

# AN INTERPLANT TEST OF THE EFFICIENCY WAGE HYPOTHESIS\*

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The analysis that follows tests the shirking model of efficiency wages by examining the relationship between rates of employee discipline and relative wage premiums across plants within the same firm. The structure of this data set controls for many of the problems that confound other tests of efficiency wage arguments, and the results suggest that greater wage premiums are associated with lower levels of shirking as measured by disciplinary dismissals. Shirking and discipline are also lower where conditions in the labor market raise the costs associated with shirking by making it more difficult to find alternative employment. It is less clear, however, whether the wage in this case is necessarily efficient in the sense of generating reductions in discipline sufficient to offset the costs of the wage premium.

## I. INTRODUCTION

Efficiency wage models are based on the notion that there is a relationship between relative wage levels and worker productivity, broadly defined, which in turn explains a variety of otherwise puzzling behavior such as the presence of involuntary unemployment. Perhaps the most popular of these arguments have been those suggesting that wage premiums and the threat of losing them create incentives for workers to reduce unproductive behavior or "shirking." The structure and implications of such efficiency wage arguments have been debated at length, but there have been few attempts to test empirically the hypothesis that wage premiums can reduce shirking. This paper provides a direct test of the main implications of the shirking efficiency wage model using plant-level data from the auto industry. The results suggest that wage premiums are in fact associated with lower levels of disciplinary problems, as the shirking models of efficiency wages imply. But it is less clear whether the overall benefits of the reduction in shirking exceed the cost of the wage premium.

## II. SHIRKING AND EFFICIENCY WAGES

The argument for a positive relationship between worker productivity and wage levels began in development economics

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where the connection was physiological: higher wages provided a better diet which in turn permitted greater effort and output (e.g., Leibenstein [1957], Bliss and Stern [1978]). Contemporary versions of the efficiency wage argument rely on the costs associated with dismissal to provide an incentive for workers to be productive and avoid shirking. Shapiro and Stiglitz [1984], for example, note that in the absence of jobs suited to piece rates, it is difficult for employers to monitor job performance continuously and therefore to adjust wages downward when performance falls. Instead, they argue that employers rely on occasional monitoring and the threat of dismissal if workers are caught shirking to provide the incentive for them to maintain their performance. A worker would have no incentive to avoid being fired at full employment and market-clearing wages, however, because they could immediately find an equivalent job at the same rate of pay. So employers pay a premium above market rates to create an incentive for workers to keep their current job. When all employers raise their wages, there is an excess supply of labor at that wage and involuntary unemployment: some workers with a reservation wage below the new market level remain unemployed.<sup>1</sup>

Theoretical arguments aside, the important empirical question for efficiency wage arguments is whether there is any evidence of a relationship between wage premiums and performance, and then whether the overall benefits from reduced shirking outweigh the costs of the wage premium (they should be equal at the margin). There is anecdotal evidence for some kind of an efficiency wage effect, such as the fact that many firms pay above market rates as a matter of policy and presumably do so because of the gains such a policy offers (see, e.g., Milkovich and Newman [1987, p. 210]). But there have been few attempts to test even a weak form of the efficiency model—are there productivity gains at all from wage premiums—because it is difficult to identify and control for exogenous, nonwage factors that might affect worker productivity, such as differences in the quality of workers and in the nature of their jobs. It is also difficult econometrically to avoid the identification problem: are higher wages the cause or the result of greater worker productivity?<sup>2</sup>

1. See Katz [1986], Stiglitz [1986], and Akerlof and Yellen [1986] for reviews of the efficiency literature.

2. Raff and Summers [1987] provide a historically based examination of Henry Ford's \$5 day wage plan and find some support for efficiency wage effects. Leonard [1987] examines levels of supervision across firms and finds for some occupations that it is higher at firms where wage premiums are higher, the opposite of what

## III. PREVIOUS RESEARCH

Although attempts to test efficiency wage models as such have been rare, previous research has examined the relationships between wage premiums and some aspects of productivity. The conclusions from this research suggest that if the efficiency wage effects exist, they may be offset empirically by other effects. For example, a wage premium of the kind associated with an efficiency wage may produce income effects that could reduce any positive relationship with productivity. One way to purchase leisure where workers cannot control their work schedule is by shirking: absenteeism, reducing work effort on the job, etc. The price of that leisure includes the expected cost associated with being caught. Employers are unlikely to set a wage unilaterally that leads to a reduction in effort, but such wage premiums might be established through collective bargaining, for example. Taylor [1961] and Walters [1977] argue that when wages for British miners were raised above market rates, the miners used the increases to purchase additional leisure through absenteeism and shirking. Hirsch and Hausman [1983] find econometric support for this argument and an overall negative relationship between productivity and the miner's wage increase.

