

## IMPROVING LABOR PRODUCTIVITY: HUMAN RESOURCE MANAGEMENT POLICIES DO MATTER

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*Despite the consistency with which the theoretical and normative connections between human resource management practices and firm-level performance outcomes are made, empirical studies that link the two are sparse. This paper presents results from a study of 319 business units that addresses this gap. Hypotheses are derived from a resource-based perspective on strategy. Positive and significant effects on labor productivity are found for organizations that utilize more sophisticated human resource planning, recruitment, and selection strategies. These effects are particularly pronounced in the case of capital-intensive organizations.*

### INTRODUCTION

The way in which a firm manages its human resources is increasingly recognized as centrally important to execution of its strategy (Hambrick *et al.*, 1989). Despite the consistency with which the theoretical and normative connection is made between human resource management and firm-level performance outcomes, empirical studies that link the two are sparse. Recent empirical studies tend to pursue what Snell (1992) terms a 'behavioral' perspective. In this perspective, firms elect to follow strategies that require employees to behave in certain ways. The central questions are thus which practices will elicit behavior consonant with the firm's chosen strategy, on the one hand, and how certain types of rewards come to be used, on the other. The emphasis in this body of work is upon compensation, incentive,

reward and control systems (see, for example, Finkelstein and Hambrick, 1989; Fisher and Govindarajan, 1992; Galbraith and Merrill, 1991; Gomez-Mejia, 1992).

While few would dispute that rewards are powerful mechanisms to elicit desired behavior, they represent only a part of a firm's total human resource management strategy. Indeed, extant theory suggests at least three other 'generic' human resource functions that deserve attention. These are appraisal, selection and development (Tichy, Fombrun, and Devanna, 1982; Devanna and Tichy, 1992). In this paper, we take a closer look at aspects of these functions, arguing that mechanisms routinely used for discerning the number and types of employees needed, their hiring, and development fundamentally influence their productivity. Our discussion is grounded in the resource-based perspective on competition, which argues that a highly productive workforce is likely to have attributes that make it a particularly valuable strategic asset. Superior workforce productivity can be difficult to imitate; can-

Key words: strategic human resource management; labor productivity; personnel; strategy; human resource

not be replicated quickly; may draw upon idiosyncratic routines and know-how; may be uniquely valuable in a given firm setting, and may add unique value to new strategic input factors (see Barney, 1991; Dierickx and Cool, 1989; Petaraf, 1993). For these reasons, we suggest that a central objective of the human resource management function of a firm is to enhance the firm's competitive position by creating superior 'human capital' resources, in parallel with the product/market strategy the firm pursues at any given time. Our argument thus focuses on human capital strategy, rather than on incentives and compensation.

We begin by drawing a connection between the resource-based perspective on strategy and human resource management. In our view, the resource-based view offers a useful basis for understanding why human resource management makes a potential contribution to performance at the level of the firm. This is followed by a conceptual framework in which it is suggested that investments in certain human resource activities, specifically with respect to human resource planning, hiring and employee development, have a positive effect upon performance, in the form of labor productivity. We then present the methods that we used to test these ideas on a sample of 319 business units. Our results indicate significant positive relationships for human resource policy variables in the framework, even when the powerful effects of industry, capital intensity, unionization and technology are controlled for. We conclude with a discussion of our findings.

## **WHEN DO INVESTMENTS IN HUMAN RESOURCES PAY OFF?**

### **The resource-based view of competitive advantage: An overview**

The strategic management literature has begun to place increased emphasis on idiosyncratic firm resources as predictors of performance. Three kinds of resources, in particular, are often distinguished: physical resources, such as assets and technologies; organizational resources, such as reporting structures and cultures; and human resources, representing the know-how and skills of individuals working in the organization (Hitt and Ireland, 1986; Barney, 1991). Our focus here

is upon the last of the three. Of particular interest are firms' processes for creating and sustaining this 'strategic asset' through human resource policies (Amit and Schoemaker, 1993).

Strategies drawing upon such processes, theory suggests, result from two interacting dynamics. The first is fundamental heterogeneity in the productive potential of organizations. As was initially pointed out by Penrose (1959), firms are heterogeneous with respect to the outputs they create, even when the inputs they utilize are substantially similar. In other words, firms will differ in the ways they utilize and combine factor inputs, thus yielding outputs whose 'services' cannot be predicted *ex ante*, even with a comprehensive understanding of the input resources utilized in their production (see also Barney, 1986). This idiosyncrasy yields superior performance for those firms that are able to create more efficient or attractive outputs as a result of the way in which they use their resources. Hence, firms with superior human resource utilization are likely to experience superior performance.

Given this conclusion, why would competitors not simply imitate those combinations that created advantage once their superiority has been demonstrated? To explain why rapid imitation is often inhibited, resource-based theory draws upon a second dynamic, or set of concepts: routines and path dependence (Nelson and Winter, 1982; Teece, Pisano, and Shuen, 1991).

Routines are usually understood to represent repetitive patterns of behavior within an organization. Processes such as combining and allocating resources in a firm to create some set of outputs rapidly become routinized. Routines become 'the most important form of storage of the organization's specific operational knowledge' (Nelson and Winter, 1982: 99). Certain qualities of routines, such as tacitness and complexity, lead to causal ambiguity, that makes imitation by competitors difficult (Reed and DeFillippi, 1990). Difficulty of imitation is exacerbated to the extent that even those carrying out routines may not consciously be aware of them. Substantial evidence suggests that people carry out repetitive tasks by relying on procedural, rather than on conscious, memory, meaning that they are not aware of nor could they articulate the nature of routines, even if they are intensely involved in carrying them out (Cohen and Bacdayan, 1991). These characteristics of routines create immobility

indicates a positive and weak relationship between wages and human resource practices ( $r = 0.24$ ). The addition of wage data to this study would have provided another test of this relationship; however, the data were not available.

Finally, there are obviously many other factors beyond human resource policies and practices that influence measures of organizational performance, including labor productivity. Likewise, there possibly exists a complex set of interactive relationships between human resource practices and other resources of the firm, such as its technologies, that are beyond the scope of this paper and remain for future research. Our purpose here is not to debate the fundamental importance of these factors and relationships. Rather, we hope to suggest that while there may be relatively little that managers can do about many of these conditions, it is relatively straightforward to consciously manage the organization's human resource management processes. For this reason, understanding the relationship between even small performance effects and human resource management practices becomes interesting.

## CONCLUSION

At the core of strategy lies the managerial question, 'what shall we do to improve performance?' Our research suggests that the way in which an organization's human resources are managed has a perceptible and significant relationship to the productivity of its employees. We argue that this set of findings supports the resource-based view of strategy, in which the competitiveness of firms is believed to be related, at least in part, to investments in firm-specific assets. Investments explored here include the planning for, recruitment, selection and development of firm-specific human capital assets.

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## REFERENCES

- Amit, R. and P. Schoemaker (1993). 'Strategic assets and organizational rent', *Strategic Management Journal*, 14(1), pp. 33-46.
- Barney, J. B. (1986). 'Strategic factor markets: Expectations, luck, and business strategy', *Management Science*, 32, pp. 1231-1241.
- Barney, J. B. (1991). 'Firm resources and sustained competitive advantage', *Journal of Management*, 17, pp. 99-120.
- Bartel, A. and F. R. Lichtenberg (1987). 'The skill distribution and competitive trade advantage of high-technology industries'. In D. Lewin, D. Lipsky and D. Sockell (eds.), *Advances in Industrial and Labor Relations*, Vol. 4. JAI Press, Greenwich, CT, pp. 161-176.
- Becker, G. S. (1964). *Human Capital*. National Bureau of Economic Research, New York.
- Berk, R.A. (1983). 'An introduction to sample selection bias in sociological data', *American Sociological Review*, 48, pp. 386-398.
- Bishop, J., J. Barron and K. Hollenbeck (1983). 'Recruiting workers: How recruitment policies affect the flow of applicants and the quality of new workers', project report, National Center for Research in Vocational Education, Ohio State University, Columbus, OH.
- Brodgen, H. E. (1949). 'When testing pays off', *Personnel Psychology*, 2, pp. 171-183.
- Bureau of National Affairs (May 1988). 'Recruiting and selection procedures', *Personnel Policies Forum Survey*, Bureau of National Affairs, Washington, DC, p. 146.
- Cappelli, P. and W. F. Cascio (1991). 'Why some jobs command wage premiums: A test of career tournament and internal labor market hypotheses', *Academy of Management Journal*, 34, pp. 848-868.
- Cohen, M. D. and P. Bacdayan (1991). 'Organizational routines are stored as procedural memory: Evidence from a laboratory study', mimeo, University of Michigan.
- Craft, J. (1980). 'A critical perspective on human-resource planning', *Human Resource Planning*, 3, pp. 197-211.
- Delaney, J. T., D. Lewin and C. Ichniowski (1989). 'Human resource policies and practices in American firms', report submitted to the Bureau of Labor-Management Relations and cooperative programs, United States Department of Labor.
- Devanna, M. A. and N. Tichy (1992). 'Creating the competitive organization of the 21st century: The boundaryless organization', *Human Resource Management*, 29, pp. 455-471.
- Dierckx, I. and K. Cool (1989). 'Asset stock accumulation and sustainability of competitive advantage', *Management Science*, 35, pp. 1504-1513.



