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Article abstract

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The Effects of High Performance Work Practices on Job Satisfaction in the United States Steel Industry

PETER BERG

A unique data set is used to examine how different practices associated with high performance work systems in the steel industry affect the job satisfaction of workers. While the effect of these practices on organizational performance is widely studied, few have examined their effects on workers. The analysis in this paper is based on data from a sample of 1,355 hourly workers in the U.S. steel industry across 13 plants. The results indicate that the effect of high performance work practices on job satisfaction depends primarily on how work roles and job duties are defined, on good employee-management relations and on practices that help balance work and family responsibilities. These results show that those who are able to use their skills and knowledge on the job, those who report positive employee-management relations, and those who believe the company helps them balance work and family responsibilities have relatively high probabilities of being very satisfied with their jobs.

Over the last ten years there has been a wide variety of research on the effects of workplace innovations on firm performance (Eaton and Voos 1992; Huselid 1995; Levine and Tyson 1990; MacDuffie 1995; Ichniowski,

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 - This paper is part of a larger research project conducted jointly with Eileen Appelbaum, Tom Bailey, and Arne L. Kalleberg on the effects of workplace and human resource practises on firm performance and worker outcomes in three industries — steel, apparel, and medical electronic instruments and imaging. I would like to thank Eileen Appelbaum, Arne L. Kalleberg, John Schmitt, the editors and three anonymous referees for their comments and suggestions. I would also like to thank the Alfred P. Sloan Foundation for its generous financial support.

Shaw and Prennushi 1997). The effects of workplace innovations on workers, however, have not been adequately addressed. The industrial relations research on workplace innovations has generally focused on outcomes such as union commitment, grievances, or organizational performance (Eaton, Gordon and Keefe 1992; Katz, Kochan and Weber 1985; Katz, Kochan and Gobeille 1983; Cutcher-Gershenfeld 1991). Recently, some case studies have examined the effects of lean production in the automobile industry on such worker outcomes as empowerment, the pace of work, workload, and worker health (Graham 1995; Lewchuk and Robertson 1996). While these studies find negative results, the issue is far from settled. More systematic analysis of worker outcomes in different industries is needed to fill what remains a major gap in the literature.

In this article, a unique data set of workers is used to analyze how different practices associated with high performance work systems in the U.S. steel industry affect job satisfaction. The effects on job satisfaction of teams, various forms of participation, and other formal and informal practices are tested. The magnitudes of these effects are also estimated in order to determine which practices have the most significant effect on job satisfaction. Following a discussion of the determinants of job satisfaction, the measures and methods employed in the analysis are explained. The results of the data analysis are then presented.

HIGH PERFORMANCE WORK PRACTICES AND JOB SATISFACTION

The declining cost of micro-processing technology is having dramatic effects on the standards of competition in the manufacturing sector. The falling price of technology is reducing the cost of flexible production equipment and making it possible to control inventory levels more tightly. In the face of increasing demands by customers for rapid and on-time delivery of perfect quality goods, manufacturing plants are finding that they cannot meet these customer requirements by inspecting for quality at the end of the process or through traditional Taylorist forms of work organization.

Moreover, the role of workers in the production process is changing as firms begin to use teamwork, problem-solving groups, and multi-tasking to involve workers more in work decisions. Traditional functional roles between departments and between workers and supervisors are breaking down as workers become more directly involved in discussions about work-related problems. This type of worker participation in decisions is becoming increasingly necessary to prevent production delays that can throw off delivery schedules and to ensure high levels of quality.

But if firms are to be successful, workers must not only have the opportunity to be involved in work decisions, they must also be motivated to put forth the discretionary effort needed to make a difference. In an effort to motivate workers, firms have implemented a number of practices such as performance-based pay, employment security agreements, practices to help balance work and family, as well as various forms of information sharing. In addition to motivation, workers need the skills and ability to do their jobs effectively. Thus, for many firms, worker training has become a necessary input into the production process.

Those practices that provide workers with the *opportunity* to intervene in the work process and to make decisions, that *motivate* workers to put forth discretionary effort, and that ensure that workers have the *skills and ability* to do their jobs are the foundation of a high performance work system (see Bailey 1992). The intent of these human resource and workplace practices is to increase organizational performance. Thus, the vast majority of empirical research on this topic is focused on the performance issue, and most studies show that high performance work practices do increase firm performance (Berg et al. 1996; MacDuffie 1995; Ichniowski, Shaw and Prennushi 1997; Huselid 1995). But what are the effects of these practices on workers? This question is rarely asked or examined in the high performance literature. Yet, the effect of these practices on workers becomes an increasingly critical issue as high performance practices more and more define the work experience.

This paper seeks to assess the effect of high performance work practices on job satisfaction. Job satisfaction represents an overall assessment of one's job and is a general indicator of the quality of one's work experience. It is a subjective measure of individual well-being, but it is a particularly powerful measure since it is strongly correlated with poor mental health, life expectancy, heart disease, turnover and absenteeism (Wall, Clegg and Jackson 1978; Palmore 1969; Sales and House 1971; Freeman 1978; and Clegg 1983). Aside from individual characteristics, which will be discussed as controls in the following section on methods, the impact of high performance work practices on workers' job satisfaction can be understood in terms of the distinction between job-specific characteristics and process-level and workplace environment-level practices associated with high performance work systems.