Industrial psychologists have also examined the relationship between pay levels and performance, and while none of their studies provides a rigorous test of efficiency wage arguments per se, some of the conclusions are relevant. The stream of research most relevant to the efficiency wage position in psychology is known as "equity theory" [Adams 1963], which examines the relationship between relative pay levels and productivity-related job behavior. Equity theory borrows heavily from Adam Smith's [1776] notions about the role of comparisons in job choice. Stated simply, workers compare the inputs they bring to a job (skill, effort, etc.) and the outcomes from the job (pay and nonpecuniary benefits) with inputs and outcomes for jobs they choose as comparisons. If workers feel undercompensated relative to their comparisons, they may redress this perceived inequity or cognitive dissonance by adjusting their inputs downward (shirking), leaving their job (turnover),

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efficiency wage arguments would suggest if supervision is thought of as providing monitoring that reduces shirking (i.e., supervision costs are a substitute for shirking costs). Whether this is a good test of shirking depends on whether supervision is a good proxy for shirking. The fact that supervisors may also perform some higher skill aspects of production work, in addition to monitoring performance, suggests that the relationship may be a complicated one.

“rationalizing” the discrepancy—reevaluating their inputs and outcomes, choosing new comparisons, etc.—or some combination of the three that will reestablish a sense of equity. (One problem with this literature is the difficulty in explaining which option will dominate.) Similarly, if they feel overcompensated, in the spirit of efficient wage arguments, they may in theory improve their performance, reduce turnover, or again rationalize the discrepancy away.

As Akerlof [1984] notes, laboratory studies based on models of equity comparisons found that subjects who were made to feel overpaid relative to a control group reduced this inequity by increasing their inputs and outperforming their more equitably paid colleagues, as efficiency wage arguments would predict [Adams and Rosenbaum 1962; Pritchard et al. 1972].<sup>3</sup> When these experiments were continued for more than one day, however, the overpaid workers soon dealt with the perceived inequity by rationalizing away any sense of overpayment—reevaluating their contributions and choosing new comparisons. One way to think of this rationalization process is that the workers come to see themselves as being in a different, higher-wage labor market. Productivity then fell back to the level of the equitably paid subjects [Vroom, 1964; Lawler et al., 1968]).

One problem with these laboratory studies is that the costs associated with dismissal, which drive the efficiency wage hypothesis, have been insignificant, especially when compared with full-time employment. But if respondents do rationalize away any sense of overpayment even where a very obvious market premium is paid, then perhaps the importance of the wage premium as an incentive not to shirk is reduced.<sup>4</sup>

3. These same studies, however, found that workers who were overpaid on a piecework basis dealt with the inequity by *reducing* their inputs and productivity; with inequitable piece rates, the argument goes, the perceived inequity in earnings gets worse with increased output, so reducing output reduces the rate of inequity.

4. A related stream of research developed by March and Simon [1958] addresses this concern by examining the relationship between alternative job opportunities and productivity in actual jobs (e.g., Smith, Kendall, and Hulin [1969]). But with the exception of weak relationships with turnover [Hulin, Roznowski, and Hachiya, 1985], they find no relationship between opportunities in the labor market, broadly defined, and productivity, also broadly defined. Unfortunately, these studies also may not accurately assess the efficiency wage hypothesis because they do not attach wages to current jobs or to measures of job opportunities making it difficult to assess accurately the costs associated with dismissal. The test we outline below addresses both problems by examining the efficiency wage hypothesis in an actual industrial setting where labor markets and alternative wages can be accurately identified.

Of course, the loss of a wage premium may not be the only cost associated with dismissal. These other costs, such as the possibility of a period of unemployment if caught shirking and dismissed, may also deter shirking independent of any concern about losing the wage premium. But the possibility that wage premiums may generate income effects or that workers may rationalize them away suggests that the relationship between wage premiums and a reduction in shirking may in fact be ambiguous and needs to be tested empirically.

