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7 New Measures of Labor Cost: Implications for Demand Elasticities and Nominal Wage Growth

Daniel S. Hamermesh

7.1 Introduction

No single measure of labor cost is appropriate for all purposes. Surely the measure appropriate to the employee relates his take-home pay plus the probability-weighted future stream of benefits deriving from his taxes to the disutility of the hours he works. This is clearly different from the measure that a profit-maximizing employer will use in hiring decisions. While I do not claim that the measures developed here are ideal descriptions of the aggregate variable characterizing the typical employer's decisions, they seem far better than the average hourly earnings data typically used in the voluminous literature that employs measures of labor cost either as indicators of the price of labor (see Hamermesh 1976) or (still less appropriately) as indicators of workers' well-being.

In section 7.2 I develop alternative quarterly time series of labor cost and show how their time paths over the past quarter century differ from that of average hourly earnings. Section 7.3 examines the general issue of whether replacing average hourly earnings by these labor cost measures in standard labor demand models affects the estimates of the demand elasticities that are produced. These models are estimated using payroll employment data for four major industries and for the entire private

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nonfarm sector. Finally, section 7.4 examines the extent to which the insensitivity of the growth rate of nominal wages in the United States, to which others have pointed, is real or merely an artifact based on too narrow a measure of labor cost. Though sections 7.3 and 7.4 and the discussion in the concluding section 7.5 show the value and importance of using better measures of labor cost, such demonstrations are only part of my purpose here. Equally important is the construction of the new measures of labor cost themselves. To facilitate their use by others, I present the values of these series in Appendix C of this volume.

7.2 Measures of Labor Cost

Series on average hourly earnings (see *Employment and Earnings*, any issue) are based on all regular payrolls (including paid vacations, holidays, etc., but excluding irregular payments, such as Christmas and other bonuses) and required and nonmandatory fringe benefit charges. The measure is clearly quite far from an employer's average cost of an hour of labor input into production. Even the U.S. Bureau of Labor Statistics' measure of average hourly compensation (see Antos in this volume) only includes employers' payments for fringes such as social security, workers' compensation, health, retirement, and so on. Despite opinions in the literature to the contrary (see, e.g., Sachs 1979), the distinction between hours worked and hours paid for does not enter into the compensation measure, and bonuses are excluded:

> Hours of wage and salary workers in nonagricultural establishments refer to hours paid for all employees—production workers, nonsupervisory workers, and salaried workers.
>
> Compensation per hour includes wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. (*Employment and Earnings*, February 1981, p. 181)

The user cost of training, which surely must be considered as part of the average cost of labor, also does not appear in either of these measures, nor does the net (after-tax) cost of labor.[1] In this section I develop a series of increasingly complex measures of labor cost that take account of these omissions from the commonly used series on wages and compensation. These include measures of the cost of an hour of work (COSTWK); that measure adjusted for the tax treatment of labor cost (COSTTAX); cost per hour worked plus the user cost of training (ECNT); and this last measure adjusted for the tax treatment of labor cost (EC). All the calculations are presented separately for manufacturing and the private business sector (because the U.S. Chamber of Commerce data, on which many of the calculations are based, have a sufficiently large sample of firms only in manufacturing among the individual industries analyzed).[2]

I start with the first three series whose trends are presented in table 7.1—straight-time average hourly earnings (AHE) (only in manufacturing); average hourly earnings (AHE), and compensation per hour (HCOMP).[3] The values of straight-time AHE for manufacturing, and for AHE and HCOMP for both sectors, as well as those of all the series derived in the present paper, are presented in this volume's Appendix C, tables C.1 and C.2. For both manufacturing and the private business sector, I present the growth in the trend of the latter two series between 1953:I and 1978:IV, and the actual growth between 1968:IV and 1978:IV.[4] The growth of each series in table 7.1 is in real terms: The deflator for manufacturing is the producers' price index of manufactured goods, that for private business is the deflator for output from the private business sector.[5]

Not surprisingly, given the sharp increases in mandatory social insurance payments and in bargained and unilaterally granted retirement and health benefits, real hourly compensation has increased far more rapidly, both in the entire postwar period and in the last decade, than have average hourly earnings. Clearly, even the slightly more comprehensive measure, hourly compensation, may produce substantially different views of phenomena relating to labor cost.

As the first step in modifying the existing cost series, I account for the existence of irregular payments, such as bonuses and the distinction between time paid and time worked. This latter distinction accounts for clean-up time, vacations, holidays, etc., though not for on-the-job leisure. I define the cost per hour worked as:

$$\text{COSTWK} = (\text{HCOMP} + \text{OTH}*\text{AHE})/(1 - s_1),$$

where HCOMP is the BLS compensation per hour paid; OTH is the fraction of payroll in the Chamber of Commerce surveys for irregular payments to labor; and s_1 is the fraction of payroll in the surveys that goes for time not worked.[6] COSTWK inflates the sum of compensation plus bonuses per hour paid for by the ratio of hours paid for to hours worked. As table 7.1 shows, this series has increased somewhat more rapidly than even hourly compensation (almost entirely because of increases in the length of paid vacations and the number of paid holidays). The differences between the trends in the two series seem fairly constant over the twenty-six-year period 1953–78. It is worth noting, though, that while the postwar trends in manufacturing and in the entire private business sector are nearly identical, real labor cost increased far more rapidly during the 1968–78 decade in the rest of the private business sector than in manufacturing.

