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THE STRUCTURE OF SUPERVISION AND PAY IN HOSPITALS

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Many models of the labor market involve explicit or implicit assumptions about the role of supervision. For instance, the efficiency wage literature assumes that supervision serves a monitoring function, and that, other things equal, increased supervision will be associated with lower wages. In contrast, if employees dislike being closely monitored, the theory of equalizing differences suggests that closely supervised workers would receive a wage premium.[1] Finally, agency and tournament models are predicated on the assumption that employees are imperfectly monitored and supervised.

Despite the importance of supervision in models of labor market behavior, very little is known about the relationship between supervision and pay, or about the organization and effectiveness of supervision within firms. A better understanding of the structure and impact of supervision is needed to understand its role in production. The goal of this paper is to document several facts regarding the extent of supervision at the workplace, and to measure its effect on the pay of nonsupervisory employees. The paper makes use of a Bureau of Labor Statistics (BLS) industry wage survey of the hospital industry. The hospital industry is the focus of our analysis because it has well-defined lines of supervision, because unusually rich employer-reported data are available for a sample of hospitals, and because independent local regulating authorities may impose exogenous supervisory intensity on hospitals.

The paper is organized as follows. Section I describes the data set that we use. Section II presents our basic findings on the structure of pay and supervision. Section III examines the effect of supervision on pay for four occupations. Section IV offers some concluding observations on the role of supervision in the labor market.

The principal findings of our analysis are summarized as follows:

1) There is a substantial hospital-specific effect on wages that cuts across occupations. Therefore, if one occupation in a given hospital is paid a relatively high wage, the other occupations in the hospital are also likely to be paid a relatively high wage. 2) In contrast to pay, there is not a uniform pattern of supervisory intensity across occupations within hospitals. 3) Among nurses, the more intensively that staff workers are supervised, the lower their pay. A similar trade-off between supervision and pay is not found for other occupations, perhaps due to the fact that in these occupations supervisory intensity is less likely to be set exogenously by local regulatory agencies.

I. Data

The data we examine are drawn from the Bureau of Labor Statistics' 1985 Hospital Industry Wage Survey. In 1985 the BLS sampled nearly 1,000 hospitals from 23 Standard Metropolitan Statistical Areas (SMSA's) to measure hospital pay and staffing.[2] Although the original survey contains observations from 23 SMSAs, for confidentiality purposes the BLS provided an extract consisting of information on employees of 300 hospitals from a random sample of 10 of the SMSAs and concealed the identity of the SMSA. The data were coded in such a way, however, that it is still possible to identify the groups of hospitals that are located in the same SMSAs (i.e., the SMSA code is scrambled but unique). Consequently, we can control for the SMSA in which the hospital is located in our subsequent analysis, without knowing where the hospital is located.

The survey contains wage and salary information, union status, and some demographic information for employees in selected occupations. In addition, several characteristics of the hospital are reported, such as the form of ownership. Most importantly, the Hospital Survey is the only BLS industry

wage survey that contains salary and staffing information (employment and hours) for supervisory workers. We focus on four separate occupations--registered general duty nurses, radiographers, physical therapists, and food service workers--because the data set allows us to derive the average supervisor-to-staff ratio for employees in these occupations. Furthermore, supervisory information for these workers is particularly valuable because the lines of supervision are typically standard across hospitals and are narrowly drawn for these types of jobs.

The Data Appendix provides a more detailed description of the data set. Included are precise definitions of the four occupations in our sample, the derivation of the full-time equivalent supervisor-to-staff ratio for each occupation, and the means and standard deviations of the relevant variables for each occupation.

II. Basic Findings

The Interoccupational Structure of Wages

To examine the interoccupational structure of wages across hospitals, we calculate the average wage paid to employees at the various hospitals for each occupation. Table 1 contains a correlation matrix of the average wage in the four occupations across hospitals. The table shows that the average hospital wage is highly correlated between pairs of occupations. For instance, the correlation between the average wage of registered nurses and radiographers across hospitals is *0.740.*

Although it may not be surprising to find a high degree of correlation in wages between two similar occupations, the same pattern appears to hold for dissimilar occupations. For instance, the correlation in wages between registered nurses and food service workers is *0.754.* The average correlation in wages among the six different pairings of occupations is *0.673.* These figures

suggest the existence of a hospitalwide wage differential that is independent of occupation.[3]

In table 2 we report the correlation between the average wages of staff workers and their supervisors in the four occupations. These results also indicate a high degree of similarity in the wage struc'tureacross occupations. For instance, the correlations between the wage of registered nurses and their supervisors is 0.805.