#### IV. THE MODEL AND DATA

The test of the relationship between shirking and wage premiums that we propose uses a unique set of plant-level data for 1982 taken from the internal records of a large manufacturing company.<sup>5</sup> The characteristics of these data address many of the problems noted above that plague econometric tests of the efficiency wage model. First, many of the exogenous factors that might affect worker performance are standardized across plants. For example, all of the plants included in the study are represented by the same union, the United Auto Workers, and are covered by the same labor agreement which standardizes virtually all of the terms and conditions of employment across plants. All of the data are for production workers, and production jobs are virtually identical within categories of plants (e.g., assembly versus component plants); the characteristics of the jobs and of the workers needed to fill them do not differ. Second, management's personnel policies on issues such as shirking and discipline are centrally controlled and are generally identical across all plants as are the union's policies for dealing with management on these issues.<sup>6</sup> Plant managers might be expected to differ in where and how they exercise discipline, but the union may appeal all discipline cases through the contractual grievance procedure, and the collective bargaining agreement states that a common, companywide Appeal Committee will rule on all grievances unresolved at the plants. The fact that a central body has de facto oversight for discipline cases across all plants serves to standardize discipline practices across those

5. The company requests anonymity as a condition of using the data.

6. Local collective bargaining agreements exist at the plant level, but they cannot alter the national agreements and are generally limited to work rules issues such as assigning job classifications.

plants. It would therefore be difficult for disciplinary practices and standards to vary across plants (e.g., with economic circumstances) and to create problems of simultaneity. In short, not only are measures of performance and shirking comparable across plants, but virtually all of the exogenous factors that could affect shirking and discipline are common across plants.

Finally, because wages and other aspects of compensation are established through a companywide collective bargaining agreement, we know that they cannot suffer from the identification problem outlined above: wages in each plant obviously are not affected by differences in productivity across plants because they are set centrally and are identical across all plants.<sup>7</sup>

Wages can, however, be a cause of differences in productivity across plants. These workers certainly appear to earn a wage premium above market rates,<sup>8</sup> and although the wage rate for production workers is the same across all plants, the size of their wage premium varies considerably across plants. The labor market for the unskilled and semi-skilled jobs that make up production work in this manufacturing industry is limited geographically to a reasonably small area, and unskilled workers focus their job searches within that area.<sup>9</sup> By comparing the hourly wage paid in each plant to the prevailing wage in the plant's labor market, defined here as the average hourly wage for production work in each Standard Metropolitan Statistical Area (SMSA), we can assess the extent of the wage premium above the market rate at each plant—what a worker has to lose if dismissed.<sup>10</sup> That premium

7. In addition, wage rates are an accurate proxy for comparing total compensation across plants relative to their labor markets because the terms and conditions of employment cannot vary across plants. For example, plants cannot offset higher wage rates relative to their labor markets with lower benefits and worse working conditions.

8. Production workers in this industry in 1982 earned approximately 150 percent of the average hourly wage for similar production work in the economy as a whole [*Employment and Earnings*, 1982], and workers in this company earned more than the industry average. Wages do not vary with seniority in this contract (other than for probationary employees) or with other characteristics that might vary systematically across plants.

9. For example, we calculate from the 1984 Current Population Displaced Worker Survey that only 5 percent of those who lost their jobs between 1979 and 1983 moved to take a job or to look for work. This is consistent with estimates that only about 6 percent of the displaced workers who received Trade Adjustment Assistance even took the relocation resources to which they were entitled [Swigart, 1984].

10. Even if one believes that differences in average wage levels in each community simply reflect cost-of-living differences, the gap between plant wages and area wages still varies across plants and represents the potential loss associated with dismissal, in this case varying with living costs. See Topel [1986] for arguments about the causes of differences in market wages across local labor markets.

varies across the plants in this company from zero (where plant wages are no higher than the area rate) to as much as 100 percent above the area rate. We recognize that because these premiums are not set unilaterally by the employer, there is no reason to believe that they will necessarily generate cost-effective reductions in shirking. Nevertheless, if the underlying theory is correct, the premiums should lead to some reduction in shirking regardless of what produced them, and the reductions in shirking should vary directly with the size of the premium.

Wage profiles that increase the returns associated with seniority and, in turn, provide incentives to avoid shirking and dismissal in order to capture those returns [Lazear, 1979] may provide an alternative to the use of efficiency wages. The presence of these seniority-based wage profiles can complicate tests of efficiency arguments because of the need to sort out the effects associated with current wage premiums from those associated with seniority profiles. This is especially so where data are taken across employers because these wage profiles may differ substantially across employers. The analysis in this case is simplified because wages in this company do not differ by seniority, eliminating that complication.<sup>11</sup> The absence of seniority-based wages, however, makes it more difficult to generalize conclusions from this case to firms that do have such wage profiles.

