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WAGE LEVELS AND METHOD OF PAY

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ABSTRACT

The traditional research on method of pay and wages compares those paid piece rates with those paid by the hour, and finds (as predicted by the theory) that those paid piece rates earn more. In this paper, those paid by the hour are divided into those paid standard rates (wage does not vary with performance) and those paid by merit pay plans. An extension of the standard theory predicts that those paid piece rates would have the highest earnings, and those paid standard rates the lowest, with merit pay an "in between" status. The evidence, however, from the Industry Wage Surveys is that those under merit pay receive lower wages than those in the other two groups.

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The causes and consequences of different ways of linking (or not linking) pay to performance have received increasing attention from academic researchers and compensation specialists. The focus of academic attention has been the hypothesized relationship between method of pay and the cost of monitoring workers in different contexts—a theme which, in turn, lies at the heart of recent theoretical insights about the structure of wages. Compensation specialists have noted a decline in the link between pay and performance, and many predict the crisis of competitiveness facing U.S. firms will force a re-strengthening of this link (McLaughlin 1986, Morse 1986).

Empirical work on this topic has not kept pace with theoretical advances. Apart from the rapidly growing literature on executive compensation[1] the literature has not moved beyond early studies showing that workers paid piece rates earn more than those paid by the hour (King 1975, Pencavel 1977, Seiler 1984). After describing the appropriate data set, Lazear (1986, p. 426) despairs that "no data set of this sort exists."

But that assessment may be too pessimistic: the premise of this paper is that a great deal can be learned by a careful analysis of currently available data collected for the Bureau of Labor Statistics Industry Wage Survey. The first section of the paper describes existing models of the choice of method of pay, in which firms choose between piece rates (which tie wages to an accurate measure of worker output) and a highly stylized "time rate" alternative in which wages depend on one's job but not one's job performance. An extension which allows for "merit" pay as an intermediate between piece rates and the stylized time rates of earlier papers is then presented. The Industry Wage Survey data, which provide detailed information on wage-setting methods, are described in Section II. The

relationship between method of pay and wage rates is explored in Sections III and IV. Conclusions and related work are discussed in Section V.

I. Theory

A recent paper by Lazear (1986), which presents a number of models of the choice of method of pay,[2] provides a convenient point of departure. My treatment of the existing theory[3] and of the extensions stresses the hypotheses which are most directly testable with data from the Industry Wage Survey. This means, in particular, that static rather than inter-temporal models are emphasized.

Models of the method of wage setting generally assume the firm has two choices: paying piece rates, in which case earnings increase dollar for dollar with an objective measure of value of output, or paying time rates (or salaries), in which case earnings do not depend on what is produced. To simplify, I will assume the work-week is fixed, which means that earnings per period are fixed under the latter system.

In the simplest model of this sort, each worker's productiveness is fixed (effort is not an issue), and the methods of pay sort workers among firms. Workers know their own productivity, but firms do not, unless they pay a monitoring cost θ. The firm can either pay θ to measure workers' productivity q directly, in which case it pays the worker $q-\theta$, or not pay the cost of the piece-rate monitoring system and pay salary S. The piece rate structure obviously satisfies the zero-profit requirement. Firms using salaries must in equilibrium choose S so they, too, earn zero profits. Since workers know their own q's, they choose the type of firm in which their earnings are highest: workers with $q>S+\theta$ choose piece-rate firms and those with $q<S+\theta$ choose the firms paying salaries. (See

Figure 1.) If q has density and c.d.f. f(q) and F(q) respectively, the zero-profit condition is

$$S = \frac{1}{F(S+\theta)} \int_0^{S+\theta} qf(q)dq$$

Lazear shows that an $S>0$ satisfying this condition exists so long as $\theta>0$. Thus, the salary firms save on monitoring costs and pay lower wages, but this is just balanced off by their having less productive workers.

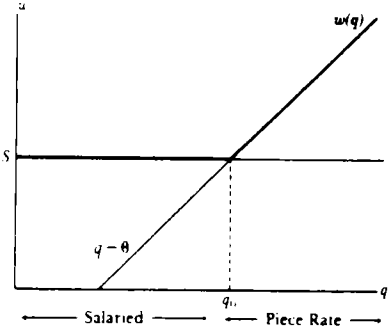

Figure 1
Salary and Piece Rate Firms

The most obvious prediction of this simple model is that, within an occupation, those paid piece rates will have higher earnings than those who are paid time rates.[4] Available evidence supports this prediction (King, 1975; Pencavel, 1977; Seiler, 1984).

