Employee Involvement and Pay at US and Canadian Auto Suppliers

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We use survey data and field research to investigate the effects of employee involvement practices on outcomes for blue-collar workers in the auto-supply industry. We find these practices raise wages by 3–5%. The causal mechanism linking involvement and wages appears to be most consistent with efficiency-wage theories, and least consistent with compensating differences. We find no evidence that employee involvement affects plants' survival or employment growth.

1. Introduction

New workplace practices such as employee involvement (EI) have become relatively common in American organizations (Osterman, 1995), largely because EI can greatly increase productivity and quality

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(Ichniowski et al., 1996; Black and Lynch; 1997). By *employee involvement* we mean blue-collar workers using abstract reasoning skills as well as performing manual tasks. Activities using these skills include meeting with a group to devise solutions to quality or safety problems, providing suggestions for improvement, and setting up machines to make different parts. These activities can occur in formal institutions (such as a suggestion system or pay-for-knowledge plan), or informally. (See Table I.)

While there is a growing consensus that EI can improve outcomes for firms, few studies have examined the question of whether new work practices can improve outcomes for employees. Some authors claim EI helps workers by providing them with higher skills, pay, and quality of work life (Womack et al., 1990). However, others fear that EI leads to speedups, lower wages, less safety, and more job loss (Drago, 1996; Parker and Slaughter, 1988).

Our study examines data from US and Canadian auto suppliers to investigate whether EI has measurable effects on employees' pay and on the survival of the plants in which they work. In addition to quantitative analysis, we report on a number of visits to plants with very different levels of EI.

In the Section 2 below, we briefly discuss hypotheses about the effects of EI on compensation derived from five standard theories from labor economics. To aid intuition, we provide examples from our field research. Our field research also led us to generate several hypotheses that we did not derive from standard economic theories. These are presented in Section 3. Section 4 describes the methods used to test the hypotheses: survey data and case studies. Section 5 provides quantitative results, Section 6 describes some qualitative evidence, and Section 7 concludes.

2. Theories Relating Workplace Practices and Employees' Outcomes

2.1 Summary of Theories

We first summarize five theories of why workplaces with EI might have different outcomes for employees than workplaces without EI: human capital, compensating differences, efficiency wages, incentives and complementarity, and rent sharing (Groshen, 1991). We also look at a type of rent-sharing theory called *management by stress.* For each theory, we draw on our field research to give examples of how EI operates in practice. Section 3 elaborates hypotheses about the factors driving the relationship between wages and EI.

TABLE I.
SUMMARY STATISTICS

Abbr.	Description	Mean	Median	Std. Dev.
	Control Variable			
	Average age	35.80	35.00	6.42
	Canadian plant	0.14	0.00	0.34
	% workforce with HS diploma	78.40	85.00	22.74
	log(employment)	5.30	5.35	1.02
	log(machines/production workers)	−1.81	−1.70	1.06
	% workforce male	59.37	60.00	23.85
	Regional price index	1.04	1.05	0.09
	Unionized shop workers	0.39	0.00	0.49
	Indices of Workplace Practices			
	Employees have completed full cycle of improvement process	0.00	0.38	1.00
	Groups of workers have influence over each of 6 policies (work methods, safety, etc.)	0.00	0.30	1.00
	z(QCs present) + z(% employees in teams) + z(teams meet on company time)	0.00	0.00	1.00
	z(semiskilled do 5 operations such as arithmetic, writing; scoring daily = 1, . . . , rarely = 4) + z(semiskilled do each of 8 tasks such as setup machines, inspect work in progress)	0.00	0.00	1.00
	Managers report that employees do improvements, managers depend on employees, and managers ask workers for help (1 = strongly agree, 5 = strongly disagree)	0.00	0.17	1.00
DIRECT	Direct Involvement = sum of z-transforms for the 5 indices above	0.00	0.14	1.00
	Labor-mgt committee exists + committee meets on company time	0.00	0.70	1.00
	Committees & union have influence over each of 6 policies (work methods, safety, etc.)	0.00	−0.42	1.00
REP	Representative Involvement = sum of z-transforms for the 2 indices above	0.00	−0.08	1.00
	No layoffs from productivity + none without management pay cuts	0.00	−0.93	1.00

(continued)

TABLE I. (CONTINUED)

Abbr.	Description	Mean	Median	Std. Dev.
	A formal grievance plan exists + highest level is outside arbitrator	0.00	0.08	1.00
	Company-wide profit sharing, gain sharing, or team incentives or skill-based pay exist (referred to below as the index of contingent pay)	0.00	0.27	1.00
	Hours of formal and informal training, measured separately for new hires and for current hourly employees	0.00	−0.06	1.00
HR	Supportive HR practice = sum of *z*-transforms for the 4 indices above	0.00	−0.09	1.00
INDEX	Index of workplace transformation = DIRECT + REP + HR	0.00	−0.03	1.00
	Outcome Variables			
	log(unskilled compensation)	2.53	2.51	0.32
	log(unskilled wages)	2.25	2.21	0.29
	Relative compensation (1: much lower, 7: much higher than local labor market)	4.70	4.00	1.37
	Annual % turnover	6.31	3.00	8.81
	% change in employment 1992 to 1999 (if still in business)	0.18	0.17	0.70
	% change in employment 1992 to 1999 (including plants that went out of business)	—	0.13	—
	Out of business by 1999	0.15	0.00	0.36

Note: All variables with mean of 0.00 have been *z*-scored to have mean zero and standard deviation equal to unity.

Human-capital theory argues that workers with higher skill levels receive higher compensation. If high-involvement employers select workers with high levels of skills that are valued generally in the market and pay them more, wages and involvement are correlated. Nevertheless, the workers would receive the high wages even if they did not work at a high-involvement plant.

If firms' returns to EI are higher when employees have greater firm-specific skill, then involvement's introduction should cause wages for trained workers to rise. At the same time, holding all else constant, starting wages should be bid down as workers compete for the high post-training wages (Becker, 1975). This reduction in starting wages may not be observed in the data if employers who train also hire more skilled or able employees. Other forms of employee

compensation, such as safety or bonuses, would also be expected to rise for trained workers.

Our plant visits turned up a vivid example of how EI can be a complement to one very general skill—the ability to speak the same language as one's coworkers and managers. We visited two plants (one in California, one in Massachusetts) that hired immigrant workers who spoke a variety of languages other than English. Managers at both plants reported that while this strategy allowed them to pay lower wages (in California, $6–7 per hour rather than the $8–12 that prevailed for nearby plants with native-born workforces), it complicated EI. Workers had difficulty sharing ideas with management and with coworkers, and training was more expensive. In the Massachusetts plant in 1995, we observed an engineer trying to explain in English to a Vietnamese worker how to overcome a problem with a machine. The engineer at first misunderstood the problem the operator was having; once he did understand, it took a lot of repetition and sign language to explain the solution.

Some plants have institutionalized pay for skill, a pay system in which employees receive additional pay for each new skill they learn. These plans closely mimic the predictions of firm-specific human-capital theory (Ledford, 1991). In the case study below we provide qualitative evidence on the effects of one such plan.

Compensating-differences theory argues that workers who face undesirable working conditions will receive higher wages. If EI requires extra effort, then plants with EI should also offer better compensation, in the form of higher wages, more bonuses, or increased safety. If employees regard EI as a benefit, then plants that have it will offer lower wages.

Our plant visits provided examples of employees regarding involvement as a benefit, as when workers made suggestions that improved life on the shop floor. For example, at Capitol Plastics in Bowling Green, Ohio, workers on one line suggested floor mats as a means to reduce the discomfort of standing on a cement floor all day. Management implemented this idea, raising that line's quality of work life (MacDuffie and Helper, 1997).

Many employees also considered it an improvement in their working conditions when management implemented suggestions that permitted a conscientious worker to do their job better, for example by improving the quality of parts. We saw a counterexample at a (now closed) GM seat-parts plant in Trenton that we visited in 1990, a plant that lacked an effective mechanism for workers to make suggestions. One younger worker was near tears because she was spending so much time trying to bend poorly made parts into place that she fell

behind, and her hands hurt. One of us overheard an older worker counseling her in the restroom not to try so hard to do a good job, if she wasn't given the correct tools to do it. The younger worker protested that this wasn't right, that she didn't want to make bad parts.

Compensating-differences theory also predicts that if EI requires extra effort, workers will be compensated for it. Our qualitative results here depended on the type of EI. On one hand, when EI meant that workers had to do more tasks in the same amount of time, for example, check quality as well as make parts, they usually believed they should be compensated. However, wages rarely rose when such tasks were added. On the other hand, when EI meant a substitution of problem-solving for production tasks, we did not find examples of employees saying that participating in programs such as quality circles required extra effort. In many cases, employees were glad to have time away from the tedium of the line.

Efficiency-wage theories predict that paying higher wages may increase workers' productivity. There are three main channels by which wages can affect productivity. [Katz (1987) and Levine (1993) review this literature.] A higher wage may increase worker effort due to the greater cost to workers of losing the job, so workers want to reduce the chances that they are dismissed for low effort. A higher wage may also increase effort by increasing workers' loyalty to the firm (Akerlof, 1984). Finally, a higher wage may reduce firms' turnover and recruitment costs. If introducing EI increases monitoring costs (plausible since (or because) it is harder to observe whether a worker produced a good suggestion than whether she met her production quota), increases the return to costly-to-measure effort, and/or increases employers' return to worker skills and retention, then plants with EI should pay higher wages.

Our field research did not turn up any firms that would fire a worker for failure to be involved enough. Several firms we visited (such as Foamade, in Auburn, MI) implemented a pay-for-knowledge scheme in which workers who did not achieve certification in their job skills by a certain date would be let go, but this was a one-time test, not ongoing monitoring of work effort.

Loyalty and gift exchange appeared to motivate employees in several cases. For example, at Industrial Strainer, workers contributed on average half a suggestion per year each, even though there was no explicit reward for doing so. When asked why, several workers said, "It's a good place to work," because of above-average wages ($12 per hour rather than the $10 prevailing in the area). One worker added

that an additional motivation was, "Management—at least some of them—cares about you."

Conversely, when workers felt that management did not reciprocate their "gifts" of suggestions, they became quite angry. For example, in the Trenton plant mentioned above, management did not make use of quality-control data which employees had collected for several months, and did not allow the employees time to analyze the data themselves. Several employees made comments like "They're wasting our time" or "They're making fools of us," and began reporting obviously bogus quality data.