In addition to the lost wage premium, the costs associated with dismissal include the search costs associated with finding a new job, and these also vary across geographic areas and plants. Where unemployment is higher, dismissed workers may have to search longer or may have to move to other communities before finding a job. Labor performance, broadly defined, should be higher, and shirking lower where the expected costs associated with dismissal are greatest: where wages in the outside labor market are lower and the difficulty associated with finding a new job is greater.

There may be more than one mechanism through which a wage premium affects performance and labor costs. For example, a wage premium may reduce voluntary turnover [Pencavel, 1970; Phelps, 1970; Salop, 1979]; Leonard [1987] and Krueger and Summers [1987] find evidence for this effect. Reductions in voluntary turnover may be a less important issue empirically in this case because voluntary turnover is less of a cost to firms in

11. We attempt to control for nonwage returns from seniority by including a variable to measure plant seniority; the relationship between seniority and any nonwage returns is covered by the contract and should be constant within the firm.

unskilled jobs like most in this industry where workers can easily be replaced. Efficiency wages may also lead to the selection of better employees with higher productivity [Malcomson, 1981; Weiss, 1980], but the selection nexus appears to be a very different type of effect because it operates not on current employees but through the selection of new ones. The mechanism most central to the basic concern of efficiency arguments—providing incentives for current workers to maintain performance—is through a reduction in shirking [Stiglitz, 1976; Solow, 1979; Shapiro and Stiglitz, 1984]. The empirical problem is to find direct measures of shirking at the workplace. Overall labor productivity measures, for example, may not be good proxies for shirking even across plants in the same firm because they can be dominated by factors other than individual worker performance, such as short-run problems with equipment or with supplies, changes in techniques and in products, union-management conflicts, etc.

Fortunately, we have a very precise measure of shirking taken from the company's internal records: The rate at which workers were dismissed at each plant for disciplinary reasons (DISL).<sup>12</sup> The costs associated with dismissals are exactly the mechanism behind the shirking model of efficiency wages. Further, we can be reasonably certain that these disciplinary actions in fact result from poor performance and productivity, broadly defined (e.g., low performance levels, tardiness, absenteeism, breaking safety procedures, bad relations with supervisors or fellow workers, etc.). The United Auto Workers' contract with the employer limits management's ability to discipline employees to such performance-related issues, and as enforced by a strong union and grievance procedures, these restrictions effectively eliminate arbitrary and capricious actions. These disciplinary actions are expressed as a rate per plant calculated as the number of dismissals/the number of workers for the year 1982.

Given standardized discipline policies within the firm, the rate of disciplinary dismissals should reflect the incidence of shirking at each plant which should in turn be a function of the utility associated with shirking for workers at each plant. Following Shapiro and Stiglitz [1984], that utility  $U_s$  should be lower where the expected value of alternative employment  $E(w')$  is lower and

12. The measure of dismissals may include cases where the union has filed a grievance and secured reinstatement of a dismissed worker through arbitration. The number of workers ultimately dismissed may therefore be somewhat lower.



the utility associated with being dismissed  $U_b$  is also lower, given a constant probability of being caught shirking and dismissed  $P$  and constant rates of voluntary turnover across workers:

$$(1) \quad rU_s = (1 - P)w - P[E(w_a) - U_b],$$

where

- $w$  = current wage
- $w_a$  = alternative wage,
- $r$  = discount rate used to evaluate the utility.

We assume that  $r$  is distributed across individuals =  $N(u_{r,r^2})$  and can be thought of as determining the preferences for shirking; higher values of  $r$  are associated with higher utility from shirking (greater weight placed on the gains from reduced effort until caught). We also assume that  $dU_s/dw > 0$ ,  $d^2U_s/d^2w < 0$ . Each worker will adjust their work behavior such that  $\partial U_s/\partial (p[E(w_a) - U_b]) = \partial U_s/\partial w$ . At the efficiency wage  $w^*$ ,  $\partial U_s/w/U_s/w = 1$ . Some workers may shirk at the efficiency wage equilibrium because of the heterogeneity of discount rates.