What might explain the high similarity in the interfirm wage structure across occupations? In particular, what role might supervision play?

Consider first the human resource management/personnel literature on compensation. This literature stresses three main factors that influence the firm's choice of location in the wage hierarchy. First, internal.equity is believed to be important in explaining wage differentials.[4] According to this argument, if workers perceive their compensation as less than coworkers who are less skilled, they will become dissatisfied with their job and withhold effort. Moreover, one might expect a link between supervisor and staff wages across establishments because supervisors are likely to be more effective when they are paid more than the workers they supervise since pay symbolizes a worker's prestige and authority.[5] If workers in one occupation of a firm are paid relatively well compared to other firms, workers in the other occupations that the firm employs would also be relatively well-paid because of vertical equity considerations.

Second, the traditional personnel literature also places much emphasis on the firm's ability to pay. Although a cost-minimizing firm would not consider its ability to pay in setting pay, workers may be able to extract rents from firms through collective bargaining--in which case the firm's ability to pay becomes a relevant factor. Alternatively, principal-agent problems may lead managers to share product market rents with workers even in the absence of collective bargaining.

Finally, and transcending the above concerns, the personnel literature has stressed the interrelationship between management strategy and personnel policy.[6] Among other factors, the type of supervision and the nature of the work that the firm provides would be aspects of managerial strategy taken into account in choosing a spot along the wage hierarchy.[7] Firms that closely monitor and control workers would be able to hire lower-quality workers and to pay lower wages than firms that allow workers more autonomy and responsibility.

Next, consider possible neoclassical economic explanations of the observed pattern of interfirm earnings differentials for different occupations. First, there may be working conditions associated with employers that cut across all jobs and dictate compensating wage differentials. For example, a firm may be located in a distant or remote section of a city, which causes all employees (regardless of their occupation) to have a long commute to work and therefore generates a companywide compensating wage differential.[8] Alternatively, the employer may closely supervise all employees to a similar extent. Such a uniform supervisory strategy would necessitate a positive wage premium if employees dislike being monitored.[9]

Finally, workers may sort themselves into firms--or firms may recruit workers--on the basis of their (unobserved) ability. Although the workers' abilities are unobserved by the econometrician, the firm may be able to discriminate among high- and low-ability workers and set their pay accordingly. This would lead researchers to erroneously conclude that equally skilled workers are paid differently. To the extent that there is uniform, hospitalwide sorting on the basis of unobserved ability in all occupations, we would observe a pattern like the one discussed above. In addition, one would suspect that firms will more intensively supervise work units that on average have low-ability workers.

The Structure of Suvervision

Table 3 reports the correlation in the supervisor-to-staff ratios across hospitals for the various occupations.[10] In comparison to the findings for wages, we find a much lower correlation in the supervisor-to-staff ratio across occupations. For example, the correlation in the supervisor-to-staff ratio between the radiographers and physical therapists among the hospitals is 0.281. The average correlation in the supervisor-to-staff ratios among the six different pairings of occupations is 0.239. These figures suggest that hospitals do not follow a general strategy of supervisory intensity that cuts across occupations. Instead, the extent of supervision varies across occupations in hospitals.

One potential explanation for this fact is that the number of supervisors and/or staff employees in hospitals is often highly regulated by state and local governments. If the mandated supervisor-to-staff ratio varies by occupation and city, one would not expect to find a hospitalwide influence on the supervisor-to-staff ratio. On the other hand, if the supervisor-to-staff ratio in all occupations are regulated to a similar extent in an area, these correlations may be biased upward. Regulations could condition these correlations. We return to this point below.

Nonetheless, the observed interoccupational structure of supervision among the hospitals suggests that the interoccupational wage structure cannot be explained by arguments based on the premises that some hospitals tend to supervise all of their workers intensively while others tend to supervise employees in all occupations less intensively.

