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Compensating wage differentials for job stress

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Recent medical studies have demonstrated a strong relationship between mental stress and cardiac events such as myocardial infarction and stroke. In the workplace, stress once accounted for less than 5% of all occupational disease claims, but it now accounts for over 15%. Although research on the effects of mental stress is increasing, few studies offer an economic perspective. In this paper, we examine the effects of job stress on weekly wages and explore the possibility that stress commands a compensating wage differential. Our findings suggest that, *ceteris paribus*, a wage differential does exist between workers experiencing mental stress and their 'non-stressed' cohorts. After controlling for other demographic and occupational factors, we found a statistically significant wage premium ranging from 3 to 10% attributable to mental stress. In addition, the magnitude of the differential varies by gender.

I. INTRODUCTION

Stressful situations at the workplace are an expected feature of many occupations. While most people experience some amount of job stress throughout their careers, stressful situations are inherently personal and may be a common characteristic of some jobs. In the past few years, reported claims of stress-related disabilities in the workplace have increased. In 1980, stress claims accounted for less than 5% of all occupational disease claims. By 1989, this figure had grown to 15% (Kottage, 1992). However, this statistic does not illustrate the full extent of stress in the workplace because it reveals only those stress cases for which compensation was sought. In a survey of 600 full-time employees conducted by Northwestern National Life Insurance Company, seven out of ten workers stated that job stress lowers their productivity and contributes to frequent health problems (Zemke, 1991). Seventeen percent of these workers reported that, in 1990, they had missed one or more days of work due to stress (Mulcahy, 1991). In another survey of approximately 500 men and women conducted by a New York-based firm, Research and Forecast, Inc, 26% of the interviewees reported that they were under 'a lot' of stress in their lives, and 20% of those reporting high stress felt that its primary source was work (Zemke, 1991). The National Institute for Occupational Safety and Health now rates stress as one of the ten leading work-related diseases (Minter, 1991).

Stress is neither a trivial problem, nor the sole responsibility of the worker. The ways in which stress manifests itself can be very costly to both the employer and employee. In the short run, stress can lead to job dissatisfaction, which often results in absenteeism and reduced productivity. It is estimated that stress-related absenteeism costs American industry over $150 billion each year (Malik, 1993). In the long run, stress can lead to health problems (e.g. heart disease, increased accident occurrence, and poor mental health); substance abuse; and social/domestic problems (Wheeler and Lyon, 1992; Meisel *et al.*, 1991; Friedman *et al.*, 1996). A recent article in the *Journal of the American Medical Association* (Jaing *et al.*, 1996) reported convincing evidence that the presence of mental stress-induced myocardial ischemia is associated with significantly higher rates of subsequent fatal and non-fatal cardiac events, independent of other influential variables. The American Institute of Stress reports that stress is a key reason for our escalating health care costs with stress-related disorders accounting for 66% of all primary-care physician visits (Malik, 1993).

There are many perceived stressors in the workplace. Most of the job stress studies in the sociological and psychological literature have focused on the mental aspects of

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stress. Mental stress is more identifiable than physical stress, and its manifestation usually involves both job characteristics and employee's perceptions of these characteristics. Many studies have found that an individual's perception of control can be a primary indicator of mental stress. Karasek (1979) asserted that the most stressful jobs combine high demands with low control; other studies have found similar results (Kemery *et al.*, 1985; Hendrix *et al.*, 1985). Sutherland and Cooper (1988) identified five categories of stressors in the workplace:

- factors related to the job (e.g. noise, boredom, shiftwork, fear of exposure to dangerous materials);
- role of the individual in the organization (e.g. insufficient information to perform tasks, lots of responsibility but little authority);
- social relationships and interpersonal demands;
- prospects for promotion and advancement (e.g. inadequate recognition or reward for good performance); and
- organizational structure and climate (e.g. unable to voice complaints or express feelings, prejudice).