Like interest payments and material costs, labor cost is an expense that corporations can deduct when calculating their profits for tax purposes. As such, a lower corporate income tax rate raises the net cost of labor to

Table 7.1 Trend Growth, 1953:I–1978:IV, and Actual Growth, 1968:IV–1978:IV, Real Labor Cost Series (in percent)

	Manufacturing		Private Business	
Labor Cost Measure	1953:I–1978:IV	1968:IV–1978:IV	1953:I–1978:IV	1968:IV–1978:IV
Straight-time AHE	53.8	1.8	—	—
AHE	55.4	1.6	66.5	11.5
Hourly compensation (HCOMP)	80.3	5.7	81.6	17.3
Cost/hour worked (COSTWK)	92.7	8.8	93.9	20.8
Cost/hour worked adjusted for taxes (COSTTAX)	123.7	10.7	124.8	23.1
Cost/hour worked adjusted for user cost of specific training (ECNT)	91.9	9.7	98.0	22.4
Cost/hour worked adjusted for taxes and user cost of specific training (EC)	121.4	11.2	127.7	24.3

the firm. (It will change the price of labor relative to that of capital, since capital costs cannot be expensed, so long as investment tax credits and allowable depreciation rates are not changed.) Since 1953 the highest marginal corporate tax rate has been steadily lowered: It was 52 percent from 1953 to 1963, 50 percent in 1964, and 48 percent from 1965 to 1978. This reduction has raised the net cost of labor by lowering the fraction of labor cost that can be subsidized through reduced taxes. I calculate COSTTAX as one minus the marginal corporate income tax rate times COSTWK.[7] The long-term and recent trends in COSTTAX are presented in the fifth row of table 7.1; they reflect the extra fillip to net labor costs that has been induced by the steady reduction in corporate income tax rates over the years.

When an employer hires a worker, the cost of hiring and training is presumably justified by the higher productivity expected. Insofar as the training is entirely general, the worker's earnings will reflect the cost of training. However, to the extent that the training is specific, the firm will bear part of the cost of training, and any measure that does not account for this will be incomplete.[8] Such costs must be included in an expanded labor cost measure. Materials costs obviously belong; and since the time of instructors is included in the denominator of COSTWK, though it does not add to production directly, it must be subtracted out implicitly by adding it to the cost per hour of those workers actually engaged in production. Essentially, instructors' time is a fixed cost to be allocated over that part of total hours worked accounted for by persons engaged in production.

The degree of bias resulting from ignoring this problem may have changed over time, both because the amount of training relative to the value of the raw labor may have changed, and because the time horizon over which the training cost can be amortized (the expected length of the worker's stay with the firm) may have changed. While we cannot measure changes in the relative cost of training and raw labor, we can account for changes that may have occurred in the time horizon. So too, we can adjust a training cost series to account for cyclical variations that do not affect long-term calculations of training cost.

The time horizon over which the employer's share of the cost of specific training can be amortized depends on the number of hours worked per time period and the expected length of the worker's stay with the firm. This latter in turn is a function of the expected quit rate. To derive measures of the firm's expectations about hours worked, H^*, and the quit rate, Q^*, I estimate:

(1a) $$Q = a_0 + a_1 t + a_2 U,$$

and

(1b) $$H = b_0 + b_1 t + b_2 U + b_3 \text{PTTIME},$$

where Q is the aggregate quit rate (measured as the fraction quitting), H is the length of the average workweek (in manufacturing or in the entire private business sector), t is a time trend, U is the unemployment rate of males 25–54 (a cyclical indicator), PTTIME is the fraction of workers (in manufacturing or the private business sector) who work part-time, and a_i and b_i are regression coefficients to be estimated.[9] Equation (1a) is estimated using quarterly data, 1953:I–1978:IV, for manufacturing only because of the lack of good data for most of nonmanufacturing. Because the data on part-time employment are not available before 1957, equation (1b) is estimated on quarterly data for manufacturing and private business, 1957:I–1978:IV.[10] The estimates are used to derive series on Q^* and H^* that are free of cyclical variations and changes induced by the changing part-time/full-time composition of the labor force. In particular, $Q^* = Q - \hat{a}_2(U - \bar{U})$, and $H^* = H - \hat{b}_2(U - \bar{U}) - \hat{b}_3(\text{PTTIME} - \overline{\text{PTTIME}})$, where the superior bar denotes the sample mean and the caret denotes an estimate. Q^* and H^* are thus the adjusted quit rate and average weekly hours, respectively.

The second input into the calculation of the user cost of training is a measure of the amount of specific training embodied in the average worker. We cannot derive a time series on the user cost, but we can measure it at a specific time for use with the time-varying Q^* and H^*. I rely on the assumption that the cost of specific training is split evenly between the worker and the employer, while general training cost is borne by, and all benefits reaped by, the worker. (The former is a reasonable outcome under certain symmetry assumptions about the underlying bilateral monopoly.) I estimate $S/(S + G)$, the ratio of specific to total (specific plus general) training, as the ratio of the effect of job tenure relative to that of total experience on the wage in a sample of typical workers. Using the estimates of Mincer and Jovanovic (1981) for a representative sample of male workers in 1975 from the Michigan Panel Study of Income Dynamics, the ratio of tenure to total experience is .324 at the mean wage.[11] Under the assumption that the cost of specific training is split evenly between the employer and the worker, the employer's share of total training cost for the typical worker is .5 $S/(S + G)$, or .162. Assume that the amount of training can be derived as the difference in earnings between the average person with no experience and the average person. (To the extent that wages of inexperienced workers are depressed because they are paying for specific training, this will overstate its true cost.) The amount of annual earnings due to training is .162 $(W - W_0)$, where W is the average annual earnings in a sample of workers, and W_0 is the earnings of the average worker with zero experience, both from Mincer's (1974) estimates for white, nonfarm males in 1959.