The assumption that pay of time-rated workers is unrelated to productivity is overly restrictive—at least for some time-rated blue-collar workers and a clear majority of clerical workers (Cox, 1971; BNA, 1981). Within the general category

of time-rated workers, some receive wages which depend on job category and perhaps seniority but not performance, while others' wages are set individually based on supervisors' perceptions of their productivity. Needed, therefore, is a model which allows the firm to choose among three wage-setting methods—one in which wages depend only marginally on performance ("standard rates"), one in which they depend on supervisors' judgmental evaluations ("merit pay"), and a piece rate system with pay based directly on an objective measure of output. The empirical motivation for this way of defining the boundaries between methods will be clearer when the data are described in Section II.

Corresponding to each wage-setting method is a monitoring technology: the relatively precise measurement of output which characterizes piece rate systems, a less costly but generally less accurate supervisory rating used for merit pay, and the least costly alternative of gathering relatively little information (standard rates).[5] The costs of these three systems are θ_P, θ_M, and θ_S, respectively. Differences in the θ'a across establishments or occupations within an establishment are hypothesized to be a key determinant of method of pay. For now, assume the supply of labor to the industry or occupation is given.

If measurement errors under the alternative systems are uncorrelated with true productivity, then the more reliable the available indicator of productivity, the greater weight the indicator will receive, and the greater the difference in expected wages between workers with a given difference in true productivity (Aigner and Cain, 1977; Lundberg and Startz, 1983; Garen, 1985). The expected wage of a worker with (true) marginal product or "ability" q is

$$w_j = a_j + b_j q, \quad j=S,M,P$$

and

$$b_S < b_M < b_P$$ [6]

This represents a slight generalization of earlier papers in that b_S need not equal zero[7] and b_P need not equal one; the real point however is adding the "in-between" merit-pay category. Merit pay may take the form of "contests" in which each worker's rating depends on his measured performance relative to everyone else's, as in Nalebuff and Stiglitz (1983). Given this ranking of the b's and the assumption that $q>0$, if all three systems are to attract some workers, it must be the case that $a_S>a_M>a_P$. Competition raises a_j for each method until the zero-profit constraint is just satisfied.

The equilibrium is shown in Figure 2. Once again expected-wage maximization by workers leads to only the envelope of the three wage schedules being observed. Figure 2 shows that the model predicts wages will be highest for piece rate workers and lowest for standard-rate workers. While the former prediction has been confirmed in the literature, the latter has never been tested.

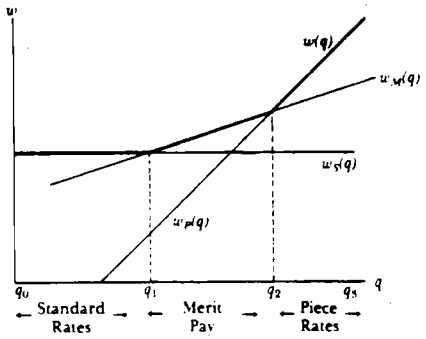

Figure 2
Standard Rate, Merit Pay, and Piece Rate Firms

The above model emphasized sorting of workers with different abilities. An alternative is to emphasize worker effort. The key distinction between ability and effort is that the latter is controlled by the worker, and can be manipulated by the firm by offering appropriate incentives. How does the three-alternative model work when workers vary their effort in response to wage incentives? A worker who exerts effort E produces E worth of output and earns an expected wage of $a_j + b_jE$ if he/she works under method of pay j. A worker with eNergy level N who exerts effort E experiences psychic costs of $E^2/(2N)$, and has utility $U_j = a_j + b_jE - E^2/(2N)$. To maximize utility, the worker chooses effort level $E_j^* = b_jN$, earns $w_j^* = a_j + b_j^2N$ and attains utility level $U_j^* = a_j + b_j^2N/2$. If we now plot $U_j^*(N)$, we have a diagram like Figure 2, except that the axes are U^* and N rather than w_j and q. Recognizing that the worker chooses the method of pay that offers the highest U_j^*, we again have the workers sorting according to N, and the merit-pay workers receiving wages between the low-wage standard-rate workers and the high-wage piece-rate workers.