Finally, we came across many plants in which EI increased management's returns to worker skills and retention. A useful comparison is between two plants making wiring harnesses, both visited in 1992. One, located in Mexico, paid the minimum wage in its city and had 100% annual turnover. Apparently an informal cartel of employers restricted management from raising wages during the employees' first year on the job. Management there had designed a four-step training process for EI, including training on working in groups, problem solving, elementary statistics, and basic quality control. However, even after two years, 90% of the training they were offering was the first stage, which had been repeated many times to a constantly changing cast of characters. Minutes of quality-circle meetings were in most cases only one or two lines, such as, "We all resolved to work harder to avoid defects." Workers did not know enough about the process to suggest countermeasures that did not depend on increased attention.

In contrast, a plant in Kentucky (Sumitomo Electric Wiring Systems) provided extensive training to workers in statistical process control and problem-solving techniques. At this plant, quality circles did research and experiments on issues such as different types of tape that would eliminate a problem of tape slippage that exposed a wire underneath. The plant's turnover rate was well below average for the area because of its promote-from-within policy that led to high wages for experienced employees [even though it paid below-average starting wages, as predicted by Lazear (1979)].

To use somewhat different language, we can say that efficiency-wage theories posit that EI and high wages are complementary policies (Ichniowski et al., 1997; Milgrom and Roberts, 1995; Milgrom, Qian, and Roberts, 1991). Thus, firms that paid high wages for exogenous reasons found EI to be relatively easy to implement. For example, one company (Industrial Strainer) had a prolonged strike during the 1970s, caused by management's refusal to increase wages by 5 cents per hour, according to the firm's current manufacturing vice president. Ever since then the firm has paid above-average wages

to avoid another costly strike. The high wages made training less costly because turnover was low and because workers were loyal (gift exchange). Both of these factors meant that the plant achieved higher levels of EI (as measured by numbers of suggestions and extent of worker contributions to process improvement) for lower training cost than did other firms we observed implementing EI in the early 1990s.

Incentives and complementarity: The prescriptive literature on organizational design emphasizes the importance of aligning rights to make decisions with incentives to make good decisions. This premise reappears in the prescriptive compensation and EI literatures (e.g., Lawler et al., 1995), expectancy theory in psychology, exchange and work-design models of sociology and organizational behavior (e.g., Pfeffer, 1994), and the rational models of economics, agency theory, and transaction-cost economics (e.g., Wruck and Jensen, 1994).

The move to higher EI involves substantial changes in decision-making rights, as frontline employees collect and analyze more data and suggest and implement improvements. Thus, we expect incentives in workplaces with higher levels of EI to align frontline workers' goals with their new authority—that is, to reward quality and improvement (Milgrom and Roberts, 1992; Levine, 1995). Consistent with this logic, management at Foamade introduced a pay-for-skills plan when they wanted workers to become more involved in determining how to reduce defects, schedule production, etc.

Rent-sharing theories and related theories of conflict, bargaining (Dow, 1993), and insider-outsider relationships (Lindbeck and Snower, 1986) posit that worker bargaining power and the size of the rents and quasirents to be divided affect compensation. These theories overlap efficiency-wage theories when the employer's benefit of high wages is avoiding unions (Dickens, 1986) or if high profits increase the level of wages that workers perceive to be fair (Akerlof, 1984).

If employee involvement is productive, then it will increase the profits of firms that adopt it. Then wages will increase if firms share these gains with workers, either because it seems fair to do so or because workers' bargaining power does not decrease as a result of EI.

EI can increase worker bargaining power by increasing workers' feeling of solidarity due to increased interaction. Involvement might also increase workers' firm-specific knowledge, which can make it difficult to replace workers and makes firms rely upon senior workers to train new employees. Involvement might also make it more difficult to monitor workers' actions, so that high productivity increasingly relies on worker cooperation. Finally, involvement might make it easier for employees to disrupt production, so that worker noncooperation or other reactions to perceived unfairness is more costly to the firm.

In addition to these channels, we saw in our fieldwork an example of EI facilitating union-organizing efforts. At a Japanese-owned stamping plant near Detroit, pro-union workers used fishbone diagrams and other tools they had learned in their problem-solving training to prioritize issues and brainstorm solutions to problems that arose during their ultimately successful 1995 organizing drive and subsequent strike. Workers from the nearby Mazda plant who had received similar training assisted employees at the supplier plant. This increased cohesiveness came largely from increased skills—a different argument (though complementary) to that made by many sociologists, who emphasize how increased feelings of solidarity can increase workers' bargaining power.

Our fieldwork provided cases where EI had both positive and negative effects on employer monitoring and turnover costs. On the one hand, EI added higher-level problem solving to workers' jobs, which is harder to monitor and more skill-intensive than working on an assembly line (as in the Industrial Strainer and Foamade examples above).

Management by stress, however, sometimes also reduced employees' bargaining power by codifying workers' tacit knowledge and by reducing unions' power (Parker and Slaughter, 1988, 1988; Sheahan et al., 1996).

One of the goals of many EI programs was to codify workers' tacit knowledge. Creating standardized worksheets (sometimes referred to as ISO 9000 worksheets) could increase productivity by diffusing best practice across employees and by making the production practices susceptible to systematic improvement (Adler, 1993). However, these "scab sheets" (as some union activists call them) also made it easier to replace trained workers with relatively unskilled ones, to move work to lower-wage locations, and to replace workers who struck. In this case EI in one plant could reduce wages at other plants.

For example, in several instances workers reported being videotaped or writing detailed descriptions of how they did their jobs; management then transferred work to other plants that paid lower wages. In one example, a wiring-harness maker in Ohio transferred knowledge to plants in China and Mexico. Another company, aptly named Federal Screw Works, used ISO 9000 work instruction sheets generated by its Detroit workforce to start a new, lower-wage plant in rural Michigan. At both companies management then used the threat of moving even more work to the new plants to bargain for lower wages at the old plants.

Second, managers can use EI to reduce union power. For example, managers can respond more quickly to problems raised through EI channels rather than through union channels, thus decreasing workers' perceptions of union effectiveness. [See Parker, 1985, and Parker and Slaughter (1988) for examples.] Management can create new positions for line workers, such as team leader or quality coordinator, that offer highly motivated individuals an opportunity to advance and to feel that they are helping fellow workers without the hassle faced by union officers of having to win election and reelection.

In nonunion workplaces, the presence of management-sponsored problem-solving channels can reduce employees' dissatisfaction. To the extent the lower dissatisfaction reduces the need for compensating differences and/or reduces the threat of unionization, wages can also decline at nonunion workplaces. These effects are hard for researchers to observe, since it is usually difficult to gain permission from management to visit plants with undesirable working conditions.

2.2 Basic Hypotheses

The first four theories discussed above provide a justification for our first hypothesis:

H1A: Wages will be higher for workplaces with substantial employee involvement than for traditional workplaces.

Theories of firm-specific training, efficiency wages, and rent sharing, but not compensating differences, also imply that high-involvement workplaces should have lower levels of voluntary turnover (quits).

H1B: Turnover will be lower in workplaces with high levels of employee involvement or training.

The management-by-stress theory, by contrast, suggests[1]:

H1C: Wages will be lower and turnover higher for workplaces with employee involvement than for traditional workplaces.

1. When EI is a benefit to employees rather than a cost, the theory of compensating differences suggests the same hypothesis about wages, but for almost opposite reasons. That is, rather than being a management innovation that shifts worker bargaining power down, EI is seen as a factor that improves working conditions.

2.3 Disentangling the Theories

In the theories above, the effects of EI work through several different channels. We can attempt to disentangle the relative importance of the effects predicted by the several theories by controlling for the intervening variables. We can also investigate the possibility that the effects of EI might be different for different types of plants (those with different work organizations, management strategies, etc.). However, given the limitations of both data and theory, this is a difficult task, and we will attempt not to overstate our conclusions (Data problems include unobserved heterogeneity). A theoretical issue was noted by a referee who pointed out that many of the hypotheses we posit about the effect of EI on wages involve adding a third variable (call it Z) to the wage equation. If Z is endogenously determined, then whether adding Z to the wage equation increases or decreases the effect of EI on wages often depends on why Z is varying. This is an important point, and we provide some examples below. However, the causal channels we emphasize are those most prominent in the literature.

Human-capital theory suggests that any link between wages and EI is largely due to the increased returns to skill when EI is present. Particularly if the firm has not hired new workers since it started EI, the increased skill will largely be obtained through training. If the training is firm-specific, or has already been completed, then employers will raise wages to make sure they retain access to the human capital they have created. This logic leads to:

HumanCapitalA: Training should be correlated with high levels of employee involvement.

and

HumanCapitalB: Controlling for the existing stock of training should largely eliminate the relation between employee involvement and wages.[2]

When some of the skills are firm-specific, human-capital theory also implies that lower turnover should accompany high levels of training, because if workers leave, then neither workers nor the firm benefits from the investment in training. Thus we have:

HumanCapitalC: Firms that have more employee involvement should have less turnover.

2. However, wages should be negatively related to the flow of current nonspecific training, because workers are investing in their human capital.

Compensating-differences theory suggests that firms that introduce new forms of employee benefits along with EI will have a smaller increase in wages than firms that do not provide such benefits. That is:

CompensatingDifferencesA: Including performance pay and no-layoff policies in the wage equation will significantly reduce the coefficient on employee involvement.[3]

Efficiency wages: If the relationship between work organization and turnover is due to efficiency wages, then we have:

EfficiencyWagesA: Wages relative to the local price level and wages relative to regional averages should correlate negatively with turnover.

and

EfficiencyWagesB: Controlling for wages should largely eliminate the relation between employee involvement and turnover.

Each of the efficiency-wage variants leads to different views of the links between EI and wages. If the link between involvement and wages is largely due to gift exchange, then employee loyalty should be higher at workplaces with high levels of EI. This loyalty should lead managers to perceive that employees are more willing to take actions beyond mechanically producing parts. This leads to:

GiftExchangeA: Managers at workplaces with more EI should report that they have fewer supervisors per worker, and that employees help out in ways not specified in their job description, are less likely to take advantage of management, and are less reluctant to share ideas with management.

and

GiftExchangeB: Controlling for these proxies for employee loyalty largely eliminates the relation between employee involvement and wages.

3. As a referee pointed out, employees would be more likely to demand no-layoff policies in industries with low employment growth. If the policies were not 100% effective, employees might still not want to participate in EI, because of their fear of layoffs due to productivity-enhancing suggestions. So it is possible that in equilibrium one would observe low EI being correlated with no-layoff policies. However, industries with low employment growth typically also have declining employee bargaining power, suggesting that employers' higher costs of a no-layoff policy in such circumstances would influence the outcome more than would employees' higher valuation.