Given the relatively high prevalence of job stress reported in industry studies (Zemke, 1991), some interesting economic questions emerge. For example, how does job stress vary in duration and intensity across occupations? Assuming job stress is undesirable, do certain workers who incur high levels of stress receive compensating wage differentials (*ceteris paribus*) relative to workers who experience average or less stress? If some amount of stress is a common characteristic of most jobs, then one could argue that there is little basis for compensating wage differentials. Alternatively, some jobs may merit additional compensation due to the unusual type or intensity of stress.

Many economic studies have examined the relationship between undesirable workplace characteristics (primarily occupational hazards) and wages. The seminal articles by Thaler and Rosen (1975) and Smith (1974) were two of the first studies to report empirical evidence that compensating wage differentials exist for risky jobs and occupations. Many other studies have supported this general finding using national data on households, individuals, occupations, and industries (e.g. Kniesner and Leethe, 1991; Biddle and Zarkin, 1988; Olson, 1981; Smith, 1983; Viscusi and Moore, 1987; French and Kendall, 1992; Thaler, 1989; Krueger and Summers, 1988; Dickens and Katz, 1987). For a careful review of this literature, see Fisher *et al.* (1989); Viscusi (1993); and Tolley *et al.* (1994).

Despite the large volume of literature on compensating wage differentials (CWDs) in the labour market, we are not aware of any studies that have examined this issue for self-reported measures of job stress. In many ways, job stress is similar to other undesirable worksite characteristics (e.g. occupational safety risks), but the key difference is that it generally does not pose an immediate physical health hazard. As such, it may not warrant additional wage compensation. In addition, while many undesirable worksite characteristics are somewhat objective and easily measured, it can be argued that job stress is largely controlled by the individual. Thus, a self-reported measure of job stress may be more useful for empirical analysis compared to more objective measures, which are hard to generalize.

The main purpose of our study is to test for the presence of CWDs for job stress at six worksites across the US. The data were collected at these worksites in the early 1990s and include detailed personal and occupational characteristics on approximately 1500 employees. The methods for this study parallel those in the hedonic wage literature to allow comparison. The results have important policy and research implications regardless of the direction or significance of the findings. For example, the presence of CWDs for job stress would suggest that job sorting based on stress is occurring efficiently at these worksites. Similarly, it would suggest that workers are not accepting job stress without a pecuniary reward. The absence of CWDs for job stress would suggest that one or more of the following situations may be occurring: (1) there may be some friction in job sorting based on job stress; (2) there may be some asymmetries in the way that employers and employees perceive job stress; (3) job stress may be viewed as a common characteristic of most jobs and therefore not worthy of additional compensation; (4) some sort of market failure is occurring.

II. THEORETICAL BACKGROUND

The principle of compensating wage differentials (CWDs) posits that, holding worker characteristics constant, employees in undesirable jobs receive higher wages than employees working under more pleasant conditions (Ehrenberg and Smith, 1988; Viscusi, 1993). Thus, firms must compensate employees (i.e. pay higher wages) to work in undesirable conditions, or, alternatively, employees purchase (i.e. receive lower wages) more desirable working conditions. CWD theory is based on six primary assumptions – three pertaining to labour supply and three pertaining to labour demand (Ehrenberg and Smith, 1988; Viscusi, 1993).

The first assumption pertaining to labour supply is that workers seek to maximize their expected utility rather than their income. This distinction between utility and income is very important. If workers strive to maximize only income, then all workers would seek the highest-paying jobs regardless of other job characteristics. In this environment, wages would eventually equalize for similar workers in the same jobs and CWDs would not exist. However, the assumption that workers maximize their expected utility implies that other factors, in addition to income, contribute to workers' levels of utility. In this environment, CWDs can exist and it is the overall utility of the jobs (i.e. income plus psychological aspects) that will equalize, rather than wages alone.

The second assumption is that a majority of workers are fully informed about the job characteristics important to them. CWDs can develop only if workers are aware of the presence of an undesirable characteristic at the workplace.[1] A good example of the importance of worker information is the history of asbestos dust in the workplace. Forty years ago the risks associated with asbestos were virtually unknown. At that time, workers' job choices in this area were made in ignorance. CWDs for asbestos exposure did not exist because workers did not identify the presence of asbestos as an undesirable job characteristic (Ehrenberg and Smith, 1988). Thus, CWDs can only develop when undesirable job characteristics are known and understood by workers.

