BEN CRAIG
Federal Reserve Bank of Cleveland
JOHN PENCAVEL
Stanford University

Participation and Productivity: A Comparison of Worker Cooperatives and Conventional Firms in the Plywood Industry

A PERENNIAL ISSUE in the study of organizational behavior is the impact on productivity of participation by workers in a firm's decisionmaking. The question has returned to the foreground in the recent debate over policies to increase U.S. productivity growth.[1] A large literature is aimed at quantifying the impact of worker participation on productivity though the results from this research fall somewhat short of being fully persuasive.[2] There are several difficulties in this research, not least that worker participation can mean various things in different contexts.

At one extreme, workers may be consulted on a narrow range of issues, and the consultations may be designed more to give the appear-

1. The 1994 *Economic Report of the President* states that "the Administration aims to increase the productivity of the work force by helping employers make better use of their workers through increased worker participation. Numerous studies have now demonstrated that cooperative techniques increase productivity substantially in a wide range of enterprises. By helping to disseminate information on what successful firms have been able to accomplish, the Administration hopes to speed the adoption of these practices throughout the economy" (p. 128).

2. Levine and Tyson (1990, p. 203) provide a comprehensive review of the literature. Even with a sympathetic reading of the evidence in favor of the hypothesis that participation enhances productivity, the authors conclude merely that, "Our overall assessment of the empirical literature from economics, industrial relations, organizational behavior, and other social sciences is that participation *usually* leads to small, short-run improvements in performance and *sometimes* leads to significant, long-lasting improvements in performance" (emphasis in original).

ance of involving workers in decisionmaking than to grant workers effective influence. The other extreme occurs when workers have full discretionary powers and both own and manage the enterprise they work in. If productivity impacts of participation are not visible when workers are the firm's owners, they are less likely when workers participate to a much smaller extent. Therefore, this paper addresses the question of whether productivity differences are evident between conventional firms and worker cooperatives, which are firms owned and managed by their workers.

This is by no means the first investigation of productivity differences between conventional firms and worker co-ops though ours is unusual in a number of respects. Most research lacks observations on *both* conventional firms and co-ops in the same product market environment. As Bonin, Jones, and Putterman observe, "To examine productivity differences between PCs [producer cooperatives] and CFs [conventional firms], the comparison should be made between firms that are 'twins' in all nonorganizational respects, e.g., in terms of technology, the product generated, and market conditions. However, identifying 'twins' (isolation) is often impossible because the existing data on product type and technology are not sufficiently disaggregated. Firm-level data that applies consistent accounting conventions to both PCs and CFs in the same industry are rare."[3] Nevertheless, the observations we have collected satisfy these stringent requirements.

They are longitudinal data on plywood mills in Washington state. The observations (collected by the authors) are at the level of the producing unit, the measurement of inputs and outputs is on a consistent basis, and the technology mapping inputs into outputs is virtually identical across the firms. It is not the case that all the co-ops are the same, and we shall mention below some differences among them. However, they share the important characteristic that virtually all the firm's owners are workers in the firm, and most workers are owners. By contrast, the workers in the conventional firms in our sample are employees.

The conventional mills are individual proprietorships or partnerships or parts of a corporation. The workers at some of these mills are unionized, while those at other mills, which we label "classical," are not. Most of the plywood produced in the Pacific Northwest comes from the

3. Bonin, Jones, and Putterman (1993, p. 1306).

unionized mills. In our work, we not only distinguish co-ops from conventional firms, but also discriminate between unionized mills and classical mills and thereby contribute to the literature on union-nonunion differences in productivity.

