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CARROTS AND STICKS: PAY, SUPERVISION AND TURNOVER

Jonathan S. Leonard

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ABSTRACT

Large and persistent differences across industries in wages paid for given occupations have commonly been observed. Recently, the efficiency wage model (EWM) has been advanced as an explanation for these wage differentials. The shirking version of the EWM assumes a trade-off between self-supervision and external supervision. The turnover version assumes turnover is costly to the firm. Variation across firms in the cost of monitoring/shirking or turnover then are hypothesized to account for wage variation across firms for homogeneous workers.

This paper presents empirical evidence of the trade-off of wage premiums for supervisory intensity and turnover. A new sample of 200 firms in one sector in one state in 1982 is analyzed. Little evidence is found to support either version of EWM. The substantial variation in wages for narrowly defined occupations across firms remains largely unexplained.

Jonathan S. Leonard
Associate Professor
School of Business
University of California
Berkeley, CA 94720
(415) 642-7048

1. Introduction

Large and persistent differences in pay for a given occupation are commonly observed across establishments and industries. If both workers and jobs are homogeneous, such differences are not predicted by standard theory. Such findings have then been taken as the basis for more complex theories of wage determination.

Principal-agent models extend standard theory to cases of imperfect information. This paper examines the particular case in which employees cannot directly and costlessly observe a worker's effort or output. The monitoring problem may be addressed either by purchasing more direct supervision, or by purchasing self-supervision. The latter choice results in what appear to be occupation and firm specific wage premiums. The aim of this paper is to determine whether there is evidence to support monitoring problems as an explanation for differences across plants in occupational wages. In particular, this paper searches for empirical evidence of a trade-off in production between supervision and wage premiums.

A second version of the efficiency wage model explains wage premiums as a mechanism to reduce turnover. Firms which find turnover particularly costly will find it profitable to offer wage bonuses so as to reduce turnover. This paper also offers empirical evidence of the tradeoff between turnover and wage premiums.

These two variants of the efficiency wage hypothesis are discussed further in the next section. The accumulated evidence on industry and establishment differences in occupational wages is surveyed in Section 3. Section 4 describes the plant level data on wages and supervision analyzed here. Tests of the trade-off between wage premiums and supervision are presented in Section 5.

Section 6 presents tests of the effect of wage bonuses on turnover. The conclusions follow.

2. Efficiency Wage Models

The foundations of efficiency wage theory are reviewed by Katz (1986), from which this section draws. Following Yellen (1984), consider an economy of identical firms in perfect competition, each with production function:

$$(1) \qquad Q = \alpha F[e(w)L]$$

where

- e = The efficiency function giving the effort of the worker, $e' > 0$, $e'' < 0$
- L = Number of employees, all homogeneous
- w = Real wage
- Q = Output
- α = Productivity shifter

The profit maximizing firm chooses both the level of wages, and the quantity of labor to satisfy:

$$(2) \qquad e'(w^*)w^*/e(w^*) = 1$$

and

$$(3) \qquad e(w^*)\alpha F'[e(w^*)L] = w^*$$

In other words at the optimal wage, the elasticity of effort with respect to the wage is equal to 1. This minimizes wage costs per efficiency unit of labor. The second condition is standard: marginal product equals marginal factor price. This model has been offered as an explanation both for unfalling wages in the face of unemployment, and for wage dispersion across firms for identical workers.

This basic efficiency wage model has been developed in a number of versions (Akerlof, 1984; Stoft, 1982). The shirking and turnover variants concern us here. The shirking model is driven by imperfect information: the firm cannot perfectly observe the effort or output of workers, and supervision is costly. The firm cannot impose "ultimate" sanctions on employees: threats of infinite cost (hanging) sufficient to compel non-shirking with infinitesimal supervision. Nor can firms fine, sue, or extract performance bonds from workers. Piece rates are also assumed to be impracticable given the difficulty of observing effort or output. The firm's problem is then to develop an effort-eliciting pay mechanism. Wage premiums may offer the appropriate incentives for self-supervision. Such shirking models are developed in Shapiro and Stiglitz (1984) and the earlier literature reviewed there.

Wage dispersion for identical workers arises in such models because of differences across firms in 1) the cost of monitoring, and 2) the cost to the firm of employee shirking. The level of such bonuses depends in turn on 3) the expected duration of employment.

