W is wages, and X is a vector of pay determining characteristics (education, sex, region, etc.). Assuming that the X vector and the dependent variables are correctly specified and measured, a series of hypotheses about the A vectors can be tested. If taxable benefits are paid in proportion to wages, coefficients A_1 and A_2 will be equal, except for the intercept. If nontax-

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able benefits are lower priced than taxable benefits, or if the proportion of nontaxable benefits in total compensation varies with elements of the X vector, A_3 will not equal A_1 or A_2. Leibowitz frames the hypothesis that "employers can purchase nontaxable benefits which are worth more to their employees than an equivalent expenditure on wages," and therefore "higher proportions of benefits at higher tax brackets" would be expected. The implied hypothesis tests are

$$H_0\colon A_1 = A_2,$$

and

$$H_0\colon A_1 = A_3.$$

Equations (2) and (3) are not estimated separately. Instead, the benefit measures in the HIS data (vacation and sick leave, and health insurance), described as "largely taxable" are combined with wages to form an earnings variable,[1] so that a limited form of equation (3) is actually estimated:

$$\text{(3a)} \qquad \ln(W + B_T + B^*_{NT}) = A_{3a}X + e_{3a},$$

where B_T is vacation and sick leave, and B^*_{NT} includes only health insurance (and no other nontaxable benefits). The hypothesis that *can* be tested by comparing coefficient estimates in columns (1) and (5) of Leibowitz's table 11.4 is thus:

$$H_0\colon A_1 = A_{3a}.$$

Additionally, Leibowitz tests the importance of the nontaxability of most benefits by including the marginal and social security tax rates directly and estimating:

$$\text{(3b)} \qquad \ln[(W + B_T)(1 - t) + B_{NT}] = A_{3b}X + e_{3b},$$

where $(W + B_T)(1 - t)$ is after-tax income from wages and taxable benefits. Two hypotheses are tested: that A_{3b} is equal to A_3, and that A_{3b} is equal to A_1:

$$H_0\colon A_1 = A_{3b},$$

$$H_0\colon A_{3b} = A_3.$$

B^*_{NT} rather than B_{NT} is also used in estimating equation (3b) and its coefficients, A_{3b}.

Estimates of equations (1), (3a), and (3b) are presented in columns (1), (5), and (6), respectively, of Leibowitz's table 11.4. There is little difference in coefficient estimates for union, sex, education, or experience variables between regressions where the dependent variable is wages, or ones where it is wages plus fringe benefits, or after-tax wages plus fringe benefits. Leibowitz's empirical results support the hypothesis that

$A_1 = A_{3b} = A_{3a}$. From this, she concludes that there is "little evidence" that "omitting benefits from earnings functions would systematically affect comparisons among sex or union groups," and therefore that employee-specific benefit data are not required for unbiased rate of return, sex, or union comparisons.[2] She has not shown, however, that $A_1 = A_2 = A_3 = A_{3b}$.

As equation (3a) makes clear, Leibowitz's actual left-hand-side variables for her columns (5) and (6) are not those implied by equations (3) and (3b). Substantial benefit expenditure categories are omitted, notably pensions and legally required benefits (primarily employer contributions for social security, unemployment compensation, and workmen's compensation). These two categories accounted for 15 percent of employer expenditures for employee compensation in 1977, or over half of the 23 percent of compensation that was paid as benefits (U.S. Bureau of Labor Statistics 1980, table 1). This omission will be shown to have serious consequences for Leibowitz's conclusions.

Additionally, the hypothesis that workers in higher marginal tax brackets receive more of their compensation in the form of nontaxable fringe benefits, thus biasing estimates that use only wages or that fail to account for the differential taxability of different fringe benefits, cannot be tested with the HIS data and the above methodology. There is not enough data on major expenditure categories of nontaxable benefits, even were equations (2) and (3) to be estimated separately.

The effect of the shortcomings of the HIS data generally and of the benefits measures in particular is shown below, using estimates of sex, union, and occupation parameter estimates based on employer-employee exact match data from two BLS establishment surveys. Wages, sex, and union coverage are reported directly for individual workers in selected occupations in one survey, and fringe benefits expenditures for each worker are calculated from the other survey.[3] These data were collected between 1976 and 1978, roughly the same span as the HIS data, collected from 1974 to 1978. Measures of education and experience are not collected in these data, but detailed occupational specifications give some indication of relative human capital attainment. Alternative estimates of equations (1), (3), and (3a), using the BLS matched employer-employee data set, are reported in table C11.1. Column (1) presents a regression using only wages as the dependent variable, as in equation (1). Column (2) presents a regression whose dependent variable corresponds to Leibowitz's "wage plus fringe benefits" in column (5) of her table 11.4; that is, the benefits portion of compensation includes only sick leave, vacation, and life, accident, and health insurance expenditures. This corresponds to equation (3a) above. Finally, column (3) reports a regression whose dependent variable is expanded to include the other benefit categories available in the Employer Expenditure for Employee Com-