III. Is There a Trade-Off between Suvervision and Pay?

There is considerable interest in estimating the relationship between supervision and pay. On the one hand, a positive relationship between super-

vision and pay would support a conclusion that employees dislike supervision, and that firms must pay a compensating wage differential to attract workers to jobs that are intensively supervised. Aoki (1984, p. 29), for instance, broaches the question of whether there will be compensating wage differentials associated with supervision and monitoring in the following way: "Why do the team players [workers] accept the monitor's control, then? Since the possibility of shirking indicates that team members derive some utilities from a saving of effort expenditure, they are unlikely to accept the latter's control voluntarily for no compensation."

On the other hand, a negative relationship between supervision and pay would be consistent with two alternative hypotheses: the efficiency wage hypothesis and sorting by ability. First, according to the efficiency wage hypothesis, at the same level of effort one would observe a trade-off between self-supervision and external monitoring, where increased monitoring is assumed to increase the likelihood of detecting poor performance (see Shapiro and Stiglitz, 1984 and Bulow and Summers, 1986). This trade-off occurs because higher pay induces more self-supervision (and less shirking) because workers value their jobs more as their pay increases, while more intensive supervision raises the probability that workers who shirk will be disciplined and therefore reduces worker shirking. Thus, holding workers' effort level constant, the efficiency wage model predicts that increases in monitoring would be associated with lower wages.

The supervisor-to-staff ratio is an input in monitoring; a greater supervisor-to-staff ratio increases the likelihood that shirking workers will be detected and disciplined.[11] At a fixed level of effort, the firm will be indifferent between expending an additional dollar on monitoring (that is, the marginal cost of a supervisor) and paying workers a dollar more in wages since both supervision and pay are choice variables to the firm in this model. Therefore, a testable implication of the efficiency wage model is that the

cost of an increase in supervision should be just offset by a decrease in the wage rate, all else equal.

Finally, if there is sorting on the basis of workers' abilities (within occupations), then we would expect low-ability workers to be supervised more than high-ability workers. If low-ability workers are paid less than high-ability workers, and if data are not sufficiently detailed to allow one to completely control for workers' abilities, then we would also expect to find a negative relationship between wages and the extent of supervision. Moreover, cost-minimizing firms will substitute low-quality labor for high-quality labor until the point is reached in which the increased supervisory costs associated with low-quality workers are exactly off-set by reductions in the wage bill. This model yields the same prediction as the monitoring efficiency wage model.

Previous Empirical Implementation

To test the monitoring efficiency wage model, Leonard (1987) regresses the wages of staff workers on the occupation-specific supervisor-to-staff ratio for each of six occupations in a sample of high-technology firms in California. His estimates generally indicate a positive, but statistically insignificant, relationship between pay and supervision. From this exercise, he concludes that there is little evidence in favor of the shirking efficiency wage model.

It is unlikely, however, that a regression of the wage rate of staff workers on the supervisor-to-staff ratio will yield a material test of the effect of monitoring on wages because supervision is a choice variable to the firm. For example, if we assume that hospitals have a Cobb-Douglas production function, with $Q = L^{\alpha} S^{\beta}$, where L is the labor input, S is the input of supervisors, and Q is the hospital output, then the first order conditions for cost-minimization will require that:

$$(1) \qquad \frac{S}{L} = \frac{\beta w}{\alpha r}$$

where w is the wage of laborers and r is the wage of supervisors.[12]

From (1) it is apparent that holding the wage of supervisors constant, random variations in w will induce a positive relationship between staff workers' wages and the supervisor-to-staff ratio even if supervision has no direct effect on employee utility or monitoring. More generally, any production technology that has a nonzero marginal rate of technical substitution between laborers and supervisors will induce a positive relationship between wages and the supervisor-to-staff ratio. As a result of the potential for substitution among factors of production, regressions of the wage rate of staff workers on the supervisor-to-staff ratio are likely to reflect "reverse causation" since an exogenously high staff wage would lead firms to substitute S workers for L workers.[13]

Only if r varies independently of w, or if the supervisor-to-staff ratio is exogenously determined, will it be possible to statistically identify the impact of supervision on wages by regressing the wage rate of staff workers on the supervisor-to-staff ratio. In Leonard's application, it is likely that any trade-off between supervision and pay would be biased and perhaps dominated by the substitution effect since his data pertain to an industry without external restrictions on S/L.[14]