It is easy to generalize the above model so that the cost of effort function is C(E,N) with the increases in N reducing the marginal (psychic) cost of E.[8] Moreover, N can as easily indicate ability as willingness to work: all that matters is that workers with higher N have lower marginal costs of producing output.

Thus far, I have taken the supply of labor to the occupation or industry in question as given. While it is clear that this is a strong assumption, it is not clear how best to relax it. One possibility is to assume that workers face an alternative wage $\bar{w}$, independent of q. This is reasonable if workers do not know their abilities,[9] but when workers do know their abilities it is equivalent to

assuming that ability in the occupation in question is uncorrelated with ability in alternatives.

A less restrictive option is to assume (returning to the simple model in which effort is ignored) that there is an alternative wage function $w^a(q)$ which must be met if workers of quality q are to be attracted. While the details depend on the shape and position of the $w^a(q)$ one chooses, the basic impact of including w^a is to eliminate part of the q distribution from Figure 2. For example, in Figure 3 workers with $q_0<q<q_1$ still work for standard rate firms, those with $q_1<q<q_4$ work for merit-pay firms, those with $q_4<q<q_5$ accept alternative employment, and only those with $q>q_5$ work for piece-rate firms. It remains true that average wages are highest under piece rates and lowest under standard rates.

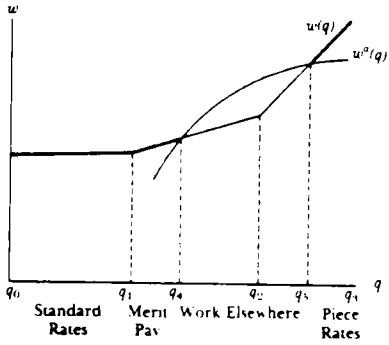

Figure 3
Standard Rate, Merit Pay, and Piece Rate Firms
with Alternative-Wage Function

Throughout this section I have assumed simple linear relationships between wages and measured output. This is particularly restrictive in the variable-effort

models. Both the principal-agent literature (especially Harris and Raviv, 1979) and efficiency wage models (Bulow and Summers, 1986 is probably closest in spirit to the method-of-pay literature) argue that imperfect monitoring makes it likely that discontinuities in the wage function (in particular, firing workers with low measured output) will be optimal. The literature on rank-order tournaments (Lazear and Rosen, 1981; O'Keefe, Viscusi, and Zeckhauser, 1984) argues for a different sort of discontinuity, again in response to imperfect output measures. I present some conjectures about how such a model would work in Section V.

II. Data

The Industry Wage Survey program of the Bureau of Labor Statistics provides data on methods of wage determination and other establishment characteristics. The Survey itself collects, from a sample of establishments in approximately 60 industries (four-fifths of them in manufacturing), these characteristics of the establishment:

- —proportion of production workers paid by various "methods of pay"
- —establishment fringe benefit policies (e.g., number of holidays, vacation days at different seniority levels)
- —establishment employment[10]
- —4-digit SIC industry
- —union coverage
- —region
- —metropolitan/non-metropolitan location

Ten methods of pay are distinguished, five for time rates and five for incentive pay:

- —Time Rates

—single rates—same wage for all those in a job category

—range of rates—each job category has a range of pay rates, and progression through the range is governed by:
  —merit
  —seniority
  —combination of merit and seniority

—individual determination of wages

—Incentive Pay

—individual piece rates

—individual bonus pay (pay for exceeding production quota)

—group piece rates

—group bonus pay

—commissions

The "single rate" and "range of rates—seniority" categories are standard-rate methods. The "range of rates—merit" and "individual determination" categories are merit-pay methods.[11] "Individual piece rates", "individual bonus pay", and (negligible in these data) "commissions" correspond closely to the piece rate system in the theory. "Range of rates—combination" straddles the boundary between merit pay and standard rates. "Group piece rates" and "group bonus pay" probably belong with the other incentive-pay methods; fortunately, these categories are fairly rare in the 10 industries studied here.[12]

In addition, for each production worker in a subset of occupations which includes the major occupations in the industry, this information is collected:

—hourly wage[13]

—sex

—whether paid by incentive or time rates

—occupation (roughly 30 occupations are distinguished for each industry)[14]

Table 1 shows the distribution of establishments by method of pay[15] for blue collar workers in 10 industries.[16] Each industry makes serious use of two or three methods, even though individual establishments typically use one or two. There is, therefore, considerable within-industry variation to explain. While union status is related to method of pay—in particular, unionized establishments are more likely to use standard rates (Freeman, 1982)—the variation in Table 1 is not just a reflection of differences in collective bargaining coverage. The distribution of piece-rate shares in Table 1 is similar to that in the broader set of IWS industries (Seiler, 1984, p. 365) except that industries with 60 percent or more paid piece rates are underrepresented.