Assuming further that the rate of return to specific training equals the rate of return to education, the present value of the employer's return to the specific-training investment relative to average annual earnings is:

$$\tau = [.162(W - W_0)/r_e] \cdot \frac{1}{W},$$

where r_e is the rate of return to education (also from Mincer 1974). I calculate $\tau = 1.076$. In any given year, then, the value of the employer's cost of specific training of full-time worker equivalents is (2000τ) AHE_t. To find the cost of amortizing this investment, convert adjusted weekly hours, H_t^*, to monthly hours ($4.33\ H_t^*$) and divide it into the adjusted monthly quit rate, Q_t^*, to derive the fraction of the investment expected to disappear each hour. Then the employer's cost of specific training per hour paid for is:

$$T_t = \frac{Q_t^*}{4.33H_t^*}(2000\tau)\ \mathrm{AHE}_t.$$

The cost of specific training, T_t, is multiplied by $(1 + s_1)$ to convert it to a per hour worked basis; the result is added to $COSTWK_t$ to derive $ECNT_t$. These series reflect differences between hours paid and hours worked, all nonwage payments, and the user cost of training. The method of construction also implicitly includes any turnover cost that is specific to the firm (that raises wages in the firm more than does general experience). The long-term and recent trends in these series for manufacturing and for private business are presented in the penultimate row of table 7.1. The differences in the trends between these series and COSTWK are slight. It is interesting to note that ECNT has been rising more rapidly than COSTWK in manufacturing since 1968, though it rose less rapidly until 1968.

The fifth and final measure of labor cost simply takes the measures ECNT and multiplies them by one minus the marginal corporate income tax rate to derive after-tax employment cost measures, EC, that include the user cost of specific training. The last row of table 7.1 shows the trends in these series. Since they differ little from those in COSTTAX, they do not merit special comment.

Are these new measures consistent with ones that might be constructed from other sources of data? Consider the ratios in the two rows of table 7.2. Those in the first row are based on average values calculated from Appendix C, table C.2. (The data for 1979:II are based on updates of the series made possible when the 1979 Chamber of Commerce data became available.) The ratio shows the rapid rise in fringe benefits and the ratio of hours paid to hours worked. Most remarkably, it is strikingly close to the ratio of total compensation to pay for time worked based on the Employer Expenditures on Employee Compensation (EEEC) survey (calculated from Smeeding, in this volume). Not only are the increases very similar, but the levels are within 1.5 percent of each other. This suggests that the adjustments that led from AHE to COSTWK are reasonable, and that our new series are fairly free of errors that might result from the unrepresentative nature of the Chamber of Commerce sample. Unlike

Table 7.2 **Comparison of the New Series to Alternatives Based on EEEC Data, Private Business Sector: 1966, 1976, 1979**

	1966	1976	1979
New series COSTWK/AHE	1.213	1.323	1.334
Total compensation/ pay for time worked, EEEC data	1.205	1.305	1.327

series based on the EEEC data, which began in 1966, or the BLS Employment Cost Index, which makes adjustment for time not worked but only began in the mid-1970s, ours can be constructed beginning in the early 1950s.

7.3 Estimates of Labor Demand Elasticities Based on Alternative Measures of Labor Cost

Numerous studies have attempted to estimate "the" elasticity of demand for labor. (See Hamermesh 1976 for a review of this literature and Solow 1980 for a discussion of its importance in analyzing the behavior of the macroeconomy.) We know fairly conclusively that short-run (perhaps one-year) elasticities for all labor are quite low, perhaps no greater than .3; that the lags of employment behind changes in the demand for output are short—an average length less than six months; and that the lags in response to changes in factor prices are somewhat longer—average lags between six months and one year.

All of the studies that comprise this literature are based on measures of factor payments to labor that either consist simply of average hourly earnings or include the slightly broader definition, compensation per hour paid. Assuming, as seems reasonable, that productivity per hours worked has not increased proportionally, other things equal, as hours worked have declined relative to hours paid since 1954, on a priori grounds the broader measures can be expected to produce higher estimated elasticities. But, in fact, do the estimates depend very greatly on these definitions? That is, will a broader, and presumably more appropriate, definition produce sharply different estimates of these elasticities? Do the more theoretically appropriate measures explain variations in employment demand better than the simpler measures that have been used in the literature? This section examines these questions.