The turnover-cost version of the efficiency-wage theory implies:

TurnoverCostA: Including measures of turnover cost such as training reduces the coefficient on employee involvement in the wage equation.

This hypothesis is the same as HumanCapitalB.

Incentives and complementarity: Because workplaces with more EI depend more on employees' incentives to take initiative, the theory of complementarities between involvement and incentives implies:

IncentiveA: Pay practices such as gain sharing and profit sharing will be more common in plants with higher levels of employee involvement.

When employees provide ideas that increase productivity, companies are sometimes left with excess employment. They have, thus, an incentive to lay off excess labor. These layoffs, in turn, will lower employees' incentives to generate new ideas. Thus, we expect EI to be most successful when it is coupled with policies that limit layoffs due to new ideas (Levine and Parkin, 1996). This complementarity, in turn, yields the hypothesis:

IncentivesB: Policies limiting layoffs due to employee suggestions will be more common in plants with higher levels of employee involvement.

3. Inductively Based Hypotheses

In addition to providing intuition for the theoretically generated hypotheses above, our fieldwork also helped us generate some hypotheses that are not highlighted in the general economics literature. Most importantly, our respondents repeatedly emphasized that when they perceived that EI increased employment security, they found this a major incentive to participate, and vice versa. As mentioned above in the discussion of compensating differentials, policies such as promote-from-within (Sumitomo) and job security in the face of productivity improvements (Industrial Strainer) can provide incentives for participation in EI.[4]

Job security was a particularly important motivator for workers in our sector, for several reasons. Most auto-supply plants paid

4. Conversely, a guarantee of lifetime employment regardless of what happens to sales removes the incentive to participate to keep one's plant open. Only one firm we visited had such a policy.

above-market wages, unemployment was fairly high in most parts of the nation at the time of the survey (1993) and many workers had painful memories of the very high unemployment of the early 1980s, and workers often valued friendships with coworkers. Thus, employment security is an important component of the welfare of semiskilled workers as a whole, a component that is missed if we look only at wages. For example, EI would be good for workers at a factory even if it lowered wages slightly as long as, it also raised employment security. For these reasons we analyzed another set of dependent variables: plant survival to 1999 and employment growth between 1993 and 1999.

EI might increase a plant's employment and its probability of survival for several reasons. To the extent that EI improves the plant's performance, it should increase profits and market share for the plant. If the management-by-stress theorists are correct and EI lowers workers' bargaining power and wages, then EI would raise labor demand (unless the productivity gains outweighed any increase in market share). Thus, we have:

SurvivalA: Plants with more employee involvement in 1992 have increased employment growth and increased probability of survival from 1992 to 1998.

It is also possible that we will observe a spurious positive correlation if employee involvement is introduced when companies are feeling flush and want to do something nice for workers (e.g., to reduce their alienation). However, we did not find any examples of programs being introduced for these reasons; our respondents indicated that their introduction of the programs was generated by the profit motive: "We do this to increase quality" and "to help us compete with the Japanese" were common explanations of the rationale for introducing EI. [For similar findings, see Kochan et al., (1984).] In any case, the early 1990s (when the data were collected and when most EI programs were starting) was a time of shrinking sales and low margins.

Alternatively, EI may *lower* a plant's employment and probability of survival. If EI helps managers extract high-wage workers' knowledge, then it increases the ability of the firm to establish a new, lower-wage plant elsewhere. Moreover, if EI increases productivity without increasing demand for the product, workers may be made redundant. This effect reduces employment, but raises the probability

of survival. These arguments lead to:

SurvivalB: Plants with more EI in 1992 have decreased employment growth and decreased probability of survival from 1992 to 1998.

We could also find a spurious negative correlation between involvement and employment changes if EI is introduced when survival is threatened.

4. Data and Methods

We first discuss our qualitative methods, and then the quantitative methods and data.

4.1 Qualitative Methods

In this paper we use evidence from plant visits in a variety of ways (Eisenhardt, 1989): to facilitate intuition in generating hypotheses, to test hypotheses, and to facilitate intuition in describing results. The cases used in generating the hypotheses above were drawn from approximately 60 auto-supplier plants visited by Helper and collaborators over the past 10 years. In most cases, plants were chosen based on convenience or the needs of other research. The visits lasted from four hours to three days, and always included a plant tour. In these visits, we (at least two interviewers were always present) spoke with two to fifteen people, ranging from company president to line worker. In about a dozen cases we had the opportunity to interview workers for at least 30 minutes without the presence of management. All but three of these cases were union plants. We took extensive notes, and cross-checked them with the other interviewers and (in about half of the cases) with the interviewees. All interviewees were promised confidentiality; where real names are used, it is with interviewees' permission. Some of the cases have been written up more extensively elsewhere; for the wiring-harness case, see Helper (1998); for Foamade and Industrial Strainer see Sheahan et al. (1996) and Helper (1999); for Sumitomo, see MacDuffie and Helper (1999).

In addition to the large convenience sample of plants, we conducted a case study as a quasinatural experiment. (See Section 6.)

4.1.1 Questionnaires. In 1993, Helper conducted two surveys of automotive suppliers. The first survey was sent to the divisional director of marketing at automotive suppliers in the United States and Canada. This questionnaire asked about relationships with

customers and product characteristics. The second survey was sent to plant managers, and asked about operations policies and relationships with workers. Each answered the questionnaire for their most important customer regarding one product that was typical of their business unit's output.

A questionnaire was sent to every automotive supplier and automaker component division named in the *Elm Guide to Automotive Sourcing* (available from Elm, Inc. in East Lansing, Michigan). This guide lists the major first-tier suppliers to manufacturers of cars and light trucks in the United States and Canada. The response rate was 55% for the sales-manager survey, and 30% for the plant-manager survey.

Survey respondents were representative of the population in firm size and location, as compared with data from the Elm Guide and from County Business Patterns for SICs 3714 (automotive parts) and 3465 (automotive stampings). However, vertically integrated business units of the automakers were underrepresented. The respondents averaged 18 years in the automobile industry and 11 years with their company.

4.1.2 Employment Growth and Survival. Data on 1999 employment came from the 1999 *Elm Guide*; we matched this information to the 1993 survey data. If we could not find a plant in the 1999 Guide, we called the plant to confirm that it was indeed out of business (that is, its phone was disconnected or had been assigned to another user). If a plant had been sold to another firm, we counted it as continuing to exist. We were able to account for all plants as either surviving or out of business. However, the 1999 employment figures were often missing from the Elm data.

4.2 Variable Construction

4.2.1 Measuring Employee Outcomes. Our wage measure is the average wage (not including benefits) at the plant for unskilled and semiskilled employees. We also used a measure of total compensation equal to this wage measure times 1 plus the percentage of total payroll devoted to benefits (not including retiree benefits).

For robustness we compared results with a measure of compensation relative to the local labor market. Specifically, we asked how total compensation (including benefits) for unskilled and semiskilled production workers compared with that received by equivalent workers in all industries in the respondent's area. This was a seven-point qualitative scale, ranging from 1 ("more than 20% lower") to 7 ("more than 20% higher").

The measure of turnover in the dataset combines quits and layoffs. Layoffs can avoid the need to fire low performers. Moreover, when employees can select to be laid off, layoffs reduce quits. If layoffs at one plant are correlated with layoffs at other potential employers, fear can reduce the desire to quit. For all of these reasons, the analysis of turnover is most convincing in workplaces where some hiring occurred last year; we emphasize results from this sample.

4.2.2 Identifying Plants with Employee Involvement. The survey measured workplace practices ranging from union-management committees to employees maintaining their own machines to the presence of problem-solving groups. Given the large number of measures, the appropriate way to measure "employee involvement" is not obvious. We used four techniques, some based extensively on theory, and others driven by the data. Each procedure has advantages and disadvantages, so we emphasize results robust to multiple methods.

4.2.2.1 Theory-Motivated Index. The theory of complementary workplace practices suggests EI is most likely to succeed when it couples high levels of direct EI with representative participation and with supportive workplace practices ranging from the rule of law to high levels of training to appropriate incentive pay plans (Lawler et al., 1995; Levine, 1995). A workplace with all of these practices looks quite different from a traditional, hierarchical factory. Because of the sweeping changes it measures, we call the index that includes direct involvement, representative participation, and supportive practices, the *index of workplace transformation.* The most theory-driven method we used to develop this measure built up indices of direct and representative participation as well as indices of the theoretically appropriate human resources (HR) polices. This subsection outlines each of these subindices.

Direct participation. The subindex of direct participation was constructed as a z-score of four components. Each component is z-scored before summing or use in a regression.

One component measured the number of tasks performed by frontline employees. It was the sum of whether semiskilled employees do each of five operations such as write paragraphs or do arithmetic or solve problems in a group, scoring daily = 4, weekly = 3, monthly = 2, and rarely = 1 (z-scored), plus the proportion of eight tasks performed at the plant, such as setting up machines and using quality assurance data to recommend improvements done by semiskilled workers (z-scored).

The second component measured whether groups of workers have influence over six policies such as work methods and task assignments, purchasing new tools, and safety and health policies (z-scored). The third component measured use of teams. It was the sum of three z-scored items: whether quality circles or similar groups were present, the proportion of employees in such groups, and whether the groups met on company time.

A one-item index measured whether at least one group of workers had completed a full cycle of a formalized improvement process such as the plan-do-check-act cycle of Deming.

Finally, an index of whether managers report listening to employees was the sum of three attitude questions: "Each year we expect our shop workers to make substantial improvements in their own method of operations," "Our plant's performance depends crucially on the active cooperation of our unskilled and semiskilled workers," and "We frequently ask workers at our plant to help us in ways not specified in their job description." These were coded from 1 for "strongly disagree" to 5 for "strongly agree."

Representative participation. The index of representative participation was the sum of two (z-scored) components. One measured whether joint labor-management committees and/or a union have influence over each of six policies, as listed in the direct-influence scale. The second component was the sum of a dummy $= 1$ if labor-management committees existed and a dummy $= 1$ if such committees met on company time.

Supportive HR practices. We examined four supportive HR practices: grievance procedures, new pay practices, training, and employment security practices. Each subindex was z-scored.

The grievance subindex was the sum of a dummy for having a grievance procedure plus a dummy for having appeals to neutral arbitration.

The new-pay-practice subindex was the sum of dummies for whether there were compensation plans for unskilled workers, including company-wide profit sharing, gain sharing, team incentives, and skill-based pay.