The turnover variant of the efficiency wage model is similar in structure to the shirking variant. Assume firms bear part of the costs of turnover, and that turnover decreases with wages. Firms with higher turnover costs have an incentive to pay high relative wages to reduce turnover. See Salop (1979) and Stiglitz (1974). Firms also have an incentive to use tenure bonuses, or to have workers post bonds or pay for their own hiring and training costs. For evidence against the use of tenure bonuses, see Abraham and Farber (1985) and Altonji and Shakotko (1985). Where these alternatives are restricted, the turnover model predicts that high wages, associated with high turnover costs, will cause lower turnover rates. This is an empirically testable proposition.

3. Past Studies: Industry Wage Effects

To my knowledge, there have been no past studies of the efficiency wage hypothesis at the level of the firm.[1] This appears to be due to the absence of requisite information in the commonly used data sets, and to the rarity of any studies of firms.

There is a long tradition showing differences in wages paid in the same occupation across industries. Dunlop (1957), for example, shows that in Boston in 1951, the industry with the highest pay for truck drivers paid 1.88 times as much as the lowest paying industry. He ascribes these substantial differences to underlying differences in product markets.

Slichter (1950) finds a high rank correlation (.71 in 1939) of unskilled and skilled wages in an industry. At any point in time, such a positive correlation of unskilled and skilled wages could reflect a transitory demand shock temporarily driving up industry wages along a short-run inelastic supply curve. If so, we would not expect to see the same industries stay at the top of the wage distribution decade after decade. Yet, industry wage differentials appear to be remarkably persistent over time. Slichter (1950), Cullen (1956), Reder (1962), Montgomery and Stockton (1985), Bell and Freeman (1975), and Krueger and Summers (1987) all present evidence of persistent industry wage differentials over differing periods ranging from 1895 to 1984. Taken together this is a century of persistent and largely unexplained industry wage effects.

Behind the Industry Wage Effect

Two regularities appear to stand out from studies that attempt to account for systematic differences in pay within occupations across plants or industries. Higher wages are usually associated with 1) higher profits or concentration, and 2) larger plants and larger firms (the size wage effect). The chief suspect in this search is product market power. Ability to pay appears to be associated with industry wage premiums. Dickens and Katz (1987), and Krueger and Summers (1987) offer useful reviews.

A strong, positive relationship between wages and plant or firm size is also persistently observed, see Brown and Medoff (1984), and the literature reviewed there. Assuming that direct supervision is more difficult in larger plants and companies, this has been taken as direct evidence in favor of the efficiency wage hypothesis.

It is not obvious why the owners of a firm should share their economic rents with their workers, although the morale version of the efficiency wage model offers a possible explanation. Unobserved quality differences in workers leading to both higher wages and profits offers another, Cain (1976). From the perspective of the shirking model, it is troublesome that wage differentials tend to be dominated by employer, rather than occupation effects (Nolan and Brown, 1983), and that at the establishment level much of the differential is accounted for by the unionization and gender of the workers (Groshen, 1985).

Tests of the Efficiency Wage Hypothesis

The earliest applications of the efficiency wage hypothesis were to the output and pay of agricultural workers near starvation. The output effects of wage bonuses in developed economies have not yet been shown. Two provocative and interesting recent studies set the stage for such tests (Dickens and Katz, 1987; Krueger and Summers, 1987). They present a variety of evidence suggesting that neither transitory demand shifts, unobserved human capital, nor compensating differentials can easily account for the observed industry wage differentials, which persist across time and countries. However, the advantage of efficiency wage models in explaining these wage differentials remains to be shown.

More direct tests of the efficiency wage hypothesis are offered by Krueger and Summers (1987), who show that wage premiums are (1) negatively associated with quits, and (2) positively associated with tenure and with self-reported effort and job discretion. In both cases, the effects do not appear to be large enough to make the payment of wage premiums profitable, and both may reflect unobserved quality differences.

4. Data

All of the data analyzed here come from a survey of employment conditions in the high-technology sector of one state. In 1982 this survey includes more than 200 plants with more than 70,000 employees. Employees are placed into one of 290 narrow occupational classifications. For each occupation in each plant, the number of employees and average pay are reported. In most cases, a plant is the sole operating asset of a firm, so one could use the terms interchangeably.