The utility associated with being dismissed and unemployed ( $U_b$ ) is measured by the maximum amount of unemployment benefits payable to dismissed workers (level  $\times$  duration, UIBEN) which vary by state and therefore across plants. (Workers discharged for willful or deliberate misconduct—above and beyond simple shirking—may lose some period of eligibility for benefits.)<sup>13</sup> The expected value of alternative employment  $E(w_a)$  is determined in part by the costs associated with finding a new job. The extent of unemployment across plants affects the probability and costs of finding alternative employment. It is measured first by the rate of

13. The fact that an employer says that a discharge was for cause does not necessarily constitute dismissal for misconduct for the purposes of unemployment insurance. State unemployment agencies review discharge claims, and in general, discipline problems must go beyond ordinary negligence, inefficiency, and poor performance to include willful, deliberate misconduct in order to be classified as dismissed for misconduct. Workers whose dismissals meet the unemployment insurance misconduct test lose some weeks of eligibility for benefits (the level of benefits is unaffected) with the number of weeks lost rising according to the severity of the misconduct—up to 26 weeks for felony crimes, e.g. See U. S. Department of Labor [1990] for details. Workers dismissed for poor performance (shirking) are generally eligible for full benefits while even those dismissed for gross misconduct, such as felony convictions, lose only some of their eligibility. Because the basic framework for eligibility is dictated by the Federal Social Security Act, the variations in administrative practices across states are relatively minor. The potential loss of some eligibility creates incentives for workers to keep any misconduct on the more moderate side of the discipline distribution.

unemployment at each plant---the percentage of workers currently on layoff (LAI DOFF), many of whom are looking for jobs (perhaps temporary jobs given that historically, most laid-off workers have eventually been recalled). In larger labor markets the number of workers laid off at the plant may have only a marginal effect on the prospect of finding jobs, but it can have a disproportionate effect on the perceptions of workers concerning those prospects. We also include the unemployment rate in the SMSA (UE) to help capture the state of the labor market for other jobs. A measure of average seniority (SEN) at the plant---percent of workers < 10 years---provides a rough proxy for age-related marketability; other things equal, workers with more seniority are older and have more difficulty in securing new employment. Workers with more seniority also lose seniority-related benefits if dismissed, and this may offset the reduced disincentive to shirk associated with having less time remaining on the job (given mandatory retirement) and therefore a shorter period in which to benefit from wage premiums. Plants with more senior workers may also experience less shirking because they have already identified and dismissed workers with a disposition toward discipline problems, in contrast to plants with more new and untested employees where workers with those dispositions may not yet have been identified.

Finally, the wage for alternative jobs ( $w_a$ ) is measured by average wages paid in each SMSA for production work. We define the wage premium, WPREM, as  $w - w_a$ , and the effect of the wage premium on shirking,  $U_a/(WPREM) < 0$  if the efficiency argument dominates; it could be  $> 0$  if the income effect dominates or  $= 0$  if the rationalization associated with equity theory holds (also if efficiency and income effects both have zero effects or cancel out).

There are several potentially important influences on discipline rates across plants that are exogenous to the efficiency wage model. The first relates to characteristics of the plant and of the type of work performed in it. Jobs in assembly plants are also thought to be more oppressive than those in other plants because the work is more heavily dominated by the assembly line and workers have less ability to influence their work. Discipline problems may be more common in these plants as a result. We include a variable to identify assembly plants (ASSMBLY) and expect it to vary positively with discipline rates. However, jobs in assembly operations where work is highly automated may on average be less skilled than those in component manufacturing, and wages in the

outside market should therefore be lower for jobs in the former than in the latter. If this is so, then the wage premium might be greater for assembly workers (because wages are the same across types of plants), reducing the incentive for these workers to shirk and working against the effect hypothesized above.

In addition, some industry observers believe that worker attitudes and behavior such as militancy and worker discipline vary by region of the country. A variable is included to identify plants in the Michigan area which are older and often have histories of conflict (MICHIGAN); plants in the south (SOUTH) are newer and, many believe have more compliant, disciplined work forces. Plants in other areas—mainly in the Midwest—constitute the omitted category.

An additional factor affecting the variance in shirking behavior across plants may be associated with Hirschman's [1970] and Freeman's [1980a] "voice" argument. If shirking, as psychologists argue, is in part a reaction against problems at the workplace (i.e., absenteeism as a form of withdrawal from an unpleasant situation), arrangements that give workers an alternative means for addressing those problems could reduce the incidence of shirking. All plants have the same mechanisms—union representation, grievance procedures, etc.—but they may not function equally well. Fortunately, we have a unique measure of the effectiveness of these voice arrangements across plants. Corporate-level management rated the problem-solving ability of local unions and management at each plant (VOICE) using a ten-point scale (1 = confrontational relations; 10 = cooperative, problem-solving relations). Where shirking behavior is a reaction against problems at the workplace, we expect less shirking at plants where union-management relations provide a more effective mechanism for solving workplace problems. These variables, their means, and standard deviations are presented in Table I.