III. Method of Pay and Wages

The model developed in Section I (summarized in Figure 2) predicts that

$$\bar{w}_P > \bar{w}_M > \bar{w}_S$$

where each mean is calculated over the "selected" samples of workers actually working under that method of pay. This does not require that we hold constant determinants of productivity like schooling or experience. (The subtler prediction that those who work under one method would earn less if they worked under some alternative does require good productivity indicators, and hence cannot be tested with the IWS.)

The wage-rate regressions in Table 2 use the establishment as the unit of observation. The dependent variable is the mean ln(wage) in the establishment, calculated over all workers in studied occupations. Several independent variables not highlighted in the model of Section I are included. There are dummy variables

for industry (21 4-digit industry dummies), region (3), SMSA (none of whose coefficients is reported in Table 2), and unionization. Also included are ln(establishment size) and the proportion of the workforce (in studied occupations) who are female. Finally, an index which uses the industry's average ln(wage) to weight the establishment's actual occupational distribution is included as a measure of the skill demands of the establishment's technology. Forty-three establishments which had no studied workers or did not indicate which such workers were female were deleted from the sample.

Column 1 of Table 2 shows a "traditional" wage regression, with these variables but none reflecting methods of pay. The results are reassuringly unsurprising. Wages are higher in unionized establishments and in larger ones, and in establishments which use more skilled and more male workers. The coefficients of the dummies for region and metropolitan location (not reported) show the expected pattern of higher wages outside the South and inside metropolitan areas.

The remaining columns of Table 2 add various ways of measuring the proportion of the establishment's production workers who are paid standard rates (single rates, range of rates:merit, and perhaps range of rates:combination) and incentive pay (individual incentive and bonus pay, and perhaps group incentive and bonus). Fortunately, the conclusions are quite robust to the alternative ways of grouping the method of pay variables, and so can be summarized easily. Establishments with larger proportions of incentive-pay workers have higher wages, in line with earlier studies. The estimated premium is 10 to 11 percent. Establishments which make greater use of standard-rate pay also pay higher wages—the premium is about seven percent—and this is true even controlling for

establishment size and unionization. Thus, instead of $\overline{w}_P > \overline{w}_M > \overline{w}_S$, as suggested by Section I, we observe $\overline{w}_P > \overline{w}_S > \overline{w}_M$. Column 7 makes it clear that the same relative ranking persists when we focus exclusively on non-union establishments. Regressions using samples defined by industry, not shown in Table 2, show that this relative ranking is general rather than being confined to one or two industries.[17]

IV. A Closer Look

An important issue for interpreting Table 2 is the correctness of the aggregation by which the ten methods of pay in the IWS are collapsed into the three methods (two explicit, one omitted "reference" method) in the table. To address this issue, proportions of workers paid by each of the less aggregated methods (with "individual determination" as the omitted the reference category) were included as independent variables. These unconstrained results strongly supported the groupings in Table 2: the coefficients were

$$\left[\begin{array}{l}\text{single rates .11 (.01)} \\ \text{range of rates:seniority .08 (.01)}\end{array}\right] \text{ standard rates}$$

$$\left[\text{range of rates:combination .05 (.01)}\right] \text{ ??}$$

$$\left[\begin{array}{l}\text{range of rates: merit .02 (.01)} \\ \text{individual determination .00 (base)}\end{array}\right] \text{ merit pay}$$

$$\left[\begin{array}{l}\text{group bonus .12 (.03)}\\ \text{group incentive pay .10 (.05)}\\ \text{individual bonus .15 (.03)}\\ \text{individual incentive pay .13 (.02)}\end{array}\right] \text{ incentive pay}$$

Thus, these unconstrained estimates show that the groupings in Table 2 are indeed grouping methods of pay with similar effects on wages.