This study analyzes average pay by occupation by plant, which is the average of the base pay rate for individuals in a single occupation. It includes cost-of-living or geographic differentials, and excludes shift differentials, lead premiums, or other differentials which are not considered base pay. Extra compensation which is not regularly paid and considered as part of the normal base pay is excluded. Commissions and incentive pay which are part of total targeted earnings are included. In other words, for incentive pay jobs, the expected value of total pay is reported, deviations from the expected value are not. The pay and employment[2] data analyzed here are for the pay period closest to September 1, 1982. Wage bonuses are taken here as the deviation of plant wages by occupation from the sample mean.

Firms are provided with 290 detailed job descriptions that reflect the normal range of duties, responsibilities and requirements found in each level of the specified job. Employees that do not match a job description by at least roughly 80 percent are to be excluded. The job descriptions are detailed, and the occupational classifications narrow.[3]

Data on supervision comes from the same survey. Organizational charts showing hierarchies and time allocation of supervisors are not available. Instead, for a number of occupations, matching supervisor or manager occupations are reported. For example, the relation of order processing clerks, purchasing assistants, and field service workers to the occupations of order processing supervisors, purchasing manager, and field service supervisor is readily apparent.

I have limited the analysis to sets of workers and supervisors for which the supervisory relationship seemed complete and exclusive from the job descriptions.[4] Absent an actual organizational chart, error cannot be precluded. In particular, supervisory intensity is incorrectly low where higher or lateral supervisors oversee a particular operation, and it is incorrectly high where direct supervisors oversee other occupations in addition to the ones specified here.[5]

Throughout this paper I assume that the very detailed occupational classifications used here serve as a control on worker quality that is at least as good, if not better than, the commonly used age and education measures. Note also that this data is bought and paid for by the participants, rather than by academicians or the government. By the market test of survival, it has proven its usefulness to survey participants, and that usefulness depends on accuracy and reliability. In particular, the occupational categories used in the survey are those that participating firms believe best reflect their own jobs.

5. The Tradeoff of Wage Premiums for Supervisory Intensity

In theory, considering the same occupation in different firms, the efficiency wage model predicts that firms employing more supervisors per worker will offer lower wage premiums. Supervisor intensity and wage bonuses are substitutes in production. This section presents tests of the tradeoff between wage premiums and intensity of supervision for six occupations in subsamples of 19 to 111 manufacturing plants. Consider a production function of the general form:

$$(4) \qquad Q = Q[e(P,S/L)L] \qquad e_1, e_2, > 0$$
$$e_{11}, e_{22}, e_{12} < 0$$

where:

Q = output
P = wage premium for workers
S/L = ratio of supervisors to workers
e = effort function

Along an isoquant, higher levels of P are associated with lower levels of S/L. In principle, this is testable. In practice, the usefulness of any such test will depend critically on 1) the ability to control for variations in output Q, and 2) the ability to hold occupation fixed, or control for the cost of shirking. For the former, this section relies on measures of number of employees; for the latter it relies on the use of occupations narrowly defined within one industry by industry participants.

To test for substitution between two factors of production, by regressing one (wage premiums) on the other (supervisory intensity) is by no means an ideal procedure, and is open to a number of criticisms, many of which are shared by substantial parts of the production function literature. First, factor mix is in theory a function of factor prices, and perhaps scale. Within a single industry in a single geographic area, one might expect little variation in factor prices. Without such variation, the elasticity of substitution in production cannot be well identified. What variation is observed may then represent transient optimization errors, rather than the production function. Second, the choices of levels for both factors of production are endogenous and jointly determined. In this case, the error term in the wage equation may be correlated with the measure of supervisory intensity. I attempt to control for variations in output quantity by including a measure for number of workers on the right hand side. This is obviously troublesome because labor input is itself endogenous. If output is not adequately controlled for, or if what is labelled a single occupation here is not homogeneous with respect to shirking costs, then this procedure biases towards finding a positive correlation between supervisory intensity and wage premiums. This makes any finding of a tradeoff more compelling, but renders the precise interpretation of a positive correlation doubtful. The results to be presented here should be interpreted with this caution in mind. With longitudinal data, one could try to limit the scope of such problems by estimating first difference equations.

The first question to be addressed is whether there is a substantial occupation-specific element of wage differentials, or alternatively, whether the firm effect on wages is similar across occupation. The shirking model is consistent with the former but not the latter case, because it predicts different monitoring difficulties across occupation, rather than a constant firm effect across occupations. Among the compelling pieces of evidence against the shirking model so far is the finding (Dickens and Katz, 1987) in CPS data of highly correlated industry effects across occupations.