Estimation

The particular institutions of the hospital industry provide some hope of identifying the trade-off between supervision and pay that is not biased by the substitution of inputs. This is the case because local regulatory authorities exercise a great deal of indirect and direct authority in setting minimum standards for the supervisor-to-staff ratio in hospitals. For instance,

the state of Georgia requires that all hospitals in the state provide at least one supervisory nurse per 40 patients and provide at least 3.4 hours of general duty nursing time per patient each day. Other states in our sample that regulate staffing requirements for at least some hospital employees include California, Florida, New York, Illinois, and Wisconsin. In addition, some cities in our sample have local regulations that restrict a hospital's authority to autonomously determine their staffing arrangements. In many hospitals, these regulations are likely to be binding in the sense that hospitals are required to use supervisor-to-staff ratios that they would not have voluntarily chosen in the absence of such regulation.

For our purposes, regional variations in the supervisor-to-staff ratio that are generated by state and local government regulations can be used to identify the hedonic relationship between wages and supervision. Ideally, the exact level of the government-mandated staffing requirements could be used to instrument for the supervisor-to-staff ratio. However, since this information cannot be matched to our data set because SMSA locations are concealed, we use a set of dummy variables that indicate the SMSA in which the hospital is located in order to instrument for the supervisor-to-staff ratio in hedonic wage equations. Since we assume that government staffing requirements vary exogenously across SMSAs, this procedure provides a way to estimate the trade-off between wages and supervision without encountering the problems created by the endogeneity of the number of supervisors and staff workers.

A potential limitation of this approach is that if SMSA location is a direct determinant of wages, hospital location is not a valid instrument for supervision. Thus, we include a direct measure of the relative wage level in each SMSA to control for regional wage effects. An SMSA wage index was obtained as follows: using the full sample of occupations and hospitals, log wages of workers were regressed on a set of SMSA dummy variables and occupation dummy variables. The estimated coefficients on the SMSA dummies are the

components of the area wage index, which is included as an independent variable in the wage equations estimated below. Table 4 reports two-stage least squares estimates of earnings equations for four occupations. The dependent variable is the log of the average staff worker's hourly wage in each hospital; the key independent variable is the supervisor-to-staff ratio. For reasons discussed above, the exclusion restriction of SMSA dummy variables --which are correlated with local staffing regulations--allows the identification of the supervisor-to-staff ratio. Comparable equations estimated by OLS are reported in table 5.

When the equations are estimated by two-stage least squares to account for the endogeneity of supervisory intensity, the supervisor-to-staff ratio has a negative, statistically significant effect on the pay of nurses. The OLS regressions show a much smaller trade-off between pay and supervision for registered nurses than the two-stage estimates, which is likely to result from reverse causality in the OLS regressions. Moreover, the other three occupations, have small, statistically insignificant coefficients on the supervisor-to-staff ratio. In these occupations, either regulation does not provide exogenous variation in supervisory intensity, or no trade-off exists between supervision and pay.

The chi-square statistics reported at the bottom of table 4 indicate that the exclusion restrictions fail the Generalized Method of Moments over-identification test for the three non-nursing occupations, but pass the test at the 5 percent level for nurses. In other words, the estimated trade-off between pay and supervision is sensitive to the choice of instruments for the non-nursing occupations, which suggests that the supervisor-to-staff ratio is not properly estimated in these occupations. On the other hand, the GMM test lends some support for using hospital location as an instrument for supervisory intensity in the nursing occupation.[15] This finding is also consistent with our understanding of the hospital regulatory

process, which appears to concentrate more on regulating supervisor-to-staff ratios for nurses than for other occupations.

The finding of a negative relationship between pay and supervision for nurses suggests that these workers do not receive a compensating differential when they are subject to close supervision. To the contrary, highly supervised workers tend to earn lower wages than those who are supervised less intensively. This would support either of the following conclusions: 1) firms that hire low-quality workers tend to supervise them more intensively; and 2) there is a trade-off between self-monitoring and external supervision for workers of a given quality level.