In principle, the theory sketched in Section I deals with compensation rather than the wage rate per se. While the IWS has dummy variables indicating the presence or absence of a range of fringe benefits (such as pensions), there is no obvious way to convert these indicators into a dollars-per-hour metric. However, the IWS also provides information on vacation[18] and holidays, so one can measure the fraction of a workyear (260 days) the workers in an establishment are actually at work. Letting timeoff=(holidays + vacation days)/260, the logarithm of the wage per hour worked is equal to

$$\ln[\text{wage}/(1\text{-timeoff})] = \ln(\text{wage}) - \ln(1\text{-timeoff}) \simeq \ln(\text{wage}) + \text{timeoff}$$

However, compared to merit pay workers, timeoff is about .3 percent higher (statistically significant) for standard-rate workers, and virtually identical for incentive-pay workers. Consequently, the standard-rate coefficients using the logarithm of wage per hour worked would be slightly larger than those in Table 2.

One might object that, in Table 2, too much is being held constant. Differences in the ability level in the firm's workforce are the result of different choices of method of pay, and they should not be held constant when computing average wages for each method. Specifically, one might argue that the proportion female should be excluded (if it is capturing differences in on the job training

between men and women), or that the skill index is inappropriate (if one interprets the model as a model of the market for blue collar workers rather than workers in a narrow occupation). In fact, however, deleting these controls had little effect on the method of pay coefficients. The largest change was in the equation analogous to column 4 of Table 2, where the coefficient of the standard-rates variable fell to .040 (.008).

If one accepts the message of Table 2 that $\bar{w}_P > \bar{w}_S > \bar{w}_M$, the result can be read as characterizing either wage of workers who are paid by each method or wages in establishments in which each method predominates. This issue can be pursued in a limited way with the IWS data.

Suppose the wage of worker i in establishment j is equal to

$$w_{ij} = \beta_0 + \beta_S \bar{S}_j + \beta_P \bar{P}_j + \gamma_S S_i + \gamma_P P_i + \alpha X_i + \delta Z_j + e_{ij}.$$

The βs reflect the effect of being in establishments which use particular methods of pay, and the γs reflect the impact of the individual worker's own method of pay. The regressions in Table 2 take establishment means for all variables, and hence identify $\beta_S + \gamma_S$ and $\beta_P + \gamma_P$. Alternatively, because the IWS identifies individual workers as time-rated (standard rate or merit pay) or incentive-paid, we can compute separate means for time- and incentive-paid workers in each establishment and the (within-establishment) difference in these means,[19]

$$\bar{w}_P - \bar{w}_T = \gamma_P - \gamma_S [\bar{S}/(1-\bar{P})] + \alpha(\bar{X}_P - \bar{X}_T).$$

Thus, within-establishment differences in principle identify the effects of individual workers' method of pay, by in effect differencing out the establishment effects.

The within-establishment differences can obviously only be calculated for establishments which use both time- and incentive-pay for some of their workers in studied occupations, only a quarter (820 observations) of the original sample. Equations like those in columns 2 and 4 of Table 2^{20} showed those receiving incentive pay again earning about 10 percent more than those under merit pay, but the premium for standard rates is only about one percent (standard error =.017). Both of these method-of-pay differentials are essentially unchanged by differencing, suggesting they are associated with individual rather than establishment level method of pay. But because the standard-rate premium is so much smaller in this sub-sample, this experiment doesn't tell us much about the seven percent standard-rate differential in Table 2.

V. Conclusions

The basic idea of this paper can be stated simply: treating "merit pay", where individuals' wages are set based on judgmental supervisors' ratings, as an intermediate case between standard rates and piece rates, how well do the simple comparisons of the time rate-piece rate literature generalize?

The model predicts that average wages of those working under merit pay would be less than wages of those working under incentive pay, but greater than those paid standard rates. Empirically, we found that merit pay was not an intermediate case in this sense: these workers consistently received lower wages than either the standard-rate or incentive-pay workers.

Modifying the theory presented in Section I to account for this unexpected finding requires some delicacy. One needs to modify the result in Figure 2 comparing standard-rate and merit-pay workers, while maintaining the empirically confirmed result that incentive-pay workers are the best paid.

A potentially important omission from the traditional "piece rate-time rate" model is the possibility that unsatisfactory workers are discharged. The threat of discharge would require that the firm offer non-discharged workers a higher wage; but, because such a threat would allow the firm to obtain a given level of effort with less spent on monitoring, a higher wage would be feasible. My intuition is that discharges are likely to be most important for standard-rate employers, and that adding in discharges leads to the prediction that such employers would pay higher wages than they would without discharges. Whether it leads them to pay higher wages than merit-pay firms is less clear.