Third, we assume that workers have mobility, which means that workers have a range of job choices with varying characteristics from which to choose. Without job mobility, workers would be unable to select desirable characteristics and avoid undesirable characteristics. For example, if all the jobs offered to workers were dangerous, then firms would not need to offer CWDs because workers could not choose less risky jobs. Thus, a job characteristic can command a CWD only if workers have job offers that allow them to avoid the job characteristic by choosing a different job.

It is easy to fit occupational stress into this theoretical context. We would expect CWDs for stress to exist if we assume that:

- workers maximize expected utility and not just income;
- workers are aware of the general levels of stress associated with different jobs and stress is identified as an undesirable trait; and
- workers have a range of job choices with varying degrees of stress from which to choose.

Holding other factors constant, we would expect that jobs with higher levels of stress pay higher wages. Thus, workers are being compensated for enduring stress, or put another way, workers averse to stress are purchasing (i.e. receiving lower wages for) jobs that have lower levels of stress.

Like employees, firms are faced with the trade-off between mitigating an undesirable job characteristic and paying higher wages. Three assumptions pertaining to labour demand govern firms' behaviour under the CWD theory. First, we assume that it is costly for the firm to reduce the level of an undesirable job characteristic present in their workplace. For example, reducing job stress might involve offering stress management classes to high-risk employees, which would include direct costs for class supplies and training personnel plus indirect costs related to lost work time for employees attending the class. The second assumption pertaining to labour demand is that, due to competitive pressures, firms will operate at zero economic profits in the long run. Thus, if a firm incurs costs to reduce an undesirable characteristic from the workplace, then it must remove costs elsewhere to maintain competitiveness and continue operating. The third assumption is that all other job characteristics are already determined.

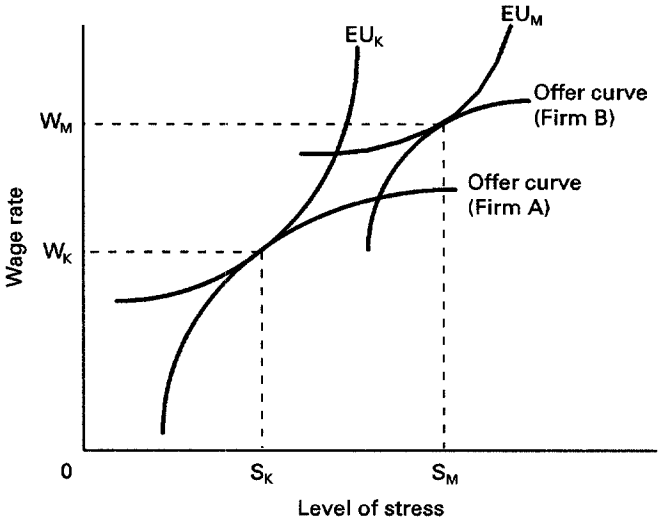

Fig. 1. *Equilibrium wage–stress trade-off*
Source: Ehrenberg and Smith (1988).

To illustrate the interaction between labour supply and labour demand and the emergence of CWDs, we examine the trade-off decision between stress and wages (Ehrenberg and Smith, 1988; Viscusi, 1993). Fig. 1 shows the equilibrium choices of two individuals, K and M, between wage rates and stress levels (all other aspects are already determined and assumed constant). Both individuals face wage–stress offer curves comprising firms' zero-profit isoprofit curves. For simplicity, we include two offer curves in Fig. 1, Firm A and Firm B. The steepness of Firm B's section of the offer curve implies that Firm B incurs a higher cost to reduce workplace stress than Firm A. Firm B finds it more efficient to offer a higher wage to workers and maintain a higher stress level.