I use a fairly standard model of employment demand in which changes in output demand reflect a scale effect; changes in factor prices reflect substitution along an isoquant; and a time trend reflects changes in factor productivity. The basic equation is:

$$(2)\qquad E_t = \alpha_0 + \sum_{i=1}^{N_1} \beta_i Q_{t-i+1} + \sum_{i=1}^{N_2} \gamma_i W_{t-i+1} + \delta t + \epsilon_t,$$

where E is employment demand, Q is output, W is a labor cost measure, t is time, and ϵ is a disturbance term. No current wage or output terms are included to avoid any potential simultaneity; further lagged measures of wages and output are included to reflect the finding in the literature that there is a lagged response of employment to these. They are specified in relatively free form because of the consensus that the lags in the responses to changes in output and factor prices are not identical. The lengths of the lagged responses to changes in Q and W, N_1 and N_2, will be determined by varying these and finding the lengths that fit the data best. Though some studies have included a measure of the user cost of capital, we do not include it in this section. (This follows the finding of Clark and Freeman [1980] for the United States that its inclusion has little effect on the coefficients of the other variables in equation [2], apparently because of the large amount of measurement error in the user cost of capital included in previous studies. See also Kollreuter [1980] for West Germany.)

The labor cost series measure *average*, not *marginal*, costs. Fixed costs, such as the training included in ECNT and EC, and part of the social insurance, health insurance, and pension costs included in all the series other than AHE, are spread over all hours worked. A complete labor demand model would estimate the responses of demand for persons and hours separately and allow for asymmetry in the responses of each to changes in labor cost. Thus the short-run elasticities of demand for employees, γ_1, are not correctly estimated; but the long-run elasticities, $\Sigma\gamma_i$, on which I concentrate here, are.

The data are quarterly time series, 1953:I–1978:IV. Because of the need to allow sufficient observations to measure lagged adjustments, the first data points on E used in estimating equation (2) are from 1955:I. The data cover the private nonfarm sector; in addition, separate equations are estimated for the goods-producing sectors, manufacturing, transportation and public utilities, and mining and construction. (These latter two are aggregated because the time series on output was only available for this aggregate.) The employment measure in each case is payroll employment from the monthly BLS-790 data, averaged to produce a quarterly series.[12] Output is gross domestic product originating in the sector, and, except for manufacturing, this and the labor cost series are deflated by the implicit deflator for gross domestic product in the sector. (In manufacturing, I use the producers' price index for manufactured goods.) For each sector the estimates of equation (2) are produced separately for each of four labor cost series discussed in section 7.2: AHE_i, COSTWK_i, COSTTAX_i, and ECNT_i.[13] The latter three measures are in each case based on the average hourly earnings in the particular sector under study.[14]

Equation (2) is estimated using polynomial distributed lags to produce the coefficient estimates β_i and γ_i. Quadratics were used in all cases, and N_1 and N_2 were set equal to 4 and 8 alternatively.[15] Since in all cases I find that the shorter lag structure performed better than the longer, the results are presented for $N_1 = N_2 = 4$. The equations are estimated, adjusting for possible autocorrelation in the error structure of equation (2), using the Cochrane-Orcutt iterative technique.

The results of estimating (2) for the total private nonfarm sector, and for the three smaller aggregates separately, are presented in tables 7.3 through 7.6. Let us consider first the peripheral issues before concentrating on the two questions raised earlier in this section that provide the rationale for examining these results. I find in all cases that there is, as is usual in time-series studies of employment demand, substantial autocorrelation in the residuals *even when* a time trend is included. This suggests that those studies (the majority) that have failed to adjust for this problem have likely produced inefficient estimates of wage and output elasticities of employment demand. I also find, somewhat disturbingly, that there is no significant negative time trend in employment demand, ceteris paribus, in transportation and public utilities, and in the entire private nonfarm sector. Since I would expect labor-saving technical progress to have occurred in these sectors, and to see it reflected in a negative trend term, this result is disturbing. Perhaps, though, previous authors' findings

Table 7.3 **Payroll Employment, Private Nonfarm, 1955:I–1978:IV, with Different Labor Cost Series**

	Cost Measure			
	AHE	COSTWK	COSTTAX	ECNT
Time	−.00021	.00090	.00054	−.00099
	(−.27)	(.89)	(.57)	(−1.33)
Output (sum of four lag terms)	.902	.905	.902	.852
	(15.35)	(15.58)	(15.53)	(4.26)
Labor cost (sum of four lag terms)	−.400	−.472	−.336	−.034
	(−2.50)	(−2.78)	(−2.69)	(−.45)
$\hat{\rho}$	.970	.970	.968	.972
	(39.21)	(39.10)	(37.90)	(40.14)
$\hat{\sigma}_\epsilon$	.003993	.003990	.004016	.004084

NOTE: The numbers in parentheses here and in tables 7.4–7.6 are *t* statistics.

Table 7.4 **Payroll Employment, Manufacturing, 1955:I–1978:IV, with Different Labor Cost Series**

	Cost Measure			
	AHE	COSTWK	COSTTAX	ECNT
Time	−.00544	−.00453	−.00447	−.00550
	(−10.81)	(−7.82)	(−7.45)	(−7.31)
Output (sum of four lag terms)	.958	.938	.948	.920
	(14.84)	(17.83)	(18.18)	(16.32)
Labor cost (sum of four lag terms)	−.230	−.288	−.253	.008
	(−2.34)	(−3.27)	(−3.24)	(.08)
$\hat{\rho}$	.908	.891	.888	.956
	(21.14)	(19.10)	(18.81)	(31.57)
$\hat{\sigma}_\epsilon$	.006854	.006704	.006717	.006897

on this (see the survey in Hamermesh 1976) have been clouded by their failure to account carefully for serial correlation in the residuals.

Consider which of the labor cost measures produces the lowest standard error of estimate in the aggregate of the private nonfarm sector and in the three separate subaggregates. We see from table 7.3 that in the aggregate COSTWK gives the best fit, as it does in manufacturing.