The principal goal of the research reported in this paper is to determine whether, for given levels of observed inputs, the worker-owned plywood mills as a group produce more or less output than do conventional firms. We take it as a truism that, if every input were observed and observed without error, then at specified levels of these inputs each firm should produce the same level of output as every other. However, whenever economists estimate production functions, every input is not observed. Not merely are the conscientiousness, vigor, initiative, and other attributes of workers (including managers) not measured, but the information normally available on physical capital and raw materials omits details regarding the great variety of the plant and equipment and the frequently varying quality of the raw material. Therefore, after accounting for observed differences in worker-hours, the quantities of raw materials, and indicators of physical capital, we shall be asking whether there is a distinct difference in the amount of output produced by mills owned and managed by their workers.

There is a long-standing interest in knowing whether worker-owned and worker-managed enterprises are more productive organizations than conventional firms. The belief that they are lies behind some suggestions that worker-owned firms serve as the vehicles for divestiture of state-owned properties in East Europe. But many of these suggestions rest more on speculation about the operation of worker-owned firms than on familiar knowledge of their functioning. Using information from the U.S. manufacturing industry where cooperative enterprises are the most common, we examine the comparative behavior of co-ops and conventional firms to inform the discussion on the relative productivity of worker-management.

Productivity, Capital Markets, and Worker-Owned Enterprises

Before investigating productivity in the plywood industry, we consider the principal reasons why worker-owned and worker-managed

Table 10. Least-Squares Estimates of Output Supply Equations by Firm Type

	Co-op mills			*Unionized mills*	*Classical mills*
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Intercept	6.888	7.009	9.507	6.587	5.835
	(1.745)	(1.524)	(5.051)	(2.198)	(5.211)
$(PONLY)_{it}$	0.162	0.194	0.157	−0.139	−0.100
	(0.127)	(0.128)	(0.126)	(0.156)	(0.843)
$(VONLY)_{it}$	N.A.	N.A.	N.A.	−1.098	−1.612
				(0.191)	(0.633)
$\ln p_{it}$	0.022	0.333	−0.289	0.470	2.636
	(0.556)	(0.516)	(0.778)	(0.538)	(1.562)
$\ln r_{it}$	−0.550	−0.674	−0.775	−0.360	−2.414
	(0.383)	(0.373)	(0.483)	(0.455)	(1.646)
$\ln w_{it}$	0.044	−0.742	0.573	−0.704	0.011
	(0.266)	(0.778)	(1.000)	(0.268)	(0.501)
$\ln s_t$	0.062	0.122	−0.486	−0.594	−1.612
	(0.314)	(0.303)	(1.025)	(0.561)	(1.278)
T_t	0.007	0.001	0.038	−0.001	0.046
	(0.013)	(0.014)	(0.056)	(0.024)	(0.061)

Source: Authors' data.
Note: Estimated standard errors are in parentheses.
N.A. not applicable

the differences in the output-price responses between the co-op mills and those of the classical mills do not necessarily imply differences in the underlying production functions. However, the differences across the firm types in the point estimates of the output supply equations are consistent with the point estimates of the production function reported in table 6.

Conclusions

The evidence we have assembled here suggests three classes of findings. First, input-output ratios among the three types of mills in the plywood industry of the Pacific Northwest are different. The differences are related to differences in their production functions: higher input-output ratios tend to be found where production function input-output elasticities are lower.

The second class of findings relates to these production functions. Though the production functions of the mills may not be identical, there is not much to distinguish these types of firms in terms of overall production efficiency. What differences we have found imply that co-ops are more efficient than the principal conventional firms by between 6 and 14 percent (as suggested by the results reported in table 8).[50] There is little difference between the efficiency of the unionized and classical mills (again as suggested by table 8).

The third class of findings relates to the output supply functions of these firms. If these firms face the same product and input prices and if these firms share a concern with net revenues, then differences in production functions should imply differences in output supply functions; indeed, this is what we find. The classical mills with the highest input-output elasticities in their production function have the highest output-price responses in the estimated supply function; the co-ops tend to have the smallest input-output elasticities in their production function and also the smallest output-price responses in their supply function.