The point estimate of the coefficient on the supervisor-to-staff ratio indicates a substantial trade-off between pay and supervision for nurses. For example, consider the following calculation of the wage reduction associated with hiring an additional nurse supervisor: On average, there are 6.5 nurses assigned to a supervisor. Hiring an additional supervisor for the average work group will thus reduce the number of nurses monitored by a supervisor to 3.25 in two work groups. This would enable the hospital to reduce these staff nurses' hourly pay by 13.3 percent. Using the average nurse's pay of $12.18 per hour, the addition of a new supervisor would therefore lead to a payroll reduction of .133 x 12.18 x 6.5 = $10.53 per hour.[16]

Although nontrivial, this cost reduction falls short of the average hourly wage of nurse supervisors ($15.39). However, one would not expect the optimality condition--which is identical for efficiency wages and labor quality models--to hold exactly in this industry since the government often regulates staff levels in hospitals. The estimated wage savings associated with hiring an additional nurse supervisor suggests that regulations require hospitals to employ more supervisors than they would voluntarily choose to employ.[17]

Another means of isolating the trade-off between supervision and pay

is to note that hospitals may vary in their ability and incentive to take advantage of such a trade-off. In particular, unionized hospitals may be limited in their ability to adjust wages and staffing levels, and government-owned hospitals may not have the same cost-minimization incentives as privately-owned institutions. These considerations suggest that the estimated trade-off may be stronger for nonunion privately owned hospitals than for government and union hospitals. In results not reported here, we find that both of these predictions are borne out for nurses. For example, the coefficient on the supervisor-to-staff ratio estimated for the subsample of privately-owned hospitals is -2.068, which is much greater in absolute magnitude than the coefficient estimated for the sample as whole.

Finally, turn to the other variables in the wage equations. The estimates show that unions have a positive effect on wages in the hospital industry for most occupations. Interestingly, full-time nurses tend to earn lower wages than part-time nurses. Moreover, this pattern was found by the BLS in the majority of the cities that were surveyed. The coefficient on the area wage index variables are, as expected, highly statistically significant and are close to one in magnitude. We note that the coefficients on the hospital size dummy variables (measured by total hospital employment) and wages vary among the occupations.

IV. Summary and Conclusion

This paper has examined the structure of pay and supervision in the hospital industry. The analysis finds that wages paid to employees in different occupations follow a similar pattern among the hospitals. In contrast, correlation coefficients suggest that the interoccupational pattern of supervisory intensity (as measured by the supervisor-to-staff ratio) is much less uniform among hospitals. Given the unusual amount of state and local govern-

ment regulations affecting staffing in the hospital industry, however, it is difficult to generalize from these results to other industries.

Regional variations in the supervisor-to-staff ratio are used to identify the effect of supervision on the wages of staff workers. This analysis finds that wages of staff nurses tend to fall with the extent of supervision. On the other hand, when we estimate wage equations for three other occupations (food service employees, radiographers, and physical therapists), the effect of supervision on pay is found to be statistically insignificant. The more limited government regulation of supervisory intensity in these occupations and the rejection of the specification tests suggest that the estimated trade-off between supervision and pay in the nursing occupation might be more reliable.

Since many theoretical models of the labor market (for example, agency and efficiency wage models) are predicated on assumptions about supervision, it is important to empirically examine the actual impact of supervision on pay and productivity. The analysis presented here suggests that workers do not require additional compensation to endure more intensive supervision. If anything, we find that hospitals that have a greater supervisor-to-staff ratio tend to pay lower wages to nurses. There are two plausible interpretations of this finding.

First, when staff workers are closely supervised, firms may substitute low-quality/low-pay workers for high-quality/high-pay workers. Although our analysis is intentionally confined to narrowly-defined occupations (for example, registered nurses) to limit worker heterogeneity, there is still scope for heterogeneity in worker ability within occupations, which is observed by employers but not reflected in our explanatory variables. An alternative interpretation or our results is that firms trade off between inducing work effort from a homogeneous group of employees by paying them a relatively high

wage or by more closely supervising them. From the current analysis, it is impossible to distinguish between these two alternative interpretations.

Data Appendix

A. Description of the Data

The data analyzed are from the Bureau of Labor Statistics Industry Occupational Wage Surveys of the Hospital Industry in 1985. Hospitals in 23 SMSAs were surveyed for the wages paid to certain occupations. We use a subsample drawn from 10 of the 23 SMSAs surveyed. Actual SMSA of origin was masked by the BLS, but unique identifiers were provided to allow the creation of SMSA dummy variables.