As shown in Fig. 1, individual K maximizes her expected utility (EU_K) by choosing firm A's wage offer of W_K with a corresponding stress level of S_K. Individual M maximizes her expected utility (EU_M) by choosing firm B's wage offer of W_M with a corresponding stress level of S_M. (Note: $W_M > W_K$ and $S_M > S_K$) The steepness and position of individual K's indifference curve implies that individual K is more averse to stress than individual M. Therefore, it is natural that individual K maximizes her expected utility by accepting a lower wage in return for a lower stress level at the workplace. On the other hand, individual M is less averse to

[1]This assumption further supports using a self-reported measure of job stress in the empirical model.

Table 1. *Worksite characteristics and survey response rates*

Worksite characteristic	Worksite 1	2	3	4	5	6	Full sample
Industry	Manufacturing	Manufacturing	Government	Financial	Health Care	Communications	
Location	rural	suburban	suburban	urban	suburban	urban	
Total employees at worksite	6000	1700	250	4445	2400	1500	16 295
Sample size	444	300	220	400	300	400	2064
Number of respondents	408	195	194	262	203	316	1578
Respondent response rate	0.92	0.65	0.88	0.66	0.70	0.79	0.76

stress, and she maximizes her expected utility by accepting Firm B's higher wage offer with a higher stress level. The compensating wage differential between these two firms ($W_M - W_K$) reflects the stress differential ($S_M - S_K$) for workers at Firm B relative to workers at Firm A.

Most of the studies on CWDs have examined quantifiable job characteristics such as the risk of injury or noise levels. However, the theory of CWDs should extend to almost any type of job characteristic perceived as undesirable by employees, including occupational stress. In this paper, we use the theory of CWDs outlined above to determine whether CWDs exist for occupational stress at six worksites.

III. SAMPLE AND DATA

The data analysed here are from a larger, multiyear study of the prevalence, cost and impact of employee assistance programmes (EAPs) in the workplace (Hartwell *et al.*, 1996, 1997; French *et al.*, 1997). This larger study included a national survey of 5000 worksites that focused on the presence and type of EAPs. To estimate the costs and benefits of EAP models, the authors completed detailed case studies on six worksites, which involved administering questionnaires to a randomly selected sample of employees at each worksite. The primary purpose of the employee survey was to determine current prevalence rates for tobacco, alcohol, and illicit drug use and for emotional/mental health problems among worksite personnel (e.g. French and Zarkin, 1995; French *et al.*, 1995). However, the survey also gathered relevant information on employees' perceived levels of mental stress in the workplace.[2]

In this paper, we use the employee survey data from the six worksite case studies to analyse the impact of mental stress on employee earnings. Table 1 presents descriptive information on each of the worksites, including type of industry, location, total number of employees at the worksite, sample sizes of employees participating in the survey, and our response rates for the survey. As Table 1 shows, the six companies represent different types of industry, including banking and finance, manufacturing, health care, government, and communications. The number of employees at each worksite ranges from 250 to 6000 with an average of 2700 employees. Employees in the sample were randomly selected from a staff roster at each worksite. Sample sizes ranged from 220 employees at the smallest worksite to almost 450 employees at the largest worksite. Response rates to the survey ranged from 65% to 92% with an average response rate of 76%.

Table 2 presents demographics on the full sample of workers, by gender. The mean age for our full sample is approximately 42 years and the mean length of tenure at the worker's current worksite is about 14 years. Thus, our sample consists mostly of workers who have been in the labour force for an extended period and, based on age, are at the midpoint of their working lives.[3] Eighty-five percent of the workers are white and 58% are male. Almost 75% of individuals in the full sample are married. Most of the employees have a high school diploma or GED (97%), and the mean highest grade completed is about 14 years.

Table 2 also illustrates the assortment of occupation types represented in our sample. Almost 40% of the workers in our full sample describe themselves as either managers or professionals. This occupation category comprises the largest percentage of workers at every worksite, except Worksite 6 where almost 75% of the sampled workers categorize their job as production work. Thus, our sample consists of predominantly white collar workers. Most employees in our sample worked full time (i.e. 35 or more hours per week) and less than 7% of the full sample reported their health as either fair or poor.

Significant gender differences in variable means exist for almost all of the demographic variables listed in Table 2.