Our research on this important case study suggests that worker participation has neither major efficiency gains nor efficiency losses. If these beneficial or deleterious effects are present, they are of secondary importance. This does not mean that there are no important differences among these types of mills. On the contrary, we have argued in other research that the co-op mills behave in quite different ways from the conventional firms. When faced with adversity, the co-ops adjust pay and avoid changes in their labor inputs and output; by contrast, when confronted with drops in output price, conventional firms adjust employment and work hours (and consequently output), and wages do not change. These are important differences, but they do not relate to the

50. This is the range of differences between the predicted outputs across the columns of table 8 for the lines corresponding to "co-op mills' inputs" and "union mills' inputs." The differences for the "classical mills' inputs" are much larger, and this might suggest an alternative explanation for these production patterns. The co-ops and unionized firms are similar in size, while the classical firms are much smaller. It could be that all three types of firms operate at different points on the same nonhomothetic production function. We estimated the first-order conditions from the nonhomothetic production function defined in footnote 31, and we simulated the resulting parameters (that were not estimated precisely) to determine whether there was evidence of changes in returns to scale by size. Our estimates of decreasing returns to scale changed very little with the level of inputs and outputs.

technical conditions of production that this paper suggests are similar across the three types of firms.

The small differences across these mills in the technical conditions of production explain why over a period of 70 years conventional firms and cooperatives have co-existed in the same industry and the same location. If the co-ops have been slightly more efficient producers, then their dominance has been offset by their capital market difficulties mentioned above. If their superiority in production were greater, it is likely their capital market obstacles would have been overcome, and cooperatives would have dominated the industry.

Interestingly, as plywood production has moved to the South, the cooperative organization has not moved with it. Why? We speculate that a conjunction of several factors accounts for the durability of the plywood co-ops in the Pacific Northwest and have obstructed its transplantation to the South. The establishment and success of the first co-op in the plywood industry in Washington state were the product of the foresight of some shrewd men who, prior to its formation, were already skilled in the work relevant to plywood production and who shared a common Scandinavian heritage. This co-op served as the model for many imitators in the area.

These factors seem to be present in other sectors where cooperatives have been important. In many instances, a group of workers with training in a given line of work and who share cultural ties form a collective organization that enjoys remarkable success. It serves as a prototype, and other firms are established along the same lines so that the cooperative form of organization constitutes a substantial component of the industry. For example, this pattern applies to Boston's Independent Taxi Operators Association, which involved many Jewish immigrants from Eastern Europe, and it applies to the scavenger companies in the San Francisco Bay Area whose owner-workers were predominantly of northern Italian origin. At the same time, the dilution of the common ties of ethnicity has contributed to the decline of the cooperatives in these two sectors: in the case of the taxi cabs, new immigrants from the Soviet Union brought different attitudes to the cooperative, attitudes that emphasized short-term monetary gain over long-term investments, while in the case of the scavenger companies, the core Italian members resisted the growing presence of Hispanic and Black workers and as a

result found themselves presented with a class action discrimination suit.

When workers share similar values, disputes within the producing unit are less likely to occur, monitoring costs tend to be lower, and social sanctions are probably more effective in deterring malfeasance. If such "cultural" factors are important in understanding the pattern and success of worker co-ops in the United States, then the value of the international comparisons of organizations that are so common today is questionable. Thus it has become routine to contrast the internal structure of Japanese firms with that of U.S. firms, and the common suggestion is that the performance of U.S. firms would improve if only they emulated the Japanese. If one of the factors contributing to the success of firms is closely tied to nonreproducible cultural factors, as the study of cooperatives in the United States would suggest, then U.S. firms may experience no more success by copying the internal structure of Japanese firms than plywood companies in the South would enjoy by imitating the worker-owned companies of the Pacific Northwest.

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Productivity, Efficiency and Strike Activity

A. P. Dickerson, P. A. Geroski & K. G. Knight

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Abstract

The economic impact of unions has received increasing attention in the literature. However, the channels through which unions impinge on performance are seldom identified. This paper examines the impact of industrial conflict on output and factor productivity in a panel of British manufacturing industries for the 1970s. Production frontiers augmented by various dimensions of strike activity are estimated and strikes are found to have a negligible net impact on output. Furthermore, while there is some weak evidence to suggest that union presence adversely affects (relative) efficiency, this effect is not derived from higher levels of strike activity.