Job-specific Characteristics

There is a substantial literature that links satisfaction to the characteristics of individual jobs. According to the psychology-based job characteristics theory, workers who experience meaningfulness of their work, who have a

certain amount of responsibility in their job, and who are able to use their knowledge and skill on the job are more likely to be satisfied with their jobs (Hackman and Lawler 1971; Hackman and Oldham 1975, 1976, 1980). Empirical studies in this literature use a variety of job design attribute measures to assess job satisfaction. These include job autonomy, skill or task variety, the use of knowledge or skills, and task significance. The research tends to find a positive, but not overwhelming, relationship between these types of job characteristics and job satisfaction.¹

To the extent that high performance work practices involve more autonomy, greater task variety, or make more effective use of knowledge and skill, it is to be expected that overall job satisfaction would increase. The question is whether such an increase in job satisfaction is driven by the practice, e.g. the existence of work teams, or by specific job design attributes or intrinsic rewards. While job design characteristics have been shown to influence the satisfaction of workers, the effect of high performance work practices on job satisfaction is less clear. High performance work practices are primarily designed to increase firm performance, not to influence the psychological state of workers. Just how these practices and job design attributes affect U.S. steelworkers will be analyzed later in the paper.

High Performance Work Practices

High performance work practices affect workers' employment experience on many different levels throughout the firm. Formal practices (such as work teams, problem-solving groups and training) as well as informal practices (such as the extent of communication across departments and between workers and managers) are directly related to the production process and the tasks performed on the job; these practices operate at the process level. Other practices, such as good labour-management relations, employment security, joint-decision making, performance-based pay, or information sharing are organization-wide issues that affect the environment in which people work; these practices operate more at the workplace environment level.

Process Level

At the process level, practices are implemented by firms to give workers the opportunity to intervene in the work process and make decisions that increase throughput or improve quality. Work teams are used to increase communication among workers in an effort to reduce delay time and increase

1. For a good review of this empirical literature, see Cotton (1993: chap. 7).

product quality. Problem-solving groups help break down organizational divisions and solve problems that cut across departmental lines. Moreover, the effectiveness of these process-level practices require extensive training that gives workers the technical and analytical skills necessary to make decisions.

Work teams have been used for many decades by job design or job enrichment advocates as a way to broaden job tasks and increase responsibility in an effort to increase job satisfaction. Self-directed work teams are also a key practice within a high performance work system. Some studies have found that work teams raise satisfaction (see Britain, Wall et al. 1986; Cordery, Mueller and Smith 1991). However, when the effects of job autonomy and work teams on job satisfaction are analyzed separately, job autonomy, rather than participating in a work team, has a significant positive effect on job satisfaction. In a study of job satisfaction and organizational commitment in the U.S. and Japan, Lincoln and Kalleberg (1990) find that simply working closely with others did not significantly affect the job satisfaction of U.S. workers, but job autonomy did have a significant positive effect. Batt and Appelbaum (1995) find that self-managed teams of workers in telecommunications and sewing operators in the apparel industry have no effect on job satisfaction over and above the effects of individual job characteristics, such as autonomy. It is expected that this analysis of U.S. steelworkers will produce similar results.

Cohen and Bailey (1996) review recently published research on different types of teams in organizational settings. They note that there have been very few scientifically rigorous evaluations studies of quality circles, off-line teams, problem-solving groups, or consultative task forces. The few empirical studies that have been carried out generally find little or no effect of participation in off-line teams or quality circles on job satisfaction (Steel, Jennings and Lindsey 1990; Adams 1991; Batt and Appelbaum 1995). Moreover, the studies cited in a 1988 review of the effectiveness of quality circles by Ledford, Lawler and Mohrman (1988) find no effect on job satisfaction (Harper and Jordon 1982; Atwater and Sander 1984; Rafaeli 1985; and Head et al. 1986), or they find that quality circles "buffer" disruption within organizations so that quality circle members experience less deterioration in job satisfaction (Marks et al. 1986; Morhman and Novelli 1985).

Extensive communication and coordination across functional areas to regulate the workflow and minimize bottlenecks is essential for a successful high performance work system. On the one hand, workers who are more involved in communicating with other workers and are directly involved in coordinating work may feel more essential to the overall production process and therefore express higher job satisfaction. On the other hand, workers may find these coordination or communication aspects of their jobs burdensome and express greater job dissatisfaction. Given the way that

steel production ties workers to a continuous process, it is expected that those workers involved in communication and coordination activities would enjoy this change of pace and would therefore be more likely to express higher job satisfaction.

With regard to training, opportunities to learn new skills are likely to be received positively by workers since training leads to higher wages and greater worth in the external labour market. It is expected that training will have a positive effect on job satisfaction.

Workplace Environment Level

Practices at the workplace environment level are designed to motivate workers in different ways and encourage them to put forth discretionary effort. Linking a portion of pay to performance is designed to motivate workers through extrinsic rewards. Putting a greater portion of pay at risk may encourage workers to work harder, but it is also likely to create uncertainty and anxiety and reduce job satisfaction. Sharing information with employees, allowing employee input into major decisions and fostering cooperative labour-management relations can create an atmosphere of trust. In a meta-analysis, Miller and Monge (1986) examine 41 estimates of the relationship between participation and satisfaction and find a strong, positive effect for perceived participation in decisions regarding multiple issues within organizations on job satisfaction. Promises of employment security may build commitment in the workforce. Family friendly policies can also increase commitment as well as directly simplify one's life. It is expected that these practices at the workplace environment level will have a positive effect on job satisfaction.