[2]The full questionnaire used for the employee survey is available from the authors.
[3]One could argue that the majority of these workers have sufficient labour market experience to decipher accurately job stress and make informed choices regarding stress and wages.

Table 2. *Variable means, full sample and by gender*

Variable	Males ($N = 916$)	Females ($N = 651$)	Full Sample ($N = 1578$)
Age[a]	42.626	40.321	41.672
Tenure[a]	15.813	12.152	14.284
Male	1.00	0.00	0.584
White[a]	0.893	0.796	0.853
Married[a]	0.822	0.635	0.744
Highest Grade Completed[a]	14.315	13.722	14.066
High School Diploma/GED	0.976	0.966	0.972
Fair or Poor Health	0.059	0.076	0.066
Enrolled in School[a]	0.131	0.154	0.140
Working Full Time[a]	0.992	0.890	0.950
Weekly Wage ($)[a]	908.87	641.17	797.97
Annual Earnings ($)[a]	46 324	30 480	39 731
Weeks Worked per Year[a]	51.389	50.444	50.961
Occupation Types			
Managers/Professionals[a]	0.425	0.343	0.388
Research	0.052	0.066	0.058
Clerical[a]	0.028	0.398	0.182
Service	0.067	0.045	0.057
Production[a]	0.302	0.103	0.220
Other[a]	0.105	0.038	0.077
Job is Mentally Stressful*	0.635	0.631	0.633

[a]Statistically significant gender differences in variable means, $p < 0.05$ (Wilcoxon 2-tail test).
*The response categories for 'job is mentally stressful' included strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree.We collapsed the first two categories into 'agrees' and used this as a dichotomous variable for a mentally stressful job.
Note: All variables except mental stress display statistically significant worksite differences in variable means (Kruskal–Wallis test), $p < 0.05$.

For example, men in our sample generally work longer hours per week, have longer tenure at their current worksite, and have higher earnings than women.

Significant differences also exist among worksites for all of the demographic variables listed in Table 2. Four of the worksite samples consist mostly of white males, and two of the samples consist mostly of white females. We found that worksites with higher concentrations of female workers also have higher concentrations of part-time workers compared with the other worksites.

Lastly, as Table 2 shows, we found that self-reported mental stress is strongly prevalent in each of the six worksites.[4] Over 60% of the full sample of workers describe their job as mentally stressful. We did not, however, find significant gender differences for mental stress. Within each gender group, approximately 63% of the sample experienced mental stress on the job. However, variation was present across worksites with a range between 49% and 79%.

IV. EMPIRICAL SPECIFICATION AND ESTIMATION RESULTS

To explore the differences in wage compensation between stressed and non-stressed workers, we completed both simple descriptive and multivariate statistical analyses. First, we divided workers into two categories – those experiencing mental stress and those not experiencing mental stress. As discussed earlier, over 60% of the full sample describe their job as mentally stressful.

Our descriptive analysis provides an examination of the differences in mean weekly wages between stressed and non-stressed workers. Table 3 reports the mean weekly wage for workers in each of these categories for mental stress. We examine the full sample of workers, segmented by gender, occupation, and worksite. Although we consistently found wage differentials between stressed and non-stressed workers, these differences cannot immediately be attributed to the presence of stress. A major shortcoming of bivariate

[4]We determined the presence of job stress from respondents' answers to a direct survey question asking their degree of agreement with the following statement: 'My job is mentally stressful.' If an individual 'agreed' or 'strongly agreed' with the statement, then they were coded as having a mentally stressful job.

Table 3. *Means analysis of weekly wage and job stress, by gender, occupation, and worksite*

Sub-sample	Mental stress		
	Yes	No	All
Full Sample[a]	$846.59	$713.76	$797.97
Male[a]	982.79	780.10	908.87
Female[a]	653.05	620.74	641.17
Manager/professional	1033.05	972.75	1020.81
Research	668.32	1089.91	834.87
Clerical	487.66	487.91	487.78
Service	699.73	597.80	656.89
Production	722.76	640.99	676.59
Other occupations	772.27	690.37	742.57
Worksite 1[a]	1018.02	786.06	948.74
Worksite 2[a]	924.44	808.01	876.74
Worksite 3[a]	672.83	575.63	641.93
Worksite 4[a]	995.85	702.26	884.83
Worksite 5	576.99	848.19	634.56
Worksite 6[a]	771.89	642.81	703.58

[a]Statistically significant difference in mean of weekly wage between mental stress categories, $p < 0.05$.