The data consist of the wages, sex, occupation, and establishment identifier of individual employees. Wages reported are straight-time hourly wages (no overtime or shift premia included). Although confidentiality restrictions prohibit the release of employers' names, the data include unique employer identifiers and the following hospital characteristics: SIC, range of number of employees in the hospital, union coverage, short versus long term, and type of ownership (state, other government, proprietary, nonprofit church, nonprofit-nonchurch, other).

We analyze the relationship between wages and supervision in the four occupations that have data on supervisors and staff: physical therapists, radiographers, nurses, and food service workers. Descriptive statistics for the relevant variables by occupation are provided in table A1.

B. Construction of Supervisor-to-Staff Ratios for Hospital Employees

The measure of supervisory intensity that we use is simply the number of supervisors divided by the number of staff workers in a given occupation for each hospital. The data only allow us to calculate the supervisor-to-staff ratio at the hospital (rather than work-group) level. The following conventions were used to obtain the number of workers and supervisors:

1. Part-time supervisors are counted as half of a supervisor in the numerator

of the ratio; part-time staff members are counted as half of a staff member in the denominator of the ratio.[18]

2. If no supervisors are reported in an occupation, we assume the hospital has one supervisor for that occupation. This correction is made in less than 10 percent of the observations. In addition, the results are not sensitive to the alternative of treating the supervisor-to-staff ratio as 0 in these cases.

C. Definition of Supervisory and Staff Workers by Occupation

Supervisor and worker definitions for the individual occupations are listed below. BLS Occupational Codes for each job classification are also listed.

1. Nurses

a. Supervisors: 010 director of nursing
020 supervisor of nurses
021 supervisor of nurses-day
022 supervisor of nurses-night
030 head nurse

b. Staff: 040 Registered general duty nurse
041 LPN-administers medications
042 LPN-does not administer medications
043 LPN-psychiatric
044 LPN-nonpsychiatric
049 LPN-no information about medications

It should'be noted that although LPNs are included in the denominator of the supervisor-to-staff ratio for nurses, the analysis of wages only pertains to registered nurses.

2. Food Service Workers

a. Supervisors: 410 food service supervisor

b. Staff: 430 food service worker

3. Physical Therapists

a. Supervisors: 640 physical therapist supervisor

b. Staff: 230 physical therapist

4. Radiographers

a. Supervisors: 270 radiographer supervisor

b. Staff: 261 registered radiographer

262 nonregistered radiographer

269 radiographer-unknown registration status

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Table 1

Correlation of Average Hospital Wage by Occupation, 1985
(Number of Hospitals in Parentheses)

	Food Service	Radiographer	Physical Therapist
Radiographer	.798 (254)		
Physical Therapist	.589 (214)	.639 (219)	
Registered Nurse	.754 (271)	.740 (270)	.517 (226)

Correlations are of average hourly wage rate. All of the above correlations are statistically significant at the .0001 level.

Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Table 2

Correlation of Average Staff Workers' Wage with their Supervisor's Wage

Occupation	Correlation	Sample Size
Registered Nurse	805	296
Radiographer	.631	217
Physical Therapist	.541	169
Food Service	.652	214

Correlations are of average hourly wage rate. All of the above correlations are statistically significant at the .0001 level.

Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Table 3

Correlation of Supervisor-to-Staff Ratios, 1985
(Number of Hospitals in Parentheses)

	Food Service	Radiographer	Physical Therapist
Radiographer	.116* (254)		
Physical Therapist	.174** (214)	.281** (219)	
Registered Nurse	.160** (271)	.549** (270)	.155** (226)

*Statistically significant difference between the correlation and 0 at the .10 level.
**Statistically significant difference between the correlation and 0 at the .01 level.

Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Table 4

Estimates of the Trade-off between Supervision and Pay
Dependent Variable: Log Average Wage
Two-Stage Least Squares Estimates[a]