The training subindex was the sum of z-scored hours of formal + informal training of new hires plus z-scored hours of formal + informal training of workers with at least one year of experience.

The subindex of employment security practices was the sum of two dummies for agreement that the company has made a commitment to its regular work force that (1) "no layoffs will result from productivity increases" and (2) "there will be no layoffs unless there have also been pay cuts for management."

Summary index. The summary index of EI was the sum of the above three (z-scored) indices: direct participation, representative participation, and HR policies.

The strength of this index is that it is derived from prior theory (Levine and Tyson, 1990). Because the questionnaire and this index were both constructed based on this theory and before the data were collected, this index avoids data mining. Moreover, the results can be expressed in a parsimonious fashion. The downside of this index is that it imposes strong functional-form restrictions on the data, restrictions that are not in fact supported. Implicitly, this method assumes each subindex is equally important and assumes they are substitutes; that is, a one-standard deviation increase in training will have the same effect as a one-standard-deviation increase in the number of tasks that line workers perform.

4.2.2.2 Multiple Subindices of Employee Involvement. We also entered the three main subindices independently. This test has most of the advantages of the theory-driven single index, yet relaxes its strong functional-form restrictions. The downside of this method is that the indices are multicollinear. Thus, individual coefficients are difficult to interpret.

4.2.2.3 Individual Subindices of Workplace Practices. Next, we entered each of the three main subindices one at a time. In this method, each subindex picks up the effects of all HR practices correlated with its presence.

4.2.2.4 Cluster Analysis. Our final method, cluster analysis, permits the data to speak about how to reduce the dimensionality of workplace practices. Cluster analysis identifies workplaces with similar practices. This technique has been widely used in management and economic research to identify meaningful subgroups of populations (Bearse et al., 1997; Henriques and Sadorsky, 1999; Sarasvathy et al., 1998). Dummies representing these clusters are then entered into the wage equation.

A meaningful set of clusters has low within-group variance and high between-group variance. For any given number of clusters, the centroid method of cluster analysis we use maximizes the ratio of within- to between-group variance on the 11 work-index subindices described above. This method uses a Euclidean metric to evaluate the distance between clusters.

In cluster analysis one must choose the number of clusters, a problem with no single best solution. If the number of clusters is chosen appropriately, then when we add an additional cluster it will be

near (in some metric) to the existing clusters. To choose the appropriate number of clusters, we started with two clusters per union on nonunion subgroup. Our statistical tests showed that this was a good solution.[5] In any case, results (not shown), results with three clusters per subgroup were similar to the results with two.

4.2.3 Baseline Wage and Turnover Equations. Table I presents summary statistics.

All regressions control for the workforce's average age, percentage of male, and percentage of high-school graduates. We include dummies for unionized plants and whether the plant is located in Canada. We controlled for the regional price index,[6] the log of employment, and the capital-labor ratio.[7] The survey data also have an extensive set of controls for product and process characteristics; these were never significant, so we omitted them to preserve degrees of freedom.

The baseline wage regression [Table II, column (1)] has the expected signs. Plants with a higher proportion of men, with a higher proportion of high-school graduates, with an older workforce, with a union, and with more employees pay higher wages. Somewhat surprisingly, the regional price index does not have a statistically significant effect on the wage level.

The baseline results on turnover are in Table II, column (4). As expected, high education, large plant size, and union status predict lower turnover. These effects are economically large, although only the first is statistically significant.

5. Calinski and Harabasz (1974) noted that if a cluster is distant from $k-1$ other clusters, then the $k-1$ logistic equations predicting cluster membership for each pair should have high explanatory power and a high P-value for the chi-squared statistic. For each subgroup we ran a logistic regression permitting 11 workplace practices to predict cluster membership. We then performed the cluster analysis with three clusters for each of the union and nonunion subgroups. We ran a logistic regression predicting cluster membership for each pair of clusters, leading to three logits for each subgroup. We then compared the geometric mean of the three P-values from the chi-squared test on the logit, with the P-value of the logit when we had only two clusters per subgroup. In both cases the geometric-mean P-value when we added the third cluster was smaller than the P-value of the logit with only two. We also redid the analysis for the dataset as a whole (not separating union and nonunion plants), and obtained similar results. See also Milligan (1980) + Milligan + Cooper (1985).

6. For plants located in US metropolitan areas, we used the American Chamber of Commerce Researchers Association Cost of Living Index; for plants outside US metropolitan areas, we used the mean for nonmetropolitan areas; for Canadian plants, we used purchasing-power parity estimates. For more detail, see Helper and Parkin (1995). We are grateful to Richard Parkin for calculating these numbers.

7. While most capital-labor ratios use the value of capital, we use the number of machines per production worker.

TABLE II.
Baseline Wage Equations

	(1) ln(unskilled wages)		(2) ln(unskilled compensation)		(3) Relative Compensation		(4) Labor Turnover Rate	
	B	SE	B	SE	B	SE	B	SE
(Constant)	0.859**	0.182	0.968**	0.212	1.266	1.213	27.957**	8.066
Average age	0.010**	0.002	0.012**	0.002	0.034*	0.013	−0.204*	0.084
Canada	0.361**	0.039	0.295**	0.045	−0.039	0.252	−3.819*	1.660
% workforce with HS diploma	0.002**	0.001	0.002**	0.001	0.006	0.004	−0.070**	0.025
log(employment)	0.069**	0.013	0.085**	0.015	0.314**	0.084	−0.861	0.563
log(machines/prodn. workers)	0.007	0.012	0.004	0.014	0.063	0.078	−1.240*	0.523
% workforce male	0.004	0.000	0.004**	0.001	0.008*	0.003	−0.014	0.022
Regional price index	0.216	0.132	0.198	0.153	−0.395	0.890	−4.392	5.854
Unionized shop workers	0.116**	0.026	0.142**	0.030	0.281	0.171	−1.363	1.139
R^2	*0.497*		*0.449*		*0.139*		*0.100*	
Sample size n	319		319		305		309	

* Significant at 10%.
** Significant at 5%.

5. Quantitative Results

5.1 Incidence

5.1.1 Regressions. Table III(A) presents regressions on the incidence of employee involvement. The index of direct EI is higher in plants that were large, Canadian, had younger workers, and had more employees with a high-school degree. Machines per worker and the proportion male or union of the workforce did not have a statistically significant effect on the level of involvement [column (1)]. Employment security and representative involvement were also predictors of direct involvement [columns (3) and (5)]. Column (2) shows overall impact of adding training (not controlling for union status) and column (4) shows different ways of conceptualizing union/nonunion differences in EI incidence.

5.1.2 The Cluster Analysis. The cluster analysis also shows that high-involvement practices were correlated, supporting theories of complementarities [Table II(B)]. The union workplaces were more likely to have grievance procedures, had more representative participation, and had lower levels of nontraditional forms of incentive pay. Our ANOVA tests show that the clusters we call *high-involvement* had statistically significantly higher levels of most of the involvement practices than did the *low-involvement* clusters.

The above results describe the differences in workplace practice that the cluster analysis used to define the clusters. It is important to know how these clusters differ along other dimensions. The clusters did not differ significantly on size, location, or the proportion of the workforce that was male or that had a high-school degree. In the nonunion, but not the union, subsample, plants in the high-involvement cluster were a bit newer and had a slightly younger workforce. In short, the employers and employees in the high- and low-involvement clusters within each subsample were rather similar.

Robustness checks: When we added a third cluster per union or nonunion subsector, the third cluster was always small (fewer than 16 workplaces). Moreover, the third cluster was intermediate in both workplace practices and compensation. Thus, our results with cluster analysis are robust to alternative clustering techniques.

5.2 Employee Involvement and Wages

The basic result of the paper is in Table IV, column (1). A one-standard-deviation rise in the summary index of EI is correlated with a wage increase of 3.6% at nonunion firms, and of 5.2% at union

TABLE III.
INCIDENCE OF DIRECT EMPLOYEE INVOLVEMENT

(A) Dependent Variable: Direct EI

	(1)		(2)		(3)		(4)		(5)	
Variable	B	SE	B	SE	B	SE	B	SE	B	SE
(Constant)	−0.835	0.858	−0.872	0.868	−0.850	0.854	−0.547	0.849	−0.429	0.817
Average age	−0.026**	0.010	0.024*	0.009	−0.025**	0.009	−0.030**	0.009	−0.027**	0.009
Canada	0.416*	0.162	0.404*	0.175	0.436*	0.173	0.395*	0.171	0.330*	0.164
% workforce with HS diploma	0.006*	0.003	0.006	0.003	0.005*	0.003	0.005	0.003	0.004	0.003
log(employment)	0.257**	0.054	0.256**	0.060	0.251**	0.059	0.238**	0.059	0.207**	0.057
log(machines/prodn. workers)	−0.013	0.051	0.014	0.056	0.000	0.056	0.008	0.055	0.010	0.053
% workforce male	−0.001	0.002	0.002	0.002	−0.002	0.002	−0.003	0.002	−0.003	0.002
Regional price index	−0.038	0.673	0.012	0.632	0.094	0.622	0.114	0.616	0.240	0.592
Unionized shop workers	−0.072	0.120	0.089	0.121	−0.047	0.119	−0.299**	0.128	−0.403**	0.126
Index of training (z)			0.082	0.054						

(continued)

TABLE III. (CONTINUED)

	(A) Dependent Variable: Direct EI									
	(1)		(2)		(3)		(4)		(5)	
Variable	B	SE	B	SE	B	SE	B	SE	B	SE
Index of employment security (z) × union					**0.195***	**0.085**				
Previous × nonunion					**0.219****	**0.067**				
Supportive HR practices (z) × union							**0.170***	**0.082**	0.175*	0.078
Previous × nonunion									0.335**	0.103
Representative employee involvement (z) × union							**0.317****	**0.081**	0.321**	0.069
Previous × nonunion									0.131*	0.073
R^2	*0.114*		*0.120*		*0.156*		*0.168*		*0.237*	
F-test of the equality of bold coefficients					8.05**		10.370**		14.566*	
Sample size n	332		332		332		332		332	