Table 4. *Regression coefficients for hedonic wage equations, full sample (dependent variable = ln [Weekly wage])*

Variable	Coefficient estimates ($N = 1578$)	
	Model 1	Model 2
Mental Stress	0.0375[b]	0.0874[a]
Constant	4.2289[a]	3.5395[a]
Age	0.0293[a]	0.0367[a]
$(\text{Age})^2$	−0.0003[a]	−0.0004[a]
Tenure	0.0123[a]	0.0105[a]
$(\text{Tenure})^2$	−0.0002	−0.0001
Male	0.1382[a]	0.2048[a]
White	0.0977[a]	0.1156[a]
Married	0.0798[a]	0.0916[a]
Fair/Poor Health	−0.0204	−0.0106
Highest Grade Completed	0.0577[a]	0.0944[a]
Currently Attending School	−0.0294	−0.0146
Working Full-Time	0.4250[a]	0.4049[a]
Manager/Professional	0.2564[a]	—
Research	0.0690	—
Clerical	−0.1963[a]	—
Service	−0.0112	—
Production	−0.0298	—
Worksite 2	0.0960[a]	0.1041[a]
Worksite 3	−0.1245[a]	−0.1057[a]
Worksite 4	0.0861[a]	0.0613[b]
Worksite 5	−0.2518[a]	−0.1860[a]
Worksite 6	−0.0825[a]	−0.1223[a]
$\bar{R}^2$	0.5239	0.4548

[a]Statistically different from zero, $p < 0.05$.
[b]Statistically different from zero, $p < 0.10$.

descriptive analysis is that it does not control for other influential factors. There are many other possible explanations for wage differentials, in addition to stress, such as differences in educational requirements for jobs, job tenure, presence of wage discrimination, and differences in other worker characteristics. The descriptive analysis does not control for other factors, and therefore should not be interpreted as implying any direct relationship between stress and wages.

As shown in Table 3, we found significant differences in the mean weekly wage between mental stress categories for the full sample of employees. Workers experiencing mental stress have a higher mean weekly wage than workers not experiencing mental stress. We found an 18% differential for the mean weekly wage between these two groups.

When examining men and women separately, we still found significant differences in the mean weekly wage between mental stress categories. As with the full sample, men and women experiencing mental stress have a higher mean weekly wage than their stress-free counterparts. However, this differential was much greater for males than for females. The mean weekly wage for stressed men was 26% greater than the mean weekly wage for men not experiencing stress. For women, the mean weekly wage differential between these two categories was only 5%.

An examination by worksite revealed significant differences in mean weekly wage between mental stress categories for five of our six worksites. Once again, we found that those workers experiencing mental stress also have a higher mean weekly wage. These differentials ranged from 14% to 42%. Although differences in mean weekly wage between stressed and non-stressed workers within occupation categories were found, none of the wage differentials were statistically significant.

These findings support the possibility that CWDs do exist for some types of occupational stress. However, as noted earlier, this bivariate descriptive analysis does not control for other varying factors among workers. Thus, the existence of a wage differential does not necessarily imply that it is due to stress compensation. In all likelihood, several variables contribute to wage differentials among workers. To separate these effects, we estimated several hedonic wage equations to examine the individual impact of different variables on weekly wages.

Tables 4 and 5 present the results from our regression analysis for the full sample and by gender. Rather than estimating a structural equation system of wages and job stress, we chose to focus on a general hedonic equation of the following form[5]

$$w_i = \alpha + \beta_j X_{ij} + \gamma S_i + \delta_j W S_{ij} + \nu_i \qquad (1)$$

[5]Data limitations in some areas influenced our choice of OLS regression models over more sophisticated structural equations.