Table 7.5 **Payroll Employment, Transportation and Public Utilities, 1955:I–1978:IV, with Different Labor Cost Series**

	Cost Measure			
	AHE	COSTWK	COSTTAX	ECNT
Time	.0025	.00090	.00080	−.0002
	(.22)	(.73)	(.61)	(−.02)
Output (sum of four lag terms)	.599	.598	.568	.497
	(6.24)	(6.54)	(6.28)	(5.88)
Labor cost (sum of four lag terms)	−.350	−.346	−.254	−.092
	(−1.78)	(−1.93)	(−1.57)	(−.85)
$\hat{\rho}$	.970	.970	.969	.971
	(38.82)	(38.56)	(38.52)	(39.36)
$\hat{\sigma}_\epsilon$	.007013	.00695	.007069	.006881

Table 7.6 **Payroll Employment, Mining and Construction, 1955:I–1978:IV, with Different Labor Cost Series**

	Cost Measure			
	AHE	COSTWK	COSTTAX	ECNT
Time	.00288	−.00244	−.00146	−.00334
	(−1.47)	(−1.10)	(−.66)	(−2.05)
Output (sum of four lag terms)	.954	.949	.982	.925
	(10.17)	(10.22)	(10.60)	(9.84)
Labor cost (sum of four lag terms)	−.219	−.218	−.355	−.081
	(−.80)	(−.90)	(−1.59)	(−.56)
$\hat{\rho}$	.975	.973	.975	.969
	(43.03)	(44.03)	(42.96)	(38.44)
$\hat{\sigma}_\epsilon$	.008954	.008962	.008762	.009149

COSTTAX produces the best fit in mining and construction, while ECNT gives the best results in transportation and public utilities. The differences in the fits across the equations using the different series are not great; nonetheless, it is apparent that, at the least, there are gains to basing the compensation measure on hours actually worked rather than on hours paid for to describe employers' labor demand.[16] While various of the labor cost measures perform best in the various sectors, in each case the measure that does best is based on hours worked. This suggests that the literature on labor demand, based as it is on measures of earnings or compensation per hour paid for, has problems.

If we view the incomplete measure of labor cost, AHE, as embodying an error of measurement, we should expect previous work to have underestimated the true elasticity. In fact, in the samples used here I find that, with the exception of transportation and public utilities (in which the wage terms are not significantly different from zero), using better measures of labor cost increases the absolute values of the wage elasticities. For example, in the private nonfarm sector the elasticity increases from .40 in the equation using AHE to .47 in the equation that gives the best fit, that using COSTWK. Similarly, in manufacturing the estimated elasticity increases from .23 to .29; in mining and construction the estimate goes from .22 to .36 in the best-fit equation, that based on COSTTAX. Though the differences are less than one standard error in all cases, it appears reasonable to conclude that labor-demand elasticities produced in previous time series studies are underestimates because of the failure to include a sufficiently comprehensive measure of labor cost.

Basing the equations on better measures of labor cost also affects the estimated trend terms and the employment-output elasticities. In the latter case, the effects are very minor. For example, in the private nonfarm sector and in mining and construction there is a tiny increase, while in manufacturing and transportation and public utilities there is a decrease. The time trend becomes more positive, except in transportation and public utilities, when the better labor cost measures are included; in manufacturing, though, the only industry in which this trend was significant, it remains negative.

Perhaps the best conclusion from this evidence is that there is some payoff to greater attention to the variables used to reflect labor cost in studies of employment demand. A more careful specification slightly improves the ability to track variations in employment, and it increases the estimated responses of employment demand to exogenous changes in labor cost. One would suppose in complete systems of factor demand equations, where incorrect data series might interact with powerful estimators to produce greater errors, that an even larger payoff would exist. This payoff is evident in the estimation of a system of equations for adult and teen labor in Hamermesh (1982).

7.4 Does Nominal Labor Cost in the United States Respond to Short-Term Price Variations?

Several authors (Sachs 1979; Grubb, Jackman, and Layard, 1982) have pointed to the apparent nonresponsiveness of nominal changes in labor cost in the United States as the rate of price inflation varies. Both narrowly define labor cost (the former, private nonfarm compensation per hour paid for, the latter, manufacturing average hourly earnings). It is claimed that this apparent rigidity in the growth rate of nominal wages has enabled the United States to maintain real wage flexibility when exogenous price shocks occur and thus to avoid the sharp increases in unemployment that plagued other Western nations in the mid- and late 1970s. Is this observation correct, though, or is it merely an artifact produced by defining labor cost too narrowly?

We can write the true cost per hour worked, C_t, as:

$$C_t = W_t(1 + M_t), \tag{3}$$

where W_t is a more narrowly defined measure of labor cost (wages or compensation per hour paid for), and M_t is the percentage by which true cost per hour of labor input differs at time t from the narrower measure. Taking logarithms and differentiating with respect to time:

$$\dot{c}_t \cong \dot{w}_t + \dot{m}_t, \tag{4}$$

where lowercase letters denote logs, and the dot denotes the time derivative. For the pattern of true labor cost to vary more closely with short-term price fluctuations than do earnings, the markup over earnings must itself change over time with the rate of price inflation. Is this likely to occur? Remembering that C and W differ by hours of paid leisure and (mostly untaxed) health, pension, and other contributions, a tentative affirmative answer seems reasonable. Given the nature of the U.S. tax structure in the 1970s, more rapid price inflation raised the marginal tax rate facing the average worker, thus lowering the price of nonwage elements of compensation. It has been shown that workers do react to the tax price of different components of compensation (Woodbury 1983); that being the case, we should not be surprised to see that $\dot{c}$ varies more closely with price changes than does the narrower $\dot{w}$.