# Teachers' Unions and Excellence in Education: An Analysis of the Decline in SAT Scores

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*Controversy surrounds the recent finding that college entrance exams are lower today than they were twenty years ago, but little empirical evidence has been offered in the debate. This paper uses cross-sectional regression analysis to examine the decline in SAT scores between 1972 and 1983. Three explanations are tested: the changing social environment, the financial resources devoted to education, and the emergence of militant teacher unions. The results show teacher unionism to be the most significant factor in the decline in scores.*

## I. Introduction

In 1983, the National Commission on Excellence in Education (NCEE) warned that "for the first time in the history of our country, the educational skills of one generation will not surpass, will not even approach, those of their parents" (NCEE, 1983). Most colleges and universities require applicants to take either the American College Test (ACT), administered by the American College Testing Program, or the Scholastic Aptitude Test (SAT), administered by the College Entrance Examination Board. Both testing services, which standardize their tests so that scores in different years are comparable, report similar score declines from the mid-1960s through 1984. Although scores have risen slightly during the past two years, the increase is not nearly enough to offset the two-decade decline.

The cause of the lower test scores has been the subject of widespread debate. Much of the decline during the 1960s can be traced to the increased number of students taking college entrance exams, especially students from traditionally low-scoring groups: women, ethnic minorities, and low-income families. During the 1970s, however, fewer students took the test and the composition of the test-takers remained relatively stable, yet test scores continued to fall. This pervasive decline could come from only six sources: the test design, the innate ability of students, the characteristics of those taking the tests, the social environment, the noninstructional resources devoted to education, or the quality of instruction.

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# Bonuses, Unions, and Labor Productivity in South Korea

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*Using a set of time-series (1972-1989) and cross-sectional data on eight two-digit Korean manufacturing industries, we examine the variability of South Korea's employee bonus system and the effect of the employee bonus on productivity. A test of the variability of the bonus showed that the bonus rate (ratio of the bonus to the wage) was positively influenced by industrial output, so the bonus is not merely a disguised wage. An augmented Cobb-Douglas production function estimation shows that the bonus has a positive and significant productivity effect. Capital-intensive and labor-intensive industries did not have significantly different productivity effects due to the bonus. Lastly, Korean unions reduced labor productivity and negatively affected the productivity effect of the bonus. Also, compared with the previous period, the productivity effect of the bonus has become negative since the 1987 Great Labor Offensive.*

## I. Introduction

Only recently have organizations focused on labor inputs as a source of efficiency gains. Traditionally, firms sought efficiency gains from the scale economies of capital and raw materials or relied on R&D for their competitive advantages. Since labor is about 60 per cent of the total operating costs, more efficient use of human resources could significantly improve productivity (Blinder, 1990, p. 1). As economic activity became more globalized and international competition intensified, many firms adopted some form of performance-based compensation system, such as gainsharing and profitsharing (Bullock and Lawler, 1984; General Accounting Office, 1981; Milkovich and Newman, 1993; Weitzman and Kruse, 1990). In the U.S., there is strong and growing interest in profitsharing. About 15 percent of the *Fortune* 1,000 firms have profit-sharing programs for all employees, and an additional 60 percent have programs for some employees (Lawler, 1990, p. 123). Another study reported that about 80,000 U.S. firms operate profit-sharing schemes for nonmanagerial employees (Conte and Svejnar, 1988). However, most U.S. firms are interested primarily in deferred, rather than cash-based, profit-sharing plans.<sup>1</sup>

Despite increased interest in variable compensation systems and their effects on firm performance, rigorous empirical research on American practices has been limited

by data availability. Most econometric studies reporting the positive performance effect of share compensation have relied on European data (Weitzman and Kruse, 1990) with some exceptions that include the study of profit sharing by Conte et al. (1990) and Kruse (1992, 1993) and the study of Improshare by Kaufman (1992).

During the period 1950–1989, South Korea realized the second highest annual growth in productivity of 5.7 percent — only Japan's 6.0 percent was higher (Bureau of Labor Statistics, 1990). Even though Korean firms do not formally recognize profit sharing (Florkowski, 1991), on the average their compensation systems have been lauded for contributing to a superior profit or gain-sharing variant of capitalism which facilitates a more equitable distribution of income (Weitzman, 1985). Despite a long history and widespread practice, the South Korean bonus scheme is not well-known and its performance effects have not been measured. Using data from eight Korean manufacturing industries over an 18-year period, we estimate the impact of the bonus on labor productivity and examine the mediating effects of capital-intensive vs. labor-intensive technologies on the bonus-productivity relationship. Also, we examine how labor unions influence the productivity effect of the bonus in South Korea.

## II. *Theoretical Approaches to the Effects of Share Compensation*

The behavioral assumption underlying share compensation based on some measure of organizational performance, such as profit, output, or revenue is that employees perform at a higher level when pay is contingent on outcomes. Several psychological theories of motivation have direct implications for linking pay to performance. The expectancy theory (Vroom, 1964) predicts that as long as pay satisfies recognized needs, such as physiological security and esteem (Lawler and Porter, 1969), an individual's motivational forces will increase as the instrumentality (perception of the link between performance behavior and reward) increases, *ceteris paribus*. Reinforcement theory (Skinner, 1969) also predicts that a desired behavior (high performance) will repeat itself when it is reinforced (rewarded). According to these theories, both the instrumentality and the reinforcement are strengthened if more resources as the performance-determined portion of pay is increased.

While no formal psychological theories have been developed to explain the performance effects of group-based share compensation, such as gain sharing or profit sharing, it has been argued that gain-sharing programs succeed because they change the culture of the firm, i.e., employees develop a broader perspective about the organization's objectives and greater commitment to achieving them (Bullock and Lawler, 1984). Some empirical studies found that profit sharing increased morale, loyalty, and feelings of partnership throughout the firm, decreased turnover, and enhanced organizational commitment (Cardinal and Helburn, 1986; O'Dell and McAdams, 1987; Florkowski and Schuster, 1992).

Some economists have been skeptical about the performance effect of group-based contingent compensation (Alchian and Demsetz, 1972; Jensen and Meckling, 1976, 1979). Based on an individualistic model of worker behavior, Alchian and

Model 5, where the interaction term *BONUNION* (*BONUSRATE*  $\times$  *UNIONDEN*) is included, the total productivity effect of the bonus is reduced to 1.113 (3.860 – .120  $\times$  22.89), but it is still positive and statistically significant. To examine the independent union effect on productivity, we use union density in Model 4 to show that increasing union density reduced labor productivity. In Model 5 the coefficient for *UNIONDEN* itself is positive and significant, but, with the interaction term *BONUNION* included, there is a negative and significant productivity effect of unions of –.005 (.011 – .120  $\times$  .130). In other words, increasing union density that reflects contentious labor relations reduces the magnitude of the positive bonus impact on productivity. In contrast to the studies of the U.S., Japan, and the U.K., the empirical results of Model 5 do not support the conventional notion of a positive union productivity effect (Blanchflower and Freeman, 1992). In Korea the adversarial labor relations reflected in the increase in the union density actually hampers productivity.