To test whether firm effects on wages are highly correlated across occupations, I select six common occupations in which shirking or heterogeneity are likely to be a relatively minor problem. Table 1 shows the correlation coefficients for these six occupations across subsamples of 48 to 91 companies. Most of the occupational wages are positively correlated with each other, and a number of these are significant, but there are also a number of insignificant and negative correlations. Firms that pay high wages in one of these occupations do not also pay high wages in the others. Wage differentials across firms do not simply reflect a constant firm effect, but also reflect occupation-specific components. This result stands in contrast to the Dickens and Katz finding of strong industry wage effects across occupations, using more aggregated occupations and industries. Aggregation across occupations, and firms would tend to average out distinctions, and so could help explain the difference between these two results. The finding here of little constant firm effect across narrowly defined occupations leaves scope for the shirking model. At the same time this finding casts doubt on simple equity theories which hypothesize strong firm effects on wages across occupations.

Table 2 presents characteristics of the sample for six additional occupations chosen using the following criteria: 1) they are found in substantial numbers in a large proportion of companies; 2) they have clearly defined supervisors who are likely to supervise the respective workers and no one else; 3) they appear to have only one set of direct supervisors; 4) they appear to be homogeneous across firms; and 5) effort may not be easily observable and failure to perform may be costly to the firm. No other occupations fulfilled these criteria, although their application obviously involves personal judgement.

There is indeed substantial variation across firms in a single industry and area in the average wage paid to workers. The coefficient of variation of wages among these occupations ranges from .14 field service workers to .22 for testers and machinists. In five of these occupations, the firm paying the highest average wage pays more than twice the lowest average wage. This is the sort of wage dispersion that industrial relations experts have long pointed out, and which efficiency wage theory now attempts to explain.

The occupations in Table 2 are ordered from lowest to highest average wage. If one thought these occupations differed greatly in cost of shirking but had similar factor price ratios of external to self-supervision, then the supervision to worker ratios should follow the same ranking. Table 2 shows no general evidence that differential shirking costs across occupations dominate twists in factor price ratios and result in both higher supervisory ratios and higher costs. Note that outlying firms with zero supervisors in a given occupation, or with more supervisors than workers, have been excluded from the sample.

Within occupations there is no significant evidence of a tradeoff between wage premiums and supervisory intensity. Table 3 shows the results of regressions of worker wages on the ratio of supervisors to workers. If shirkers are more of a potential problem in larger units, and if scale effects dominated this data (or if workers demanded a compensating differential for working under supervisors), we would expect to see strong positive correlations between wages and supervisory intensity. If the efficiency wage hypothesis played an important role in explaining wage premiums, we would expect to see a strong negative coefficient on the supervisor variable. What we actually see in Table 3 can best be described as noise, compounded in some cases by few degrees of freedom. There is substantial variation in wages in these occupations, but there is little evidence that the efficiency wage model helps to explain this variation.[6] In other regressions (not shown) of the average workers' wage aggregated over all occupations, aggregate supervising intensity again has an insignificant and small effect.[7]

Factor Quantities as a Function of Factor Prices

This section tests for substitution between factors of production by regressing the ratio of factor quantities on the ratio of factor prices. In the usual application this has the virtue of relegating the endogenous variables to the left hand side. The results of regressions of the ratio of supervisors to workers on the ratio of supervisors' wages to workers' wages are presented in Table 4. In each of the occupations, firms not reporting supervisors, or supervisors' wages are deleted from the sample. Controls for detailed industry, area, and scale are included.

As the standard theory predicts, the wages of supervisors relative to workers increases when the ratio of supervisors to workers employed falls. This effect is found in all occupations except testers, but is only significant in the case of machinists. The interpretation of this effect is complicated in efficiency wage models because wages are choice variables. It is clear that firms that pay higher wages to workers (relative to supervisors) -- either because they have to or they choose to -- employ fewer workers (relative to supervisors). The negative correlation between supervisory intensity and workers' wages (so a positive coefficient in these regressions) predicted by the shirking model is not generally apparent in these estimates.[8]

Output, Supervisory Intensity and Wages

A production function may be characterized by observing how output varies as inputs change. The inputs in question here, supervisory intensity and workers' wages, are observed. The output of workers is not directly observed. Table 5 assumes that firm output is correlated with firm sales. This is a noisy measure of the relevant output, and is available only for a subset of firms. Table 5 shows regressions of sales on supervisory intensity, the average wage of non-supervisory employees, total employment and the set of dichotomous variables for industry and area. Neither higher wages nor more supervisors per worker are significantly associated with greater sales conditional on total employment.