Overall, high performance work practices are expected to positively affect job satisfaction. Practices that involve workers in decisions, increase their skills, and improve employment security are likely to be viewed positively by employees. Past empirical research has found job autonomy to dominate the effect of work teams on satisfaction. Work teams are expected to have a positive effect on job satisfaction, but once job autonomy and other job design characteristics are introduced, this effect is likely to disappear. The analysis presented later will show whether this is the case for other high performance work practices as well.

METHODS

Sample

The data for this paper come from a unique data set on workplace change in the U.S. steel industry. Over the last decade or more, the steel

industry has been affected by the introduction of information-intensive technologies which has increased the payoff to adopting innovative workplace practices. Similar to other manufacturing industries, computer-based process controls and inspection equipment have made it possible for customers to demand, and for manufacturers to produce steel that conforms to strict specifications for gauge, shape, flatness, strength and/or quality. In addition, the movement by automobile and original equipment manufacturers to just-in-time inventory practices has made it necessary for sheet and bar producers in this market to consistently deliver perfect quality steel on time.

In addition, the consolidation of the steel industry that took place during the 1980s paved the way for historic labour agreements at integrated steel companies in the 1990s that produced greater employment security for workers and provided opportunities for joint decision making and extensive labour participation at the strategic level of the company. Many companies in the primarily nonunion minimill sector of the steel industry have also adopted human resource practices that promise employment security, involve workers in decisions and link pay to performance. The diversity of innovative practices and the fact the industry has reemerged as a world-class competitor makes this an important industry to study. Moreover, there has been little, if any, research assessing worker outcomes from these innovative practices in the steel industry.

The data was gathered through visits to over 18 U.S. steel plants during 1996–97. At each plant visited, interviews with various managers were conducted to gather data on organizational performance and on formal workplace and human resource practices. In addition to these interviews, a stratified random sample of hourly workers at each site was drawn and a 30-minute telephone survey with these individuals was carried out. The sampling frame for the plants focused on rolling mills with steelmaking capacity at the facility. Therefore, the sample did not include superprocessors or stand-alone rolling facilities that may specialize in cold rolling or galvanizing. The intent of the sample design was to capture a large part of the steel production process that could be compared across integrated and minimill producers. Whereas steelmaking processes differ across integrated mills and minimills, the hot and cold rolling and cold finishing operations are quite similar.

In addition, the sample was restricted to sheet and bar producers. These products represent a large portion of the industry output and are represented by both high- and low-end producers. Sheet steel can be produced as a basic commodity (called hot roll band) or further processed through cold rolling, pickling, tempering or galvanizing. The more highly processed sheet steel is used as exterior auto or appliance parts. There are also different types of steel bars. Reinforcing bar (or “rebar”) is a commodity

product that is used in construction. Other bar manufacturers produce "SBQ" or special bar quality. These bars are used in high stress applications such as transportation drive shafts or machine parts.

The plants that agreed to participate do not constitute a random sample of U.S. sheet and bar producers. Whereas a disproportionate number of the plants have taken steps to introduce some types of high performance workplace practices, the research team consciously worked to include plants where work is organized and managed in more traditional ways.

The analysis in this paper is based on data from a sample of 1,355 hourly workers in 13 of the steel plants studied. Seven plants are sheet mills and six plants are bar mills. Six of the mills are minimills. The size of the facilities range from several thousand employees to several hundred. Sixty percent of the worker sample are employed in integrated steel mills and 75 percent are covered by a union contract. The workers in the sample include operators, craft workers (millwrights and industrial electricians), labourers, and indirect personnel (shipping).

Measures

The variables used in the analysis are drawn from the literature described above and include various formal and informal workplace practices at the process and workplace environment levels. The means of the variables are reported in Table 1. The dependent variable is an overall measure of job satisfaction (All in all, how satisfied would you say you are with your job?). This measure is consistent with that used by Clark and Oswald (1996) and is the most widely used indicator of job satisfaction. A number of independent variables are included as controls. These include: hours of work, level of hourly pay, workers' perception of the fairness of pay, age, gender, job tenure, union coverage and education. Workers spend, on average, 46 hours at work in a typical week. It is not unusual to work over 40 hours in this industry where 12-hour shifts are common. Greater hours of work are associated with lower levels of job satisfaction (Clark and Oswald 1996). Fairness of pay is used as a proxy for relative income. Clark and Oswald (1996: 370) find that relative income has a strong negative relationship between job satisfaction. The greater the difference between an individual's wage and the wages of that worker's peer group, the lower that worker's job satisfaction.

With regard to gender, it is common to find that men are significantly less likely to be satisfied with their jobs than are women, indicating that women may have different expectations from employment than men (Hunt and Saul 1975; Meng 1990; Clark and Oswald 1996). In addition, many studies find that older employees tend to report higher levels of job satisfaction