As discussed previously, the 1987 *Great Labor Offensive* led to dramatic upsurge in union formation, strikes, and collective bargaining. Did the dramatic upsurge in the unionism since 1987 affect the productivity impact of the bonus compared with the pre-1987 period? Model 6 and Model 7 address this question. The negative and significant coefficient of *SINCE87* (= 1 for the years 1987, 1988, and 1989) in Model 6 shows that, in those years, labor productivity decreased relative to the previous period. However, when the interaction term *BON87* (*BONUSRATE*  $\times$  *SINCE87*) is included in Model 7, *SINCE87* loses statistical significance while the interaction term shows a strongly negative, significant effect. The total productivity effect of the bonus changed from positive to negative: from 1.686 to –.014 (i.e., 1.686 – 1.700). In other words, between 1987 and at least 1989, the Korean bonus system lost its traditional productivity-enhancing role. This confirms the Levine and Tyson (1990) argument that share compensation contributes to higher productivity only when it is coupled with employee participation programs — under the worsening state of labor relations since 1987 the Korean bonus system did not enhance productivity.

### VIII. Conclusion and Future Research

Contrary to the common observations by Korean scholars and practitioners, we found that the bonus in Korea was relatively more responsive to industrial output than the wage and, thus, rejected the notion that Korean bonuses are disguised wages. We also found that Korean bonuses positively affect labor productivity. However, we did not find any significant differences in the productivity impacts of the bonuses between the labor-intensive and capital-intensive manufacturing sectors.

Unions may either enhance or reduce productivity, and we hypothesized that South Korea's antagonistic labor relations have reduced the productivity effect of the bonus system. We showed that: (1) increasing union density negatively contributed to labor productivity; (2) the positive productivity effect of bonus was reduced as union density increased; and (3) with the upsurge of labor disputes since the 1987 *Great Labor Offensive*, the productivity effect of the bonus changed from positive to negative.

Although there is empirical evidence of the positive productivity effect of the Korean bonus system, the state of labor relations rather than unionism and collective bargaining per se determines productivity (Blanchflower and Freeman, 1992), and the productivity effect of share compensation schemes may not be realized without employee participation programs (Levine and Tyson, 1990). To maintain and improve a competitive edge in intensifying international competition, the Korean government, business, and labor need to build cooperative labor-management relations that promote employee participation. The resulting labor-management partnership should enable the parties to develop a more effective share compensation system that contributes to productivity and competitiveness, thus, to a high wage, high value-added economy.

Our work has limitations. First, to better understand the mechanism of productivity effect of bonus, firm-level longitudinal data are preferable to our industry-level aggregate data. Also, we measured the state of labor relations with the union density in manufacturing sector as a whole. Two-digit industry-by-industry strike data may better reveal the true state of labor relations in Korea. Second, the data for this study ends in 1989, and since late 1989, the Korean government has reverted to a repressive, interventionist labor policy. Now, although the number of strikes has been reduced to the pre-1987 level, the state of labor relations has not necessarily improved. What effect has this policy change had on the productivity of the bonus? More recent data collection would be required to answer this question.

#### NOTES

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<sup>1</sup>For example, Coates (1991) disclosed that only one percent of U.S. full-time employees were participating in cash-based profit-sharing plans in 1989, 13 percent in deferred plans, and two percent in combination plans.

<sup>2</sup>The total number of firms in Table 1 for 1988 and 1989 do not match because different numbers of firms responded to the two different questions in the survey.

<sup>3</sup>This survey covers all establishments engaged in mining, manufacturing, electricity, gas, water, construction, wholesale and retail trade, restaurants and hotels, transport and storage, communication, finance and insurance, real estate and business services, and community, social, and personal services which employ 10 or more regular employees. Among those, about 3,300 establishments are extracted for the survey by a stratified one-stage sampling method by industry and establishment size.

<sup>4</sup>Regular pay includes not only base pay but also several types of allowances for job, tenure, geographical location, merit, occupational hazard, family, yearly and monthly time-off not taken, vacation, transportation, inflation, etc. Overtime pay includes pay for overtime work in working days, night work, and holidays. The in-kind payment includes cash value of the provision such as meals, fuel, and other necessities.

<sup>5</sup>The manufacturing sector union membership was compiled from *Korea's Labor Unions* (Korea Institute of Labor, p. 37) and *Quarterly Labor Review* (Korea Labor Institute, 1991, Vol. 4-3, pp. 164-65). The

# The Effect of Unionization On Labor Productivity: Some Additional Evidence\*

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*Following Brown and Medoff (1978), a number of studies have investigated the effect of unionization on labor productivity using a log-linear, Cobb-Douglas model of technology. To derive this model, a first-order Taylor-series approximation to the intrinsically nonlinear unionization variable is made; the resulting linear equation is estimated with generalized least-squares (GLS) techniques. We demonstrate that this approximation introduces a bias that necessarily results in an overstatement of the absolute value of the exact union productivity effect. We illustrate the magnitude of this bias by comparing GLS estimates of the linear Brown-Medoff model with GLS estimates of the exact, nonlinear relationship, using aggregate time-series data from the private domestic sector of the U.S. economy.*

## I. Introduction

Several years ago, in a very influential but controversial paper, Brown and Medoff (1978) presented cross-sectional evidence in support of Freeman's (1976) hypothesis that unions increase output per worker by negotiating a system of industrial jurisprudence and a set of collective work-place characteristics that conform more closely to workers' preferences than would be possible under decentralized bargaining. Specifically, using a Cobb-Douglas specification of technology and state-by-industry data, Brown and Medoff estimated a statistically significant and positive union productivity effect of approximately 22 percent, holding constant labor quality, the capital-labor ratio, and industry of employment. Subsequent studies have used the Brown-Medoff production function framework to estimate the effect of unions on productivity in specific indus-

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tries and for the economy as a whole.<sup>1</sup> The results of these investigations have been mixed, with findings ranging from significantly positive effects of unionization on productivity to significantly negative effects.

To derive a linear estimating equation within the Brown-Medoff framework, an intrinsically nonlinear explanatory variable — which represents union and nonunion labor of (potentially) differing productivities — is transformed by a first-order Taylor-series approximation. The use of this approximation, however, introduces a specification bias that necessarily results in an overstatement of the *absolute value* of the true union productivity effect, when that true effect is non-zero. Under the last assumption, therefore, there exists a downward bias due to the approximation error in the negative union effect Warren (1985) estimated and an upward bias in the positive estimated effect reported by Brown and Medoff. The ability to quantify the upward bias inherent in those studies that use the Brown-Medoff approach and that report positive union productivity effects may also lead to a reconciliation of those estimates with the seemingly contradictory evidence discussed by Wessels (1985) that union wage increases do not substantially reduce employment.

This paper provides an analytical expression for the approximation bias and illustrates this bias empirically by comparing generalized least-squares (GLS) estimates of the union productivity differential obtained by estimating the Brown-Medoff equation with GLS estimates of the exact, nonlinear relationship. To accomplish the second task, we use the aggregate time-series data which Warren employed to examine the effect of union membership on output per worker in the private domestic sector of the U.S. economy. To preview our results, we find empirical confirmation of the theoretical bias: the effect Warren estimated with the linear approximation overstates by about 15 percent the effect derived from the exact, nonlinear equation.

## II. *The Model*

Following Brown and Medoff (1978) and Warren (1985) we represent technology by the parametric production function:

$$Q = \phi(K, L_n, L_u) = AK^\alpha(L_n + cL_u)^{1-\alpha}, \quad (1)$$

where  $Q$  is output,  $K$  is capital,  $L_n$  is nonunion labor,  $L_u$  is union labor,  $A > 0$  is a technical efficiency parameter,  $0 < \alpha < 1$  is the elasticity of output with respect to capital, and  $c \gtrless 1$  is a parameter that reflects the productivity differential between  $L_n$  and  $L_u$ . If  $c > 1$ , then union labor is more productive than nonunion labor, other things equal, as hypothesized by the "new institutionalist" view of

<sup>1</sup>Allen (1984, 1985) and Ehrenberg, Sherman, and Schwartz (1983) used establishment data to examine the effect of unionization on productivity among construction firms and libraries, respectively. Warren (1985) investigated the relationship between union membership and output per worker in the private, domestic sector of the U.S. economy.

technical efficiency is a maintained hypothesis. This feature rules out an inquiry into the issue of the effect of unionization on management's use of best-practice technology. An alternative framework that is capable of addressing the question of technical inefficiency (as well as other issues, such as allocative, scale, and congestion inefficiencies) is the nonparametric production frontier approach. Byrnes, Färe, Grosskopf, and Lovell (1985) have applied this framework to analyze the relative efficiency of union and nonunion establishments in the U.S. surface coal-mining industry. Because their approach is nonparametric, it also avoids both the approximation bias and potential specification errors that attend the Brown-Medoff framework. Although these and other generalizations promise to shed additional light on the union-productivity controversy, they are beyond the scope of the present paper.

productivity effects. Use of this approximation necessarily results in an overstatement of the absolute value of the unionization effect on labor productivity, when the null hypothesis of no effect is false. In this case, the 13.7 percent union productivity reduction obtained from the nonlinear model is overstated by 15 percent in the linear model.