One potentially important omitted variable may be a comparison of the level of fringe benefits between the plants and their outside labor markets. These benefits represent a significant aspect of compensation, and as Freeman [1980b] notes, fringe benefits are correlated with wages that could bias a wage measure upward. Given that fringe benefits vary with wages, it may be best to think of the wage premium as measuring compensation: both wages and benefits. It is not obvious what other kinds of variables are omitted:

TABLE I  
VARIABLE DEFINITIONS, MEAN VALUES, AND STANDARD DEVIATIONS

Variable	Definition	Mean	S.D.
DISL	Rate of worker dismissals for disciplinary reasons	0.0968	0.076
$W_a$	Average hourly wage in 1982 for production workers in each plant's SMSA	\$ 10.58	1.5
WPREM	The wage premium for each plant defined as the average hourly company wage— $W_a$	\$ 2.92	1.5
WPREM'70	The wage premium for each plant in 1970 as defined above	1.03	0.4
UE	Unemployment rate in the SMSA in which the plant is located	13.06	4.0
LAIODFF	Percentage of workers on layoff	25.47	14.7
SEN	Percentage of workers with less than ten years of seniority	45.08	18.8
VOICE	Corporate assessment of cooperative relations/problem-solving at plant (1 = least cooperative; 10 = most)	6.96	1.4
ASSMBLY	Dummy variable for assembly plants	0.23	0.4
MICHIGAN	Dummy variable for plants in Michigan	0.60	0.5
SOUTH	Dummy variable for plants in the South	0.06	0.2
UIBEN	Maximum state unemployment insurance benefits by plant location	\$4,928.31	1,044.3

SMSA data from U. S. Bureau of Labor Statistics 1982 Area Wage Surveys. Unemployment data are from *Employment and Earnings* (1982) and from *Highlights of State Unemployment Compensation Laws* (1983). All other data are from internal company records for 1982.

while it may be that some workers may be more inclined to shirk, *ceteris paribus*, there is certainly no consensus as to what characteristics determine that inclination and no a priori reason to believe that they would be correlated with the right-hand-side variables.

The incidence of shirking as measured by disciplinary layoffs

across plants can be estimated as follows:

$$(2) \ln [\text{DISL}/1 - \text{DISL}] = a - b_1\text{WPREM} - b_2\text{UE} \\ - b_3\text{LAIDOFF} + b_4\text{SEN} - b_5\text{VOICE} + b_6\text{ASSMBLY} \\ + b_7\text{MICHIGAN} - b_8\text{SOUTH} + b_9\text{UIBEN} + e.$$

Plant-level data based on the average characteristics of the individual workers in each plant are especially susceptible to heteroskedasticity because the error term varies inversely with the number of workers employed in the plant: where  $N$  = workers in each of  $k$  plants,  $E(e_k^2) = 1/N_k^2 E[\sum_{ctk}^2] = s^2/N_k$ . As Amemiya and Nold [1975] note, the weighting used to correct for heteroskedasticity should be modified in log odds regressions to include an equation error as a measure of omitted variables. Otherwise, the standard errors of the estimates will be underestimated, and the efficiency of those estimates reduced. Each observation was weighted by  $[s_{\text{OLS}}^2 + \{\text{EMPLOYMENT}_k^* \text{DISL}_k(1 - \text{DISL}_k)\}^{-1}]^{-1/2}$ , where  $s_{\text{OLS}}^2$  is an estimate of the variance calculated from the parameters of an OLS estimation of the above log odds equation, and  $\text{EMPLOYMENT}_k$  is the number of workers at each of  $k$  plants. The log odds equation was estimated again using the weighted observations.

## V. RESULTS

The results in Table II provide empirical support for the efficiency wage hypothesis as applied to shirking. The wage premium (WPREM) suggests that there are fewer shirking-related discipline problems where wage premiums are higher. This relationship dominates any income effects or any of the rationalization associated with equity theory that may be nested in the model and that would operate in the opposite direction.

There is also support for the argument that the costs associated with dismissal in addition to the loss of the wage premium influence the incidence of shirking. Those costs include the prospects for reemployment as measured by layoff rates across plants (LAIDOFF) and seniority/age-related job prospects (SEN).<sup>14</sup> The fact that the costs associated with unemployment could provide such discipline is an old argument in economics that goes back at

14. To examine whether the variance in layoff rates across plants is driven by a variance in management practices which, in turn, could also account for the difference in discipline rates across plants, we ran the above regression without the LAIDOFF variable. The results (see Appendix) are virtually unchanged.