Table C11.1 Full-Time Office Workers: Labor Cost Regressions ($N=20544$)

	ln (Wage) (1)	ln (Labor $Cost_L$) (2)	ln (Labor $Cost_A$) (3)
Union (office workers)	.0828	.0934	.1125
	(.0042)	(.0041)	(.0044)
Male	.0410	.0381	.0441
	(.0051)	(.0049)	(.0053)
Percentage female in occupations surveyed	−.1142	−.1095	−.0545
	(.0115)	(.0112)	(.0121)
Office workers as percentage of total	−.0847	−.2249	−.2232
	(.0134)	(.0131)	(.0141)
Part of larger firm	.0527	.0749	.0957
	(.0033)	(.0110)	(.0047)
Employment 5,000+	.2865	.3227	.4637
	(.0112)	(.0110)	(.0118)
Employment 1,000–4,999	.1727	.2090	.3144
	(.0110)	(.0108)	(.0116)
Employment 500–999	.0290	.0631	.0946
	(.0129)	(.0126)	(.0136)
System analyst	.8215	.7858	.7967
	(.0082)	(.0080)	(.0086)
Secretary	.3515	.3301	.3493
	(.0066)	(.0065)	(.0070)
File clerk	−.0446	−.0400	−.0187
	(.0088)	(.0086)	(.0093)
$\bar{R}^2$	.6973	.7156	.7077

NOTES: The regressions contain other occupation dummies, and also include industry and region dummies. See Atrostic (1983) for a detailed description of the data.

Labor $Cost_L$ = Sum of employer expenditures for each worker on wages, sick leave, vacation pay, and life, accident, and health insurance. Corresponds to "Wage plus benefits" in column (5), table 11.4, in Leibowitz's paper. Labor $Cost_A$ = Sum of employer expenditures on all wages and fringe benefits for which data are collected in the Employer Expenditures for Employee Compensation Survey. Includes all fringe benefits in Labor $Cost_L$, plus pensions and legally required benefits.

Standard errors are in parentheses.

pensation data (primarily pensions and legally required benefits), corresponding to equation (3). These estimations do not exactly duplicate Leibowitz's, as the data sets do not contain identical information about employer and employee characteristics, but the differences in empirical findings nonetheless are highly suggestive.

A comparison of columns (1) and (2) yields results similar to Leibowitz's: the addition of (selected) fringe benefits has little effect on estimates of sex, union, or occupational differentials. A comparison of columns (1) and (3) or columns (2) and (3), however, yields quite different results. Male premiums remain at about 4 percent.[4] Union coefficients increase substantially from 8 to 12 percent. The discount associated with increasing the percentage of females in the occupation falls from 12 to 6 percent. Occupational differentials narrow: the system analyst premium decreases by about 9 percentage points, while the file clerk discount decreases by about 2 percentage points. Additionally, estimates of the effect of employer characteristics, such as establishment size, differ between specifications. Statistical tests of the hypotheses that $A_1 = A_3$, $A_1 = A_{3a}$, and $A_3 = A_{3a}$ lead to rejection of these hypotheses at the 0.0001 level.[5] Thus the completeness of benefits data included in the dependent variable substantially alters estimates of labor market differentials. Additionally, the adjusted R^2 values in table C11.1 are higher for regressions using some measure of fringe benefits in the dependent variable (this is also true of Leibowitz's table 11.4).

Other problems with the data and analysis in Leibowitz's paper suggest that its conclusions should be viewed with caution. The censoring problem in the HIS study (a $25,000 income cutoff in 1973 dollars) is a liability for studying the effect of the differential taxability of fringe benefits. Her estimated union and sex differentials are not compared with those estimated elsewhere in the human capital or wage determination literature. Leibowitz does not include variables such as establishment size, occupation, and industry, which have proven important in other studies.

In conclusion, Burkhauser and Quinn show changes in estimated labor supply effects from expanding the concept of labor cost. Smith and Ehrenberg and Leibowitz fail to find expected differences in estimates of labor market parameters, and both results are attributable to the use of incomplete data. Consideration of the complete set of benefits that are relevant to Leibowitz's study makes the data recommendations of this session unanimous: detailed employer-employee data *are* needed for accurate estimates of the determinants of labor cost.

Notes

1. Although Leibowitz states in section 11.2.1 that health insurance expenditures are *not* taxable, in section 11.5.2 she describes this group of fringes as "largely taxable." Health insurance, one of the "most costly" fringe benefit expenditures, was about 4 percent of compensation in 1977, while sick leave and vacation pay comprise 6.9 percent of compensation, according to the 1977 Employer Expenditures for Employee Compensation Survey (U.S. Bureau of Labor Statistics 1980, table 1). These three benefits are "largely taxable" only in the sense that 58 percent of them are taxable.

2. What is meant, it would appear, is that omitting *taxable* benefits does not bias comparisons, for these otherwise contradictory statements then follow: the "exclusion of nontaxable benefits . . . may pose a problem for relative earnings comparisons," and that "ignoring benefits would lead to underestimates." Neither of these statements is supported by the empirical results.

3. The data, and the Area Wage Surveys and Employer Expenditures for Employee Compensation Survey from which the data are derived, are described more fully in Atrostic (1983).

4. The percentage is given by: exp(coefficient) − 1.

5. The appropriate test for equality of (some or all) parameters of regression equations

in which alternative dependent variables are employed is described in Rao (1973, pp. 543–56), and implemented in the SAS statistical package (SAS Institute Inc. 1981). Rao's test assumes that the ratios of the variances of the residuals with respect to the various dependent variables are unknown. Leibowitz's test—entering the difference between alternative specifications as the dependent variable in a regression, and testing whether the coefficients thus estimated are equal to zero—is correct for the case of two alternative dependent variables. I am indebted to Richard J. McDonald for discussions on this point.

For the data presented in this comment, both Leibowitz's test and Rao's test were applied, with essentially equivalent results: the hypotheses that $A_1 = A_3$, $A_1 = A_{3a}$, and $A_3 = A_{3a}$ should not be accepted.

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