TABLE 1
Variable Means

<i>Variable</i>	<i>Mean</i>	<i>Standard Deviation</i>
Overall Job Satisfaction (scale 1-4)	3.12	.63
Hours	46.10	6.79
Hourly pay	\$14.95	\$4.22
Fairness of pay (scale 1-4)	2.90	.77
Gender	.94	-
Age	44	8.96
Union	.75	-
Job tenure (months)	90.64	96.72
Less than high school	.06	-
High school graduate	.54	-
Some college	.35	-
College	.05	-
Self-directed team	.57	-
Off-line team	.49	-
Communicate w/workers in team	.95	-
Communicate w/workers outside team	.63	-
Communicate with supervisors and technical experts	.15	-
Communicate with customers and suppliers	.02	-
Training	.68	-
On-the-job learning	.30	-
Employment security	.75	-
Work/Family balance (scale 1-4)	2.06	.92
Employee-management Relations (scale 1-5)	3.5	1.00
Discuss major decisions	.40	-
Workers not consulted	.61	-
Sharing information	.47	-
Contingent pay	.43	-
Task variety	.50	-
Task influence	.58	-
Use of skills (scale 1-4)	2.90	.75
Job autonomy (scale 1-4)	2.71	1.05
Stress (scale 1-5)	2.77	1.03

than do younger workers (Glenn, Taylor and Weaver 1977; Kalleberg and Loscocco 1983; Warr 1992). The effect of age may be explained by workers' expectations as well. Employees start out with high expectations as they begin work and modify them downward over time as they experience a succession of jobs that do not meet their expectations, or alternatively, the

match between employee and job characteristics may improve as a result of these labour market experiences. Job tenure should also have a positive relationship with job satisfaction since more senior workers have sampled the job market and are more likely to be in jobs that match their expectations.

Because unionism tends to reduce quits significantly, it would be expected to raise job satisfaction since dissatisfied workers are more likely to quit their jobs (Freeman 1978). Paradoxically, many analyses find that union members report significantly less overall job satisfaction than do non-union workers (Miller 1990). One explanation is that unions promote collective voice. Unionized workers can express discontent to management without fear of being dismissed and have reason to believe their dissatisfaction will be addressed. Thus, unionized workers are more likely than others to express dissatisfaction and less likely to report being satisfied with their jobs (Freeman 1978; Freeman and Medoff, 1984).

Education also has an important influence on job satisfaction. More schooling may increase the probability of a successful job match and so increase job satisfaction; however, it may also make workers more willing to express dissatisfaction with work (Borjas 1979; Bartel 1981). Moreover, higher education may be associated with less job satisfaction because education raises aspirations which may not be met. Studies have found either negative or insignificant effects of education on job satisfaction (Clark and Oswald 1996 ; Warr 1992; Borjas 1979; Miller 1990; and Meng 1990).

Several standard job design attributes, which capture the key elements of Hackman and Oldham's (1980) model, are included in the analysis. Similar to Batt and Appelbaum (1995), a measure of stress is included in the analysis. It is expected that stress will reduce job satisfaction; however, the size of this effect will also be measured so an assessment can be made about the effect of stress relative to other variable effects.

The high performance work variables are divided into two groups. The first group of variables operates at the process level. These include whether a worker is part of a self-directed work team. Workers were asked: "In your daily activities, are you part of a team of people who work together?" If they answered yes, they were asked: "Is this a self-directed team of people who work together and jointly make decisions about task assignments?" If they answered yes to this second question, they were coded as participating in self-directed team. Fifty-seven percent of the sample classify themselves as working in a self-directed work team. This may seem high, but many steel mills, responding to pressures to reduce cost, have reduced the number of front-line supervisors and expanded the number of workers reporting to them. It is not unusual for night shifts to be staffed only by supervisors "on-call" and not actually present at the facility. This development

has given work crews (usually 10 people) in various departments more autonomy to make decisions and to run the production process.

The question remains, however, whether those who report themselves in self-directed work teams actually have different work responsibilities than traditional work crews, i.e., whether they behave differently on the job than those who do not report themselves as part of a self-directed team. Are these self-directed teams real, and do they have the characteristics of self-directed teams as described in the team literature? Do they select a team leader, participate in setting performance goals, conduct quality inspection, meet to solve work-related problems, conduct routine maintenance, assign daily tasks and schedule time away from work? In order to validate the self-directed team variable, a maximum likelihood logit model was run regressing the key characteristics of a self-directed team against the self-reported team variable. The results, available from the author, show that those who report themselves in self-directed teams are significantly more likely to be in teams or groups that select a team leader, participate in setting performance goals, conduct quality inspection, meet to solve work-related problems, and assign daily tasks. However, those in self-directed teams are significantly less likely to conduct routine maintenance. This negative relationship may reflect established procedures across mills that only allow certified industrial electricians or mechanics to work on the large steel rolling equipment or the extent to which the maintenance department is decentralized within a mill. For the most part, however, there are clearly real differences between those who report themselves in self-directed teams and those who do not.

With regard to off-line teams or committees, workers were asked the following question: "Do you work on a team, committee, or task force that deals specifically with: product quality, reducing cost, purchases or modifications of equipment, working conditions, training or other work related problems or issues?" If they answered "yes" to any one of these responses, they were coded as participating in an off-line team. Using this broad measure, 49 percent of the sample report that they participate in some type of off-line team in which these issues are discussed.

Other process-related variables include on-the-job learning, the incidence of formal training and worker communication. Informal learning, which is an important means for workers to gain expertise in job skills in the steel industry, consists of one worker training another in the fundamentals and nuances of the job. Thirty percent of the sample indicate they have learned short-cuts or other ways to improve their work from other workers. Formal classroom training and training from a supervisor usually occur when an area is being redesigned or a new process is being implemented and there is a need to upgrade worker skills. Sixty-eight percent of the sample received some type of formal training during the survey period. The fact that most

workers received some formal training is indicative of the efforts within the industry to reorganize the work process and upgrade the skills of the workforce.