These results may help resolve the puzzle posed by Wessels concerning the apparent contradiction between studies that report significantly positive union effects on labor productivity and those that fail to show substantial disemployment effects. If, as we claim, the productivity estimates reported by Brown and Medoff are biased upward, then the true productivity effect may be small or even zero. As a consequence, there need not be a contradiction between small disemployment effects of union-negotiated wage increases and upwardly biased positive productivity effects based on the Brown-Medoff approach.

#### IV. *Concluding Remarks*

Several studies have used a Cobb-Douglas production model to investigate the effect of unionization on labor productivity. To derive a linear estimating equation associated with this model, a first-order Taylor-series approximation is applied to the intrinsically nonlinear explanatory variable representing union membership. This approximation introduces an upward bias in the measured union productivity effect, regardless of the direction of that effect.

To illustrate this theoretical bias empirically and to quantify its magnitude, we compared GLS estimates of the effect of unionization on aggregate labor productivity derived from the linear approximation equation with NGLS estimates of the effect obtained from the exact, nonlinear relationship. The results of this comparison confirm this theoretical proposition; estimates obtained by Warren, using aggregate time-series data for the U.S. economy and the linear approximation, overestimate the union effect derived from the nonlinear model by about 15 percent.

This paper has focused on the nature and the extent of the bias in measuring union effects on productivity introduced by following the Brown-Medoff procedure of linearly approximating a nonlinear unionization variable. There are several other restrictive features of the Brown-Medoff approach, however, that would seem to merit attention and possible generalization. First, the Cobb-Douglas specification of technology restricts the elasticity of substitution among pairs of inputs to unity and, therefore, prejudgets the ease or difficulty with which firms can respond to union-negotiated changes in relative input prices. Second, use of a production function of any form focuses attention on the effect of unionization on productivity alone and thus precludes an investigation of the effects of unionization on costs and profits. Allen (1987) has relaxed both of these restrictive features, using translog cost and profit function systems to examine union impacts on construction projects. Third, in the parametric production function approach,

## The Productivity Effects of Unionization and Firm Size in British Engineering Firms

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This paper considers the relationship between union presence and labour productivity in a sample of British engineering firms. Rather than use a single indicator of union presence to determine union effects, several indicators of union presence are combined to form an index of union presence. Average union non-union effects on labour productivity estimated using this measure, or using a dummy variable indicating the presence of closed-shop arrangements, are found to be statistically insignificant. However, there is some variation around this average, and the union impact on value added per employee is found to depend significantly on firm size, the estimated effects being more negative in larger firms.

### INTRODUCTION

That trade unions have the potential to influence a number of economic variables is well established.<sup>1</sup> One such economic variable is the productivity of the workforce, namely the amount of output produced per unit of labour input, and the link between unionism and productivity has generated interest among industrial relations specialists and labour economists for some time.<sup>2</sup> Furthermore, the recent introduction of government legislation aimed specifically at union activity, coupled with rising productivity in Britain in the 1980s, has made study of this link a very topical issue.<sup>3</sup>

This study uses data on British engineering firms over the period 1978-82 to examine the relationship between unionism and productivity. Estimates are reported which indicate that, on average, union effects on productivity are neutral. There is, however, some variation around this average, and one particularly striking result that emerges is that negative effects are present only in the larger firms in the sample. This more negative effect in larger firms is reproduced in some situations even when unobservable firm-specific factors are controlled for via the inclusion of fixed effects in the estimated production function.

The layout of this paper is as follows. Section I first considers how a number of routes through which trade unions are postulated to influence productivity are also linked to firm size; it then lays out the modelling strategy followed in the paper, and finally discusses estimation techniques and the measure of union presence to be used. Section II describes the data and presents some raw data on levels of productivity, union presence and firm size for the firms in the sample. Section III presents some empirical estimates of the union impact on productivity and Section IV concludes by highlighting the main results emerging from this paper.

### I. THE UNION IMPACT ON PRODUCTIVITY: THEORETICAL NOTIONS AND MODELLING STRATEGY

The need for economists to analyse the non-wage influence of trade unions has been made forcefully by the US work of Freeman and Medoff (1984) and

their associates. Their basic claim is that some of the non-wage effects of unions can act to offset the efficiency losses that the more conventional monopoly view of union behaviour tends to emphasize. One way in which this may occur is for unions to raise levels of productivity. Indeed, a number of US studies provide empirical evidence which is broadly supportive of this.<sup>4</sup> The existing British evidence is less optimistic, as Pencavel's (1977) historical study and the work of Edwards (1987), Knight (1989), Metcalf (1989) and Wilson (1987) point to neutral or negative effects on levels of labour productivity.<sup>5</sup>

#### *Union productivity effects and firm size*

A variety of possible routes via which unions may affect productivity levels have been identified in the economic and industrial relations literature. Some of the more popular ones are the notion that a union may monitor the behaviour of management and hence reduce  $X$ -inefficiency (Clark, 1980a, b, Faith and Reid, 1987); that unions may exert some control over the production technology and hence affect productivity either favourably or unfavourably as a show of bargaining power (Cable, 1987); that quit rates may be lower in unionized firms so that increased firm-specific human capital can raise productivity (Freeman, 1976, 1980); and that union 'equality of opportunity' policies prevent ambitious workers from climbing the promotion ladder, hence reducing productivity.<sup>6</sup> On top of these non-wage routes, the traditional union monopoly model predicts that the managerial response to a positive union wage effect causes a substitution from labour to capital, from unskilled to skilled labour, thereby raising productivity and, market structure permitting, a rise in product prices, which (according to the standard neoclassical model) subsequently induces a misallocation of resources.

Hence the existence of numerous routes via which unions may affect productivity either favourably or adversely means that ascertaining the direction and magnitude of the effect is ultimately an empirical question. Note also that most of these channels are intrinsically linked to firm size: for example, large firms are often pinpointed as those with problems of  $X$ -inefficiency; exercising some control over production may be easier for unions located in larger firms as the enforcement of work effort and the monitoring of workers becomes harder; union presence tends to be greater in larger firms. Hence a potentially important area of examination is whether union productivity effects differ with firm size, and this is addressed explicitly in the empirical work to follow.

#### *Modelling strategy*

The usual methodology followed in the union productivity literature was developed in the seminal paper by Brown and Medoff (1978) and effectively amounts to the inclusion of a union variable in a rearranged form of the Cobb-Douglas production function  $Y = AK^\beta(L_n + cL_u)^\gamma$ . Here,  $Y$  denotes output,  $A$  is technical efficiency and  $K$  and  $L$  are capital and labour inputs, the labour input being disaggregated into union and non-union labour ( $L_u$  and  $L_n$ ) with the parameter  $c$  indicating the relative productivity of unionized to non-unionized labour. ( $c > 1$  implies that union labour is more productive.)

