Teacher Unions and Black Students' Scores on College Entrance Exams

PAUL W. GRIMES and CHARLES A. REGISTER*

Using data from the National Assessment of Economic Education survey, this paper examines the influence of teachers' unions and students' race on college entrance examination scores. An "education production function" is estimated for a sample of white and black high school seniors. The model accounts for variations in school districts and student inputs and controls for the self-selection nature of taking an entrance exam. The results indicate that students in unionized schools score higher on the SAT than like students in nonunion schools, ceteris paribus. Black students who attend unionized schools are estimated to score 13.11 percent above the black SAT mean. These findings suggest a positive productivity effect of collective bargaining for teachers which significantly benefits minority students.

THE RELATIVE DECLINE of student scores on the Scholastic Aptitude Test (SAT) during the past two decades has received attention in both the popular and academic press. Sociological, political, and economic theories have been offered as possible explanations for the phenomenon (Flynn, 1988). In an empirical study using aggregate macro-level data, Kurth (1987, p. 351) concludes that teacher unionization is "the most significant factor" contributing to the decline in SAT performance. Kurth's model relies on the traditional monopoly view of teachers' unions, whereby union-induced productivity declines are translated into less student

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learning and, hence, lower exam scores. Kurth's results have not gone uncriticized (Nelson and Gould, 1988), however, nor are they wholly consistent with the few studies that have used micro-level data to analyze the effect of teachers' unions on student performance. In the two most recent such studies, Eberts and Stone (1984, 1987) report higher standardized test scores for students of average ability in unionized environments. The authors also find, however, that in a unionized school, test performance is lower for students either significantly below or above average. Eberts and Stone explain this finding by hypothesizing that unions tend to standardize the workplace, so that resources are reallocated from programs for the disadvantaged and gifted into the more traditional teaching areas. While results from studies such as Kurth's and Eberts and Stone's are not in perfect agreement, they imply an undesirable relationship between collective bargaining by teachers and scholastic performance by minority students.

Blacks and other racial minorities have historically scored lower on standardized achievement tests such as the SAT relative to whites (Stewart, 1987). This fact has often elicited allegations of racial bias in the tests' design (Crouse and Trusheim, 1988). Regardless of the extent of such potential bias, minority students are more likely to be *measured* as below average or disadvantaged than are white students (Miller, 1974). Thus, if teachers' unions do create a reallocation of resources away from programs targeted to students classified as below average or disadvantaged, minority students will bear a greater burden. Further, if Eberts and Stone are correct that below-average students perform less well in a unionized setting, ceteris paribus, we should expect to find a negative racial effect between teacher unionization and student achievement test scores.

This note tests for the existence of such a relationship by applying a standard educational production function regression model to samples of white and black high school students. We find a strong and positive union effect for all students. Further, our results indicate that the union effect is substantially larger for black students.

Data and Analysis

The data used here are taken from the National Assessment of Economic Education (NAEE) survey, conducted in 1987 by the Joint Council on Economic Education. The NAEE survey reports information on approximately 3,000 high school seniors enrolled in 63 school districts throughout the United States. The survey contains detailed demographic and descriptive information on the surveyed students, teachers, schools,

Conclusions

The results of our analysis of the effect of teachers' unions on student SAT scores by race run counter to those expected based on the few previous empirical studies that have investigated the relationship between teachers' unions and student achievement. When our results are viewed in the context of the union effects literature, however, possible explanations for the findings emerge.

It is widely accepted that labor unions generate positive wage premiums and tend to standardize the working environment through formal work rules and procedures. Thus, in a unionized environment a teacher will have less autonomy, in and out of the classroom, than in a nonunionized environment. Union work rules may reduce the possibility of discriminatory practices by the school staff. (If this is so, it presents an unusual case of a positive economic benefit created by union work rules.) Additionally, it may be that unionized districts mix capital and labor inputs differently than do nonunion districts and that these mixes are more suited to the learning styles of minority students. The present study calls attention to these complex relationships but does not attempt to explicate them. Larger and more detailed databases must be constructed and formal models of the education production process must be developed in order to more adequately explore the issues.

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HIGH-INVOLVEMENT WORK PRACTICES, TURNOVER, AND PRODUCTIVITY: EVIDENCE FROM NEW ZEALAND

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Study results indicate a positive association between use of high-involvement work practices and employee retention and firm productivity. A disordinal interaction was indicated: employee turnover was associated with decreased productivity when use of high-involvement work practices was high and with increased productivity when use of these practices was low.

There is a developing literature focusing on the impact of firms' industrial relations or human resource management systems on organizational performance. A number of texts have appeared in recent years promoting the advantages of using high-involvement or high-commitment human resource practices, a system of human resources practices thought to enhance employees' levels of skill, motivation, information, and empowerment. (Kochan & Osterman, 1994; Lawler, 1992; Levine, 1995; Pfeffer, 1998). Further, recent studies have found empirical links between the use of these practices and firm performance (e.g., Arthur, 1994; Huselid, 1995; Koch & McGrath, 1996; MacDuffie, 1995).

This literature is developing rapidly, but there are still significant research needs. Of relevance to this study, Shaw, Delery, Jenkins, and Gupta (1998) noted that relatively few studies within this literature have examined the determinants and consequences of turnover at the organizational level. These issues were the focus of this study. Consistent with the work of Arthur (1994) and Huselid (1995), this study examined the relationship between firms' use of high-involvement work practices and employee retention and productivity. Arthur found evidence for an interactive effect of human capital investments (through the use of a "commitment" human resource system) and employee retention (turnover) on firm productivity. In collecting data on a multi-industry sample of 164 New Zealand firms, this study offers a test of whether Arthur's (1994) results generalize beyond his small, U.S., single-industry sample. These issues were explored in New Zealand, a country that has recently made sweeping market changes in an effort to boost national competitiveness. With some exceptions (e.g., MacDuffie, 1995), the majority of research on the firm-level impact of human resource (HR) systems has been specific to the U.S. context.

HIGH-INVOLVEMENT WORK PRACTICES IN NEW ZEALAND

As the context for this study, the recent New Zealand experience is unique enough to warrant some description. Because of the singularity of this context, Erickson and Kuruvilla (1998) used recent events in New Zealand to illustrate their application of the punctuated equilibrium model of evolutionary biology to national industrial relations systems. Viewing recent times in New Zealand as analogous to a period of discontinuous and rapid biological evolution, these authors used developments in New Zealand as a prime example of rapid, fundamental, "deep structure" change in a national industrial relations system.