(B) Cluster Analysis of the Plants

Variables Used to Create the Clusters	Union, High Involve.			Union, Low Involve.			Nonunion, High Involve.			Nonunion, Low Involve.			ANOVA Sig.[a]		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	I	II	III
Index of committee existence (z)	0.37	0.70	0.62	0.08	0.70	1.04	−0.10	0.00	0.96	−0.27	0.00	0.89	**0**	**0.02**	0.164
Index of direct involvement (z)	0.60	0.53	0.49	−0.96	−0.79	0.72	0.67	0.65	0.52	−1.05	−0.92	0.68	0.12	0	**1E−20**
Index of job security (z)	0.03	0.78	0.92	−0.27	−0.93	1.00	0.22	0.78	1.01	−0.12	−0.93	1.02	0.07	**0.04**	**0.01**
Index of grievance plans (z)	0.92	1.24	0.60	0.87	1.24	0.61	−0.45	−1.08	0.83	−0.77	−1.08	0.57	**0**	0.57	**0.001**
Supportive HR practices (z)	0.46	0.42	1.08	0.11	0.04	0.83	0.05	−0.04	0.94	−0.50	−0.63	0.86	**0**	**0.02**	**4E−06**
Index of improvement process (z)	0.22	0.38	0.67	−0.25	0.38	1.23	0.34	0.38	0.33	−0.66	0.38	1.43	0.83	**0**	**2E−16**
Employee involvement (z)	0.92	0.91	0.80	−0.34	−0.34	0.73	0.19	0.19	0.74	−1.03	−0.95	0.70	**0**	**0**	**1E−20**
Index of worker group influence over policies (z)	0.71	0.90	0.74	−0.69	−0.89	0.80	0.48	0.30	0.70	−0.87	−0.89	0.71	0.16	**0**	**1E−20**
Index of committee & union influence over 6 policies (z)	1.03	0.82	1.16	0.20	−0.01	0.89	−0.32	−0.83	0.68	−0.56	−0.83	0.48	**0**	**0**	**0.003**
Index of improvement through listening (z)	0.33	0.17	0.73	−0.82	−0.97	0.95	0.44	0.74	0.72	−0.48	−0.40	1.04	**0**	**0**	**1E−15**
Index of contingent pay (z)	−0.23	0.27	0.89	−0.26	−1.02	0.90	0.34	0.27	1.07	−0.07	0.27	0.91	**0**	0.83	**0.002**
Index of representative involvement (z)	0.90	0.92	0.91	0.18	0.18	0.94	−0.27	−0.08	0.86	−0.53	−0.54	0.76	**0**	**0**	**0.014**

(continued)

TABLE III. (CONTINUED)

Variables Used to Create the Clusters	Union, High Involve.			Union, Low Involve.			Nonunion, High Involve.			Nonunion, Low Involve.			ANOVA Sig.[a]		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	I	II	III
Index of tasks performed by semiskilled workers (z)	0.41	0.34	0.69	−0.59	−0.38	0.84	0.40	0.34	0.86	−0.67	−0.66	0.91	0.61	0	5E−19
Index of use of teams (z)	0.10	0.00	0.70	−0.41	0.00	1.09	0.33	0.44	0.67	−0.36	0.00	1.13	0.02	0	2E−09
Index of training (z)	0.18	0.00	1.35	−0.12	−0.04	0.61	−0.01	−0.06	0.61	−0.05	−0.22	0.89	0.4	0.07	0.709
Other Variables															
Average age	38.33	39.00	6.36	38.86	38.50	6.52	33.18	33.00	5.70	35.28	35.00	5.85	0	0.61	0.008
Canada	0.19	0.00	0.40	0.24	0.00	0.43	0.09	0.00	0.29	0.08	0.00	0.28	0	0.43	0.821
% workforce with HS diploma	78.69	85.00	20.03	70.14	80.00	26.08	81.11	90.00	23.61	79.65	80.00	19.67	0.02	0.02	0.631
log(employment)	5.60	5.53	0.83	5.38	5.55	1.02	5.30	5.33	0.96	4.86	4.87	1.14	0	0.13	0.001
log(machines/production workers)	−1.89	−1.83	1.13	−2.02	−1.77	1.07	−1.81	−1.70	1.06	−1.48	−1.44	0.90	0.02	0.46	0.02
% workforce male	62.87	65.00	24.36	62.82	65.00	26.73	55.64	55.00	22.23	60.46	60.00	23.25	0.03	0.99	0.108
Regional price index	1.05	1.07	0.08	1.06	1.09	0.08	1.04	1.01	0.09	1.04	1.00	0.11	0.01	0.25	0.963
log(compensation of skilled)	2.96	2.94	0.27	2.89	2.87	0.36	2.82	2.84	0.22	2.75	2.78	0.26	0	0.18	0.027

log(wages of skilled)	2.65	2.64	0.24	2.60	2.64	0.35	2.55	2.56	0.21	2.50	2.48	0.24	0	0.3	0.049
log(compensation of unskilled)	2.71	2.69	0.31	2.65	2.63	0.36	2.46	2.43	0.25	2.39	2.40	0.27	0	0.28	0.07
log(wages of unskilled)	2.40	2.38	0.28	2.36	2.33	0.34	2.19	2.16	0.24	2.14	2.14	0.24	0	0.4	0.099
Relative compensation	5.07	5.00	1.51	4.76	4.50	1.23	4.63	4.00	1.31	4.39	4.00	1.39	0	0.17	0.175
Labor turnover rate	5.21	2.00	8.62	3.82	2.00	5.23	7.36	4.00	10.19	7.44	5.00	8.06	0	0.26	0.948
log(total no. employees 1999/ total no. employees 1992)[b]	0.07	0.11	0.54	0.05	0.11	0.70	0.21	0.19	0.62	0.35	0.24	0.91	0.01	0.87	0.191
log(total no. employees 1999/ total no. employees 1992)[c]		0.04			0.03			0.13			0.25				
Out of business by 1999	0.17	0.00	0.38	0.18	0.00	0.39	0.16	0.00	0.37	0.09	0.00	0.29	0.21	0.92	0.13
Number of plants in cluster	98			78			173			95					

* Significant at 10%.
** Significant at 5%.
[a] I: Union vs. nonunion firms; II: Low- vs. high-involvement union clusters; III: Low- vs. high-involvement nonunion clusters.
[b] Conditional on being still in business in 1999.
[c] Employment equals negative infinity for firms that shut down; thus, only the median is well defined.

TABLE IV.

THE EFFECT OF THE SUMMARY INDEX ON WAGES AND TURNOVER[a]

Variable	(1) ln(Unskilled Wages) B	SE	(2) ln(Unskilled Compensation) B	SE	(3) Relative Compensation B	SE	(4) Turnover Rate B	SE
(Constant)	0.964**	0.180	1.065**	0.226	1.711	1.206	25.910**	9.671
Average age	0.001**	0.002	0.012**	0.002	0.033**	0.015	−0.213*	0.088
Canada	0.345**	0.038	0.279**	0.045	−0.122	0.258	−3.158*	2.066
% workforce with HS diploma	0.002**	0.001	0.002**	0.001	0.004	0.004	−0.068**	0.035
log(employment)	0.059**	0.013	0.075**	0.016	0.253**	0.088	−0.692	0.595
log(machines/prodn. workers)	0.008	0.012	0.007	0.014	0.068	0.073	−1.092*	0.624
% workforce male	0.003**	0.000	0.004**	0.001	0.008*	0.003	−0.012	0.021
Regional price index	0.208	0.130	0.207	0.168	−0.275	0.883	−3.145	6.258
Unionized shop workers	0.093**	0.026	0.114**	0.030	0.134	0.169	−1.155	1.092
Employee involvement (z) × nonunion	**0.036***	0.015	**0.033**	**0.015**	**0.189**	**0.111**	**−0.514**	**0.607**
Employee involvement (z) × union	**0.052****	0.018	**0.069**	**0.018**	**0.287***	**0.120**	**−0.335**	**0.597**
R^2	*0.516*		*0.473*		*0.163*		*0.093*	
F-test of EI index and its interaction with union	6.80**		7.23**		4.33*		0.34	
Sample size n	318		318		319		318	

* Significant at 10%.
** Significant at 5%.
[a] Differences in union vs. nonunion coefficients were not significant.

firms.[8] These results support the hypothesis H1A (human-capital theory, efficiency wages, and rent sharing), but not H1C (management by stress). If we examine compensation (wages + benefits) the results are similar in magnitude, although not statistically significant [column (2)].

Similarly, we can analyze managers' reports of compensation relative to the local labor market [column (3)]. A one-standard-deviation rise in the index of employee involvement increases relative compensation about 0.24 points (averaging union and nonunion effects). A one-point move is equal to changing from about 4–9% higher to 10–20% higher than compensation received by all workers in the area; thus, a 0.2-point move corresponds to perhaps a 2% move in wages—not too far from the 3.5% estimated in column (1).

5.2.1 Results with Less Aggregated Workplace Practices. We also examined which components (direct involvement, representative involvement, or supportive HR practices) drove the positive correlation with wages (Table V). The index of direct involvement has the largest effect in nonunion workplaces, but no effect in union workplaces. The index of representative involvement, in contrast, has the largest effect in union workplaces, but no effect in nonunion workplaces. The differences in coefficients, while large, are not statistically significant.

5.2.2 Results with Clusters. In the union subsample the high-involvement cluster paid average production-worker wages about 5.5% above the more traditional cluster; this gap was not significant [Table III(B)]. In the nonunion subsample the high-involvement cluster paid average production worker wages about 6.3% above the more traditional cluster ($P < 0.10$). For other variables, gaps in cell medians between EI and non-EI plants were bigger for union than for nonunion plants, but always had the same sign.

In the wage equation with standard controls, the high-involvement nonunion cluster paid average production worker wages almost 9% above the more traditional nonunion cluster ($P < 0.01$), while the union high-involvement cluster paid average production worker wages about 4.5% above the more traditional union cluster [difference not significant: Table VI, column (1)]. These effects were slightly larger for compensation than for wages [column (2)], and smaller and not significant for the relative compensation measure [column (3)].

8. We tested throughout for differences in coefficients between union and nonunion plants; these differences were never statistically significant.