UNION EFFECTS ON TEACHER PRODUCTIVITY

RANDALL W. EBERTS*

This paper examines the effect of collective bargaining on several factors known to be determinants of student achievement in the public schools, particularly its effect on the teacher's allocation of time among various activities. Estimates based on a national survey show that bargaining appears to reduce time spent in instruction, to increase the level of education of teachers, and to increase the number of administrators—all differences associated with lower student achievement. On the other hand, bargaining tends to increase the time teachers spend in class preparation, the experience level of teachers, and the teacher-student ratio—differences associated with higher student achievement. The net effect of collective bargaining on teacher productivity is therefore not clear at this time.

A MAJOR theme in the collective bargaining literature is the effect of bargaining on the allocation of resources. Following the neoclassical view that distortion in prices leads to allocative inefficiency, much of the empirical research devoted to collective bargaining issues concentrates on the effect of unions on worker compensation. Evidence from both the private and public sectors provides overwhelming support for the claim that union workers are paid more than nonunion workers.[1] This union-induced difference in wages and fringe benefits often leads to the conclusion that in the absence of employer monopsonies, collective bargaining causes resources to be allocated inefficiently.

Recent work by Freeman and Medoff and others challenges this assertion.[2] These authors contend that unions increase productivity by reducing worker turnover, expanding worker training programs, and facilitating communication between workers and management. If unions do increase worker productivity, the argument continues, and if the productivity differential is sufficiently large to offset the compensation differential, then it cannot be said that unions contribute to allocative inefficiency. The reasoning is straightforward, but empirical evidence to test the

*The author is Associate Professor of Economics at the University of Oregon. He would like to thank Joe Stone for his helpful comments and Patty Beeson and David Hedrick for their expert computational assistance. The preparation of this paper was made possible through an Institutional Grant awarded by the National Institute of Education to the Center for Educational Policy and Management at the University of Oregon.

[1]Excellent surveys of these studies include William H. Baugh and Joe A. Stone, "Teachers, Unions, and Wages in the 1970s: Unionism Now Pays," *Industrial and Labor Relations Review,* Vol. 35, No. 3 (April 1982), pp. 368-76; and Richard B. Freeman and James L. Medoff, "The Impact of Collective Bargaining: Can the New Facts Be Explained by Monopoly Unionism?" National Bureau of Economic Research Working Paper No. 837 (Cambridge, Mass.: NBER, January 1982).

[2]A summary of the "new" view of unionism is presented in Richard B. Freeman and James L. Medoff, "Two Faces of Unionism," *The Public Interest,* Vol. 57 (Fall 1979), pp. 69-93.

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hypothesis that union workers have a higher marginal productivity schedule is difficult to obtain.

Estimation of union-induced differences in labor productivity is limited to only a few studies of a handful of industries. Attempts to study the productivity issues in the private sector have been plagued by the lack of firm-specific data and, at least until recently, the scarcity of nonunion firms in many industries. The scattered results to date suggest that unionized enterprises are more productive than comparable nonunionized enterprises in manufacturing, construction, and the underground bituminous coal industries, although coal mining showed the opposite relationship during its turbulent years around 1975.[3] Investigations of union-nonunion productivity differentials in the public sector have been thwarted by the ambiguities in defining and measuring the output of public services. Nevertheless, a few publicly provided services, notably libraries, fire protection, and education, are suitable for investigating productivity issues. Ehrenberg and others, for example, use recent innovations in the measurement of library services to study differences in labor productivity between union and nonunion libraries and find no significant difference.[4]