In some ways, New Zealand is illustrative of worldwide trends in seeking to reform its markets in order to increase competitiveness. These reforms, dubbed the "New Zealand experiment" (Kelsey, 1995), have been more radical than most, and they have been described as the most comprehensive and sweeping economic restructuring undertaken by any country participating in the Organisation for Economic Co-operation and Development (OECD) (Bray & Walsh, 1998). In 1984, following several decades of flagging economic

An earlier version of this paper was presented to the Human Resources Division of the Academy of Management. These data were collected while I was a visiting associate professor with the University of Waikato. I am very grateful for the support and guidance provided to me by the faculty and staff of the Department of Strategic Management and Leadership, at the University of Waikato, most especially by Professor Clive Gilson, department head. Thanks also to Robert O. Nyamori and Chester Spell for their able assistance with this project and to Deepak Datta for his advice and counsel. A grant from the Graduate Research Fund of the University of Kansas provided partial support for this research.

The absence of firm-level measures of capital intensity in the regression models might lead to biased results.[2] As Huselid (1995) and Huselid and Rau (1997) noted, the correlation between capital intensity and high-involvement work systems is somewhere between 0 and −1.0. This would mean that my estimate of the effect of high-involvement work practices on productivity was biased *downward*, or conservative (Maddala, 1977). However, to further address this concern, in lieu of the ability to obtain firm-level measures, I collected data on 85 publicly traded New Zealand companies from the DataStream database as a basis for creating industry-level proxies of capital intensity for each of the seven industries represented in the sample. The industry measures of capital intensity and industry dummy codes are collinear to the point that both could not be included in the same regression model. Thus, the industry codes were omitted and a series of regressions was run with the measures of industry capital intensity as an alternative industry control. In sum, the main effects for high-involvement work practices on employee retention and productivity did not change (that is, they remained significant). In addition, the interaction effect (employee retention × high-involvement work practices) also held. However, model explanatory values, as indicated by the multiple squared correlation coefficient (R^2), decreased substantially, indicating that the models with the industry dummy codes (versus the industry-level measures of capital intensity) were a much better fit to the data. Entered as a block, the industry dummy variables accounted for 20 percent of the variance in firm productivity, whereas the industry-level capital intensity measure accounted for only 3 percent of productivity variance. This pattern is most likely due to the fact that the industry codes subsume many other industry differences beyond capital intensity.

DISCUSSION AND CONCLUSION

This analysis supports arguments and previous results suggesting that firm competitiveness can be enhanced by utilizing high-involvement work practices (Arthur, 1994; Huselid, 1995; Koch & McGrath, 1996; Kochan & Osterman, 1994; Lawler, 1992; Levine, 1995; MacDuffie, 1995; Pfeffer, 1998). Based on a sample of firms competing in New Zealand, the findings in this study are particularly supportive of the generalizability of Arthur's (1994) study of the U.S. steel minimill industry. Like Arthur, I found that turnover and employment practices interact to affect firm productivity; employee retention is especially critical when investments in high-involvement work practices are relatively high. The results of Arthur (1994) and of the present study suggest that use of high-involvement work practices may have implications for the effect of turnover on firm productivity; turnover is adversely associated with productivity when the use of these practices is high and, conversely, turnover is positively associated with productivity when use of the practices is low.

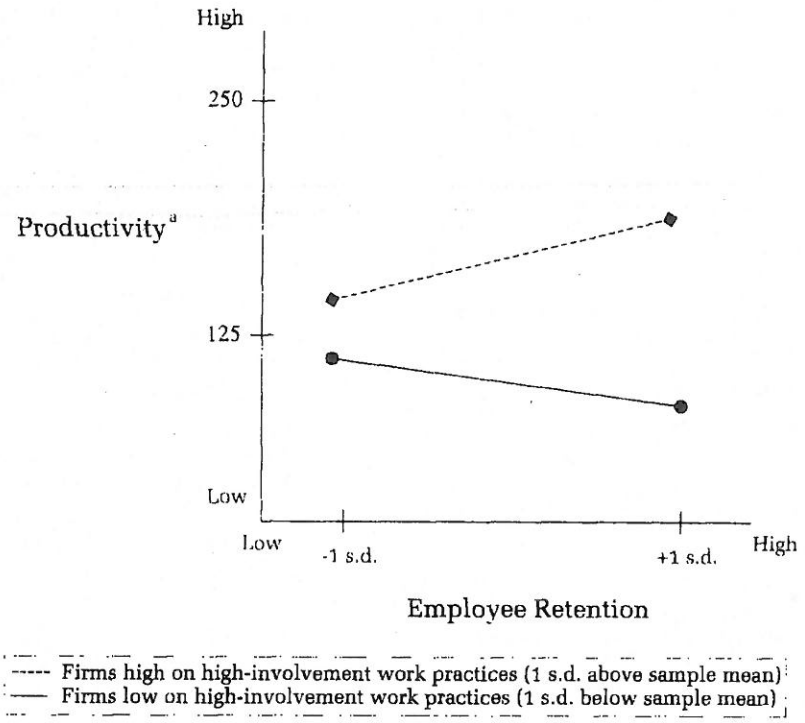
These results should be interpreted cautiously, given the limitations inherent in this study. First, self-report, cross-sectional data are susceptible to biases associated with common method variance. This bias is most problematic in examining relationships among psychological or attitudinal data collected from a single respondent at one time. The problem lies in the difficulty of determining whether observed covariance among study variables is attributable to valid relationships or to common method variance. As Podsakoff and Organ (1986) argued, data that are factual, that the respondent possesses accurate knowledge of, and that are (in principle) verifiable do not pose serious problems. The primary dependent variables (sales/employees, turnover) in this study are of this type. In addition, data collected from secondary sources on the components of the productivity index (that is, sales and number of employees) for a portion of the sample strongly agree with the survey data. Descriptions of HR practices are somewhat less factual in nature and, although ratings by individuals display reliability over time (Huselid & Becker, 1996), the possibility of measurement error and bias still exists (Gerhart, 1999). A second concern is bias introduced by nonrespondents. Again, this threat cannot be dismissed, but the time trend extrapolation test lessens this concern.

Another legitimate concern is the question of simultaneity. Data have been analyzed and discussed here as if the use of high-involvement work practices affects firm turnover rates and productivity, but this interpretation is limited by the cross-sectional nature of the data. Respondents completed surveys during late 1996 or early 1997 and were encouraged to describe employment practices

view of authors such as Lawler, who suggested that firms will most benefit from their use of high-involvement work practices with frontline employees: "The fundamental difference between the control-oriented approach and the involvement-oriented approach concerns how work is organized and managed *at the lowest level in the organization*" (1992: 28; emphasis added).

[2] This analysis was also the result of a reviewer suggestion.