TABLE V.
EFFECTS ON WAGES[a]

(A) The Effect of Subindices

Independent Variable	(1) B	(1) SE	(2) B	(2) SE	(3) B	(3) SE	(4) B	(4) SE
Dependent Variable = log(Wages of Unskilled Workers)								
Unionized shop workers	0.105**	0.026	0.124**	0.025	0.096**	0.027	0.088**	0.027
Supportive HR practices (z) × nonunion	0.014	0.016					−0.004	0.016
Supportive HR practices (z) × union	0.039*	0.012					0.036	0.014
Direct employee involvement (z) × nonunion			0.050**	0.013			0.051**	0.014
Direct employee involvement (z) × union			0.019	0.018			−0.010*	0.021
Representative employee involvement (z) × nonunion					0.000	0.017	−0.008	0.017
Representative employee involvement (z) × union					0.050**	0.018	0.050**	0.019
R^2	*0.504*		*0.516*		*0.508*		*0.513*	
F-test on 3 subindices in union workplaces							4.101**	
F-test on 3 subindices in nonunion workplaces							4.146**	
Sample size n	319		318		319		318	
Dependent variable = Employee Turnover								
Unionized shop workers	−1.342	1.100	−1.445	1.036	−1.150	1.173	−1.114	1.234
Supportive HR practices (z) × union	−0.267	0.602					0.178	0.680
Supportive HR practices (z) × nonunion	−0.090	0.543					−0.099	0.529
Direct employee involvement (z) × nonunion			−1.083	0.557			−1.227	0.658
Direct employee involvement (z) × union			0.188	1.201			0.596	1.417
Representative employee involvement (z) × nonunion					0.469	0.707	0.644	0.737
Representative employee involvement (z) × union					−0.819	0.540	−1.032	0.854

R^2	*0.092*	*0.100*	*0.095*	*0.169*
F-test on 3 subindices in union workplaces				0.504
F-test on 3 subindices in nonunion workplaces				1.213
Sample size *n*	309	309	309	309

(B) The Effect of Supportive HR Practices

Dependent Variable = log (Wages of Unskilled Workers)

	(1)		(2)	
Independent Variable	B	SE	B	SE
Unionized shop workers	0.101**	0.027	0.107**	0.028
Direct employee involvement (z) × nonunion	0.050**	0.013	0.051**	0.014
Direct employee involvement (z) × union	−0.003	0.020	−0.009	0.021
Representative employee inv. × nonunion	−0.009	0.017	−0.011	0.017
Representative employee inv. × union	0.051**	0.020	0.052**	0.021
Contingent pay × nonunion (z)			−0.020	0.015
Contingent pay × union (z)			0.037	0.018
Employment security × Nonunion (z)			0.020	0.016
Employment security × Union (z)			0.023	0.016
R^2	*0.528*		*0.542*	
Sample size *n*	319		319	

Note: All regressions controlled for workforce average age, a dummy for Canada, the percentage of the workforce with a high-school diploma, log(employment), log(machines/production workers), the percentage of the workforce male, and the regional price index.

[a] All regressions include the baseline controls from Table II. Differences in union vs. nonunion coefficients were not significant.

TABLE VI.

The Effects of Clusters on Wages[a]

	log(Unskilled Wages)		log(Unskilled Compensation)		Relative Compensation		Labor Turnover Rate	
	B	SE	B	SE	B	SE	B	SE
(Constant)	0.861**	0.189	0.942**	0.226	1.235	1.222	26.387**	9.470
Average age	0.010**	0.002	0.013**	0.002	0.036**	0.015	−0.204**	0.086
Canada	0.352**	0.039	0.286**	0.042	−0.062	0.265	−3.344**	2.013
% workforce with HS diploma	0.019**	0.001	0.002**	0.001	0.006	0.004	−0.074**	0.035
log(employment)	0.060**	0.014	0.075**	0.017	0.271**	0.088	−0.828	0.592
log(machines/prodn. workers)	0.005	0.013	0.003	0.015	0.052	0.073	−1.118*	0.630
% workforce male	0.004**	0.000	0.004**	0.001	0.009**	0.003	−0.013	0.021
Regional price index	0.184	0.141	0.182	0.165	−0.405	0.889	−2.465	6.251
Nonunion high-involvement cluster	0.090**	0.032	0.105**	0.036	0.306	0.210	−0.325	1.232
Union, low-involvement cluster	**0.152****	0.038	**0.177****	0.045	**0.265**	0.254	**−2.777**	1.265
Union, high-involvement cluster	**0.196****	0.035	**0.242****	0.040	**0.642****	0.236	**−0.852**	1.378
R^2	*0.511*		*0.467*		*0.151*		*0.095*	
F-test of the equality of bold coefficients	10.910**		12.064**		2.466		0.972	
Sample size *n*	319		319		305		309	

* Significant at 10%
** Significant at 5%
Note: Clusters are defined in Table III(B). Baseline (omitted) cluster is nonunion and low involvement.
[a] Differences in union vs. nonunion coefficients were not significant.

5.2.3 Overview of Results on Wages and Employee Involvement. In short, the results paint a fairly consistent picture of a small but usually statistically significant effect of new workplace practices on wages or compensation. The results were robust to various measures of EI.[9] We did not find statistically significant differences in coefficients between union and nonunion plants.

5.2.4 Turnover and Employee Involvement. With standard controls, turnover is estimated to be essentially uncorrelated with workplace practices [Table IV, column (4)].[10] Thus, the turnover results do not support the hypothesis that specific human capital, rent-sharing, or efficiency wages are the reason that high-involvement employers pay higher wages.

5.3 Disentangling (Some of) the Theories

5.3.1 Human-Capital Theory. The theory of human capital suggests that any apparent relation between wages and EI is actually due to the relation between wages and employee skill. Our composite measure of EI, then, is picking up skills in two fashions. Most directly, a measure of training (hours of training received last year per worker) is included in the index. Moreover, human-capital theory interprets many EI practices as requiring higher skills, such as problem-solving or equipment maintenance.

We find no strong support for the predictions of human-capital theory. First, in contrast to the hypothesis HumanCapitalA, our measure of frontline EI is almost uncorrelated with our measure of training [Table VII(A), column (1)]. We also find no support for the hypothesis that controlling for training largely eliminates the relation between EI and wages [HumanCapitalB, Table VII, columns (2–4)]. Specifically, when we add training to the wage equation, the coefficient on training is small and insignificant. Furthermore, adding training does not change the coefficient on direct EI by an economically or statistically significant amount.[11]

9. In addition to the results presented here, we also found significant wage increases with employee involvement when EI was measured using factor analysis, and when worker suggestions were included as a measure of EI. The results presented in this paper concern wages of semiskilled or unskilled employees. We also looked at the effect of EI practices on the wages of skilled blue-collar workers; we found such workers also earned 3–5% more at plants with EI.

10. If the subindices are entered separately, each one is uncorrelated with turnover (results not shown).

11. As noted above, the hypotheses concerning human-capital theory hold if training has already been completed. This stock assumption would seem most valid for plants that had only experienced employees, since their past training would be large relative to the current flow of training. Thus, we reran the regression including only plants that had not hired in the last year. Still, we found that training did not reduce the coefficient on EI; in fact, this coefficient increased slightly [Table VII(A), Panel 2, columns 1–3].

TABLE VII.
Tests of Theories

(A) Does Training Explain the Wage-Involvement Relation?[a]

All Plants

	(1) Direct EI[b]		(2) ln(Unskilled Wages)		(3) ln(Unskilled Wages)		(4) ln(Unskilled Wages)	
Sample	B	SE	B	SE	B	SE	B	SE
Union	−0.089	0.122	0.124**	0.027	0.118**	0.024	0.122**	0.024
Index of training (z) × nonunion	**0.084**	0.087			**0.013**	0.019	**0.008**	0.018
Index of training (z) × union	**0.081**	0.068			**0.015**	0.010	**0.014**	0.010
Direct employee involvement (z) × nonunion			**0.050****	0.013			**0.049****	0.012
Direct employee involvement (z) × union			**0.019**	0.020			**0.017**	0.019
R^2	*0.120*		*0.516*		*0.498*		*0.517*	
F-test of the equality of bold coefficients	*1.157*		*6.568***		*0.719*		*3.533***	
Sample size n	332		319		319		319	

Plants without Recent Hiring

	(5) ln(Unskilled Wage)		(6) ln(Unskilled Wage)		(7) ln(Unskilled Wage)	
Sample	B	SE	B	SE	B	SE
Union	0.099	0.138	0.045	0.026	0.076	0.027
Index of training (z) × nonunion			**−0.003**	0.021	**0.040**	0.019
Index of training (z) × union			**0.058**	0.009	**0.054**	0.009
Direct employee involvement (z) × nonunion	**0.066**	0.024			**0.071**	0.014
Direct employee involvement (z) × union	**0.065**	0.012			**0.051**	0.021
R^2	*0.613*		*0.586*		*0.622*	
F-test of the equality of bold coefficients	1.369		0.312		0.813	
Sample size n	86		86		86	

(B) Efficiency Wages and Supervision

Whole Sample	Turnover (1) B	SE	Turnover (2) B	SE
Union	−0.446	1.308	0.886	1.350
z(Train)	−0.879*	0.532	−0.792	0.545
z(Direct)			0.019	0.609
ln(unskilled wage)			−12.360**	2.860
R^2	*0.101*		*0.171*	
Sample size *n*	295		295	

	The Effect of Supervision				Does Loyalty Mediate?			
	Direct EI[c]		ln(Unskilled Wages)		Direct EI[c]		ln(Unskilled Wages)	
Whole Sample	B	SE	B	SE	B	SE	B	SE
Union	−0.069	0.120	0.124**	0.025	0.055	0.116	0.125**	0.026
Direct employee involvement (*z*) × nonunion			0.046**	0.013			0.052**	0.021
Direct employee involvement (*z*) × union			0.015	0.018			0.017	0.014
Index of mgt. reports of worker loyalty (*z*) × nonunion					0.420**	0.066	−0.009	0.024
Index of mgt. reports of worker loyalty (*z*) × union					0.346**	0.100	0.001	0.017
Supervisors/worker	−1.168*	0.372	−0.211*	0.113				
F-test on both loyalty indices (and supervisor/shop worker)	5.983**		4.617*		27.633**		0.484	
R^2	*0.132*		*0.525*		*0.245*		*0.516*	
Sample size *n*	330		317		332		319	

(continued)

TABLE VII. (CONTINUED)

(C) Wages and Intensive Employee Involvement [a]

Independent Variable	Dependent Variable = log(Unskilled Wage) B	SE
Unionized shop workers	0.0994**	0.031
Supportive HR practices (z) × nonunion	−0.0087	0.018
Supportive HR practices (z) × union	0.039*	0.019
Direct employee involvement (z) × nonunion	0.048**	0.016
Direct employee involvement (z) union	−0.007	0.022
Representative employee involvement (z) × nonunion	−0.014	0.018
Representative employee involvement (z) × union	0.054**	0.020
Dummy for intensive EI and nonunion	0.038	0.048
Dummy for intensive EI and union	−0.033	0.061
R^2	0.536	
F-statistic on inclusion of dummy variables	0.461	
Sample size n	319	

*Significant at 10%.
**Significant at 5%.
[a] All regressions controlled for workforce average age, a dummy for Canada, the percentage of the workforce with a high-school diploma, log(employment), log(machines/production workers), the percentage of the workforce male, and the regional price index. Differences in union vs. nonunion coefficients were not significant.
[b] The coefficients on direct EI do not change by a statistically significant amount when the indices of training are added.
[c] The coefficients on direct employee involvement do not change by a statistically significant amount when the indices gift supervision or of loyalty are added [comparing column (2) or (4) here and the corresponding regression in Table V].