This study examines union-induced effects on productivity in public schools. Instead of estimating union-nonunion differences in productivity within a production-function framework, however, the analysis focuses on the behavior and characteristics of teachers that have been shown to be significantly related to student achievement. The general consensus in the educational production-function literature is that teachers do significantly affect student achievement. Murnane, in a recent survey, concludes that "virtually every study of school effectiveness finds that some attributes of teachers [such as experience and educational attainment] are significantly related to student achievement."[5] In addition, an estimation of an educational production function, using the same data as those used in this paper, reveals that the time teachers spend in instruction and class preparation, the number of years of experience of teachers, and the teacher-student ratio are among the most important school-based effects on the educational process.[6]

It is the contention of this paper that if collective bargaining is to have a significant effect on the productivity of schools, its effect must be channeled through one or more of those components of productivity. Since no previous study using cross-sectional data has estimated the effect of collective bargaining on the allocation of teacher time, this study gives primary attention to that effect. The effect of collective bargaining on the teacher-student ratio and on the experience of teachers is also considered, but in less detail. The question that is not addressed in this paper is the overall effect of teacher collective bargaining on student achievement. Such an effort would require estimating a simultaneous system of

[3]Studies of productivity include Charles Brown and James Medoff, "Trade Unions in the Production Process," *Journal of Political Economy*, Vol. 86, No. 3 (June 1978), pp. 355 - 78; Kim B. Clark, "The Impact of Unionization on Productivity: A Case Study," *Industrial and Labor Relations Review*, Vol. 33, No. 4 (July 1980), pp. 451 - 69; Marie Connerton, Richard B. Freeman, and James L. Medoff, "Productivity and Industrial Relations: The Case of U.S. Bituminous Coal," mimeo (Cambridge, Mass.: Harvard University, 1979).

[4]Ronald G. Ehrenberg, Daniel R. Sherman, and Joshua L. Schwarz, "Unions and Productivity in the Public Sector: A Study of Municipal Libraries," *Industrial and Labor Relations Review*, Vol. 36, No. 2 (January 1983), pp. 199 - 213.

[5]Richard J. Murnane, "Interpreting the Evidence on School Effectiveness," *Teachers College Record*, Vol. 83, No. 1 (Fall 1981), p. 21.

[6]For our estimation of an educational production function, see Randall W. Eberts and Joe A. Stone, *Unions and Public Schools; The Effect of Teacher Collective Bargaining on American Education* (Lexington, Mass.: Lexington Books, 1984), chap. 3. David E. Wiley and Annegret A. Harnischfeger, "Explosion of a Myth: Quantity of Schooling and Exposure to Instruction, Major Educational Vehicles," *Educational Researcher*, Vol. 3, No. 4 (1974), pp. 7 - 12, and Benjamin S. Bloom, "Time and Learning," *American Psychologist*, Vol. 29, No. 9 (1974), pp. 682 - 88, also show that instructional time is an important factor in education. For the effect of class size on student achievement, see Mary Lee Smith and Gene V. Glass, *Meta-Analysis of Research on the Relationship of Class-Size and Achievement* (San Francisco: Far West Laboratory, July 1979).

equations—an equation for each behavioral response and an equation for the educational production function. This paper, by considering primarily the effect of collective bargaining on the allocation of time, can be viewed as the first stage of a much broader task of assessing the effect of collective bargaining on student achievement.[7]

A Model of Teachers' Allocation of Time

Teachers perform a variety of activities during a typical school day. Outside the classroom, they choose among such activities as preparing for class, meeting with parents, and attending after-school functions. Within the classroom, teachers determine the amount of time students devote to various subject matters and skill development. Although time spent on specific instructional tasks is important in an examination of teacher effectiveness and can conceivably be affected by collective bargaining's influence on teacher attitudes, this paper is less ambitious and focuses rather on broader categories of time. Thus, all of the various tasks performed by teachers and students in the classroom are grouped together under the rubric instructional time, which is assumed, on the basis of previous studies,[8] to be positively related to student achievement.