Annual percentage changes in five labor cost series are presented in table 7.7 along with their coefficients of variation and changes in the CPI for the period beginning with the oil shock. Especially in manufacturing, AHE and HCOMP are far less variable than are the broader measures I have derived, as simple inspection of their values for 1975–78 and consideration of the standard deviation of these four values shows. More important, the broader measures seem to vary with changes in the CPI during this period substantially more closely than do hourly earnings or compensation per hour paid in manufacturing. In the entire private business sector even AHE and HCOMP do show some signs of varying with the CPI during the mid-1970s; however, their variability is less, and apparently less closely related to that of the CPI, than is the variation in the broader labor cost measures I have derived.

Additional light on the relation between $\dot{m}$ and inflation is shown by estimates of:

$$\text{(5)} \qquad \text{CO\dot{S}TWK}_t - \text{A\dot{H}E}_t = a + b\ \text{C\dot{P}I}_t,\ t = 1973, \ldots, 1979.$$

For manufacturing, $\hat{b}$ from equation (5) is .28 ($t = 1.40$); for the private business sector it is .04 ($t = .47$). This provides some confirmation, though, perhaps because of the size of the postshock sample, hardly overwhelming evidence, of a positive relation between inflation and the divergence between growth in labor cost per hour and average hourly earnings.

My purpose here has not been to demonstrate that the coefficient on labor market slack, in an equation relating changes in labor cost to expected price changes and the extent of slack, increases when one defines labor cost more broadly (though I think that is the case). Rather, it has been the narrower one of pointing out the pitfalls of basing one's view of macroeconomic adjustment on inappropriate measures of labor cost. The rate of change of nominal labor cost may have been less responsive to price inflation in the United States than in other countries in

Table 7.7 **Percent Changes in Nominal Labor Cost Series and Consumer Prices (fourth quarter to fourth quarter), 1972–1980, and Their Coefficients of Variation**

	Manufacturing					Private Business					
Year	AHE	HCOMP	COSTWK	ECNT	EC	AHE	HCOMP	COSTWK	ECNT	EC	CPI (lagged one year)
1972–73	8.2	8.0	8.2	9.5	10.9	7.1	8.3	8.6	10.1	10.1	3.5
1973–74	10.1	12.7	14.0	10.5	11.5	10.1	10.7	11.3	7.6	8.3	8.4
1974–75	7.5	9.0	9.8	11.6	11.9	8.0	8.6	9.0	11.6	11.6	12.1
1975–76	8.4	9.0	8.6	7.8	7.5	8.0	8.7	8.5	7.5	7.5	7.2
1976–77	8.9	9.1	7.7	6.9	6.7	7.1	7.3	7.2	6.3	6.3	4.8
1977–78	9.0	8.7	8.6	9.3	9.2	9.2	9.0	9.2	9.7	9.6	6.7
1978–79	8.3	9.2	9.1	—	—	8.1	8.9	8.7	—	—	9.0
1979–80	10.6	12.1	12.7	—	—	10.1	10.5	10.7	—	—	12.7
Coefficient of variation:											
1972–78	.101	.177	.243	.185	.226	.143	.126	.149	.226	.215	
1972–80	.116	.175	.232	—	—	.142	.124	.142	—	—	

the 1970s, but its variability was greater than is indicated by commonly used measures of the demand price of labor.

7.5 Conclusions and Other Uses

There is no perfect measure of labor cost, but in this study I have presented calculations leading to the construction of easily usable alternative measures beyond the published ones on average hourly earnings and hourly compensation. These new series account for deviations of hours paid for from hours worked, for the tax treatment of wages under the corporate income tax, and for variations in the user cost of training. When used in place of the published series in regression equations describing the demand for labor in the United States, they generally produce slightly better fits and somewhat higher wage elasticities. This is to be expected insofar as they purge the published series of additive errors of measurement. The new series also provide a somewhat different view of the recent path of wage inflation in the United States, suggesting that nominal wage growth has been more responsive to variations in price inflation than the published labor cost series indicate.

I have not given the potential user of these series any guide about which one is in any sense the "best" to use for various purposes; in fact, no such guide is possible. However, the results on labor demand and a consideration of the concept of the employer's cost of labor suggest at the very least that a series that adjusts for the hours paid/hours worked distinction is required. Thus the series COSTWK, which adjusts hourly compensation and average hourly earnings to account for this distinction, would seem a good choice for use in any research requiring a measure of the demand price of labor. It has the additional virtue of being easy to update from readily available information using very simple techniques, as I have done in Appendix C of this volume for 1979 and 1980, and it is much "cleaner" than the more complex series I have constructed.