TABLE II  
REGRESSION RESULTS FOR RATES OF DISCIPLINARY LAYOFFS ACROSS PLANTS

	[(Dependent variable = $\ln \text{DISL}/1 - \text{DISL}$ )]		
	Weighted least squares		Elasticity <sup>a</sup>
	(1)	(2)	(3)
Intercept	-1.071 (0.96)	-1.20 (1.16)	—
WPREM	-0.21** (0.10)	-0.24* (0.13)	0.547
UE	-0.03 (0.04)	-0.012 (0.045)	0.330
LAIIDOFF	-0.009* (0.005)	-0.008* (0.005)	0.207
SEN	0.007* (0.004)	0.008* (0.004)	0.285
VOICE	-0.14*** (0.054)	-0.14*** (0.05)	0.908
ASSMBLY	1.008*** (0.182)	1.02*** (0.18)	0.210
MICHIGAN	0.09 (0.238)	0.289 (0.24)	0.053
SOUTH	0.054 (0.336)	-0.057 (0.36)	0.003
UIBEN	-0.00004 (0.00009)	-0.00006 (0.00009)	0.178
WPREM'70		0.37 (0.54)	0.291
<i>S.E.E.</i> =	0.62	0.61	
<i>F</i> =	6.43	6.32	
<i>n</i> =	78	78	

\* = significant at 10 percent.

\*\* = significant at 5 percent.

\*\*\* = significant at 1 percent (two-tailed tests).

All of the values for *DISL* lie between zero and one. Standard errors are in parentheses. The proportion of the variance in *DISL* explained by regressions 1 and 2 is 46 and 49 percent, respectively.

a. Evaluated at the mean from the weighted regression in equation (2).

least to Marx's [1976] notion of an "industrial reserve army." In addition, the quality of the relationship between plant management and the local union (VOICE) has a significant effect on the incidence of shirking, perhaps providing a means for solving problems that might otherwise contribute to discipline rates. Finally, assembly plants (ASSMBLY) are associated with significantly higher discipline levels, perhaps because workers there have more to lose from dismissal or perhaps because the work there may be more difficult. The other variables were not significant.

The wage premium result (although not the unemployment

result) is also consistent with a different mechanism: the selection of better workers. Higher wage premiums may lead to larger queues of workers and possibly to the selection of better workers who, for example, may have less initial preference for shirking. But this mechanism relies on a relative wage premium not at the current date but when the present work force was hired. While the premiums in the two periods are probably not identical, it is possible that the variable for the 1982 premium is positively correlated with the hiring premium and could be picking up some of the effects associated with the latter.

#### VI. EXAMINING AN ALTERNATIVE HYPOTHESIS

We attempt to examine the potential effect of a wage premium on selection first by calculating the wage premium across plants for the year 1970. Given median seniority of twelve years in our 1982 data, this corresponds to the year the median employee was hired. The wage premium in 1970 (WPREM'70) was calculated in the same way as was the 1982 premium, and we enter it along with the 1982 premium into equation (2). The results are reported in Table II and suggest that the wage premium at the point of hire did not have a significant effect on discipline rates. Indeed, the effect is in the wrong direction. The current premium, however, retains its significance and the expected sign, suggesting that it is not driven by selection effects.

These results are consistent with the basic shirking argument that the costs of dismissal, including the loss of a wage premium, create incentives that reduce shirking. The more difficult question is whether the wage premium is in fact a cost-effective way of reducing shirking. In other words, does the optimality condition for efficiency wages hold? As noted above, because wage levels and the premiums that result are not set unilaterally by the firm, we would not necessarily expect the premiums to optimize the reduction in shirking. It might still be interesting, though, to try to estimate the value of the reduction in shirking.

The best way to estimate the benefits of the reduction in shirking associated with wage premiums would be to estimate a production function that includes the discipline rate as a right-hand-side variable. Ideally, such tests might also include measures of any reductions in turnover associated with wage premiums in order to assess the relative importance of these different efficiency wage mechanisms. Unfortunately, we do not have the data to estimate a production function consistent with the relationships examined above or to draw comparisons with turnover.

Instead, we must rely on less direct measures. As measured by the elasticities reported in Table II, the relationship with the market wage is second only to voice in its effect on discipline rates. But the dollar comparisons tell a more complicated story. A one dollar increase in the wage premium over market rates at a representative plant of 1,000 workers would lead to 16.5 fewer disciplinary actions per year.<sup>15</sup> The wage costs alone of that dollar increase, however, total well over \$2 million per year, or approximately \$121,000 per disciplinary action.