FIGURE 1
Effects of High-Involvement Work Practices and Employee Retention on Firm Productivity



[a] Thousands of U.S. dollars of sales per employee.

as they existed during 1995 and 1996. In contrast, they were instructed to provide the most current levels of employment and annual sales revenues. Although this approach helps reduce the simultaneity problem, it is certainly possible that firms experiencing lower turnover and higher productivity were better positioned to invest in greater levels of high-involvement work practices. Another limitation of this study is a focus on productivity as the sole measure of organizational effectiveness. Future research examining similar issues might utilize additional measures of effectiveness, including financial accounting outcomes and, for publicly traded firms, measures of market value.

Given this study and other cumulative research evidence to date, business owners and managers may want to heed the prescriptive advice of authors, such as Lawler (1992), Levine (1995), and Pfeffer (1998), who have advocated greater use of high-involvement work practices. Within the limitations outlined above, this study supports their argument that greater use of such practices is associated with positive organizational outcomes. However, results reported here also suggest that greater use of these practices is associated with significant productivity losses in the face of mounting employee turnover. It is likely that this is partly due to greater use of high-involvement work practices by firms in which employees are considered more critical to firm success (MacDuffie, 1995). It is also probable that use of these practices increases the value and importance of human capital and hence the cost of employee departures.

As Cascio stated, "The crucial issue in analyzing turnover . . . is not how many employees leave but rather the performance and replaceability of those who leave versus those who stay" (Cascio, 1998: 623). Owners and managers should recognize that use of high-involvement work practices will likely increase their reliance upon employees' tacit or specialized knowledge, making them more distinctive and less easily replaceable. Thus, failure to retain these increasingly valuable human assets may markedly diminish the payoff associated with the use of high-involvement work practices. Firms utilizing high-involvement practices may therefore find utility in adopting additional practices or policies that further reduce employee turnover. For example, in this study and elsewhere (e.g., Huselid, 1995), above-market wages were found to be associated with increased employee retention. The high-involvement firm may find that the marginal

benefit of the reduced turnover exceeds the additional wage costs. Similarly, investing in other retention-enhancing practices should yield increasingly higher returns as firms move toward being high-involvement enterprises.

Much work remains to determine the pathways by which high-involvement work practices affect employees' attitudes, behaviors, and productivity. It is hoped that both academics and practitioners will find this study a meaningful contribution to the literature examining human resource management and firm outcomes.

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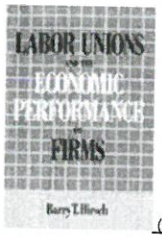

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Title

Labor Unions and the Economic Performance of Firms (http://research.upjohn.org/cgi/viewcontent.cgi?article=1091&context=up_press)

Authors

Barry T. Hirsch, *Florida State University* (http://research.upjohn.org/do/search/?q=author_lname%3A%22Hirsch%22%20author_fname%3A%22Barry%22&start=0&context=1125943)

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Abstract

Hirsch develops a model of union rent-seeking in which the unions capture a share of quasi-rents that make up the normal ROI in long-lived capital and R&D. He finds that in response, firms adjust their investments in vulnerable tangible and intangible capital. Hirsch also attempts to explain the connection between the contraction of the size of unions which occurred in the 1970s and firms' lower profitability, diminished market value, and lower investment levels.

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ILR Review

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Wages, Employer Costs, and Employee Performance in the Firm

Harry J. Holzer*

SAGE journals

Abstract

Analyzing data from a 1982 survey of firms, the author finds evidence that firms' wage levels are positively associated with the previous experience of new hires, the tenure of employees with the firm, managers' perceptions of employee productivity, and managers' perceptions of the ease of hiring qualified workers; they are negatively associated with job vacancy rates and training time. Although the magnitudes of some of these relationships are not large, in combination they suggest that high-wage firms can sometimes offset more than half of their higher wage costs through improved productivity and lower hiring and turnover costs. The effects are generally stronger for firms that have chosen high wage levels than for firms in which unions have imposed high wage levels.

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THE IMPACT OF HUMAN RESOURCE MANAGEMENT PRACTICES ON TURNOVER, PRODUCTIVITY, AND CORPORATE FINANCIAL PERFORMANCE

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This study comprehensively evaluated the links between systems of High Performance Work Practices and firm performance. Results based on a national sample of nearly one thousand firms indicate that these practices have an economically and statistically significant impact on both intermediate employee outcomes (turnover and productivity) and short- and long-term measures of corporate financial performance. Support for predictions that the impact of High Performance Work Practices on firm performance is in part contingent on their interrelationships and links with competitive strategy was limited.

The impact of human resource management (HRM) policies and practices on firm performance is an important topic in the fields of human resource management, industrial relations, and industrial and organizational psychology (Boudreau, 1991; Jones & Wright, 1992; Kleiner, 1990). An increasing body of work contains the argument that the use of *High Performance Work Practices,* including comprehensive employee recruitment and selection procedures, incentive compensation and performance management systems, and extensive employee involvement and training, can improve the knowledge, skills, and abilities of a firm's current and potential employees, increase their motivation, reduce shirking, and enhance retention of quality employees while encouraging nonperformers to leave the firm (Jones & Wright, 1992; U.S. Department of Labor, 1993).

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Arguments made in related research are that a firm's current and potential human resources are important considerations in the development and execution of its strategic business plan. This literature, although largely conceptual, concludes that human resource management practices can help to create a source of sustained competitive advantage, especially when they are aligned with a firm's competitive strategy (Begin, 1991; Butler, Ferris, & Napier, 1991; Cappelli & Singh, 1992; Jackson & Schuler, 1995; Porter, 1985; Schuler, 1992; Wright & McMahan, 1992).

In both this largely theoretical literature and the emerging conventional wisdom among human resource professionals there is a growing consensus that organizational human resource policies can, if properly configured, provide a direct and economically significant contribution to firm performance. The presumption is that more effective *systems* of HRM practices, which simultaneously exploit the potential for complementarities or synergies among such practices and help to implement a firm's competitive strategy, are sources of sustained competitive advantage. Unfortunately, very little empirical evidence supports such a belief. What empirical work does exist has largely focused on individual HRM practices to the exclusion of overall HRM systems.

This study departs from the previous human resources literature in three ways. First, the level of analysis used to estimate the firm-level impact of HRM practices is the system, and the perspective is strategic rather than functional. This approach is supported by the development and validation of an instrument that reflects the system of High Performance Work Practices adopted by each firm studied. Second, the analytical focus is comprehensive. The dependent variables include both intermediate employment outcomes and firm-level measures of financial performance, and the results are based on a national sample of firms drawn from a wide range of industries. Moreover, the analyses explicitly address two methodological problems confronting survey-based research on this topic: the potential for simultaneity, or reverse causality, between High Performance Work Practices and firm performance and survey response bias. Third, this study also provides one of the first tests of the prediction that the impact of High Performance Work Practices on firm performance is contingent on both the degree of complementarity, or internal fit, among these practices and the degree of alignment, or external fit, between a firm's system of such practices and its competitive strategy.