Four variables measure the extent to which workers communicate with each of four different groups about work-related issues on a daily or weekly basis: other workers inside their work group; other workers outside their work group; supervisors and/or technical experts outside their work group; and vendors, suppliers, and/or customers. These types of communication and coordination practices are very important in the production of steel. Steel production consists of many steps, ranging from steelmaking, to casting, to rolling, to a variety of finishing procedures. In many cases, the distance between these stages of production is huge. Tracking the steel through the production process is critical, and regular communication within and across departments is essential to increase throughput and reduce delays. The means on these variables indicate that workers are primarily communicating on a regular basis with other workers in and outside their work groups.²

Workplace environment variables include employment security, employee-management relations, the extent to which workers take part in major departmental decisions, the extent to which workers are consulted about changes in practices or rules, the extent to which top management is open about sharing company information, the extent to which the company helps workers balance work and family responsibilities and the use of performance-based pay. Rather than rely on managers' perceptions or the researchers' own assessment of the organizational environment, worker responses to specific survey questions are used to measure various aspects of the workplace environment. The perceptions of workers are likely to be more accurate and have a clearer relationship to their own job satisfaction.

Table 1 shows that, on average, 40 percent of the sample feel that they have the opportunity to discuss major departmental decisions before they are put into practice and that 39 percent believe they are generally consulted when workplace practices and rules at the plant change. About half of the sample feels that top management is usually open about sharing company information with workers. These three measures of various aspects of employee participation appear quite consistent across the sample. Performance-based pay is included in order to assess the extent to which putting pay at risk affects one's overall job satisfaction. Forty-three percent of the sample have some of their pay based on the profit of the company, meeting work group

2. For a more extensive discussion of the importance and extent of communication among employees in the apparel, steel, medical electronics and imaging industries, see Appelbaum and Berg (forthcoming).

or department quality goals, and/or meeting work group or department production goals.

RESULTS AND DISCUSSION

A maximum likelihood ordered logit procedure was used to estimate the effect of high performance work practices on the job satisfaction of steel workers in the sample. In order to determine which practices affect workers positively or negatively, many different types of high performance work practices are considered in the analysis as well as standard controls and job design attributes. Table 2 shows the four model specifications used to assess job satisfaction. Whereas we can obtain the significance of the variables that affect job satisfaction from Table 2, we cannot obtain the magnitude of the effects of the variables. Table 3 reports the estimated magnitudes of the significant coefficients. Evaluating the effects of a given variable while holding all other variables at their means, the average probability of being in various response categories of the job satisfaction variable is estimated. Table 3 reveals that no matter what a worker's situation or background, the response with the highest probability is "satisfied." However, Table 3 provides additional information on which significant variables have the strongest effect on the probability of reporting very high or low job satisfaction.³

The control variables have the expected effects on job satisfaction. In addition, fairness of pay is consistently positive across the various ordered logit specifications. As is consistent with the literature, the more workers perceive their pay as fair relative to others, the higher their job satisfaction.

The union variable in Table 2 is insignificant, but, surprisingly, not significantly negative as found in many previous studies. Past research has interpreted a negative relationship between unionization and job satisfaction as the result of a workforce that is more able to express dissatisfaction because of mechanisms such as grievance procedures. The U.S. steel industry in the 1990s, however, has witnessed a new kind of unionism. The United Steelworkers of America (USWA) have negotiated joint decision-making bodies at strategic levels within large steel companies; they have negotiated extensive employment security for their members; and they have been very proactive in redesigning work and prodding steel companies to make investments in order to preserve jobs. Although union coverage does not significantly affect job satisfaction, the fact that its relationship is not significantly negative may reflect the perceptions of workers toward this new type of unionism.

3. I exclude the "very dissatisfied" response category because probabilities of responding in this category are extremely low across all the variables.

TABLE 2
Ordered Logit Estimates of Overall Job Satisfaction

<i>Independent Variables</i>	<i>Model I</i>	<i>Model II</i>	<i>Model III</i>	<i>Model IV</i>
<i>Control Variables</i>				
Fairness of pay	1.015*** (.095)	.966*** (.097)	.767*** (.104)	.748*** (.108)
Gender	-.310 (.261)	-.356 (.267)	-.661** (.291)	-.944*** (.297)
Union	1.047 (.730)	.880 (.746)	.851 (.773)	.569 (.813)
Less than high school	-.238 (.272)	-.333 (.283)	-.303 (.291)	-.546* (.300)
Hsplus	-.288** (.136)	-.351** (.136)	-.181 (.148)	-.251 (.153)
College	-.705** (.284)	-.742** (.291)	-.847*** (.307)	-.613** (.312)
<i>Process Level Variables</i>				
Self-directed team		.477*** (.134)	.231 (.144)	.204 (.148)
Off-line team		.269** (.131)	.102 (.139)	.061 (.145)
Communicate w/workers in team		-.040 (.302)	-.007 (.319)	-.128 (.327)
Communicate w/workers outside team		-.109 (.143)	-.192 (.150)	-.194 (.156)
Communicate with supervisors and technical experts		.210 (.187)	.032 (.200)	.026 (.209)
Communicate with customers and suppliers		.113 (.510)	-.162 (.532)	-.323 (.562)
Training		.167 (.150)	.069 (.158)	.071 (.162)
On-the-job learning		.427*** (.143)	.412*** (.152)	.420*** (.157)
<i>Workplace Environment Variables</i>				
Employment security			-.110 (.180)	-.178 (.184)
Work/family balance			.390*** (.084)	.259*** (.087)
Employee-management relations			.669*** (.084)	.571*** (.088)
Discuss major decisions			.169 (.160)	.029 (.166)
Workers not consulted			.158 (.144)	.172 (.149)

TABLE 2 (Continued)

<i>Independent Variables</i>	<i>Model I</i>	<i>Model II</i>	<i>Model III</i>	<i>Model IV</i>
Sharing information			.211 (.161)	-.138 (.167)
Contingent pay			.109 (.152)	.113 (.156)
<i>Job Design Attributes</i>				
Task variety				.061 (.145)
Task Influence				.103 (.157)
Use of skills				.749*** (.105)
Job Autonomy				.189** (.075)
Stress				-.351*** (.072)

Notes: In each of the four models, I control for age, age², hours, hourly pay, plant, job tenure and job tenure².