Teachers allocate time among instruction and four additional categories of activities: class preparation, administrative and clerical duties (such as taking attendance and duplicating material), parent conferences, and other noninstructional duties. The amount of time devoted to each activity depends upon both teacher preferences and school policies. Within the constraints of school policies, teachers are assumed to allocate their time according to an individual objective function that comprises student achievement (usually measured by test scores) and the teachers' own objectives. Under this model of teacher behavior, teachers must know the amount of time required to bring about a certain level of student achievement in order to allocate their time efficiently. It is obviously difficult for teachers to know the precise marginal productivity of the time they spend in each activity with each student, since the educational process depends upon a number of factors that are stochastic and beyond the control of teachers. Through testing and other means of evaluation, however, they can be presumed to have a reasonably good idea of the effectiveness of their various activities.

Recognizing that student i's achievement (S_i) is a function of the amount of time a teacher spends with student i in activity j (a_{ij}) as well as a variety of exogenous factors (Z_i), we can describe the teacher's utility function as follows, with time spent in each activity as the decision variable:

$$U[S_1(a_{11},\ldots,a_{15};Z_1),$$
$$\ldots S_N(a_{N1},\ldots,a_{N5};Z_N);a_1,\ldots a_5],$$

where $a_1,\ldots,a_5$ is the total amount of time the teacher spends in each of the five activities.

By constructing the model in this way, we assume that teachers receive sufficient compensation to offset the disutility associated with sacrificing leisure in order to engage in the various activities. It is generally the case that if school districts base teacher salaries on the length of time at work, they base it upon the total length of the school day or school year, and not upon the amount of time a teacher spends in any one of the first four activities listed above. The only exception may be after-school activities, the fifth category. In many school districts, teachers receive supplemental pay for participating in such after-school functions as musical programs, athletic events, and even, in some instances, staff or parent-teacher meetings. Thus, the extent to which teachers engage in these activities may depend upon the amount of extra compensation. With regard to the other four activities performed during regular

[7]Murnane, in "Interpreting the Evidence," p. 27, offers a compelling argument for considering the effect of collective bargaining on the allocation of educational effects before simultaneously entering all factors in a production function. He points out that "resource configurations in ongoing systems result from a large number of institutional mechanisms, internal labor market rules and customs, and the responses of teachers and students and families to these mechanisms."

[8]See sources cited in note 6.

indicate that collective bargaining reduces instruction an equivalent of five school days a year, when a typical school day is one in which the teacher spends approximately 60 percent of the day in instruction. On the other hand, collective bargaining increases class preparation time by an equivalent 6.5 school days.

Collective Bargaining and Other Educational Effects

Although the major emphasis of this paper is on the effect of collective bargaining on the allocation of teacher time, a number of interesting results concerning class size and teacher characteristics also emerge. These relationships are important in understanding the overall effect of collective bargaining on student achievement. Although definitive conclusions cannot be made until these factors are formally integrated in an educational production function, these preliminary results are still instructive in understanding the direction of influence of collective bargaining on student achievement.

The effect of collective bargaining on staff size has already been discussed in connection with the indirect effects of collective bargaining on administrative constraints. Results in Table 3 show that districts with collective bargaining have more teachers and administrators per student but employ fewer clerical staff and aides per student than districts without collective bargaining. Estimates reveal that districts with collective bargaining have on average five more teachers per 1,000 students (or 10 percent more teachers) than districts without collective bargaining. Similarly, districts with collective bargaining have 5 percent more administrators. These increases are partly offset by a 7 percent reduction in clerical staff. Results also reveal that teachers covered by a master contract (one covering all teachers in a district) have more teaching experience (roughly one and a half years or 16 percent more) and have received more education.

Table 5 summarizes the effects of collective bargaining on various components of teacher productivity by listing the direction of influence of collective bargaining on the specific variables considered in this study and the direction of influence of these variables on student achievement. Collective bargaining appears to reduce student achievement by reducing time spent in instruction, by increasing the level of education of teachers, and by increasing the number of administrators. On the other hand, collective bargaining tends to increase student achievement by increasing the time teachers spend in class preparation, by increasing the experience level of teachers, and by increasing the teacher-student ratio. The net effect of collective bargaining on student achievement, exerted through these several conflicting channels, is obviously ambiguous.