THEORETICAL BACKGROUND

The belief that individual employee performance has implications for firm-level outcomes has been prevalent among academics and practitioners for many years. Interest in this area has recently intensified, however, as scholars have begun to argue that, collectively, a firm's employees can also provide a unique source of competitive advantage that is difficult for its competitors to replicate. For example, Wright and McMahan (1992),

haps unsurprising given the preliminary nature of the measures of fit I developed. And given the substantial main effects associated with systems of High Performance Work Practices, one might conclude that the simple adoption of such practices is more important than any efforts to ensure these policies are internally consistent or aligned with firm competitive strategy. However, the theoretical arguments for internal and external fit remain compelling, and research based on refined theoretical and psychometric development of these constructs is clearly required before such a conclusion can be accepted with any confidence. The very large theoretical literature in the fields of human resources management based on the premise that fit makes a difference cries out for more work in this area, and the primary import of the current findings may in fact be to call attention to this important line of research.

Finally, the reader is cautioned to recognize the limitations associated with the use of cross-sectional data when an attempt to draw conclusions about causality is made. Although the use in this work of simultaneous equations, corrections for response bias, measures of current and subsequent years' profits, extensive control variables, and a large and diverse sample mitigate many of the traditional methodological concerns, longitudinal data on both High Performance Work Practices and firm performance are needed to conclusively replicate the findings presented here. But such data are extremely costly to generate and are as yet unavailable.

This caveat is not intended to obviate the central conclusions of this study, however. Although traditional economic theory would suggest that the gains associated with the adoption of High Performance Work Practices cannot survive into perpetuity (because the returns from these investments will be driven toward equilibrium as more and more firms make them), the substantial variance in the HRM practices adopted by domestic firms and the expectation that investments in such practices help to create firm-specific human capital that is difficult to imitate suggest that, at least in the near term, such returns are available for the taking.

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er than my OLS regression results, which implies that the specifications relied on here are conservative.

DISCUSSION

Prior work in both the academic and popular press has argued that the use of High Performance Work Practices will be reflected in better firm performance. This study provides broad evidence in support of these assertions. Across a wide range of industries and firm sizes, I found considerable support for the hypothesis that investments in such practices are associated with lower employee turnover and greater productivity and corporate financial performance. That my results were consistent across diverse measures of firm performance and corrections for selectivity and simultaneity biases lends considerable confidence to these conclusions.

The magnitude of the returns for investments in High Performance Work Practices is substantial. A one-standard-deviation increase in such practices is associated with a relative 7.05 percent decrease in turnover and, on a per employee basis, $27,044 more in sales and $18,641 and $3,814 more in market value and profits, respectively. These internally consistent and economically and statistically significant values suggest that firms can indeed obtain substantial financial benefits from investing in the practices studied here. In addition, these estimates imply a constant level of investment in such practices each year. If an increase requires only a one-time expense (as perhaps could be the case with recruiting or selection costs), these values will be underestimates of the impact of High Performance Work Practices on firm performance. Moreover, these calculations only include a firm's portion of the gains from increasing use of these practices. Presumably, some of the value created by adopting more effective HRM practices will accrue to employees, in the form of higher wages and benefits (Becker & Olson, 1987). Since higher levels of High Performance Work Practices lead to lower turnover, and presumably greater employment security, there appears to be considerable justification for encouraging firms to make such investments from a public policy perspective.

The impact of High Performance Work Practices on corporate financial performance is in part due to their influence on employee turnover and productivity. The identification of some of the processes through which these practices affect firm profits helps to establish the plausibility of a link with corporate financial performance. However, some of their influence on firm profits remains unaccounted for, and the source of these remaining gains is an important topic for future research.

But despite the compelling theoretical argument that better internal and external fit will increase firm performance, I found only modest evidence of such an effect for internal fit and little evidence for external fit. These findings are in fact consistent with recent attempts to model fit in the organizational strategy literature (Venkatraman, 1989), and they are per-

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The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines

By CASEY ICHNIOWSKI, KATHRYN SHAW, AND GIOVANNA PRENNUSHI*

We investigate the productivity effects of innovative employment practices using data from a sample of 36 homogeneous steel production lines owned by 17 companies. The productivity regressions demonstrate that lines using a set of innovative work practices, which include incentive pay, teams, flexible job assignments, employment security, and training, achieve substantially higher levels of productivity than do lines with the more traditional approach, which includes narrow job definitions, strict work rules, and hourly pay with close supervision. Our results are consistent with recent theoretical models which stress the importance of complementarities among work practices. (*JEL* J24, J5, L20, M11)

This study presents new empirical evidence on the productivity effects of alternative employment practices using data that we have assembled on steel finishing processes. The unique data set makes this study's estimates of productivity differentials due to employment practices particularly convincing for several reasons. First, the data set is restricted to observations on one very specific type of manufacturing production process. This narrow focus eliminates many sources of heterogeneity that confound productivity comparisons in more aggregate data and in more heterogeneous samples. Second, we develop a detailed model of this particular production process based on personal visits to each work site. We estimate the productivity model using precise measures of productivity, capital equipment, employment practices, and other line-specific determinants of productivity that we collected from each work site. Third, we obtain longitudinal data on each production line to estimate fixed-effects models that investigate changes in productivity within production lines due to changes in their employment practices. The primary limitation of the study is, of course, that it reflects work practices and performance outcomes in only one industry.

We find consistent support for the conclusion that groups or clusters of complementary human resource management (HRM) practices have large effects on productivity, while changes in individual work practices have little or no effect on productivity. In Section I we describe the unique sample and data assembled for this study. Section II identifies studies in the incentive contract literature which stress the importance of complementarities among employment practices, while Section III develops measures of the production lines' HRM practices. In Sections IV–VI we present alternative econometric specifications of the productivity model and the empirical estimates. Section VII offers a conclusion.

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tem variables also are included. These results from Table 7 demonstrate that the apparent positive effects of individual practices in models without controls for HRM systems are biased by the omission of other HRM practices with which the one included practice is correlated. New work practices (such as work teams, quality circles, job rotation, or information sharing) are often introduced together as part of a coherent system of practices; thus, the productivity effects of individual practices cannot be readily isolated.[29]

To provide further evidence about the possible complementarity of HRM practices, we test whether the interactions among HRM practices that are measured implicitly by the four HRM system dummies are significant when they are added to a regression containing dummies for all the individual practices. Specifically, we reestimate the OLS model corresponding to the Table 4, column (2b), model, but we include dummies for all individual HRM policies in addition to the HRM system dummies. An F-test rejects the hypothesis that the HRM system variables add no explanatory power to the model that already includes all individual HRM policies entered separately ($F[3,2134] = 7.62$). Similarly, when we reestimate the Table 4, column (3), fixed-effects model but include dummy variables for each of the individual HRM policies that change over time in the sample period, an F-test rejects the hypothesis that the HRM systems variables add no explanatory power to the model ($F[2,2142] = 5.40$).