There are both substantial scope and need for using these new series or refined versions of them in other empirical work in labor economics. I have shown that they add to our ability to understand empirical aspects of labor demand. Though their effects in the simple equations I have presented are not major, they may well be far greater in the very closely specified equations (see Sargent 1978) that have used only the average earnings per hour paid for. Similarly, studies of the behavior of layoffs in the aggregate (e.g., Brechling 1981), which are important for analyzing the impact of unemployment insurance, for testing the theory of implicit contracts, and for examining unions' effects on the employment relation, should be based on these newer series rather than the earnings or compensation measures now used. Some of the complicated testing of recent theoretical results in macroeconomics, for example, tests of disequilibrium in aggregated markets (Rosen and Quandt 1978) or of the intertemporal substitution hypothesis (Altonji and Ashenfelter 1980), would be better examined using the new series derived here. Finally, though the conventional wisdom in the hoary debate of the cyclical behavior of real wages is that they are procyclical (Tobin 1980), not supported by the most recent empirical work (Chirinko 1980), the issue has not been examined using proper measures of the price per hour worked. In all these cases, then, there is a need for basing empirical work on a measure of labor cost more closely related to the concept being examined than are the average earnings or compensation measures that have been used. Though the trends in our series do not differ that greatly from those in the standard series, even slight differences are likely to have major impacts on estimates from tightly fitting time-series equations.

The measures are not true reflections of the price of an efficiency unit of labor, as they have not made two corrections. First, they do not account for changes in the composition of hours within industry aggregates because of changes in the occupational mix of employment. (This is done by the new Employment Cost Index series produced by the Bureau of Labor Statistics.) Second, they do not adjust for cyclical and secular changes in labor quality (nor does any other series). Thus, though representing an improvement over what is available, they must be viewed as a step on the road between the series now available and the ideal series.

Notes

1. Chinloy (1980) includes some fringe benefits, such as employer contributions for social insurance, in his calculation of labor cost, but ignores the distinction between hours paid and hours worked.

2. The source for these series is U.S. Chamber of Commerce, *Employee Benefits*, a biennial survey through 1977 that has been conducted annually since then. Though sample sizes were smaller in the early years of the survey, in 1978 the data are based on 497 manufacturing firms and 361 nonmanufacturing companies. These surveys clearly overrepresent large firms (though decreasingly so), for firms with fewer than one hundred employees are excluded. Since larger firms do offer higher fringe benefits relative to wages, the levels of the measures I produce are biased up from what a representative sample would produce. There is, though, no reason to expect their growth rates to be biased up for this reason, and the discussion below suggests this is the case.

3. Straight-time AHE and AHE are monthly published BLS data gleaned from the CITIBASE data file. These data were averaged to provide quarterly series for use in this study. Unpublished data on compensation per hour of employees were provided to me by Randy Norsworthy of the Bureau of Labor Statistics. Antos (this volume) describes all these series in greater detail.

4. These trends are derived from a bivariate regression of the logarithm of the labor cost series on a time trend.

5. The deflator and the producers' price index for manufacturing are taken from the CITIBASE data file. The latter series was averaged to put it on a quarterly basis.

6. Because the Chamber of Commerce data are available only biennially, I interpolated linearly between observations in this series, treating each observation as having been made in the middle of the calendar year to which the survey is attributed. (Thus I assume implicitly that the surveys were taken on July 1 of the years in question.)

7. I recognize that not all employers in the private business sector are incorporated; that not all corporations pay the highest marginal tax rate; and Lazear's point that the average tax rate may be more appropriate than the marginal for some purposes. Nonetheless, many of the largest employers do pay the highest rate; marginal rates paid by others are correlated with the top marginal rates; and average rates are likely to be correlated over time with marginal rates. I therefore base the COSTTAX series on the highest marginal corporate income tax rate payable in the calendar year. In doing so I also ignore any issue of tax incidence.

8. This distinction and the conclusions about the burdens of the cost of training of different types stem from Becker (1964).

9. Data on the number of voluntary part-time workers are from BLS, *Handbook of Labor Statistics*, Bulletin 2000, and *Employment and Earnings*, January 1979.

10. For manufacturing, the parameter estimates are: $a_0 = .0294$; $a_1 = .000047$; $a_2 = -.0037$; $b_0 = 43.59$; $b_1 = .028$; $b_2 = -.40$; $b_3 = -1.46$. The coefficients of determination for the two equations are .753 and .615. The equations were estimated by ordinary least squares. For the private business sector, the estimates are: $b_0 = 44.58$; $b_1 = -.0067$; $b_2 = -.21$; $b_3 = -.31$. The R^2 for this equation was .956.

11. W is calculated from Mincer's regression (1974, p. 92) as \$5636 and W_0 as \$1633. The implied rate of return to education is .107. In regressions from the National Longitudinal Survey (NLS) adult women's sample in Mincer and Jovanovic (1981), $S/(S + G)$ is .349, while in similar regressions for older males in the National Longitudinal Survey sample in 1973 the same calculation yields .638. I use the Michigan estimates because they are the only ones that are representative of the entire population of adult male workers.

12. Equations like (2) were estimated for man-hours also. The results in manufacturing were similar to those found for employment: The series based on AHE never fit as well as other series, and the wage elasticities produced with the more complex series were higher. For the private business sector the results were remarkably insensitive to the specification of the labor cost variables.

13. Since the equations using HCOMP or EC never produced a lower $\hat{\sigma}_\epsilon$ than those listed in the tables, and since I include equations based on AHE for comparison purposes, I do not present the equations using these two measures.

14. The inclusion of AHE_i, $COSTWK_i$, and $ECNT_i$ is straightforward (though the calculation of $ECNT_i$ for the nonmanufacturing sector requires that T_t be deflated by the ratio of the sector's AHE_t to manufacturing AHE_t).