Thus, training does not seem to explain the wage increases associated with EI.[12] This finding also casts doubt on the idea that firms pay efficiency wages to offset increased turnover costs after training for EI (TurnoverCostA). Finally, we did not find that EI predicts lower turnover, contradicting HumanCapitalC.

5.3.2 Compensating Differences. When we added measures of supportive HR practices to our regressions, we found that the coefficient on our measures of EI changed very little in the wage equation, contradicting the compensating-differences theory's prediction that adding bonuses or a no-layoff policy would reduce wages. [See Table V(A).]

5.3.3 Efficiency Wages. Consistent with efficiency-wage theories, wages that are high relative to the local price level or to the region predict low turnover (EfficiencyWageA). A 32% rise in the plant average compensation for unskilled employees (1 standard deviation) reduces turnover by about 3 percentage points per year. This effect is about half the mean or a third of the standard deviation of turnover rates across plants [Table VII(B), first panel].

In addition, we found that firms with more supervisors per worker had both less involvement and lower wages [Table VII(B), second panel, columns (1) and (2)]. This result is consistent with gift-exchange versions of efficiency wages (e.g., workers feel management trusts them more if there are fewer supervisors, making workers more willing to provide the "gift" of involvement). It is also consistent with monitoring-cost versions (supervisors are a substitute for a high cost of job loss in generating effort).

We further investigated the gift-exchange hypothesis by using a two-item measure of managers' perception of employee loyalty: The extent to which managers report that workers "might take unfair advantage of management," and that "workers sometimes feel reluctant to share their ideas" (1–5 scales). Consistent with gift-exchange theory, plants with more loyal employees (as perceived by the employer) had more EI. A one-standard-deviation rise in

12. Another human-capital story would be that when firms introduced EI, they also hired new, more highly skilled workers, and paid them more. However, that story does not apply to this industry. It is true that plants with a higher percentage of high-school graduates had more involvement, but the workforces did not change when EI was implemented. Our impression from plant visits is that most of the EI programs were only a few years old in 1993. (Unfortunately, we didn't ask this in the survey.) This period was characterized by low turnover; almost all plants reported that their turnover rates (only 3.6% on average in 1993) had changed little since 1989. The period was also characterized by little hiring; 27% of respondents had not hired production workers in the year preceding the survey.

perceived employee loyalty predicted 10% higher direct EI (results available on request; standard controls were included).

This measure of gift exchange does not appear to drive the wage-involvement correlation. Including the two-item index of loyalty in the wage equation had no effect on the index of direct EI's coefficient on wages (results available on request). Thus, we have support for the hypothesis GiftExchangeA, but not GiftExchangeB [Table VII(B), column (3)].

Inconsistent with efficiency-wage theories, EI does not predict low turnover, so there is no relationship for wages to mediate (contradicting EfficiencyWageB). However, more training does predict marginally lower turnover. Consistent with EfficiencyWageB, this training effect goes away when wages are controlled for [Table VII(B), first panel, columns (1) and (2)].

5.3.4 Incentives and Complementarity. Consistent with the hypothesis IncentiveA, pay practices such as gain sharing and profit sharing were more common in plants with higher levels of EI. In a noncausal regression, a one-standard-deviation-higher use of new pay practices predicted 0.11-higher standard deviations on the index of direct EI (standard controls; results available upon request).

Also consistent with the theory of complementarity and the need for employee incentives, high-involvement plants had policies limiting layoffs, due to employee suggestions (hypothesis IncentivesB). The cluster analyses also found that high-involvement plants had above-average employment security and new pay practices [Table III(B)]. The various subindices of EI were positively correlated, as predicted by theories of complementarities [Table I(B)].

5.3.5 Management by Stress. As noted above, we did not find quantitative support for the predictions of management-by-stress theorists that wages at plants with EI would be lower. However, we did find some support for the management-by-stress view that union participation is important for workers to win high wages at unionized plants. In union plants, wages rise only if the plant has high representative involvement; and the effect of direct involvement alone on wages was negative (and, in some specifications, significant) for union plants. In nonunion plants, workers did receive higher wages if they had direct involvement, but not enough to overcome the union-nonunion pay gap. (See Table V, first panel.)

We were unable to test the theory's hypotheses about EI at one plant affecting wages and employment at other plants, because we lack data on transfer of information from one supplier plant to another, and data on plants outside the US and Canada.

5.4 Plant Survival and Employment Change

We had two measures of employment growth: the indicator variable for plant survival between 1993 and 1999, and the percentage change in employment.

The odds of plant closure were essentially identical for the union high- and low-involvement clusters and for the nonunion high-involvement cluster, ranging from 16% to 18% (differences not significant). In contrast, only 9% of the nonunion low-involvement cluster went out of business (different from the other three clusters at $P < .01$).

The median employment rise (coding plant closure as a very large decline) was 24% at the low-involvement nonunion cluster, which was statistically significantly different from the 9% rise at the high-involvement nonunion cluster. Both were statistically significantly higher than the near-zero median change at the two union clusters.

In regression results, involvement in 1993 did not predict a plant's staying in business until 1999 [Table VIII, column (1)]. Moreover, in the limited sample with data on employment in 1999, employee involvement in 1993 did not predict employment growth (Table VIII). In results not shown, these findings were robust to various measures of workplace practices in 1993.

These results suggest high-involvement workplaces do not save jobs at US auto suppliers, consistent with the hypothesis SurvivalB and contradicting SurvivalA.

One possible explanation for the lack of employment growth at high-involvement plants is that EI raises productivity, but that product demand is inelastic, so labor demand often declines. In this scenario EI should predict fewer plant closings, even at low employment growth. In fact, the data do not exhibit this pattern.

Alternatively, it may be that plants that faced financial difficulties in 1992 were more likely to adopt more employee involvement, but the benefits of employee involvement did not outweigh the bad conditions that led to its adoption. Again, the data are not consistent with this interpretation: Managers in high-involvement plants were less, not more, likely to report their plants had had

TABLE VIII.

Effects of Employee Involvement on Employment Growth, 1993–1999

	(1) OLS Employment 1999 Full Sample		(2) Logit, Survival Full Sample		(3) OLS Employment 1999 Sample: Films Still in Business in 2000	
	B	SE	*DP/DX*	SE	B	SE
(Constant)	334.659	454.145	−5.676**	2.244	170.238	375.329
Employment 1993	0.682**	0.149	−0.002*	0.001	1.744**	0.174
Employment 1993 squared	0.000	0.000	9.00E−07*	6.00E−07	−5.57E−04**	1.92E−04
Canada	6.824	100.570	−1.213*	0.571	108.117	95.69
Average age	4.125	5.025	0.044	0.026	1.628	4.713
% workforce with HS diploma	2.126	1.474	−0.010	0.007	2.427	1.511
% workforce male	−0.451	1.290	0.006	0.007	2.076	1.15
Regional price index	−348.110	324.540	2.831	1.692	−527.43*	274.143
Unionized shop workers	29.640	67.534	0.046	0.346	−54.479	62.512
log(machines/production workers)	29.854	32.069	−0.259	0.155	18.34	27.698
Index of direct involvement (*z*) × union	12.566	51.002	−0.275	0.232	10.447	43.799
Index of direct involvement (*z*) × nonunion	−22.589	35.271	0.156	0.195	−52.953	29.247
R^2	0.547		77.54% correctly classified		0.688	
Sample size *n*	128		332		82	

* Significant at 10%.
** Significant at 5%.
Note: Independent variables are from the same 1993 survey as in the other tables. Differences in union vs. nonunion coefficients were not significant.

layoffs or downsizing in the four years preceding the survey than were managers at low-involvement plants (results available on request).

6. Qualitative Evidence: A Quasinatural Experiment

As the above section showed, EI is correlated with higher wages. What we would really like to know is: If a random plant adopts EI, will wages rise? Our OLS regression results do not necessarily shed light on this question, because the determinants of adoption of EI may be correlated with the determinants of EI's effect on wages (Athey and Stern, 1998).

By directly observing firms both before and after they introduced EI, we can gain some insight into the causal processes that might link the two. We learned during visits made for other reasons that the plant described below was about to change its EI policy. In the course of writing this paper, we made arrangements to visit it again, without knowing what the outcome of the policies had been. (The semistructured interviews we used for this portion of the research, written before we made our second visit, are available from the authors.) This design reduces the sample-selection problems endemic to case-study research.

We wanted to find a plant that changed its EI policies, and then look at what happened to its wages. In 1996, Helper visited Forest City Technologies in the course of a project on pollution prevention. This firm's four plants are located in the small town of Wellington, Ohio, which is about one hour south of Cleveland. The firm was established in 1956, and has grown steadily since. It remains nonunion. In 1996, the firm had 450 employees, almost 1/3 more than it had in 1992.

A large part of this firm's operation involved putting anticorrosion and other types of coatings onto fasteners used in automotive engines. The business was highly competitive; our interviewees complained of "Gestapo-like tactics" on the part of their customers to depress prices. The firm made about 200 products, which it supplied to dozens of customers. Although the firm had some contracts that went for "years and years," much of the business is done on a short-term basis with no contracts; if a customer sends a batch of parts to be coated, there is no assurance if or when it will send another one.

The core of Forest City's process is getting many small, odd-shaped parts, as fasteners are wont to be, into some kind of mold,

mount, or convenient position in which to apply a coating en masse. Forest City's competitive advantage appeared to lie in having engineers who could design ever more clever jigs, fixtures, and leads to orient the parts quickly and precisely so that the coating could be applied by machine rather than by hand.

All processes were intensive in the use of unskilled labor; on average, direct labor accounted for 55% of costs. The operators were paid on average $8 per hour (about average for the area); training for most jobs consisted of watching someone else do the process for a while. However, the nature of work appeared to vary a fair amount across processes.