The evidence shows that *systems of HRM practices determine productivity and quality, while marginal changes in individual work practices have little effect.* The preponderance of evidence in this study also is consistent with the conclusion that complementarities among innovative work practices are important. Note first that the positive correlations among innovative HRM practices show that firms are likely to select multiple innovative practices rather than single practices, suggestive of complementarities among policies. Second, the productivity regressions reenforce the view that complementarities are important, even though the collinearity among practices inherently limits our ability to distinguish between the impact of individual practices and the impact of systems of practices. HRM system variables are shown to raise productivity substantially, and the effects of these system variables exceed the effects of the full set of individual practices. Third, in extensive interviews during our plant visits, operations managers offered numerous explanations as to why practices that are introduced in isolation have little effect on performance (Ichniowski et al., 1995 pp. 36–37). Finally, as described in Section V, subsection F, growing knowledge of the effectiveness of sets of innovative work practices has led steel companies to adopt these practices in all "greenfield" sites, while high transition costs of adopting entirely new systems of work practices have slowed their introduction at "brownfield" sites.

VII. Conclusion

This paper presents new evidence on the productivity effects of employment practices. The evidence, derived from unique monthly panel data on productivity and HRM practices in a homogeneous sample of production lines, shows that innovative HRM practices raise worker productivity. Moreover, systems of innovative HRM practices have large effects on production workers' performance, while changes in individual employment practices have little or no effect. Thus, the preponderance of the evidence suggests that, in these steel finishing lines, innovative employment practices tend to be complements, as is proposed in the recent theoretical work on optimal incentive structures. That is, workers' performance is substantially better under incentive pay plans that are coupled with supporting innovative

[29] The estimated negative coefficient on union status in the OLS model without the HRM system dummies [Table 7, column (3), line 14] also reflects the more complex dynamics of how systems of HRM policies determine productivity. On average, union lines are less productive than nonunion lines in our sample. But not all union lines are less productive than the nonunion lines in the sample. The negative union coefficient in Table 7, column (3), line 14, reflects the fact that a large number of union lines have the low productivity practices of HRM Systems 3 and 4, even though the lines in the most productive HRM System 1 are unionized lines. Once the productivity models control for the effect of HRM systems in columns (1a)–(1d), the union productivity effect becomes insignificant.

work practices—such as flexible job design, employee participation in problem-solving teams, training to provide workers with multiple skills, extensive screening and communication, and employment security—than it is under more traditional work practices.

APPENDIX

TABLE A1—FULL SET OF COEFFICIENT ESTIMATES OLS AND FIXED-EFFECTS UPTIME MODELS [FOR COLUMNS (2B) AND (3) OF TABLE 4]

Variable	OLS model with detailed controls	Fixed-effects model
1a. HRM System 1	0.078***	—
	(0.007)	
1b. HRM System 2	0.041***	0.035***
	(0.005)	(0.008)
1c. HRM System 3	0.025***	0.025***
	(0.003)	(0.006)
2. Maintenance shifts per year	0.0002***	—
	(0.00004)	
3. Index of steel input quality	0.008***	0.005**
	(0.002)	(0.002)
4a. Year built	0.018***	—
	(0.003)	
4b. (Year built)^2	−0.0001***	—
	(0.00002)	
5a. Line age	0.0102***	0.011***
	(0.0011)	(0.001)
5b. (Line age)^2	−0.0002***	−0.0002***
	(0.00002)	(0.00002)
6a. Dummy for start-up period	−0.043**	−0.071***
	(0.011)	(0.017)
6b. Time trend for start-up period	0.004**	0.004**
	(0.001)	(0.002)
7a. Equipment dummy 1a	0.032***	—
	(0.004)	
7b. Equipment dummy 1b	0.019***	—
	(0.003)	
8a. Equipment dummy 2a	−0.043***	—
	(0.005)	
8b. Equipment dummy 2b	−0.017***	—
	(0.005)	
8c. Equipment dummy 2c	−0.029***	—
	(0.005)	
9. Equipment dummy 3	−0.003	—
	(0.002)	
10. Equipment dummy 4	−0.005	—
	(0.003)	
11. Equipment dummy 5	0.022***	—
	(0.003)	
12. Age of dummy 5 equipment	−0.0013***	−0.0018***
	(0.0002)	(0.0007)
13. Equipment dummy 6	−0.004	—
	(0.006)	
14. Dummy for low computerization	−0.015***	—
	(0.003)	
15a. Maximum line speed	−0.00067***	—
	(0.00005)	
15b. (Maximum line speed)^2	8.1×10^{-7}***	—
	(7×10^{-8})	

(46)

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Industrial Relations and Productivity in the U.S. Automobile Industry

IN THE LATE 1970s and 1980s intensified international competition in motor vehicle manufacturing and sales was reflected by an increase in the share of the American market captured by imports.[1] Some analysts argued that this increase reflected the low productivity of American automobile producers compared with that of Japanese and other foreign companies. Inflexible work rules or the adversarial nature of labor-management relations was often blamed.[2]

Financial support for this research was provided by the International Motor Vehicle program, Massachusetts Institute of Technology.

1. Imports rose from 15.2 percent of passenger car sales in the United States in 1970 to 28.3 percent in 1986; *Ward's Automotive Yearbook* (Detroit: Ward's Communication, 1971), p. 57; (1987), p. 194.

2. William J. Abernathy, Kim B. Clark, and Alan M. Kantrow estimated that U.S. automakers required 1.61 times the labor used by Japanese firms to produce a small car in 1981; see *Industrial Renaissance: Producing a Competitive Future for America* (Basic Books, 1983), p. 61. Using data from the level of the individual firm to estimate a multiproduct cost function and factor demand equations, Clifford Winston and others found Japanese labor 1.36 times more productive than American labor in automobile production; see *Blind Intersection? Policy and the Automobile Industry* (Brookings, 1987), p. 16. Also see Alan Altshuler and others, *The Future of the Automobile* (MIT Press, 1984). J. R. Norsworthy and Craig A. Zabala estimated that U.S. auto companies lost

The managements of the American auto companies apparently accepted the proposition that industrial relations practices on the shop floor contributed significantly to their competitive problems. In the 1980s they argued that better practices were necessary to avoid layoffs and further erosions in market share.[3] Often their arguments led to changes in industrial relations that gave managements greater discretion in allocating workers (and lessened the power of formal negotiated rules), increased the pace of work, and attempted to facilitate greater cooperation between management and the work force.[4] These new work rules and the pay concessions that often accompanied them received wide attention in the press, in part because the auto industry had been the pacesetter in collective bargaining since World War II.[5]