Given the structure of the data, we can perhaps more reasonably view estimation of (3) as a useful diagnostic check: if  $\lambda_3$  is estimated to be negative, this suggests confirming evidence for the models in Table 3. Instrumental variables estimates of (3) (setting  $FS = \ln L$ ) are reported below:<sup>17</sup>

$$\ln(Y/L) = \text{fixed effects} + 0.238 \ln(K/L) + 0.633 \ln L \\ (0.180) \quad (0.557)$$

$$-0.762 INDEX * \ln L + \text{time dummies} \\ (0.501)$$

$$S = 24.03 (33)$$

$$\ln(Y/L) = \text{fixed effects} + 0.339 \ln(K/L) + 0.586 \ln L \\ (0.219) \quad (0.457)$$

$$-0.475 CLOSED * \ln L + \text{time dummies} \\ (0.360)$$

$$S = 27.69 (33).$$

Because of the small cross-section and time-series elements of the panel, estimation of these fixed-effects equations obviously asks a lot of the data.<sup>18</sup> However, despite some imprecision in the point estimates, for both the *INDEX* and *CLOSED* measures of union presence a negative coefficient is obtained on the interaction term so that trade union effects prove to be more negative among larger firms.<sup>19</sup>

One final point is that the productivity measure utilized thus far is value added per employee. The results reported to date may therefore just be proxying an hours effect arising from differing levels of labour utilization. While the data-set is not ideal in this regard, it does contain data on the annual hours worked by manual employees in the firms in the sample. Hence making some assumption regarding the number of hours worked by non-manuals permits the construction of an alternative productivity measure defined as value added per employee hour. Following Cable and Wilson (1989), an assumption of 1656 annual hours for non-manuals is adopted. Results using this measure as dependent variable (and  $\ln(K/H)$  and  $\ln H$  where  $H$  is total employee-hours as independent variables) produced very similar results. That is, in comparable specifications to those in Table 3, unionized firms had, on average, no lower productivity than non-union firms, and any negative effects were confined to firms with over 1000 employees. In fixed-effects specifications the coefficient on  $U * \ln H$  was estimated to be negative for both *INDEX* and *CLOSED*.

#### IV. CONCLUSIONS

This paper has presented some evidence on the impact of union presence on the average productivity levels of a sample of British engineering firms in the late 1970s and early 1980s. The very specific nature of the sample cannot be stressed too much: it is important to remember that the data refer to a sample of highly unionized firms operating in a particular sector of British manufacturing. It should also be pointed out that the large number of potential unobservables associated with the estimation of productivity equations imply that the isolation of a union effect on productivity levels is not easy.

Bearing these comments in mind, results deduced from two measures of union presence indicated that on average estimated union non-union effects on labour productivity are neutral. Despite this, there is some variation around this average and the variation is strongly related to firm size. In particular, union non-union effects on productivity are estimated to be more negative among relatively large firms. When firm-specific fixed effects were controlled for it is reassuring that, given the limitations of the data, the same pattern of results persisted. Obviously, it would be very interesting to see if similar results emerged from data-sets in which there is time variation in measures of unionization.

An interesting question is whether the negative unionization-firm size interaction reported in this paper is due to greater *X*-inefficiency in larger unionized firms or to the increased control over the workings of the production process held by unions in large firms. Future research may be able to link information on the organizational form of companies, thereby permitting some discrimination between control and *X*-inefficiency arguments. The untangling of these effects is, however, beyond the scope of this study.

As a final point, it is not entirely surprising that some of the US results indicating that unions raise productivity are not mirrored using British data. This is especially true given the traditional adversarial relationship between British unions and management compared with the US situation, where cooperative industrial relations and business unionism are more the order of the day.

#### ACKNOWLEDGMENTS

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#### NOTES

1. See, for example, the discussion of union effects on variables such as wages, employment, productivity, profitability and income distribution in the reviews by Blanchflower and Oswald (1988), Machin (1988a) and Metcalf (1988).
2. Freeman and Medoff (1984) and Hirsch and Addison (1986) review the relevant literature.
3. See the important series of papers on this subject by Bean and Symons (1989), Layard and Nickell (1989), Metcalf (1988, 1989), Nickell *et al.* (1989) and Machin and Wadhwani (1991).
4. Examples are Brown and Medoff (1978) or Allen (1984). Some other US studies report neutral effects, but very few identify negative effects (See the surveys in Hirsch and Addison, 1986 or Freeman and Medoff, 1984.)
5. The focus of this paper is on the relation between unionism and levels of productivity. However, note that the effects on productivity growth may be different: indeed, a number of papers (see the references in no. 3) have provided empirical evidence to suggest that unionism and productivity growth are positively correlated for Britain in the early 1980s. An exception is Denny and Muellbauer, 1988, which points to a negative (or, at best, insignificant) union impact on productivity growth for 1980-84.
6. Reviews of this literature that highlight a number of other channels via which unions may impact on productivity, discussed mainly in the context of the United States, are given in Freeman and Medoff (1984) or Hirsch and Addison (1986). Metcalf (1988) discusses the British unions and productivity literature.

## *Trade Unions and Productivity: Conventional Estimates*

Dennis R. Maki

*This paper discusses the issues and concepts involved here, criticizes recent studies and suggests an agenda for future research. The author also presents some empirical results pertaining to Canadian manufacturing.*

Although the question of the effect of trade unions on productivity has been researched for a long time,<sup>1</sup> the literature on the subject is still scanty, and many unanswered questions remain. While there are many potential reasons for this state of affairs, surely the most important must be the conceptual difficulty of defining and measuring productivity in the first place, with even leading experts in the area disagreeing about current practice<sup>2</sup>. Further, the question is basically an empirical one, since there exist abundant theoretical arguments for both positive and negative effects, but data appropriate for investigating the question are generally lacking. In particular, factor share data for union versus nonunion labour are not available, and even unionization data are highly aggregated and of dubious quality, at least in the Canadian case<sup>3</sup>. Partially for this reason, most of the empirical work on the effect of unions on productivity has been of a case study nature<sup>4</sup>. However, if one is interested in the more macroeconomic effects of unions, case study results can lead to erroneous conclusions because of the potential existence of various spillovers<sup>5</sup>. For example, nonunion

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<sup>1</sup> BOK and DUNLOP (1970) report economists have debated the question "for more than a century and a half". Quoted in BROWN and MEDOFF (1978).

<sup>2</sup> See comments by JORGENSEN (1980).

<sup>3</sup> The same comments about the nature of the data probably pertain to the U.S. For example, the unionization estimates presented by FREEMAN and MEDOFF (1979), contain a large number of industries for which union membership exceeds covered workers, a logical possibility, but highly unlikely circumstance.

<sup>4</sup> As noted by BROWN and MEDOFF (1978, p. 355), who present more aggregated analysis. For a recent case study approach, see CLARK (1980).

<sup>5</sup> Spillover effects of unionization have been noted and discussed in the literature dealing with the effect of unions on wages. Analogous arguments would seem to apply in the case of productivity. See STARR (1973) for a lucid discussion.

firms might change their production technology in an attempt to prevent unionization or at least minimize the effects if it should occur — a sort of "threat effect". Another sort of spillover could occur if, e.g. unionized firms became more productive due to unionization,<sup>6</sup> then their nonunion competitors in the product market may be forced to change their production technology to prevent loss of sales. While these arguments point to the desirability of measuring the productivity effect of unions at some aggregate level, they also suggest the difficulty of doing so.

This paper makes two contributions to the literature in this area. First, a discussion of the issues and concepts involved, together with a critique of recent studies, suggest an agenda for future research. Second, some empirical results pertaining to Canadian manufacturing are presented.

#### POTENTIAL EFFECTS OF UNIONS ON PRODUCTIVITY

Since the main arguments are summarized elsewhere,<sup>7</sup> only a brief review of the highlights is presented here. Rees (1963) has presented an excellent statement of the detrimental effects of unions on output (and hence productivity) in the perspective of the usual neoclassical paradigm. There are two main effects. First, by raising wages in unionized firms above those in nonunionized firms, assuming unionized employers respond by increasing the capital-labour ratio and the nonunion labour market is competitive,<sup>8</sup> unions cause reallocation of labour from higher to lower marginal productivity employment. Second, various work rules negotiated by unions, ranging from the infamous "make work" and "feather-bedding" practices to simple seniority systems, may prevent employers from selecting their profit maximizing (most efficient) production technology. While some more "sociologically oriented" writers have questioned the validity, even for analytical as opposed to policy purposes, of comparing a partially unionized world with a competitive ideal which never has and probably never could exist in practice,<sup>9</sup> the two arguments presented above form the theoretical base for expectations of a negative effect of unionization on productivity.