6. Turnover and Wage Premiums

In its short history, efficiency wage theory has quickly spawned a number of different varieties. Now I turn from the shirking version to the turnover version. The hypothesis is that wage bonuses are profitably paid to reduce costly turnover. This section investigates whether turnover is lower in high wage firms, whether this can explain much of the observed wage dispersion, and whether the wage bonuses are efficient in the sense that they pay for themselves through reductions in turnover.

For each of 200 plants I observe the total number of separations among non-exempt (non-managerial) employees over the previous 6 months, along with total employment of non-exempt employees at the beginning (March 1982) of this 6-month period. I calculate the mean wage paid by each firm to non-exempt employees by weighting mean firm wages for detailed non-exempt occupations by employment share of each occupation in each firm. Separations include quits, fires, and retirements, but should not include temporary layoffs. Unfortunately, I cannot subtract out the retirements, but this is a small proportion of all separations. The turnover rate for each firm is calculated as the ratio (for non-exempt workers) of total separations over the previous 6 months to total employment at the beginning of that period. Turnover averages 25% per half year in the firms sampled here.[9]

The turnover version of the efficiency wage model predicts that higher wages cause lower turnover, and more distinctively that wage premiums increase until the point that marginal reductions in turnover do not add to profits. Table 6 presents the results of regressions of turnover rates on wages for 200 firms. Column 1 presents an unadorned simple regression. Column 2 presents a multiple regression with controls for total employment, occupational composition, industry and area. These additional controls reduce the wage effect on turnover by 14%. In both cases, the first prediction of the efficiency wage model is borne out: higher wages are associated with lower turnover, and the result is statistically significant. But note that a number of other models predict the same result. In particular, a model of accidents predicts this. A smaller proportion of workers is expected to quit at any firm that accidentally pays higher wages.

The important questions are 1) whether this association is strong enough to explain a substantial part of wage variation across firms, 2) whether it is profitable. In both cases, the answer appears to be no. In the first case, while there is considerable variation in both turnover and wages, the former is not highly enough correlated with the latter to account for its variation.

The second question can be addressed by asking how high the marginal cost of turnover would have to be to justify the observed wage premiums. Suppose, as in the first equation of Table 6, that an additional dollar of wages per worker per hour reduces turnover by 3.6 percentage points per worker per half-year. For convenience, think of this as a 3.6 percentage point decrease in the probability that the representative worker turns over per half-year. Assuming a 2080 (52x40) hour work year, this result is achieved at a marginal cost of $2080 per worker-year. For a risk neutral firm, this is profitable only if the marginal cost of turnover exceeds $57,777. Because the wage bonus effect on turnover is small, payment of such bonuses only profitably reduce turnover if the benefits of actual turnover reduction exceeded 28 times the cost. In view of the fact that workers in this sample average an annual pay of $15,500, such exorbitant turnover expenses may be ruled out.

Higher wages are associated with lower turnover, as the efficiency wage model (among others) predicts, but the reduction in turnover achieved by such wages premiums hardly justifies the payment of observed wage premiums as a profit maximizing act.[10]

7. Conclusion

The shirking version of the efficiency wage model makes a strong prediction that self-supervision is a substitute in production for external supervision. This paper tests for evidence of a trade-off between wage premiums and supervisory intensity. While all of the tests presented here are subject to serious qualification, little evidence is found to support the hypothesis. There is little evidence that the considerable differences in occupational wages paid across firms can be accounted for by the shirking model.

This paper has shown that there are large differentials in wages paid within narrow occupations between plants in the high-technology sector of a single state. Take the very narrowness of the occupational definitions used as a good control for unobserved worker quality. Assume that the concentration of employees in one industry in one state controls for much of unobserved location, union threat, or industry effects. Under these assumptions, the results here of wide wage dispersion across firms remains a puzzle from the perspective of both of the competing theories.

The turnover version of the efficiency wage model predicts that wage bonuses are paid up to the point at which further reductions in turnover cease adding to profits. This paper presents evidence that higher wages are indeed associated with lower turnover rates, but that the reductions in turnover achieved are not sufficient to establish the profitability of wage bonuses.