American management generally focused its efforts to improve shop floor practices on reducing the number of job classifications, hoping that such reductions would lead to lower costs. In a number of plants they pressed for the introduction of team systems of work organization and a lessening of the importance of seniority rights in intraplant transfers and promotions.[6]

The auto industry's efforts to improve competitiveness by changing industrial relations practices likely will continue as a result of new

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between $2 billion and $5 billion in profits in the 1970s because of poor industrial relations; see "Worker Attitudes, Worker Behavior, and Productivity in the American Automobile Industry, 1959–1976," *Industrial and Labor Relations Review*, vol. 38 (July 1985), pp. 544–57. Also see Harry C. Katz, *Shifting Gears: Changing Labor Relations in the U.S. Automobile Industry* (MIT Press, 1985); and Michael J. Piore and Charles F. Sabel, *The Second Industrial Divide: Possibilities for Prosperity* (Basic Books, 1984).

3. Katz, *Shifting Gears*, pp. 49–72.

4. Wage settlements also reflected the effects of more intense foreign competition. In national contracts after 1980 the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) negotiated wage increases with Chrysler, General Motors, and Ford that were smaller than the 3 percent annual improvement factor plus cost-of-living increases common in contracts from 1948 through 1979. These pay concessions were accompanied by the introduction of profit-sharing and job security programs.

5. For example, the automobile industry was the first major American industry to have cost-of-living adjustment escalators in a collective bargaining agreement. The industry also introduced supplementary unemployment benefits and "30 and out" retirement systems. Industrial relations in the auto industry since World War II are described in Katz, *Shifting Gears*.

6. Problems associated with the use of team systems are described in Katz, *Shifting Gears*, pp. 73–104.

companywide collective bargaining agreements negotiated in the fall of 1987 between the UAW and General Motors and Ford.[7] These agreements included guarantees providing that workers can be laid off only because of decreases in auto sales and not because of technological changes, outsourcing, negotiated improvements in productivity, or corporate reorganizations. In return the UAW agreed to the establishment of plant-level committees to examine ways for using team concepts more fully and altering work practices to improve productivity and product quality. These committees are to report back to corporate management regarding jointly accepted changes in work rules. Meanwhile, Chrysler and the UAW have negotiated a number of plant-level agreements that introduce teamwork and decrease the number of job classifications.[8]

While the companies are clearly counting on changes in industrial relations to improve their competitiveness, the economic effects of shop floor practices are not clear. Are numerous job classifications to blame for poor plant performance? Have the recent changes in work rules adopted in some plants produced significant results, and if so, which produced the greatest improvements? In particular, given the focus of management's efforts to introduce work teams, do such systems lead to improved productivity or product quality, and how significant are the improvements?

There is no systematic evidence for evaluating the effects of shop floor industrial relations practices on economic performance.[9] Research

7. These agreements are described in "Summary of Autoworkers' Settlement with Ford Motor Company as Presented to UAW Executive Council Sept. 18," *Daily Labor Report*, September 23, 1987; and "UAW, GM Pact Includes Wage Hike, Job Security Patterned After Ford," *Daily Labor Report*, October 13, 1987.

8. See John Bussey, "UAW Learns 'Innovative' Labor Pacts Can Run Into Rank-and-File Resistance," *Wall Street Journal*, September 5, 1986.

9. Research has looked at how industrial relations performance indicators such as absentee or grievance rates affect economic performance, but these studies have not measured the impact of work rules and work practices on economic performance. See, for example, Harry C. Katz, Thomas A. Kochan, and Kenneth R. Gobeille, "Industrial Relations Performance, Economic Performance and QWL Programs: An Interplant Analysis," *Industrial and Labor Relations Review*, vol. 37 (October 1983), pp. 3–17; John H. Pencavel, "Analysis of an Index of Industrial Morale," *British Journal of Industrial Relations*, vol. 12 (March 1974), pp. 48–55; and Casey Ichniowski, "The Effects of Grievance Activity on Productivity," *Industrial and Labor Relations Review*, vol. 40 (October 1986), pp. 75–89.

has so far been limited by the lack of consistent measures for the practices and the economic performance of a large sample of plants. To remedy this deficiency, we surveyed work practices in the plants of one of the major American auto companies. The survey was carried out with the cooperation of company executives and union officials, but for proprietary reasons we cannot reveal the name of the company. The survey included measures of work rules and the extent of worker participation in shop floor decisions in 1979 and 1986. We used the survey data and corporate measures of product quality and plant productivity to analyze the effects of industrial relations practices on plant economic performance.

The issue that motivated our analysis is the extent and nature of the contribution of industrial relations to the competitive position of American auto companies. To assess that issue, policymakers need to know how American productivity compares with that in foreign auto plants and in plants operating in the United States that are owned by Japanese auto companies (the so-called transplants). Comparative company and country data also are necessary to identify the extent to which differences in industrial relations practices explain productivity differences.

To address these issues, we analyzed data collected by John Krafcik on labor productivity in auto plants in a variety of countries. The data were particularly useful because they compared the productivity in union and nonunion plants in the United States and the performance of the domestically owned plants and the transplants.

Our analysis adds the effects of the industrial relations system to a standard economic production function analysis. We assumed that production is a function of industrial relations practices in the plants as well as of capital and labor. We hypothesized that industrial relations affect economic performance primarily through two channels: discretion exercised by management and the level of cooperation between management and labor.[10] We expected plant economic performance to be better the greater the degree of discretion exercised by management in the allocation and pace of work and the greater the extent of labor-management cooperation.

10. This model is described more fully in Thomas A. Kochan, Harry C. Katz, and Robert B. McKersie, *The Transformation of American Industrial Relations* (Basic Books, 1986), pp. 81–108.

Effects of Work Practices on Productivity among Firms

The foregoing discussion has analyzed the contribution of industrial relations practices to the productivity among the plants of one American auto company. The data suggested that differences in such practices contribute significantly to differences in plant productivity. The data also showed that team systems of work organization in this firm did not yield positive results. We now turn to a data set that allows us to compare the labor productivity in this firm with that in a broad sample of U.S. and foreign auto plants.

These comparative data were collected by John Krafcik as part of the International Motor Vehicle program at the Massachusetts Institute of Technology.[32] We first focus on what Krafcik's comparative data suggest regarding the extent of company and country auto productivity differentials and then discuss what these data imply for the role of industrial relations.