The arguments for a positive effect are more eclectic. One argument, compatible with Leibenstein's (1966) concept of X-efficiency but not

<sup>6</sup> This is the sign of the effect found empirically by BROWN and MEDOFF (1978) and CLARK (1980), but it is used here purely for illustrative purposes.

<sup>7</sup> See, for example, BROWN & MEDOFF (1978).

<sup>8</sup> This is a sufficient, but not necessary set of assumptions. Several other "stories" lead to the same conclusion.

<sup>9</sup> See MACDONALD (1966).

a statistically significant *negative* effect of about the same magnitude<sup>29</sup>. This decline is accompanied by a very substantial (and statistically significant) estimated increase in labours' share. Indeed the estimated change in labour's share is probably too large to be believable. At 50 per cent unionization, the estimated share is 0.49, while at 100 per cent unionization it is 0.84.

### CONCLUDING COMMENTS

Given the opposite conclusions reached in equation (11) versus the estimates presented in previous sections, it is obvious that much work remains to be done. Additional theoretical development is required to provide standards for judging the meaning of quantitative results. For example, deciding whether the results in equation (1.5) or equation (11) are more reliable is not an empirical question. This decision must ultimately rest on theoretically-based tests of whether unions have affected factor shares.

Alternatively, it could be argued that existing theoretical development is adequate, if sufficient amounts of proper data for sequential testing of relevant hypotheses were available. The time series utilized in this paper were very short for the intended purpose, and the linking of data over SIC code changes was often performed in a naive manner. Multicollinearity problems become very severe with short time series using the types of specifications suggested by existing theory. Thus, data development is a necessary part of future work.

Finally, the implication of these comments, and the central theme of this paper, is that there is little reliable information on the effects of trade unions on productivity contained in existing research.

<sup>29</sup> Comparing zero unionization to complete unionization the difference is  $1.406/4.234 = 33$  per cent. Remember the caveat previously made about extrapolating from this data set to the case of "zero unionization".



# Unions and Productivity: Evidence from Academe

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*In order to test competing hypotheses about the effect of unions on labor productivity, we examine research performance in a sample of 889 Ph.D.-granting departments (175 unionized) in public universities. We find no support for the hypothesis that unions enhance productivity in academe. If we compare union and nonunion departments endowed with (sample) mean amounts of labor and capital, we find that unionization is associated with a 17 percent reduction in output of published articles and a 9 percent reduction in peers' survey evaluations of a department's level of scholarly achievement.*

## I. Introduction

Theory has spawned conflicting predictions about unionism's effect on productivity. The traditional view was that unions damaged productivity via restrictive work rules, featherbedding, and disruptive strikes or other adversarial tactics. More recently, however, Freeman (1976) and Freeman and Medoff (1984) advanced the hypothesis that unions may enhance productivity. In their formulation, unions constitute a desirable "voice/response" mechanism which can improve worker morale and cooperation, reduce labor turnover, negotiate improvements in the organization of the workplace, or otherwise reduce X-inefficiency in affected firms.

In recent years, many investigators have tried to determine whether favorable or unfavorable union productivity effects predominate. At present, it appears that studies concluding that unions enhance productivity outnumber those concluding that unions reduce (or have no effect on) productivity. One oft-cited study is by Brown and Medoff (1978), who applied a production function framework to 1972 cross-state data on 20 two-digit SIC industries and concluded that unionization increased output per worker by about 22 percent (approximately the same percentage, incidentally, by which unions raised wages in their sample). Subsequent researchers have applied the Brown-Medoff methodology to particular industries. For example, Clark (1980) analyzed establishment data for the U.S. cement industry and concluded that unionization raised productivity six to eight percent; Allen (1984) analyzed data from the 1972 Census of Construction Industries and concluded that unions raised productivity (measured by valued added per employee, adjusted for interarea construction price differences) by 17 to 22 percent.<sup>1</sup> On the other hand, Clark (1984) analyzed

To get a rough idea as to unions' net contribution to research output, we can use our estimates of  $a'$ ,  $b'$ ,  $c'$ ,  $d'$ , and  $e'$  to calculate the incremental effect of unionization on each output measure at the overall sample means of  $L_1$ ,  $L_2$ ,  $K_1$ , and  $K_2$ . Based on our  $R_1$  regression, we find that a unionized department with mean input characteristics will produce 4.45 fewer publications per year than a comparable nonunion department. Relative to the overall sample mean of 25.2 publications per year, this represents a 17.4 percent reduction. Based on our  $R_2$  regression, unionization is associated with a 0.254 reduction in the index of scholarly achievement. Relative to the overall sample mean index value of 2.83, this represents a reduction of 8.98 percent.

#### V. Summary and Conclusions

Previous empirical tests of unions' effects on productivity are afflicted with several important problems. While many such studies have concluded that unions increase labor productivity — perhaps because unions constitute an efficiency-enhancing "voice/response" mechanism — it is possible that these estimates are (a) the result of unions' effects on wages or (b) the outcome of a dynamic process in which less productive unionized firms are "selected out," and thus are under-represented in cross-sectional data.

We think that a study of unionism in academe is relatively free of such problems. Note first that several studies document that the union wage premium is small in academe — as little as 1.3 to 1.6 percent, according to Barbezat (1989). Absent a union wage effect, then, we can have greater confidence that any observed union productivity effect in our sample is not merely a movement along a stable marginal product curve but rather a result of a shift in such a curve. Note also that we restrict our analysis to Ph.D.-level departments residing in public institutions; since the "failure" of such programs is an extraordinarily rare event, it is unlikely that our results are affected by the problem of "survivorship bias" that afflicts other cross-sectional studies.

We examine research productivity using two alternative measures of faculty research output (a count of published articles, and a peer evaluation of the scholarly achievements of faculty); our methodology allows for the possibility that unionization affects the slope parameters of the production functions as well as the intercept terms. *We find no support in our data for the hypothesis that unions enhance productivity in academe.* Seven of the ten unionization parameters in our equations are negative; five of these parameters are significant at generally accepted confidence levels. None of the three positive unionization parameters are significant. If we compare departments with amounts of labor and capital equal to the mean values for our sample, we calculate that unionization reduces output of published articles by about 17 percent, and reduces a more subjective measure of scholarly achievement by about 9 percent.

One explanation for these results is that unions, though they do not raise average academic salaries by very much, may alter the distribution of returns to faculty members. Indeed, Barbezat (1989) found that unionization increases the return to

seniority and decreases the return to several measures of merit, including an individual's output of published books and articles. Clearly, when the pecuniary return to research falls relative to other activities, we should expect less research and more of the other activities.

The key question is what these other activities might be. If unions simply substitute the passage of time (i.e., seniority) for research output as a criterion in compensation decisions, then we might conclude that unions' negative effect on research productivity is inefficient, leading to the substitution of, say, leisure for academic output. It is possible, however, that unionization produces an alteration in the output mix of faculty. We are aware of one case (though not at a Ph.D.-level institution) where a newly-unionized faculty voted to require all full-time professors to hold a minimum of nine office hours per week. To the extent that this work rule was a binding constraint, it may have reduced research output but increased the quantity or quality of teaching output.

Future research should be aimed at determining whether such output substitution is a significant feature of academic unions and, if it is, whether this substantially alters the conclusion that faculty unions reduce efficiency. One promising avenue of inquiry is the nonparametric production frontier approach pioneered by Fare et al. (1985), and used by Byrnes et al. (1985) to assess the impact of unions on productivity in surface coal mining. The nonparametric approach is readily applicable to a multi-product setting, and also may allow us to identify the composition of any union/nonunion productivity differential (e.g., technical efficiency vs. scale efficiency) as well as its magnitude and direction. Such inquiry is, however, beyond the scope of the present paper.



# THE EFFECT OF UNIONS ON PRODUCTIVITY IN A MULTINATIONAL MANUFACTURING FIRM

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This paper examines the effect of unions on productivity in 31 plants of a large multinational firm in the years 1975-82. The plants, 60 percent of which are unionized, all produce a similar line of products using material-intensive, labor-intensive, low-technology methods. Results obtained by estimating a translog production function indicate that unionization's overall effect on productivity is positive. Specific findings are that unionization increases the capital-labor ratio and improves management performance, but it also raises the absenteeism rate. A net positive effect on productivity remains even when these channels of union influence are controlled for, a result that, the author suggests, may reflect an improved labor relations climate or improved labor quality associated with unionization.