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Standard errors are given in parentheses.

Model I: N=1170, Log Likelihood = -986.322, chi2(24) = 200.57, prob > chi2 = 0.0000, Pseudo R2 = .0923

Model II: N=1155, Log Likelihood = -949.335, chi2(32) = 232.10, prob > chi2 = 0.0000, Pseudo R2 = .1089

Model III: N=1114, Log Likelihood = -841.078, chi2(39) = 377.62, prob > chi2 = 0.0000, Pseudo R2 = .1833

Model IV: N=1102, Log Likelihood = -781.659, chi2(44) = 463.68, prob > chi2 = 0.0000, Pseudo R2 = .2288

In model II in Table 2, I add various process-level variables associated with high performance work systems, such as self-directed work team, communication variables, off-line team, and training variables. As expected, the self-directed work team variable is significant and positive, but this effect disappears as other variables are added. This result will be discussed later. Surprisingly, those who participate in off-line teams are also more likely to be satisfied with their jobs. Although this result also disappears in later model specifications, achieving any positive effect for off-line teams is indicative of the importance of these teams in this industry. In an analysis of the apparel and telecommunications industries, Batt and Appelbaum (1995) found that off-line teams never had a significant effect on job satisfaction

TABLE 3

Estimates of the Magnitudes of the Effects of key Variables on the Likelihood of Reporting different Levels of Job Satisfaction

<i>Variable</i>	<i>Prob(Y) =</i>		
	<i>(1) Dissatisfied</i>	<i>(2) Satisfied</i>	<i>(3) Very Satisfied</i>
College = 1	.110	.777	.104
College = 0	.053	.740	.203
Less than high school = 1	.068	.749	.178
Less than high school = 0	.054	.744	.198
On-the-job learning = 0	.058	.750	.189
On-the-job learning = 1	.049	.734	.214
Balance work/family = 1	.069	.768	.157
Balance work/family = 3	.046	.715	.236
Balance work/family = 4	.036	.680	.281
Employee-management relations = 1	.177	.748	.059
Employee-management relations = 4	.042	.712	.243
Employee-management relations = 5	.024	.616	.358
Gender = 1 (men)	.058	.749	.189
Gender = 0 (women)	.024	.626	.348
Use of skills = 1	.174	.751	.058
Use of skills = 3	.053	.737	.206
Use of skills = 4	.023	.610	.366
Job autonomy = 1	.069	.766	.159
Job autonomy = 3	.053	.737	.206
Job autonomy = 4	.043	.709	.244
Stress = 1	.031	.658	.309
Stress = 2	.041	.708	.248
Stress = 4	.089	.779	.125
Stress = 5	.110	.781	.100

Note: I exclude the "very dissatisfied" response category because the probabilities of responding in this category are extremely low across all the variables.

Estimates are made holding all other variables at their means. Formally:

$$\text{Prob}(Y=0) = \Phi(-\beta_x)$$

$$\text{Prob}(Y=1) = \Phi(\mu_1 - \beta_x) - \Phi(-b_x)$$

$$\text{Prob}(Y=2) = \Phi(\mu_2 - \beta_x) - \Phi(\mu_1 - \beta_x)$$

$$\text{Prob}(Y=3) = 1 - \Phi(\mu_2 - \beta_x)$$

across several model specifications. The role of off-line teams in these latter industries is far less crucial to operational efficiency than it is in the steel industry, where cross-department problem solving can have a significant impact on improving delays, product quality and throughput. Where off-line teams are more important to the overall operation of the facility, they are more likely to require the substantive participation of workers and more likely to affect overall job satisfaction.

The communication variables are insignificant. The insignificance of the "communicate with supervisors and technical experts" and "communicate with customers and suppliers" variables may be the result of the small portion of the sample that actually engages in this type of communication on a frequent basis. Whereas communication may be important for the work process and reflect the interaction among workers, supervisors and professionals, it does not affect workers' overall job satisfaction.

On-the-job learning has a significant positive effect on job satisfaction and remains significant through models III and IV. In Table 3, we show that those who engage in on-the-job learning to a great extent have a higher probability of being very satisfied with their jobs, but this effect is not nearly as high as other organizational variables.

In model III, I add those high performance work practices that influence the workplace environment. Table 2 shows that the more companies help workers balance work and family responsibilities, the more satisfied workers are likely to be with their jobs. It is common in the steel industry to work 10- to 12-hour shifts that rotate between day and night from week to week. These scheduling practices put a tremendous strain on the family life of workers. In addition, 66 percent of the sample report working over 40 hours in a typical week. Given these pressures, it is understandable that company efforts to help balance work and family are welcomed by workers. The effects of these types of practices on worker satisfaction can be seen in Table 3. The probability of being very satisfied with their jobs increases steadily as workers perceive that the company better helps them manage work and family responsibilities. Those workers who believe that their company helps them to balance work and family responsibilities *to a great extent* (balance work/family = 4) have a .281 probability of being very satisfied with their jobs. This probability is greater than for those who report a high degree of on-the-job learning.