Krafcik calculated the labor productivity in twenty-nine assembly plants owned by a variety of companies and operating in a number of countries. He calculated the number of hours of hourly and salaried labor used to accomplish a group of designated standard activities on a product standardized by size, option content, and weld requirements. The number of workers involved in assembly operations in each plant and the number of vehicles assembled were counted and then standardized across plants by adjusting for the complexity of the product and excluding labor hours used to perform nonstandard final assembly tasks. The exclusion essentially adjusted for differences in corporate structure and the degree of vertical integration in corporate assembly and related operations. Making these adjustments was difficult and required knowledge of plant operations acquired through visits and through familiarity with the automobile assembly process.

Krafcik's calculations contrast with economists' traditional efforts to derive marginal production costs from a production function analysis.

32. See John F. Krafcik, "High Performance Manufacturing: An International Study of Auto Assembly Practice," working paper (International Motor Vehicle program, Massachusetts Institute of Technology, January 1988). We are grateful to Krafcik and James Womack for allowing access to the data. Original access to the plants in this data set was provided with the condition that specific plants and companies not be identified. Our analysis benefits from the fact that we have visited some of these plants and observed their industrial relations practices.

In his procedure there are no controls for such things as differences in the quantity or quality of the capital stock used in assembly plants or differences in product design that might influence the ease with which workers can assemble the autos (what is referred to in the industry as product manufacturability). Furthermore, his productivity measures focused on the number of labor hours used to assemble a vehicle and ignored differences in rates of pay, capital costs, and the costs of other inputs.

Krafcik derived labor productivity figures for five plants in Japan, thirteen in North America, and eleven in Europe. Of the North American plants, three were Japanese transplants and some were in Canada. Krafcik found that Japan averaged 20.3 labor hours per vehicle, North America 24.4, and Europe 33.9. The productivity differential of 20 percent between U.S. and Japanese assembly plants was on the same scale as the 36 percent differential Clifford Winston derived from his econometric estimation of automobile industry cost functions. Earlier analyses had estimated a more substantial differential.[33]

Do differences in industrial relations practices help explain why Japanese auto plants have higher productivity? Japanese practices do differ significantly from those traditional in American and European manufacturing.[34] Japanese plants use few job classifications, encourage worker participation in production decisions on the shop floor, and link pay to workers' and firms' performance. Our field observations in Japanese auto plants concluded that these practices facilitated the operation of just-in-time inventory systems and the prevailing decentralized mode of decisionmaking. The plants seemed to link informal and decentralized industrial relations and work practices to highly effective manufacturing practices.

Yet the lack of detailed data on these industrial relations practices

33. See Winston and associates, *Blind Intersection*, p. 16. Winston's estimate is lower, for example, than that found in Abernathy, Clark, and Kantrow, *Industrial Renaissance*, p. 61. Krafcik's data also revealed substantial diversity in labor productivity among companies as well as among plants within particular companies in a country. For example, two domestically owned North American assembly plants had productivity figures below the Japanese average. Labor hours in the six North American assembly plants of one company ranged from 26.1 to 35.7 hours per vehicle in Krafcik's data set.

34. See Yasuhiro Monden, *Toyota Production System: Practical Approach to Production Management* (Norcross, Ga.: Industrial Engineering and Management Press, 1983); and Michael A. Cusumano, *The Japanese Automobile Industry: Technology and Management at Nissan and Toyota* (Harvard University Press, 1985).

makes it impossible to know if or to what degree the higher Japanese productivity suggested in Krafcik's data is caused by greater managerial discretion (equivalent in our American company data set to higher scores of *Mandis*), more extensive use of team systems (equivalent to higher scores of *Teams*), greater worker and union participation in decision-making (equivalent to higher scores of *Wrkgrppar* and *Techpar*), or some other work practices. It is noteworthy, nonetheless, that team systems appear to be an integral part of the Japanese auto production system.

In the American company there was no positive advantage to using team systems, and in some cases the systems provided no increase in worker participation in shop floor decisionmaking. Is this a problem common to all U.S. auto plants? Krafcik's data set suggested that Japanese transplants may have avoided some of the problems plaguing the American auto company we analyzed. The three transplants in his data set showed significantly better labor productivity than the average American plants. And in an earlier paper he reported that as of the summer of 1986 the New United Motor Manufacturing (NUMMI) assembly plant jointly owned by General Motors and Toyota in Fremont, California, used only 8.2 percent more labor hours per vehicle than did its extremely high-performing sister plant (Takaoka) in Japan.[35]

Do industrial relations practices contribute to the superior performance of the transplants? The transplants do use manufacturing and industrial relations practices that are similar, although not identical, to Japanese practices. The NUMMI plant, for example, uses work teams and has only four job classifications (one for production workers and three for skilled trades). Unlike the two other transplants, the plant is unionized (UAW). Unionization per se, however, does not appear critical. Krafcik's data showed that NUMMI's labor productivity was nearly identical to that of one of the unorganized transplants and 18.1 percent higher than that of the other. It is difficult to draw strong conclusions with such limited data, but NUMMI's experience suggests that it is possible to operate with unionized labor and come very close to Japanese levels of productivity.[36]

35. Krafcik, "High Performance Manufacturing," p. 17; and Krafcik, "Learning from NUMMI," working paper (Massachusetts Institute of Technology, International Motor Vehicle program, September 1986).

36. Since all U.S. assembly plants of General Motors, Ford, and Chrysler are unionized, it is not possible to compare union and nonunion experiences.

Like their sister plants in Japan, the transplants do seem to have found a way to link team systems and informal industrial relations to decentralized and effective manufacturing practices.[37] Krafcik's analysis of his data lends further support to this view: he found that an index of management policy measuring the use of team systems, dedicated repair space, visual control of the production process, and the absentee rate was a strong predictor of productivity and product quality.[38] Nonetheless, for the transplants as well as the Japanese plants, we do not yet have sufficient data to assess the contribution of specific shop floor practices as we did for the American auto company we analyzed.

Summary and Policy Implications

Much of the debate and conflict in American industrial relations in recent years has focused on changes in shop floor work practices. Confronted with intensified international competition, management and labor are searching for ways to lower costs and improve quality. Management continues to press for fewer job classifications, higher work loads, and greater discretion in allocating human resources. Unions sometimes oppose these changes, in part because they remain unconvinced that the changes will lead to improved competitiveness and employment security.

Our analysis suggests that it is important to distinguish between various types of work practices. Some practices influence the pace of work and the degree of discretion exercised by management, while others affect the degree of worker and union participation in shop floor decisions. Our analysis of plant-level data from one American company indicates that where there is less relief and idle time and more managerial discretion in the allocation of overtime, layoffs, and job transfers, labor hours and the number of supervisors per production worker are significantly decreased and product quality is improved.

37. For a similar argument that effective integration of Japanese manufacturing practices with teamwork and worker participation in decisionmaking leads to the high performance of the transplants, see Haruo Shimada and John Paul MacDuffie, "Industrial Relations and Humanware: Japanese Investments in Auto Manufacturing in the United States," working paper 1855-87 (Massachusetts Institute of Technology, Sloan School of Management, December 1986).