THE issue of if, and how, labor unions affect productivity is of theoretical interest to economists and practical significance to managers. Neoclassical economic theory suggests that the higher wages that usually result from unionization should raise labor productivity by causing substitution of capital for the more expensive labor. The manager would typically argue that, on the contrary, labor productivity falls as the labor union erects a structure of restrictive work rules and other impediments to the employer's freedom of action. There is an evident need to address this contentious and important issue empirically, and indeed, a few studies have investigated the relationship of unionization to labor productivity. These studies have, however, been plagued by some difficult measurement problems, and their results have been mixed. Also, they have not been

able to adequately trace the channels through which unionization may affect productivity.

The research reported here is an attempt to overcome these limitations and provide additional evidence on the unionization-productivity issue. A sample of 31 plants of a single, large multinational firm, all producing similar products with the same technology, is utilized to ensure product and technology homogeneity and consistent measurement of variables. A plant-level approach also allows measurement of several micro-level variables that have been omitted from other studies. An international sample of plants allows testing of the proposition that a unionization-productivity relationship is not confined to a particular collective bargaining environment.

## Theoretical Framework and Previous Research

Neoclassical economic theory states that if the price of a resource increases there will be a substitution away from it to other,

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set of regressions; some regions exerted a positive effect and others a negative one for all four dependent variables.

It was not possible to investigate the performance of union and nonunion plants in a specific country, since in each country all plants were either union or nonunion. Even by region, in only one case—Latin America—were there both union and nonunion plants. A union-region interaction term for the Latin American region was added to the regressions reported in Table 1. It was found that in that region unionism had a positive influence (significant at the 5 percent level) on the capital-labor ratio, management performance, and absenteeism. Unionization had no effect on the turnover rate in the Latin American region. These results provide a clue that there is in fact a difference between the union and nonunion plants in Latin America. As economic theory would predict, the unionized plants have a higher  $K/L$ . They also appear to have better management, as the "shock theory" would suggest.

When the union-region interaction term is added to the column 1 regression of Table 2, the UNION variable becomes insignificant ( $\beta = 0.021$ ,  $t = 0.450$ ), whereas the region variable for Latin America becomes more strongly negative (significant at the .01 level), and the union-region interaction term is positive but only significant at the 16 percent level ( $\beta = 0.111$ ,  $t = 1.422$ ). This result also suggests (weakly) that the union and nonunion plants are different in some key dimensions that affect productivity. In addition to nonspecified effects, the differences would seem to be in the capital-labor ratio and management performance, as the results for this region reported above indicate. The low significance for the direct union effects on productivity in Latin America may be due to the indirect effects on productivity of unionization exerted via the management and capital-labor ratio variables.

### Discussion

This study has yielded some evidence that unionization positively affects labor productivity in a labor-intensive, consumer

goods industry. This positive union productivity effect appears to obtain across twelve countries in North America, Europe, Asia, and Latin America. Unionization's effect on productivity comprises both positive and negative factors, the net effect being positive. Even when the mechanisms of unionism's influence on the capital-labor ratio, management performance, and worker turnover and absenteeism are controlled for, the union dummy variable is positive.

Unionization was found to increase the capital-labor ratio, as economic theory would predict. Higher wages that usually result from unions may cause the firm to invest in more automated equipment to make their higher-priced labor more productive. In this particular firm, however, the capital/labor ratio was not found to be a positive influence on labor productivity; in fact it was negative or insignificant. The reasons for this pattern probably relate to the nature of the industry and technology of the firm studied. As noted, the industry is a very labor-intensive one in which technological change has been slow and total factor productivity is essentially labor productivity. Automation of the process is difficult, and the technology used in all of the plants is similar. The dependent variable, productivity, is also adjusted for the small technology differences that do exist, removing much, if not all, of the effect that technology would have on productivity. There are also measurement problems with the capital data not present with the other variables. Incorporating the capital measure, the only monetary variable used, necessitated converting from different currencies and adjusting for varying inflation rates, a procedure that undoubtedly introduced some errors into the data.

It was possible to test the "collective voice" and "shock effect" theories in this study, as variables for worker turnover and management performance were available. The evidence does not confirm the "voice" theory, since turnover was found to be unaffected by unionization. In addition, absenteeism was actually increased by unionization.<sup>11</sup> If absenteeism is seen as an

<sup>11</sup>This result is similar to Allen's finding (1984) of

expression of exit behavior, this result also contradicts the prediction of the "collective voice" theory. The role of unions in providing a collective voice for employees, and thereby lowering "exit" behavior such as turnover and perhaps absenteeism, is not apparent in this firm.

Although unionization was not found to be significantly related to the turnover rate, turnover was more detrimental to productivity in the unionized plants. In fact, in the nonunion plants turnover was not significantly related to productivity, whereas its association with productivity in the union plants was strong and negative. A possible explanation for this finding is that the "quality" of the work force is higher in the union plants—that is, workers in the union plants may be more skilled, experienced, or motivated than workers in the nonunion plants—and their quitting has a more detrimental effect on productivity. Thus, even if the overall turnover rates were the same in union and nonunion plants, a predominance of that turnover among "higher-quality" employees in union plants would account for this finding. This work force quality factor could also be an explanation for the positive residual effects of unions on labor productivity in these plants, as captured in the UNION variable. Unfortunately, the available data did not allow a test of either hypothesis.

The "shock effect" on management of a union receives some confirmation in this study. The unionized plants had substantially better management performance than the nonunion plants. Either the firm is assigning its better managers to the union plants, or the managers already there are performing better due to the presence of a union. Higher wage rates or more formalized labor relations may cause plant management in the unionized factories to place more emphasis on efficiency and human relations. Since the quality of management is shown to be a significant determinant of labor productivity, this is an important mechanism by which unionization positively affects productivity. Since no

plants changed status from nonunion to union or vice versa during the period of the study, no before-after investigation of unionization's effect on labor productivity was possible. Therefore, exactly how management behavior changes in response to unionization could not be investigated.

How can we explain the findings reported in Table 2 that, even after accounting for the various mechanisms by which unionization has been hypothesized to influence labor productivity—"voice," "shock," and allocative effects—unionism still had a residual positive effect on labor productivity of either 13 percent or 29 percent, depending on the variables included in the estimate? One possible explanation, offered above, is that the "quality" of labor differs between union and nonunion plants. If unionization results in better-quality workers through selection procedures, training, and motivation, then productivity should be higher in union plants. Another hypothesis is that unions exert their main influence on productivity by affecting the industrial relations climate and worker motivation (Freeman and Medoff 1984). Turnover and absenteeism rates were included as variables in this study, but they are only partial measures of employee motivation and the labor relations climate. Perhaps a better measure of worker motivation or the state of industrial relations in a plant would account for the remaining positive influence of unionization on productivity.

Of course, the presence of a union can influence labor relations either positively or negatively. In this particular firm the effect is positive, assuming that unionism's effect on labor relations is indeed the mechanism by which it exerts its influence on productivity. In other situations, however, as can easily be imagined, strikes, grievances, and antagonism between labor and management could make the union effect a negative one. If the effect of unionization on the industrial relations climate is the mechanism at work here, there is still a role to be played by the "collective voice" theory; and a clear implication is that the relationship of unionization to productivity must be judged on a case-by-case basis.

higher absenteeism among union workers than non-union workers. Even the magnitude is similar: 27 percent in this study, 29 percent in Allen's study.

Freeman and Medoff, in their recent survey of union-productivity studies, argue that "unionism per se is neither a plus nor a minus to productivity. What matters is how unions and management interact at the workplace" (1984:179).

As for the firm examined in this study, unionism's positive effect on productivity appears to be strong and international in scope. Even when differing capital-labor ratios and regional effects are controlled for, unions still increased productivity in this firm's plants in a dozen countries throughout the world. The "shock effect" mechanism appears to account in large part for this transnational effect, as well as perhaps the influence of unionization on the plants' labor relations climates and labor quality. In the one region that had both union and nonunion plants, it was also found that unionization had a positive influence on productivity.