Explanatory variable[b]	Registered Nurses	Food Service	Radiographers	Physical Therapists
Supervisor-to-Staff Ratio	-.866 (.216)	-.115 (.159)	.050 (.104)	.114 (.068)
Covered by Union Contract	.044 (.016)	.111 (.016)	.022 (.017)	-.038 (.029)
Proportion Full time	-.041 (.031)	.105 (.029)	.061 (.032)	.013 (.041)
Proportion Male	1.059 (.300)	-.047 (.040)	.103 (.032)	.043 (.045)
Proportion of Unknown Sex	.041 (.021)	-.018 (.021)	.049 (.019)	.002 (.020)
Area Wage Index	.772 (.063)	1.213 (.079)	1.036 (.058)	.791 (.077)
Hospital Size				
1 - 99	-.068 (.111)	---	---	---
100-249	.050 (.046)	-.115 (.048)	-.109 (.056)	-.018 (.067)
250-499	.025 (.034)	-.066 (.031)	-.006 (.030)	-.026 (.039)
500-999	.030 (.025)	-.024 (.023)	-.023 (.021)	-.004 (.030)
1000-2499	-.005 (.020)	-.008 (.020)	-.011 (.019)	.020 (.021)
Chi-Square Over-Identification Test (DF=8)	14.7	25.3	91.5	76.2
Sample Size	297	273	271	226

a. Nine SMSA dummy variables are excluded instruments for the supervisor-to-staff ratio.
b. Equations also include dummy variables indicating whether the hospital is government-owned, proprietary or nonprofit; a dummy variable indicating whether the hospital is a long-term care facility; two dummy variables indicating the type of hospital; and an intercept term.
Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Table 5

Estimates of the Trade-off between Supervision and Pay
Dependent Variable: Log Average Wage
Ordinary Least Squares Estimates

Explanatory Variable	Registered Nurses	Food Service	Radiographers	Physical Therapists
Supervisor-to-Staff Ratio	-.097 (.044)	.028 (.041)	.006 (.032)	.077 (.022)
Covered by Union Contract	.039 (.011)	.111 (.016)	.023 (.017)	-.030 (.024)
Proportion Full time	-.035 (.022)	.096 (.027)	.055 (.029)	-.002 (.031)
Proportion Male	.126 (.113)	-.043 (.039)	.104 (.032)	.043 (.045)
Proportion of Unknown Sex	-.001 (.013)	-.017 (.021)	.047 (.019)	.003 (.020)
Area Wage Index	.756 (.043)	1.255 (.063)	1.041 (.056)	.768 (.065)
Hospital Size				
1 - 99	-.067 (.076)	---	---	---
100-249	-.079 (.021)	-.149 (.030)	-.089 (.033)	.011 (.044)
250-499	-.050 (.018)	-.078 (.028)	-.0002 (.027)	-.016 (.034)
500-999	-.015 (.015)	-.028 (.022)	-.023 (.021)	.005 (.026)
1000-2499	-.015 (.013)	-.001 (.019)	-.012 (.018)	.023 (.021)
R^2	.714	.777	.691	.469
Sample Size	297	273	271	226

a. Equations also include dummy variables indicating whether the hospital is government-owned, proprietary or nonprofit; a dummy variable indicating whether the hospital is a long-term care facility; two dummy variables indicating the type of hospital; and an intercept term.
Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Appendix Table A1
Means and Standard Deviations

Variable	Registered Nurses	Radiographers	Physical Therapists	Food Service
Hourly Wage of Staff	$12.18 (1.68)	$10.18 (1.90)	$12.21 (1.85)	$ 6.53 (1.45)
Hourly Wage of Supervisors	$15.39 (2.27)	$13.65 (2.47)	$15.46 (2.20)	$ 9.10 (1.79)
Supervisor-to-Staff Ratio	.152 (.143)	.239 (.312)	.389 (.426)	.162 (.184)
Covered by Union Contract	.374 (.485)	.251 (.434)	.146 (.354)	.447 (.498)
Proportion Full time	.641 (.251)	.716 (.253)	.765 (.292)	.615 (.256)
Proportion Male	.026 (.048)	.209 (.239)	.085 (.178)	.214 (.207)
Proportion of Unknown Sex	.191 (.392)	.191 (.392)	.196 (.397)	.198 (.397)
Government-Owned	.273 (.445)	.255 (.436)	.234 (.423)	.263 (.440)
General Hospital	.788 (.409)	.845 (.362)	.854 (.353)	.817 (.387)
Psychiatric Hospital	.118 (.323)	.070 (.256)	.040 (.196)	.088 (.284)
Specialty Hospital	.094 (.293)	.085 (.279)	.106 (.309)	.095 (.294)
Hospital Size				
1 - 99	.003 (.058)	---	---	---
100-249	.101 (.302)	.074 (.262)	.049 (.216)	.099 (.299)
250-499	.135 (.342)	.122 (.328)	.092 (.291)	.117 (.322)
500-999	.219 (.414)	.225 (.418)	.199 (.400)	.231 (.422)
1,000-2,499	.380 (.486)	.402 (.491)	.447 (.498)	.377 (.486)
> 2,500	.162 (.369)	.177 (.382)	.213 (.409)	.176 (.381)

Source: Authors' tabulations from the 1985 BLS Hospital Industry Wage Survey.