Table 5. *Regression coefficients for hedonic wage equations, by gender (dependent variable = ln [weekly wage])*

	Males ($N = 916$)		Females ($N = 651$)	
Variable	Model 1	Model 2	Model 1	Model 2
Mental Stress	0.0494[b]	0.0986[a]	0.0388	0.0825[b]
Constant	4.6247[a]	3.8353[a]	5.0648[a]	4.3449[a]
Age	0.0288[a]	0.0478[a]	0.0265[b]	0.0275[b]
$(Age)^2$	−0.0003[a]	−0.0005[a]	−0.0003	−0.0003
Tenure	0.0192[a]	0.0136[a]	0.0046	0.0051
$(Tenure)^2$	−0.0003[a]	−0.0001	0.0001	0.0001
White	0.0836[a]	0.1088[a]	0.0950[b]	0.1109[b]
Married	0.1033[a]	0.1092[a]	0.0102	0.0301
Fair/Poor Health	−0.0600	−0.0501	0.0061	0.0205
Highest Grade Completed	0.0679[a]	0.0997[a]	0.0371[a]	0.0784[a]
Currently Attending School	−0.0635[b]	−0.0685[b]	0.0433	0.0674
Manager/Professional	0.2837[a]	—	0.1485	—
Research	−0.0201	—	0.0411	—
Clerical	−0.3237[a]	—	−0.2764[a]	—
Service	−0.0250	—	−0.0747	—
Production	0.0351	—	−0.2470[b]	—
Worksite 2	0.0494	0.0610	0.2444[a]	0.2474[a]
Worksite 3	−0.2142[a]	−0.1587[a]	0.0668	0.0514
Worksite 4	0.0252	0.0136	0.2108[a]	0.1707[a]
Worksite 5	−0.3111[a]	−0.3196[a]	−0.2598[a]	−0.1841[a]
Worksite 6	−0.1813[a]	−0.2047[a]	0.1828[b]	0.1044
$\bar{R}^2$	0.5618	0.4825	0.2913	0.1973

[a]Statistically different from zero, $p < 0.05$.
[b]Statistically different from zero, $p < 0.10$.

where w_i is the weekly wage rate for worker i; X_{ij} are demographic and personal characteristics; S_i is an indicator variable for whether or not a job is stressful; WS_{ij} are indicator variables for worksite j; α, γ, δ_j and β_j are parameters to estimate; and v_i is a random error term.[6]

The core set of explanatory variables includes both continuous and dichotomous measures. Continuous variables include the worker's age, tenure at present worksite, and highest level of education achieved. The remaining explanatory variables are all dichotomous and control for gender, race, marital status, health, current school enrollment, full-time worker, occupation type, and worksite.

Equation (1) can be estimated with ordinary least squares, but mental stress may also be endogenous, leading to a violation of the normality assumption of the error term and biased parameter estimates. To explore this possibility, we used a Hausman test (Hausman, 1978; Wu, 1973) to test the null hypothesis that S_i is exogenous in Equation 1. The instrumental variables in the first-stage stress equation are (1) my job has frequent changes in supervisors; (2) my job has frequent changes in coworkers; and (3) my job depends on the job performance of others.

After estimating a logistic regression for the stress equation with the same set of explanatory variables in Equation 1, except stress, and the three instruments noted above, we used the predicted stress variable in the hedonic wage equation. Implementing the Hausman test, we could not reject the null hypothesis that stress is an exogenous variable ($F = 1.34$, $p = 0.25$). In addition, the instruments appear to be reliable ($F = 62.06$ for joint significance) and we cannot reject the null hypothesis that the instruments are overidentifying ($F = 1.72$, $p = 0.18$). Based on these results, we estimated various specifications of Equation 1 with OLS.

The final specifications are reported in Table 4 for the full sample and Table 5 by gender. Model 1 includes the core set of explanatory variables discussed earlier and an indicator variable for mental stress. Recognizing the possibility that the occupational variables in Model 1 may be endogenous, we excluded these variables from the specification and report the results as Model 2. Table 5 presents the regression results for Model 1 and Model 2, by gender.