Table 1
Establishments by Method of Pay by Industry

Industry	Number of Establishments	% of Establishments Using†			% Covered by Unions
		Standard Rates	Merit Pay	Piece Rates	
Nonferrous Foundries	367	38	47	15	49
Paints	292	58	42	0	62
Textile Dyeing & Finishing	149	72	20	7	49
Industrial Chemicals	270	79	20	1	74
Cotton Textiles	343	66	9	26	16
Wool Textiles	57	61	17	22	33
Shirts	221	3	23	74	28
Plastics	892	43	53	4	45
Household Furniture	336	18	63	19	41
Steel	332	54	42	4	71

†Apart from rounding error, these three columns sum to 100%.

Table 2
Wage Equations
Dependent Variable = mean ln (hourly wage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
sample	all	all	all	all	all	union	non-u
union	.080	.054	.054	.059	.058		
	(.006)	(.006)	(.006)	(.006)	(.006)		
establishment size	.031	.027	.027	.025	.025	.019	.035
	(.003)	(.003)	(.003)	(.003)	(.003)	(.004)	(.004)
wage-weighted occ index	1.036	1.038	1.034	1.046	1.043	1.228	.860
	(.052)	(.051)	(.051)	(.051)	(.051)	(.080)	(.063)
pfemale	−.184	−.191	−.190	−.195	−.195	−.188	−.207
	(.016)	(.015)	(.015)	(.016)	(.015)	(.025)	(.019)
single or range:seniority		.066	.068			.070	.043
		(.007)	(.007)			(.010)	(.009)
single or range: seniority or combo				.066	.070		
				(.007)	(.007)		
indiv incen or bonus		.103		.117		.098	.093
		(.016)		(.017)		(.025)	(.021)
all incentive methods			.100		.116		
			(.014)		(.014)		
N =	3216	3216	3216	3216	3216	1526	1690

All equations include dummy variables for 4-digit industry (21), region (3), and SMSA.

FOOTNOTES

[1]For recent examples, see Abowd (1990), Gibbons and Murphy (1990), and Leonard (1990). For a survey of earlier work, see Ehrenberg and Milkovich (1987).

[2] An alternative approach would be to emphasize the somewhat different principal-agent literature, as developed by Harris and Raviv (1979), Holmstrom (1979 and 1982) or Green and Stokey (1983). A fundamental difference between these papers and Lazear's is the assumed source of randomness. Lazear assumes that, unless the cost of an accurate piece rate system is undertaken, the firm does not know how much the worker has produced. The principal-agent papers, on the other hand, assume that firms do observe each worker's output (an exception is part of Holmstrom's 1982 paper) but this output depends on environmental factors the worker cannot control as well as effort, so that paying piece rates introduces undesirable risk for risk-averse agents. The extra information sought by the firm is some measure of effort, so that the worker can be partially insured in cases where output is low due to environmental randomness rather than worker shirking. This approach is very likely the right one for thinking about corporate CEOs or salespersons, for whom output is easily measured but environmental randomness is important. Lazear's seems better suited to the blue collar workers in the IWS, for whom environmental randomness is relatively unimportant (the most important randomness, breakdown of machines or material unavailability being easily measured) but measuring output (performance) is costly.

[3] The material in this section is drawn from a longer treatment in Brown (1990).

[4] A second prediction is that, as the costs of directly monitoring output increase, fewer workers will work in piece-rate firms, since an increase in θ shifts down the w(q) function for piece rate firms. The determinants of firms' choice of method of pay are discussed in Brown (1990).

[5]One might make two objections to this classification. First, one might argue that, in some cases, piece rates are less accurate than supervisor ratings as an indicator of productivity (e.g., where quality of output is very important). Such a situation is consistent with the framework in the text, by describing such a

situation as one where the cost of a precise piece-rate system is very high. Second, one might wonder whether merit ratings are very expensive, given that supervisors have a reasonably accurate estimate of workers' productivity which comes "free" from the act of supervising. However, a merit pay system in which considerable weight is placed on the evaluations (see next paragraph) imposes not only the cost of the supervisors writing down what they already know; morale considerations seem to demand that a serious merit-pay system be formalized so that workers will accept it as fair, and co-ordinated so that otherwise identical workers with different supervisors are not treated very differently. Finally, the personnel literature suggests it is difficult—perplexingly so to an economist—for top management to enforce sizeable merit differentials on those setting salaries at lower levels. See Hamner,1983; Strauss and Sayles, 1980.