Footnotes

[1] Of cburse, if workers prefer more supervision to less supervision, one would expect just the opposite prediction.

[2] For further details on the original survey, see Industrv Wage Survey: Hospitals (US Dept. of Labor, Bureau of Labor Statistics, Bulletin 2142, December 1982) and Industrv Wage Survey: Hospitals (US Dept. of Labor, Bureau of Labor Statistics, Bulletin 2273, February 1987).

[3] Other researchers have found a similar pattern at the industry level. For instance, Dickens and Katz (1986) estimate that the correlation in the inter-industry wage differential for managers and operatives (after controlling for education, age, region and other variables) is .73. In addition, Groshen (1988) finds evidence that different occupations have highly correlated wage across firms in the chemicals, steel, plastics, wool textiles, cotton textiles, and men's and boys' shirts and nightwear industries. Leonard (1987), however, finds relatively low inter-firm correlations in wages among 6 occupations in the "high technology" industry, ranging from −.18 to .38.

[4] See Milkovich and Newman (1984), Kochan and Barocci (1985), and Heneman, Schwab, Fossum and Dyer (1986) for statements concerning the importance of internal equity in pay setting. See Akerlof and Yellen (1987) for an economic model of vertical pay equity.

[5] As Taylor (1959) puts it, "For a man to believe he is in truth 'the boss,' he must know he is receiving more pay than the men and women he supervises and, with few exceptions, more than any employee in the operation who occupies a nonsupervisory job" (p. 126).

[6] Kochan and Barocci (1985) provide a discussion of the link between managerial strategy and personnel policy.

[7] See Lester (1952) for an early statement of the "range theory of wage differentials."

[8] For example, Rees and Shultz (1970) find evidence of geographic wage differentials across different sections of the Chicago metropolitan area. The locations that require a longer commute to work tend to have higher wages. A compelling interpretation of these wage differentials is that they are compensating wage differentials needed to attract workers to less accessible establishments. Eberts (1981) reaches a similar conclusion after examining the spatial pattern of wages of municipal employees in the Chicago area.

[9] Employees may dislike supervision for two reasons: first, they may consider supervision a disagreeable intrusion on their privacy and independence; second, supervisors may exact more work effort from workers than they would provide in the absence of supervision.

[10] See the appendix for a description of the calculation of supervisor-to-staff ratios for each occupation.

[11] Odiorne (1963, p. 30) defines a supervisor's tasks to include organizing work, planning performance targets, and "...checking the actual performance and noting its quality level and direction against his previously set plan".

[12] We ignore issues concerning monopsony power, which might be relevant in the labor market for nurses (see Sullivan, 1987).

[13] Ehrenberg(1974) finds that hospitals substitute registered nurses (RN's) for licensed practical nurses(LPNs) when the wage of LPNs is high relative to RNs, especially in private-for-profit hospitals. It is likely that substitution also takes place between nurse supervisors and registered nurses. Estimating Ehrenberg's model with our data, we find a high elasticity of substitution between registered nurses and supervisors, nearly -4.

[14] Leonard notes that cost minimization implies that $w = Q/L$. Therefore, if Q could be held constant in his analysis, the regression of w on S/L would trace-out the trade-off between supervision and pay along an isoquant. However, given data limitations he must proxy for Q with the total employment of the firm, which is likely to be a very imprecise measure of output.

[15] We note that if the equations are re-estimated excluding the area wage index, the over-identification test is overwhelmingly rejected for the sample of nurses.

[16] This calculation assumes that productivity is constant.

[17] Integer restrictions on the number of nurse supervisors is probably not a relevant constraint in this situation since hospitals could hire part-time supervisors.

[18] We note that the estimated effect of the supervisor-to-staff ratio was not sensitive to counting part-time staff members as equivalent to full-time staff members, or by counting LPNs as less than RNs.