15. Choosing the appropriate N reduces to finding the best fit, since the degrees of freedom in the regression are the same (dependent on the degree of the polynomial used) for any N.

16. The importance of the distinction between hours paid and hours worked has been stressed in the context of measuring cyclical changes in labor productivity by Fair (1969).

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Comment Edward P. Lazear

Hamermesh must be complimented on his examination of various definitions of labor cost and the way in which altering the definitions affects estimates based on them. It must be true that too little attention is paid to the construction of the variables on which we base our analyses and any attempt to investigate their validity should be applauded. Further, the issues on which Hamermesh focuses are important and difficult ones. That having been said, this reader remains unwilling to reject the more standard measures of labor cost in favor of those proposed by Hamermesh, despite the paper's claims of the new measures' superiority.

My apprehension is over two types of issues. First, I am not as convinced as the author that the new measures perform better even in the tests that he conducts. Second, I believe that some of the conceptual underpinnings of new measures are defective. Before discussing some of the more subtle theoretical issues, let us simply reexamine the results.

Hamermesh demonstrates the importance of the new measures by employing them in one of the most important applications of labor cost data—namely, estimating the elasticity of labor demand. I wholeheartedly support this approach to validating the new measures, but conclude that those tests suggest, at best, that new measures make no difference and at worst, that they simply add measurement error.

The relevant comparisons are derived from tables 7.3–7.6. First, the author suggests that the criterion to be used for comparison is the standard error of the estimate. By this criterion, the best measure is COSTWK, if we rely on the aggregate private nonfarm data (table 7.3). However, the traditional measure, AHE, is a very close second, and the two other new measures, COSTTAX and ECNT, are considerably poorer performers. The picture is more complicated if we look at the disaggregated estimates contained in tables 7.3–7.6. For mining and construction, the best measure by this criterion is the traditional AHE. The worst is ENCT with COSTWK third. For transportation and public utilities, the best is ECNT with COSTTAX performing worst. For manufacturing, the best is COSTWK with ECNT performing worst. To this reader, this is a pattern which effectively defies conclusion.

The point is even clearer if another criterion, namely examination of the actual labor cost coefficient, is adopted. The author points out that the absolute value of the coefficient is larger in the COSTWK equation than in the AHE equation (see table 7.2). But this difference, which is the largest one in the "right" direction in any table, amounts to less than one-half the standard error of any one coefficient. Further, there is hardly

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a consistent pattern of any definition's dominance over another in magnitude of the estimated coefficient. There is one exception to this: The coefficient on ECNT is as close to zero in all samples as one can imagine. This reflects the fact that it is almost pure noise as a measure of labor cost. Below, I will provide some theoretical reasons why this might be so.

The second source of apprehension stems from the lack of a coherent statement of what comprises a conceptually appropriate measure of labor cost. Measurement problems aside, it is important to know what one is looking for so that we can recognize its discovery. This does not negate that the appropriateness of a measure may well depend on the use to which it is applied. But the failure to be more specific about what one wants to find causes confusion. Consider an example:

The most creative measure that Hamermesh derives is ECNT, which takes into account the employer cost of specific human capital. Although I believe that there are some technical mistakes in its construction, let us for now assume that it measures exactly what it purports. My contention is that for most purposes, including the estimation of demand elasticities, it is inappropriate to take that cost into account.

Specific human capital makes the worker more productive when he is at the firm in question. So does the machine with which he works. Yet one would never argue that the amortized cost of the machine should be included into the cost of labor. But, one might argue, the machine is different because its cost is explicitly measured elsewhere whereas the cost of providing specific human capital is not. Yet even this is not correct. Specific human capital must be produced with other inputs currently at the firm. Consider the extreme case where the production of specific human capital requires only labor, e.g., a senior worker teaches a junior worker. The cost of this labor has already been taken into account in the reported earnings of the teacher. Accounting for the cost of specific human capital and the teacher's earnings counts cost twice without counting the output of the human capital. Thus, a firm which engages in a significant amount of training of junior workers would show up as a low productivity firm, not only because the output of human capital is not counted, but also because labor cost has been double counted.

Another example is useful. The author bemoans the fact that we are unable to take labor quality into account. At the same time, he argues that ignoring bonuses leads to an understatement of labor cost. But if it is labor per unit of quality that we are interested in, we might do better to ignore bonuses. For example, suppose that labor qualities are perfect substitutes in production. Then a worker who is worth one more dollar earns one more dollar. The bonus may reflect the premium paid to higher quality workers. We surely would not want to argue that workers who receive bonuses are necessarily more costly in efficiency units than those who do not. Yet accounting for bonuses without also adjusting for quality would lead us to this conclusion. In the context of estimating demand elasticities, an increase in the use of high quality workers who receive larger bonuses increases the "cost of labor" when bonuses are included in that cost measure. But the corresponding adjustment in the number of workers employed does not reflect a movement up the labor demand curve. Under these circumstances, we might do better to ignore bonuses altogether.

This discussion should not be interpreted to imply that corrections for specific human capital or bonuses should not be made. Rather, the intention is to point out how important it is to specify more concretely the definition of the conceptually appropriate measure before new measures can be constructed and evaluated.

In closing I wish to reiterate that, although I was not as convinced that this paper conclusively demonstrates the superiority of new measures of labor cost as the author, I share the author's enthusiasm for the issue. I also believe that this paper takes an important step toward a better understanding of labor cost, its uses and misuses.