The results shown in Table 4 indicate that, for the full sample of workers, workplace stress is significantly correlated with workers' wages. In Model 1 we found a statistically significant positive correlation ($p < 0.10$)

[6]We also estimated hedonic wage equations for each worksite. Although the sample sizes for some of the individual worksites are relatively small, the results were generally consistent with the full sample findings. These regression results are available from the authors.

between mental stress and weekly wage with a wage premium of approximately 4% for workers experiencing mental stress. Excluding the occupational categories (Model 2) increases the magnitude of the estimated stress premium to almost 9%, and the significance level is now $p < 0.05$. It should also be pointed out that the predictive power of these regressions are quite high with R^2 values around 0.5.

In addition to the full sample, we estimated each regression model for males and females in our sample. As shown in Table 5, the findings from our regressions on the full sample extend to the gender subgroups. We found that a statistically significant positive correlation exists for men between mental stress and weekly wage. Depending upon whether you prefer Model 1 or Model 2, a predicted wage premium of approximately 5 to 10% exists for men who experience mental stress at these worksites.

The qualitative results were consistent for women as well, but the magnitude of the differential was slightly smaller compared with men, and the standard errors were a little larger. The estimated wage differential due to mental stress was just under 4% in Model 1 ($p = 0.36$) and just over 8% in Model 2 ($p = 0.06$).

Our findings suggest that a compensating wage differential does exist in occupations with above-average levels of mental stress. Following the principles of hedonic wage theory, this suggests that mental stress, similar to the risk of occupational injury, is an undesirable job trait and that employers must offer a higher wage to entice workers to accept a job with this characteristic.

V. CONCLUSIONS

We caution that these findings are preliminary, and more research is needed in this area. Specifically, the research presented in this paper has some limitations that could affect our conclusions. First, we treat job stress as an exogenous variable in our single-equation hedonic model. It is still possible that job stress might be an endogenous variable. Using three statistically reliable instruments for job stress, we could not reject the null hypothesis of exogeniety, but some people may be less inclined to accept this result. If stress is, in fact, exogenous, then we may have some bias due to model misspecification. Second, we use self-reported information to measure job stress. Self-reports are desirable for empirical analysis because job stress, largely controlled by the individual, is hard to measure objectively. Such reports, however, raise the possibility of measurement bias due to differences in respondent interpretation and perceptions. Third, job stress is inherently subjective, which limits the possibility of defining a standard measure or even an index that can be applied to a variety of workers and occupations. Fourth, our findings are only representative of the six worksites in our sample and should not be used to draw national inferences.

Several studies have reported that job stress is having a profound impact in today's workplace. Our findings indicate that the majority of workers in six different worksites have jobs that are mentally stressful, which puts them at risk for job dissatisfaction, higher absenteeism rates, and lower productivity. Mental stress can also lead to health problems and social/domestic problems. As the prevalence of stress increases in the workplace, the results of this research have some direct applications. For example, if workers are well informed about the hazards of mental stress and the levels of mental stress in various occupations and worksites, then wage premiums should allow workers to sort themselves according to their preferences for stress. Furthermore, if the market is working efficiently in this regard, then the workers' compensation system may be redundant since employees are already being compensated for higher stress through higher wages. Of course, not all compensation claims are stress related, but our findings raise paradoxical questions about current compensation practices for stress-related conditions.

Most research pertaining to occupational stress has appeared in the psychological and sociological literature (e.g. Fox *et al.*, 1993; Perrewe and Ganster, 1989; Dwyer and Ganster, 1991; Firth-Cozens, 1992; Fenwick and Tausig, 1994). Very little empirical research has examined the effects of occupational stress on economic variables. Our results indicate that mental stress affects compensation levels at six worksites. It would be interesting to explore whether CWDs for job stress are also present at other worksites, both regional and national. In addition to CWDs, future research could examine the effects of stress on other workplace characteristics such as absenteeism and accidents. The findings from this line of research will offer important information for workers' compensation systems, free-market advocates, private industry, and individual workers.

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