[6] Part of the weaker link between pay and performance under merit pay comes from errors in supervisors' ratings of performance; the peculiar feature of most merit-pay systems that increments feed into the base wage contributes as well (Schwab and Olsen, 1989).

[7] Thus, we can allow those who perform better under standard-rate regimes to have a greater probability of higher compensation in the future, but the relationship between pay and performance would still be "less than that associated with the other forms of compensation that are more closely tied to current output." (Barron and Loewenstein, 1986, p. 604). Future compensation is neglected in the text because we cannot measure it in the IWS. It is worth noting that future promotions would probably depend on measured performance under any of the systems, so neglecting them may be a defensible simplification when our focus is a comparison among systems. Also, to the extent that less accurate monitoring leaves standard-rate firms less able to identify the "right" workers to promote to higher positions, there is presumably a productivity loss which should be counted as part of the cost of using this system.

[8] A worker maximizing utility under any one of the pay methods will have higher values of E if b or N increases. Moreover, holding b_S and b_M constant, increases in N increase U_M-U_S, so that M will attract higher-N workers than S (and, similarly, P attracts higher-N workers than M). Therefore, a method of pay with

a higher b pays higher wages because it both attracts better (higher N) ones and because N constant they work harder.

[9] Lazear (1986) introduces $\bar{w}$ when workers do not know their own abilities, but reverts to the fixed-supply model when the worker knows q.

[10] The IWS data tape had employment coded in eight size categories. These were converted to a continuous variable by assigning to each category the mean establishment size (for the establishment's 4-digit industry) using data from County Business Patterns for 1977 (U.S. Department of Commerce, 1979, Table 1B).

[11] This usage differs slightly from that used in compensation textbooks, where merit pay means range of rate systems in which position in the range depends on merit reviews (and perhaps seniority), and thus usually would not include a less formal "individual determination" system. For a more detailed description of what is meant by merit pay in that context, see Schwab and Olson (1989).

[12] A more precise definition of the IWS categories is available from the published IWS volumes: Formal rate structures for time-rated workers provide single rates or a range of rates for individual job categories. In the absence of a formal rate structure, pay rates are determined primarily by the qualifications of the individual worker. A single rate structure is one in which the same rate is paid to all experienced workers in the same job classification. (Learners, apprentices, or probationary workers may be paid according to rate schedules which start below the single rate and permit the workers to achieve the full job rate over a period of time.) An experienced worker occasionally may be paid above or below the single rate for special reasons, but such payments are exceptions. Range-of-rate plans are those in which the minimum or maximum, or both of these rates paid experienced workers in the same job are specified. Specific rates of individual workers within the range may be determined by merit, length of service, or a combination of these. Incentive workers are classified under piecework or bonus plans. Piecework is work for which a predetermined rate is paid for each unit of output. Production bonuses are based on production over a quota or for completion of a task in less than standard time.

[13] The hourly wage includes piece rates and production bonuses but excludes annual nonproduction bonuses and premium pay for overtime, holidays, and shiftwork.

[14] One can get a sense of the IWS detail from this sampling of the occupations identified in the wood household furniture study: router operators (distinguished by whether they do set up work or not), rip saw operators, furniture sanders (3 types), and furniture packers.

[15] Establishments which used more than one method are assigned to the three methods in Table 1 in proportion to the fraction of workers paid by each method.

[16] These are the same industries analyzed by Freeman (1982), with the addition of men's and boys' shirts (which Freeman deleted because he was focusing on non-piece-rate pay).

[17] When the sample was divided according to two-digit industry, there were seven sub-samples. The coefficient of the standard-rate dummy was positive in all seven samples, and statistically significant in five. The coefficient of the incentive pay dummy was positive in six industries, and statistically significant in five of these.

[18]The IWS vacation data are presented separately at different levels of seniority. These are converted to an overall average using distributions of workers by tenure by industry from Sekscenski (1980).

[19] Notice that $\bar{S}_T$, the proportion of time-rated workers who are paid under standard rates, is the proportion paid standard rates divided by the proportion paid time rates, and the latter equals the proportion <u>not</u> under incentive pay.

[20] These columns use the definition of incentive pay which corresponds to that used by IWS to classify individual workers as time- or incentive-paid.

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