Wages for narrowly defined occupations within one sector of one state are widely dispersed. Neither the shirking nor the turnover variants of the efficiency wage model appear able to explain this dispersion. The task that remains for contemporary wage theory is to provide evidence supporting an explanation for this observed wage dispersion.

Footnotes

1. Since writing this, two others have appeared: Krueger (1987) and Levine (1987).

2. Part-time employees who regularly work over 20 hours per week and are eligible for pro-rated normal benefits are reported at their full-time equivalents. Temporary or seasonal employees are excluded unless they are paid as are full-time regular employees. Those on job-shop rates are excluded.

3. For some occupations, two or more levels of the job are reported, for example Field Service "B" and Field Service "A". In such cases I take the total of employment in each of the subclassifications, and the weighted average of pay.

4. Where more than one level of supervision is reported, I take the sum of employment and the weighted average of pay.

5. It is not clear that firms have an incentive to act strategically in reporting wages. Any individual response has a negligible effect on reported averages. In addition, a firm may cause comparable damage to a competitor by fooling it into paying wages above market as by fooling it into below market wages. Given the high level of "trading" in this concentrated market, market price is a difficult secret to keep.

6. The analysis in Table 3 excludes firms that report zero supervisors in the sample. This has no effect of note on the results.

7. There is also no evidence of a size-wage effect, at this detailed level of analysis, with size measured as number of employees within a given occupational group.

8. Table 4 also shows no significant scale, industry or area effects on the supervisor-to-worker ratio, although there are differences in this ratio across occupations.

9. It ranges from 0 to 1.7. The mean wage of non-exempt workers in these firms is $7.45, ranging from $4.99 to $11.13. The firms in this sample average 144 non-exempt employees, ranging from 3 to 2,444. Both the turnover rate and the mean wage of non-exempt employees vary across firms because of changes in the occupational composition of the non-exempt work force. In the analysis that follows, I control for each firm's occupational composition by including control variables giving the proportion of each firm's non-exempt employment in each of 7 occupational groups. The average wage here, conditional on this broad occupational distribution, may not precisely capture the wage bonuses within detailed occupations relevant to efficiency wage models.

10. Table 6 also contains other results of interest. Some have theorized that turnover is a greater problem at large plants because of a greater sense of alienation. Here, I observe lower turnover rates at larger plants, although the effect is small and insignificant. Design and drafting workers, and operative have (insignificantly) higher turnover rates than do electronic technicians. Across industries, turnover rates are significantly higher in computer equipment, medical equipment, and electronic instru-

ments, by 14 to 20 percentage points. Obviously, other factors besides wages (such as promotion prospects, or quality of supervision) are of importance in explaining turnover.

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Table 1: Correlation of Firm Effects on Wages Across Six Occupations

	PBX Receptionist	Accounting Clerk B	Light Truck Operator	Shipping Receiving Clerk A	Drafter B
Secretary A	.33 (.005) 69	.28 (.007) 91	.09 (.47) 61	.23 (.05) 73	.24 (.06) 61
PBX Receptionist		.13 (.27) 73	.35 (.009) 54	-.05 (.71) 62	.23 (.12) 48
Accounting Clerk B			.38 (.001) 70	-.007 (.95) 83	.15 (.25) 64
Light Truck Operator				.34 (.009) 58	.23 (.08) 57
Shipping-Receiving Clerk A					-.18 (.18) 58

Note: First line is correlation coefficient, second is p-value; third is sample size.