While this may appear to be an expensive means of reducing shirking, it is difficult to know the total benefits associated with a reduction in discipline cases. A company representative suggested that the administrative costs alone associated with a dismissal can run as high as \$75,000.<sup>16</sup> The costs of the incidents leading to discipline vary depending on the cause but could be high, for example, if the cause was sabotage. More important, wage premiums may lead to a reduction in unobserved shirking—unobserved because of the imperfect monitoring of employee behavior—and if we assume that only a relatively small proportion of shirkers are caught, this reduction could be substantial. The uncertainty associated with these benefits makes their value vary with the risk preferences of the employer. Finally, there may also be benefits from the wage premium in addition to the reduction in shirking, such as reductions in turnover, which are not measured here.

## VI. CONCLUSIONS

Efficiency wage arguments rely on a largely untested relationship between wage premiums and worker productivity. The arguments above find evidence supporting the assertion that wage premiums are associated with reductions in shirking as measured by discipline rates. The wage premium appears to provide incentives to avoid dismissal rather than leading to the selection of workers less inclined to shirk. Factors such as the level of unemployment in the local labor market and the seniority of the work force also influence the costs associated with dismissal and

15. Part of the reason is that unions invariably file grievances against all dismissals, and the administrative costs of a full grievance procedure are high. Further, management loses a nontrivial share of these grievances and must pay back wages for the period since the discharge, often a year or more. Dismissals may also raise the experience rating costs associated with unemployment insurance. All of these costs must be included in the expected costs of a discharge.

16. The new disciplinary rate =  $e^d/1 + e^d$ , where  $d = \ln(\text{DISL}/1 - \text{DISL}) + (b_w)(\text{WPREM})$ . The change in discipline rates varies with the initial level of the rate and is evaluated here at the mean.



are similarly related to the level of shirking. Finally, discipline rates are also lower in plants where the union and management are better able to resolve their problems. It is difficult to identify the value of the reduction in shirking associated with a given wage premium, but it does seem that there could be nontrivial returns associated with a wage premium.

APPENDIX: SUPPLEMENTARY REGRESSION RESULTS FOR RATES OF DISCIPLINARY LAYOFFS ACROSS PLANTS

Dependent variable: ln (disciplinary rate/1 - disciplinary rate)					
Weighted least squares					
	(1)	(2)	(3)	(4)	(5)
Intercept	-1.48** (0.50)	-1.67 (0.54)	-2.23** (0.88)	-1.59 (1.16)	-1.331 (1.24)
WPREM	-0.14** (0.06)	-0.25** (0.12)	-0.20* (0.11)	-0.25* (0.13)	-0.23* (0.13)
UE			-0.02 (0.04)	-0.006 (0.05)	-0.01 (0.047)
LAIPOFF	-0.009* (0.005)	-0.009* (0.005)	-0.008* (0.005)		-0.01* (0.005)
SEN	0.007* (0.004)	0.008** (0.003)	0.005 (0.004)	0.01** (0.004)	0.004* (0.0075)
VOICE	-0.14*** (0.52)	-0.15*** (0.052)		-0.14*** (0.053)	-0.14*** (0.054)
ASSEMBLY	1.03*** (0.17)	1.015*** (0.18)	1.09*** (0.19)	1.08*** (0.18)	0.94*** (0.23)
MICHIGAN	0.122 (0.18)	0.18 (0.19)	0.06 (0.25)	0.31 (0.24)	0.28 (0.25)
SOUTH	0.02 (0.32)	0.05 (0.32)	-0.17 (0.33)	-0.01 (0.36)	-0.067 (0.36)
UIBEN			0.00006 (0.00009)	-0.00006 (0.00009)	-0.00006 (0.00009)
WPREM'70		0.45 (0.46)			0.44 (0.56)
SKILL <sup>a</sup>					-0.005 (0.009)
SEN15 <sup>b</sup>					-0.005 (0.008)
SEE	0.62	0.62	0.62	0.62	0.61
n =	78	78	78	78	78

a. SKILL = percentage of plant work force with craft skills.  
 b. SEN15 = percentage of plant work force with seniority less than 15 years.  
 Equation (5) contains all of the variables available from the data set.  
 \* = significant at 10 percent level.  
 \*\* = significant at 5 percent level.  
 \*\*\* = significant at 1 percent level (two-tailed tests).

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