#### Conclusions

This study of 31 plants of a large mul-

tational firm has found that unionization exerted a positive effect on labor productivity in 1975-82. The channels by which unions appear to affect labor productivity in this firm are changes induced in management performance and worker behavior. In the unionized plants, absenteeism rates and the negative effect of turnover on productivity were higher than in the nonunion plants, but these factors were offset by a positive union influence on management performance. An increase in the capital-labor ratio due to unionization was also found, although the capital-labor ratio is not a major determinant of productivity in these plants. A residual positive effect of unions on productivity remained after controlling for the capital-labor ratio, management performance, and worker turnover and absenteeism. This may be due to an improved labor relations climate and worker morale or to improved labor quality in the union plants.

#### REFERENCES

- Allen, Steven G.**  
 1986 "Unionization and Productivity in Office Building and School Construction." *Industrial and Labor Relations Review*, Vol. 39, No. 2, pp. 187-201.
- 1984 "Trade Unions, Absenteeism, and Exit-Voice." *Industrial and Labor Relations Review*, Vol. 37, No. 3, pp. 331-45.
- Brown, Charles, and James Medoff**  
 1978 "Trade Unions in the Production Process." *Journal of Political Economy*, Vol. 86, No. 3, pp. 355-78.
- Christensen, L., D. W. Jorgenson, and L. J. Lau**  
 1973 "Transcendental Logarithmic Production Frontiers." *The Review of Economics and Statistics*, Vol. 55, No. 1, pp. 28-45.
- Clark, Kim B.**  
 1984 "Unionization and Firm Performance: The Impact on Profits, Growth, and Productivity." *American Economic Review*, Vol. 74, No. 5, pp. 893-919.
- 1980a "The Impact of Unionization on Productivity: A Case Study." *Industrial and Labor Relations Review*, Vol. 33, No. 4, pp. 451-69.
- 1980b "Unionization and Productivity: Micro-Econometric Evidence." *Quarterly Journal of Economics*, Vol. 95, No. 4, pp. 613-39.
- Freeman, Richard B.**  
 1980 "The Exit-Voice Tradeoff in the Labor Market: Unionism, Job Tenure, Quits, and Separations." *Quarterly Journal of Economics*, Vol. 94, No. 4, pp. 643-73.
- 1976 "Individual Mobility and Union Voice in the Labor Market." *American Economic Review, Papers and Proceedings*, Vol. 66, No. 2, pp. 361-68.
- Freeman, Richard B., and James L. Medoff**  
 1984 *What Do Unions Do?* New York: Basic Books.
- 1979 "The Two Faces of Unionism." *The Public Interest* (Fall), pp. 69-93.
- Griliches, Z., and V. Ringstad**  
 1971 *Economics of Scale and the Form of the Production Function*. Amsterdam: North-Holland.
- Mefford, Robert N.**  
 1986 "Introducing Management into the Production Function." *Review of Economics and Statistics*, Vol. 68, No. 1, pp. 96-104.
- Nicholson, Nigel, Colin A. Brown, and J. K. Chadwick-Jones**  
 1976 "Absence from Work and Job Satisfaction." *Journal of Applied Psychology*, Vol. 61, No. 6, pp. 728-37.
- Pencavel, John H.**  
 1977 "The Distributional and Efficiency Effects of Trade Unions in Britain." *British Journal of Industrial Relations*, Vol. 15, No. 2, pp. 137-56.
- Slichter, Sumner**  
 1941 *Union Policies and Industrial Management*. Washington, D.C.: Brookings Institute.
- Slichter, S., J. Healy, and E. R. Livernash**  
 1960 *The Impact of Collective Bargaining on Management*. Washington, D.C.: Brookings Institute.

# Teachers' Unions, Productivity, and Minority Student Achievement

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*I estimate the union/nonunion productivity differential for minority students attending public high schools. Education production functions are estimated for minority students attending union schools and for minority students attending nonunion schools using achievement scores as the measure of output and the individual student as the unit of observation. The union/nonunion productivity differential for average minority students is positive. However, the productivity differential is negative for minority students attending schools where the majority of students are nonminority, but the productivity differential is positive for minority students attending schools where the majority of students are minorities.*

## *L. Introduction*

I analyze the union/nonunion productivity differential for minority students. There are two central reasons for investigating how teachers' unions affect these students. First, the minority share of total school age population increased dramatically in the 1970s and 1980s: Today, minority students account for over 25 percent of the school-age population. One study attributes part of the decline in SAT scores in the 1970s to the growing minority share of the total school-age population: "In the nation as a whole, changes in the ethnic composition of the school-age population between 1971 and 1979 probably depressed the score of the median student by roughly one percentile" (CBO, 1987, p. 54). The tendency of minority students to score lower than majority students on standardized test scores, even when socioeconomic status is held constant, has troubled researchers. Second, an examination of the impact of collective bargaining on minority student achievement contributes to the growing literature on minority student achievement levels.

Minority students may have special needs and respond differently than majority students to educational resources. Eberts and Stone (1987) and Milkman (1989) both find that the union/nonunion productivity differential is higher for average students than it is for students with either high or low pre-test scores which suggests that teachers' unions tend to standardize the educational environment. If this standardization is responsible for the distribution of the union/nonunion productivity differential, then the union/nonunion productivity differential should also be lower for minority students.

Other studies also estimate how collective bargaining affects high school student achievement. Kurth (1987) and Register and Grimes (1991) examine the relationship between teachers' unions and student achievement on college entrance exams. Their results are mixed. Register and Grimes (1991) report that teachers' unions increase college achievement scores whereas Kurth (1987) reports that teacher unions decrease SAT scores. One shortcoming of these two studies is that many low-achieving students do not take college entrance exams. Since both Eberts and Stone (1987) and Milkman (1989) find that the union/nonunion productivity differential is lower for low-achieving students, it may be misleading to examine the relationship between teachers' unions and student achievement using a sample which omits most low-achieving students.

Grimes and Register (1990) estimate the impact of collective bargaining on student achievement in high school economics as measured by performance on the Test of Economic Literacy (TEL), a nationally normed multiple-choice test. "Students in unionized school districts demonstrated a significantly higher level of achievement in economics, when other instructional inputs and personal characteristics were held constant" (p. 304). One problem with this study is that Grimes and Register use only one educational production function to estimate the productivity effect of collective bargaining. Union status is measured with a simple discrete variable, a methodology which does not allow the production function to vary between union and nonunion schools. This variance in the production function is responsible for the vast majority of the union/nonunion productivity differential in both Eberts and Stone (1987) and Milkman (1989).<sup>1</sup>

Grimes and Register (1991) also examine the effect of attending a unionized school on black students' SAT scores. They report that "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" (p. 492). There are two problems with the Grimes and Register (1991) study. First, many low-achieving minority students are not included in the sample. Second, Grimes and Register (1991) use only one educational production function to estimate the productivity effect of collective bargaining.

## II. *The Union/Nonunion Productivity Differential*

The union/nonunion productivity differential is calculated by estimating two educational production functions, one for union schools and one for nonunion schools. Following Hanushek (1979), value-added educational production functions are estimated:

$$A_{it} = f(B_i(t-t^*), P_i(t-t^*), S_i(t-t^*), I_i, A_{it}^*) \quad (1)$$

where, for the  $i^{\text{th}}$  student and for the period  $t^*$  to  $t$ ,  $A_{it}$  = achievement at time  $t$ ;  $B_i(t-t^*)$  = vector of family background influences;  $P_i(t-t^*)$  = vector of peer influences;  $S_i(t-t^*)$  = vector of school inputs;  $I_i$  = vector of innate abilities; and  $A_{it}^*$  = initial achievement.

Table 3  
*Productivity Differentials*

Student Group	Union/Nonunion Productivity Differential
All Students (Milkman, 1989)	.39*
All Minority Students	.24**
Minority Students in Majority Schools	-.14*
Minority Students in Minority Schools	.31**

\*(\*\*)Significant at the 0.05 (0.01) level.

#### VI. Conclusion

My empirical results indicate that minority students benefit from the positive union/nonunion productivity differential. However, this benefit is lower than the benefit received by the typical majority student.

While my results are consistent with the hypothesis that teacher unions tend to standardize schools, the evidence here and in Eberts and Stone (1987) and Milkman (1989) is only indirect. Future research is needed to directly test the hypothesis that teachers' unions tend to standardize schools. Such research should focus on teacher union effects on curriculum and the allocation of school resources across different types of students.