Table 2: Sample Characteristics for Six Occupations

	Mean	S.D.	Min	Max
Production Assemblers (N=118)				
# Employees	88.46	527.04	1.00	5731.00
Avg. Wage of Employees	6.33	1.10	4.29	9.88
# Supervisors	10.30	61.98	1.00	675.00
Avg. Wage of Supervisors	13.60	2.56	8.08	23.32
Ratio (Supervisor/Workers)	0.23	0.24	0.02	1.00
Testers (N=23)				
# Employees	19.61	60.55	1.00	296.00
Avg. Wage	7.09	1.55	5.08	11.94
# Supervisors	9.48	35.24	1.00	171.00
Avg. Wage	13.95	2.77	8.00	20.53
Ratio Supervisors/Workers	0.48	0.31	0.06	1.00
Order Processing Clerk (N=37)				
# Employees	10.14	45.12	1.00	277.00
Avg. Wage	7.26	1.20	4.77	11.83
# Supervisors	2.35	7.89	1.00	49.00
Avg. Wage	11.69	2.03	7.13	17.01
Ratio	0.54	0.31	0.13	1.00
Machinists (N=25)				
# Employees	20.24	64.12	1.00	327.00
Avg. Wage	7.94	1.71	4.43	12.13
# Supervisors	3.92	10.72	1.00	55.00
Avg. Wage	14.46	2.23	9.50	18.75
Ratio Supervisors/Workers	0.37	0.31	0.07	1.00
Maintenance Worker (N=28)				
# Employees	11.14	41.98	1.00	225.00
Avg. Wage	8.85	1.89	5.90	12.50
# Supervisors	2.46	6.97	1.00	38.00
Avg. Wage	14.25	1.97	10.58	19.38
Ratio Supervisor/Employees	0.58	0.36	0.11	1.00
Field Service (N=26)				
# Employees	35.62	114.04	1.00	587.00
Avg. Wage	10.53	1.52	7.02	13.27
# Supervisors	6.12	19.27	1.00	100.00
Avg. Wage	14.66	1.95	9.90	19.15
Ratio	0.34	0.26	0.05	1.00

Table 3: Average Wage as a Function of Supervisory Intensity

	Production Assemblers	Machinists	Tester	Maintenance Workers	Field Service	Order Processing Clerk
#Supervisors/ #Employees	1.11 (0.48)	3.35 (1.81)	0.55 (2.47)	-1.32 (1.20)	-1.09 (1.67)	0.80 (0.84)
Total Employees	0.00003 (0.00033)	0.0020 (0.0007)	-0.0005 (0.0014)	0.0004 (0.0009)	0.0005 (0.0008)	0.0008 (0.0007)
R^2	0.32	0.93	0.48	0.75	0.77	0.49
S.E.E.	1.04	1.11	2.12	1.36	1.32	1.23
N	111	19	21	24	23	34

Note: Standard errors in parentheses. These regressions include additional dichotomous variables controlling for 4 areas and up to 19 detailed industries.
Sample sizes are smaller than in Table 2 because observations lacking industry or area information are deleted.

Table 4: Ratio of Factor Quantities (Supervisors/Workers) as a Function of the Ratio of Factor Prices (Supervisors/Workers)

	Production Assembler	Machinist	Testers	Maintenance Worker	Field Service	Order Processing Clerk
Supervisor Wage/ Employee Wage	-0.05 (0.05)	-0.77 (0.20)	0.12 (0.25)	-0.15 (0.37)	-0.35 (0.72)	-0.37 (0.24)
Total Employment	-0.0002 (0.00007)	-0.0002 (0.00009)	-0.0003 (0.0002)	-0.0004 (0.0002)	0.0002 (0.0002)	-0.0002 (0.0002)
R^2	0.25	0.97	0.62	0.58	0.62	0.44
S.E.E.	0.23	0.12	0.34	0.35	0.29	0.33
N	111	19	21	24	23	34

Note: Standard errors in parentheses. These regressions include additional dichotomous variables controlling for 4 areas and up to 19 detailed industries.

Table 5: Sales as a Function of Supervisory Intensity and Wages

Ratio of Supervisors to Workers	-13.4 (24.1)
Mean Wage of Workers	13.1 (15.2)
Total Employment	.12 (.02)
R^2	.70
S.E.E.	61.8
Mean of the dependent	47.9
N	86

Note: Standard errors in parentheses. This regression also contained controls for industry (17), area (4), and occupational distribution of workers (7).

Table 6: Turnover and Wage Premiums

	1	2
Mean Wage	-.036 (.015)	-.031 (.021)
Employment 6 Months Prior	--	-.00011 (.00007)
Proportion of Non-exempt Employees in:		
Design & Drafting	--	1.02 (.55)
Electronic Technician	--	.15 (.46)
Clerical	--	.42 (.46)
Electronic Assembly & Test	--	.50 (.46)
Crafts	--	.49 (.51)
Operatives	--	.81 (.58)
Laborers	--	.66
R^2	.03	.22
S.E.E.	.21	.20
N	200	200

Note: Standard errors in parentheses. Dependent variable is the ratio to total separations of non-exempt workers (excluding temporary layoffs) in last 6 to total employment of non-exempt workers 6 months ago.
The mean wage is of non-exempt employees. The mean of the dependent variable is .25, with mean employment 144 and mean wage $7.45.
Equation 2 includes additional dichotomous variables controlling for 4 areas and 17 detailed industries.