38. Krafcik, "High Performance Manufacturing," p. 9.

Yet, greater use of team systems in this company has led to substantially higher labor hours and more supervisors. We found no evidence that plants with fewer production-worker job classifications performed better. The absence of positive results from adopting work teams and reducing production-worker job classifications was particularly striking in light of the fact that a number of auto and other companies have recently invested so much effort in shifting to these kinds of work practices.

Although the use of work teams does not per se appear to increase productivity, our data do suggest that increased worker and union participation in work group and technology-related decisions has decreased production costs and improved product quality. The statistical associations between our measures of participation and plant economic performance, however, remain weak.

It is possible, of course, that the negative effects of work teams on plant productivity in the company we analyzed resulted from problems associated with introducing the system and that teams may yet help improve productivity (they were first introduced into this company in the late 1970s). Furthermore, teams do represent a significant departure from traditional American industrial relations practices, and their successful implementation may require other changes in managerial practice and worker attitudes that take time to accomplish. Yet it is surprising that even by 1986 there was no evidence of a positive return from the use of teams.

Data collected by John Krafcik have showed that the labor productivity of Japanese plants and Japanese-owned transplants operating in the United States is high relative to that of the average American plant. Our field observations of plants in Japan and of transplants suggest that reliance on teams and the use of fewer job classifications contributed to the high performance of these plants. The Japanese auto companies benefit from team systems because the systems are linked to decentralized manufacturing practices, a linkage missing in the American auto company.

American auto companies and the UAW are counting on changes in work rules spurred by expanded employment security to improve competitiveness. If auto company managements use any new cooperative spirit on the part of the work force to introduce team work systems more rapidly, our data suggest the teams will be counterproductive

unless they promote increases in worker and union participation in shop floor decisions and unless they are linked to revised manufacturing practices. Furthermore, the data suggest that plant performance also can be improved by changes in work rules that increase the pace of work and allow greater managerial discretion in assigning work. Workers often find such increased managerial power distasteful, and it is possible that the new employment security programs at Ford and General Motors will reduce worker incentives to make such work rule changes. The new employment security programs at Ford and General Motors will prove extremely costly if auto workers come to believe that these programs insulate them from the need to improve plant productivity and to modify industrial relations. What appears necessary are integrated changes in work and manufacturing practices that increase worker participation and lower production costs.

Krafcik's data suggest that the interests of the American consumer can be promoted by encouraging the expanded operation of Japanese-owned transplants. These plants have high productivity even when, as in the case of NUMMI, they operate with a unionized work force.

In the face of the dramatic depreciation of the dollar against the yen in the past two years, the transplants likely will become important competitors with American auto companies. Such a challenge will make it even more important to understand which industrial relations practices contribute to the high productivity of Japanese transplants and how much they contribute. We also need to understand why the American auto company we analyzed received so little benefit from its expansion of team systems and reductions in job classifications. The need for more research is obvious.

Appendix A: Statistical Properties of Principal Components Analysis

Principal components analysis reduces the dimensionality of a data set of a large number of interrelated variables through the construction of linear combinations of the original variables that account for the maximum amount of total variation.[39] This reduction is accomplished

39. Principal components analysis is described in Harold Hotelling, "Analysis of a Complex of Variables into Principal Components," *Journal of Educational Psychology*, vol. 24 (September 1933), pp. 417–41; vol. 24 (October 1933), pp. 498–520; and I. T. Jollife, *Principal Component Analysis* (Springer-Verlag, 1986).

Union Effects on Productivity, Personnel Practices, and Survival in the Automotive Parts Industry

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We estimate the effects of unions on productivity and compensation in the automotive engine and non-ornamental body parts manufacturing industry using data obtained from a detailed questionnaire and a series of personal interviews. We find no significant union productivity effect but a significant 30 percent compensation premium in firms organized by the United Auto Workers. Individual personnel policies were shown to differ significantly in the expected manner between the union and nonunion sectors. Finally, we use data on bankrupt firms to show how the failure to correct for sample selection bias might yield upwardly biased estimates of the union productivity effect.

I. *Introduction*

The debate over the effects of unions on productivity has recently intensified. Researchers studying union productivity effects have found that unions increase productivity in the cement, construction, office building, and wooden household furniture industries and in manufacturing industries as a whole. In contrast, researchers studying underground coal mining and individual businesses have found negative productivity effects as have others examining the effects of unions on aggregate labor productivity and productivity growth.

After a brief critical review of the theoretical and empirical effects of unions on productivity, we estimate the effects of unions on productivity and compensation in the automotive engine and non-ornamental body parts manufacturing industry using data obtained from a detailed questionnaire and a series of personal interviews. We then compare the incidence of various personnel policies among union and nonunion firms and across different unions and estimate their effects on productivity. Finally, we adjust our estimation procedure for one type of sample selection bias that may exist in all previous studies and suggest reasons why at least part of the previously observed union productivity effect may be illusory.

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found are due to differences in the market for schoolteachers across states, since state and local education officials relax licensing constraints in response to the condition of the market.

11.3 Conclusions

Our cross-state analysis suggests that greater teacher unionism is associated with better performance of students across states, consistent with the analysis of individual students by Eberts and Stone. The relatively strong relation between unionism and student performance found in the longitudinal analysis, compared to the negligible relation between unionism and wages there, is our strongest piece of evidence that teacher unionization is in fact a positive factor in education. Our inability to show empirically how unionization improved outcomes, and the sensitivity of the cross-section results to the measure of outcomes and unionization represent the major weaknesses in our findings. At a minimum, however, our study rejects any claim that unionization contributed to the decline in student achievement scores during the 1970s and early 1980s. With respect to licensing, given the modest statutes in existence during the period, it is perhaps not surprising that we obtained ambiguous effects in the statistical analysis. Recent strengthening of licensing laws and pressures to increase entry requirements for schoolteachers may result in greater and more consistent effects of licensure in the future.

Finally, while our analysis provides some evidence of the relation between unionization and education, there are several important questions that we did not address. First, from the perspective of economics, what was the effect of teacher unionization on the earnings of graduates as opposed to on their test scores? Second, how do licensing and unionization affect students who do not take college entrance exams or are on the verge of dropping out? Third, would we obtain similar longitudinal results with more disaggregate school district data over time to those reported for states? More evidence on these issues would enhance our knowledge of the role of unions in education.

Notes

1. These variables are obtained as follows: percent population graduated high school, percent students in private school, per capita income, student/teacher ratio, percent minority students. All are from the U.S. Bureau of the Census *Statistical Abstract*, various editions. Mean experience of teachers (age − education − 5 years) is tabulated from annual Current Population