In one area, the fasteners were painted with a thin strip of sealant coating, which had to go in a precise location. The firms' engineers had figured out how to use tumblers (big bowls of parts that are jiggled by an electric motor underneath) to orient the small parts so that the coating could be applied by machine rather than by hand. The operators' job was to watch the parts coming out of the machine, to remove any that were defective, and to call a skilled maintenance worker if the machine stopped. In practice, the operator could not check every part, because the parts came out very quickly. (Also, the work quickly induced boredom, as could readily be observed on the operators' faces.) If quality was very important (as in an airbag part), extra inspectors were added.

In contrast, in the rubber-coating area (known in the plant as "shake and bake"), the operators paced themselves. They placed small rubber gaskets on trays with cavities (like a muffin pan with holes for many tiny muffins), and then switched on a vibrating mechanism to get the gaskets to fall into the holes. After putting a few gaskets in holes by hand, the operator put another tray on top, and then placed them in the oven to bake. When they came out of the oven, she visually inspected them and packed them into shipping containers. The pace was not particularly onerous, and relations with management seemed quite friendly. (As we stood there watching, the manager who was leading us around started to help the operator orient the parts, completely without fanfare—he seemed to feel that since he was standing there, he might as well help out. This was the only case of a manager performing such assistance we observed on our plant visits.)

Forest City had started a suggestion program in late 1992, but it seemed moribund in 1996. Operators were not expected to contribute suggestions for improvement, and typically did not stay more than a year or two. Particularly in the painted-sealant area, there seemed to be unrealized potential for involving operators. For example, these

operators spent all day watching how the parts came out of the tumblers and into the feeder trays; if asked, they might well have been able to make suggestions about the circumstances under which misalignments or other defects are likely to occur. There was no quality-circle program in either 1992 or 1996.

The firm's management agreed there was untapped potential. In a 1993 survey, the firm's marketing director listed "increasing employee involvement" as "extremely important." (Interestingly, he also listed "moderating the growth of wages and benefits" as "very important.") At the time of our visit in summer 1996, the firm was in the early stages of implementing an employee empowerment program, called the "5-point star" program, developed by Dimensions International, a Pittsburgh consulting firm. The drive to do this was spearheaded by the HR manager.

In cooperation with the consulting firm, Forest City identified five functions of supervisors; the plan was to devolve these among work teams of about five people each. When a worker took over an additional function, they earned wage incentives; in addition there was profit sharing and seniority bonuses. To explain the system to employees (and to demonstrate why their income would now fluctuate with the business cycle), financial information had just begun to be posted in the lunchroom.

We interviewed the human resource vice president again in July 1999. The base wage had risen slightly, to $8.85 per hour. But the pay-for-knowledge system had raised wages significantly, in two ways. The first was a direct outcome of the program; workers could get up to $12.10 per hour for having all five star points and doing well on a subjective evaluation. About 60% of workers had earned at least one star point, and the average wage had increased to $10 per hour, well above the rate of inflation. (Note that this increase was not a foregone conclusion; if the pay-for-knowledge system existed but workers did not get certified, there would be no pay increase.)

A second source of wage increase was a bonus system based on firm performance. The bonus had ranged from $1500 to $2000 per year, 7% to 10% of average straight-time earnings. The HR manager felt that the profit increase was due in substantial part to the EI system. The evidence for this assertion was varied, but indirect: individual tasks done by operators acting as star points were cheaper (and higher quality) than when done by supervisors; turnover was down, particularly among those who had been at the plant 2–3 years; employment at the firm had continued to increase (to 515); and the

plant managers had changed from serious skepticism about the program to enthusiastic support of it.

7. Discussion and Conclusion

After qualitative results from dozens of plant visits and quantitative results from a large survey, what have we learned?

The preponderance of evidence suggests that EI raises wages for blue-collar workers. This evidence is broadly consistent with theories of human capital, efficiency wages, incentives, and rent sharing. We also found that managers usually implemented these programs in ways that were consistent with economists' notions of incentives and complementarity, because firms with more involvement tended also to have more employment security and contingent pay.

We had less success uncovering the drivers of the wage-involvement relationship. As discussed below, we found the most support for efficiency-wage notions, and no support for hypotheses based on compensating differences.

The five theories we examined posited that EI affects wages by affecting workers' levels of skill, utility, and bargaining power:

- *Skill.* We found qualitative support for human-capital hypotheses that involvement leads to higher wages because it requires higher skill. For example, in our qualitative quasi-experiment management believed that training was crucial for the successful delegation of supervisory tasks to workers. We found modest quantitative support, in that plants with more involvement have a higher percentage of high-school graduates in their workforces. However, we found no correlation between EI and training in the data.
- *Compensating differences.* In our fieldwork we found that workers did not consider some types of EI (such as participation in problem solving) to be onerous, and that introduction of the types of involvement they did find onerous (additional tasks to be done on the line in the same amount of time) were not typically associated with increased compensation. In our quantitative work, we did not find that plants that introduced additional forms of compensation (such as protection from layoffs) paid lower wages. Thus, we found almost no support for the compensating-differences idea that involvement leads to higher wages because it requires more effort or more onerous effort than production work. However, the

frequent combination of EI with supportive HR policies is predicted by theories of complementarity.

- *Bargaining power.* We found a number of ways in which EI increased workers' access to rents. Plants with more supervisors per worker had both lower wages and less employee involvement. This result is consistent both with gift-exchange versions of efficiency wages, where workers feel management trusts them more if there are fewer supervisors, and with monitoring-cost arguments, where a combination of higher wages and employee self-policing is a substitute for supervisors. In our fieldwork workers frequently reported that their participation in EI programs was a form of gift exchange with management. This finding was echoed in our regressions, in that in plants with high involvement, managers reported workforces were more loyal. However, we did not find statistical support for the hypothesis that this loyalty-mediated participation explains higher wages. We did find evidence that paying a higher wage helps managers to protect an investment in training, by reducing turnover.

In our fieldwork we found a number of workplaces that seemed to be run according to management-by-stress principles, where introduction of EI led to workers' knowledge being used against them, to speed up their work and to facilitate the startup of rival, lower-wage plants. But (perhaps not surprisingly in a survey filled out by managers) we did not find direct support for the theory in our data.

We did find indirect support, however, for the idea, common to rent-sharing and management-by-stress theories, that union participation in EI programs increases their benefits to workers. Different aspects of EI lead to wage increases in union and nonunion plants. In union plants, wages rise only if the plant has high representative involvement; the effect of direct involvement on wages was negative. In nonunion plants, workers did receive higher wages if they had direct involvement, but not enough to overcome the union-nonunion pay gap. This result supports one hypothesis of the management-by-stress view—that representative employee involvement is better for workers in the presence of unions—but not the stronger argument that workers benefit from EI only if a union is present.

While we found consistent evidence that EI leads to higher pay, we found that it does not increase the probability of plant survival. Our evidence is consistent with the possibility that typical EI plans are poorly implemented, even though best-practice plans can improve

organizational performance. A story that is consistent with our evidence would be the following:

Many firms adopted EI in the early 1990s as part of a fad, one that had low costs, but also low benefits. However, some firms adopted the programs quite intensively. These plants saw significant increases in fixed costs. These costs included expenditures of money for training, and of management time for responding to fears about what the program would mean, participating in quality-circle meetings, responding to suggestions, etc. These upfront expenditures cannot be recouped if the program is canceled. They were quite large; for example, the EI program reduced Forest City's profitability in its first two years, according to the HR vice president, who championed the program. In addition, complementary HR policies such as no-layoff policies make labor a quasifixed factor. Even if EI on average eventually improves performance enough to outweigh these costs, a liquidity-constrained firm can still go bankrupt if demand shrinks enough that the firm cannot pay its higher fixed costs.

The auto-supplier industry is characterized by such severe competitive conditions. For example, 40% of plants in the database had laid off at least 10% of their workforces in the 4 years prior to the survey, and these were all plants that had survived long enough to be surveyed. Thus, higher death rates due to higher fixed costs were quite possible, even if productivity and quality were rising. However, if a firm managed to avoid bad product-market shocks, substituting the higher fixed costs of EI for lower variable costs (due to less scrap and more efficient material and labor usage due to worker suggestions) could be quite profitable, leading the plant to expand.[13]

Our results are still preliminary. One set of problems concerns the internal validity of the quantitative results. Modest changes in specification sometimes changed results (or, more commonly, their statistical significance). For example, results often depended on whether we pooled subindices into a single index. The causal connection between adoption of new workplace practices and organizational performance is also in doubt. However, we do not find much support for the theory that desperate plants adopt EI and then still go out of business.

13. We attempted to test this hypothesis by investigating the effect of changes in the sales of the car model (e.g., Chevrolet Cavalier) most important to each of our plants. However, this variable had little effect on survival, either by itself or interacted with EI. A plausible explanation is that most supplier plants are quite diversified across car models, so that loss of sales of one model did not reduce total demand very much.

An additional set of problems concerns the external validity of the quantitative results. Most of our hypotheses received some qualitative support. Nevertheless, few of the hypotheses received much support from the quantitative data, in part due to modest sample sizes, large measurement error, and low precision of estimates. Many of our measures look at the existence of programs, rather than the thoroughness or consistency of their implementation, increasing the measurement error.[14] In future analysis, we can control for these effects more thoroughly, by separating out measures of the extent of participation in programs (such as numbers of suggestions received, and subjective assessments of program effectiveness).

In general, we have more confidence in results that are replicated using multiple methods. One thing we have learned from our plant visits is that EI programs are adopted in a dazzling variety of ways. In future work, we can link these insights more closely with the survey data, to better disentangle which types of programs have which types of effects.

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14. One situation we encountered surprisingly often was workers feeling that management had reneged on promises, and withdrawing participation from the program. One would not expect such an EI program (one with little actual involvement) to be very effective in improving firm performance enough to keep plants open. A prominent example of perceived reneging occurred at a large steel mill, where the United Steelworkers at the firm's Cleveland Works pulled out of all joint programs after management in 1995 announced participation in a nonunion joint venture to make steel in Alabama. Thousands of workers had lost their jobs at the facility over the preceding 15 years, and the union saw management's move as signaling a lack of commitment. "How can we be like family here if they're setting up a competing plant somewhere else?" asked one union official. They also felt that some of the profits being used to invest in the new plant had come from their hard work, and should be used to compensate them for sacrifices (e.g., wage cuts, layoffs, and increased work effort) in lean times. Managers did not see their behavior as reneging; they regarded the Alabama project as "another business venture," and did not see why the union should be concerned. This firm announced its bankruptcy in December, 2001. For other examples of such incidents, see MacDuffie and Helper (1997, p. 127); Helper (1998).

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