Table 2 also shows that working at a workplace characterized by good employee-management relations also has a significant positive effect on job satisfaction. The magnitude of the effect of employee-management relations on job satisfaction is quite large. Table 3 shows an almost 30 percentage point increase in the probability of being very satisfied with one's job for

those who believe employee-management relations are very bad (employee-management relations = 1) compared to those who regard them as very good (employee-management relations = 5). Even the distinction between good and very good has an important effect on job satisfaction. The probability of being very satisfied with one's job is .358 for workers who believe that employee-management relations as very good compared to .243 for those workers who simply rate them as good (employee-management relations = 4).

Other variables in Table 2, such as working in an environment where one is not consulted about changes in workplace practices, or where top management is open about sharing information, do not significantly affect job satisfaction. In addition, perceptions of employment security do not affect job satisfaction. The insignificance of these variables may seem puzzling. However, they may reflect the fact that these issues were addressed for many unionized and some nonunionized steelworkers in the early 1990s or before, and they no longer influence job satisfaction. It may be that the effects of these types of practices on job satisfaction are temporal and do not individually affect job satisfaction once they have been institutionalized as norms of employment (see Griffin 1991). What remains significant is the overall employee-management relations climate. However, should these norms or expectations be violated, it is likely that job satisfaction will be affected either directly through these variables or through poorer employee-management relations.

Model IV adds the job design variables. Being able to make full use of one's knowledge and skills on the job has a strong positive effect on job satisfaction. Table 3 also shows it to be a key variable affecting the probability of being very satisfied with one's job. The probability of being very satisfied with one's job is .366 for those who strongly agree with the statement "my job makes good use of my knowledge and skills" (use of skills = 4). The probability is .206 for those who simply agree (use of skills = 3) with this statement and .058 for those that strongly disagree (use of skills = 1). The 16.6 percentage point increase between use of skills = 3 and use of skills = 4 shows the payoff in terms of job satisfaction of creating jobs that fully utilize workers' skills and knowledge. In part, this finding shows the importance of correctly matching workers to jobs, but, more importantly, it illustrates the importance of work organization and the nature of jobs within an organization. Table 2 shows that workers' job satisfaction is not driven by whether they work in a team, but much more by whether they are able to use their knowledge and skills, i.e., the nature of their work and the parameters of their job. Simply organizing jobs in teams does not necessarily mean that workers will be able to use their knowledge and skill. This depends much more on how roles within the team are defined.

Model IV in Table 2 shows that job autonomy also has a significant and positive effect on job satisfaction. This positive result and the insignificance

of the self-directed team variable is consistent with other studies of self-directed work teams that find autonomy to have a key effect on satisfaction (Cohen and Ledford 1994; Seers, Petty, and Cushman 1995; Batt and Appelbaum 1995). However, the magnitude of the effect of job autonomy as shown in Table 3 reveals that those who have a lot of say about their jobs (job autonomy = 4) have a .244 probability of being very satisfied with their jobs. This probability is much lower than being able to use one's skills on the job, employee-management relations, and even balancing work and family. Whereas job autonomy is important, the likelihood of it leading to very satisfied workers is less than these other variables. This relative effect of job autonomy is striking, given the historical importance it has had as a key indicator of job satisfaction.

Finally, Table 2 shows that stress has a significant and consistently negative association with job satisfaction. In Table 3, those who respond that they are never stressed by their jobs (stress = 1) have a probability of being very satisfied with their jobs of .309. On the other hand, those who say that they are always stressed by their jobs (stress = 5) are more likely to respond that they are dissatisfied rather than very satisfied with their jobs. While this is not a surprising result, the magnitude of this effect is not as large as one might have expected. In this sample, it has a similar effect on satisfaction as having a college degree. Rather than high stress (stress = 5) having a strong negative effect on job satisfaction, it appears that the absence of stress (stress = 1) has a much stronger positive effect.⁴

CONCLUSION

This article uses a sample of U.S. steelworkers to examine the effects of high performance work practices on job satisfaction. Rather than focusing on one specific practice, such as work teams, a wide range of high performance work practices are considered. In addition, this paper measures the magnitudes of the effects of these practices on job satisfaction as a way of comparing the effects across practices.

Like many others manufacturing industries, steel firms are introducing work teams, creating off-line teams, and encouraging various forms of communication among employees in order to meet more demanding customer

4. The source of stress for these workers is an open question. Previous research in the apparel industry showed that working in teams is associated with higher levels of stress (Berg et al. 1996). Analysis conducted on this sample of U.S. steelworkers and available from the author indicate that working in a self-directed team is not associated with greater stress. Moreover, on average, those not working in a team report that they are more often asked to do more work than they can handle, which is a typical stressor.

requirements. This article shows that the effect of these practices on workers depends very much on how the jobs and work roles are defined. Jobs that allow workers to use their knowledge and skills, provide some autonomy and provide opportunities for learning lead to higher levels of job satisfaction.

However, job satisfaction is not just influenced by the characteristics of the job. Rather, good employee-management relations and practices that help balance work and family have strong positive effects on job satisfaction. Most of the research on balancing work and family has focused on women and female-dominated workplaces. This article shows that in a mature industry with a predominately male, middle-aged workforce, concerns about balancing work and family responsibilities significantly affect job satisfaction and contribute substantially to the likelihood of being very satisfied with one's job. Company efforts in this area include informal practices, such as supervisors allowing workers to come in late or leave early to take care of family responsibilities, to more formal procedures for taking time off away from work to deal with family issues.

Good employee-management relations matter to workers as well. This is important to remember as more companies implement high performance work practices, since company and worker interests regarding these practices may differ. Certain practices at the process level may be more important from the company's perspective as it pursues higher performance through greater flexibility, greater task variety, new forms of work organization, and problem solving strategies. From the workers' perspective, however, well-being at work is primarily affected by how their job roles are defined, whether they have opportunities for learning, whether they are able to use their skills, and their ability to balance work and family life. Thus, manager and worker interests regarding new work systems may overlap in some areas but differ in others. Constructive negotiations over the implementation of high performance work practices where these differences are worked out and the interests of both sides are respected can go a long way toward reducing uncertainty and toward increasing the overall job satisfaction of workers.

Surprisingly, practices that link pay to performance, share information with workers, provide employment security, or involve workers in decisions do not affect job satisfaction. However, as argued above, workers in the steel industry may be unique in that they have been on the path of joint consultation, employment security and pay-for-performance for many years. Thus, the results may be different in other industries where these issues have not yet been widely addressed.

Taken as a whole, this article shows that high performance work practices have a generally positive effect on job satisfaction. While the steel industry is not representative of the U.S. economy, it is characteristic of traditional

manufacturing industries where high performance work practices are being implemented. However, because high performance work practices are implemented and constructed differently across industries, additional research is needed to see if these results hold for other types of industries. In particular, more empirical analysis of industry-level data that links workers with detailed information about various practices would be helpful in better understanding the consequences of high performance work systems for workers.

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RÉSUMÉ

Pratiques de travail de haut rendement et satisfaction au travail dans l'industrie américaine de l'acier

Les économies des nations industrialisées sont en pleine transition. Une concurrence mondiale croissante et le développement de l'informatique changent fondamentalement la façon dont les biens sont produits, dont les services sont rendus, et dont le travail est organisé. Pour être compétitives, les compagnies opèrent des changements de processus pour atteindre une efficacité accrue. De nouvelles pratiques telles la réorganisation du travail, l'utilisation de main-d'œuvre bien formée, la participation aux décisions sur le travail et de meilleurs réseaux d'information constituent maintenant des composantes importantes des lieux de travail.

Ces pratiques qui permettent aux travailleurs d'intervenir dans le processus de travail et de prendre des décisions, qui motivent à l'effort constant et qui font en sorte que les travailleurs ont les qualifications et habiletés

nécessaires pour faire leur travail sont à la base d'un système de travail à haut rendement. L'objet de telles pratiques est d'accroître la performance de l'organisation. Mais quels en sont les effets sur les travailleurs ? Voilà une question qu'on ne pose pas assez souvent et qui est de plus en plus pertinente.

Nous utilisons ici des données uniques pour étudier l'effet de telles pratiques sur la satisfaction au travail dans l'industrie américaine de l'acier. Nous vérifions l'effet sur la satisfaction au travail des équipes, des différentes formes de participation et de d'autres pratiques formelles et informelles. Nous évaluons également l'amplitude de ces effets pour identifier les plus significatifs.

Comme plusieurs autres industries manufacturières, les aciéries ont implanté les équipes de travail, les équipes « off-line » et diverses formes de communication entre travailleurs afin de répondre aux exigences croissantes des clients.

Notre recherche démontre que l'effet de telles pratiques sur les travailleurs dépend beaucoup de la façon dont les emplois et les rôles sont définis. Les emplois qui permettent aux travailleurs d'utiliser leurs connaissances et habiletés dans un cadre d'autonomie et d'apprentissage fournissent de plus hauts niveaux de satisfaction.

Cependant, la satisfaction au travail ne dépend pas seulement des caractéristiques de l'emploi. Ainsi, ces relations de travail qui permettent d'équilibrer travail et famille ont des effets fortement positifs sur la satisfaction au travail – et cela est vrai dans une industrie mature, à prédominance masculine et dont les travailleurs sont dans la fleur de l'âge.

De façon surprenante, ces pratiques qui lient rémunération et rendement, qui partagent l'information avec les travailleurs, qui prévoient la sécurité d'emploi ou qui impliquent les travailleurs dans les décisions n'ont pas d'effet sur la satisfaction au travail. Cependant, les travailleurs américains de l'acier peuvent être uniques en ce qu'ils sont, depuis plusieurs années, sur la voie de la consultation, de la sécurité d'emploi et de la rémunération au rendement. Les résultats peuvent alors différer dans ces industries où on ne s'est pas attardé à ces questions sérieusement.

En somme, nous concluons à une relation positive entre les pratiques de travail de haut rendement et la satisfaction au travail. Cependant, vu que ces pratiques sont conçues et implantées de façon différentes dans d'autres types d'industries, on a besoin de recherches additionnelles pour voir si nos résultats sont observés ailleurs. De façon plus particulière, il serait utile d'analyser de façon empirique des données au niveau de l'industrie qui lieraient les travailleurs à une information détaillée sur un éventail de pratiques. Cela ajouterait à notre compréhension des conséquences des systèmes de travail à haut rendement sur les travailleurs.