Conclusion

The monopoly view of unions hypothesizes that unions, through negotiating higher wages and fringe benefits, cause allocative inefficiency. Freeman and Medoff, however, contend that the distortion will be reduced if unions shift upward the marginal productivity schedule of workers. The purpose of this paper was to examine the effects of collective bargaining on the allocation of teacher time and other determinants of student achievement, with the acknowledgement that this is the first stage of analysis in assessing the overall effect of collective bargaining on student achievement and thus the productivity of teachers.

The results indicate that there is a tendency for unions to shift the marginal productivity of public school teachers, but the direction of the shift is unclear. Analysis of data from a national survey of over 3,000 elementary school teachers indicates that teachers covered by collective bargaining spend approximately 3 percent less time in instruction than teachers not covered by collective bargaining. These same teachers, on the other hand, spend more time preparing for class. In addition, collective bargaining increases the experience and education level of teachers and increases the number of teachers and administrators per student.

It is not possible at this time to assess the overall effect of collective bargaining on

Table 5. Summary of the Effect of Collective Bargaining on Selected Variables and the Effect of These Variables on Student Achievement.†

Variable	*Effect of Collective Bargaining on the Variable*	*Effect of the Variable on Student Achievement*	*Direction of Net Effect*
Time Teachers Spend in Instruction	−	+	−
Time Teachers Spend in Preparation	+	+	+
Experience Level of Teachers	+	+	+
Education Level of Teachers	+	−	−
Teacher-Student Ratio	+	+	+
Administrator-Student Ratio	+	−	−

†The table contains only those variables considered in the analysis whose effects on student achievement have been estimated by the author or supported by other studies. Signs in the second column are taken from the studies listed in footnotes 5 and 6 of the text.

teacher productivity. Such an assessment depends upon the relative magnitudes of the marginal productivities of the various components of productivity, and these are not yet estimated with sufficient precision and consistency across studies to draw definitive conclusions. The results presented here do indicate, however, that collective bargaining has a significant influence on the allocation of important educational activities, thereby providing a better understanding of the mechanisms by which collective bargaining influences teacher productivity.

(36)

UNIONS AND PRODUCTIVITY IN THE PUBLIC SECTOR: A STUDY OF MUNICIPAL LIBRARIES

RONALD G. EHRENBERG, DANIEL R. SHERMAN, and JOSHUA L. SCHWARZ*

This paper develops and illustrates the use of two methodologies to analyze the effect of unions on productivity in the public sector. Although the methodologies are applicable to a wide variety of public sector functions, the focus of the paper is on municipal libraries because of the availability of relevant data. The empirical analysis, which uses 1977 cross-section data on 260 libraries, suggests that collective bargaining coverage has not significantly affected productivity in municipal libraries.

THE traditional neoclassical view of unions asserts that although unions may benefit their members by creating noncompensating wage differentials, they also cause allocative efficiency losses and thus have a negative impact on the economy as a whole. Recently, however, this view has been challenged by Richard Freeman, James Medoff, and their associates at Harvard.[1] Drawing on hypotheses put forth long ago by institutional economists, they have argued that unions may well increase productivity in a number of ways: by reducing turnover, increasing morale and motivation, and expanding formal and informal on-the-job training. Indeed, several of these scholars' econometric studies suggest that union/nonunion productivity differentials in the private sector are often positive.[2] To the extent that these results are generalizable, one must question whether unions in the private sector have actually had net adverse effects on efficiency.

No research, however, has been directed toward ascertaining the effect of unions on productivity in the public sector. This

*Ronald Ehrenberg is a professor of economics and labor economics at Cornell University and a research associate at the National Bureau of Economic Research. Daniel Sherman and Joshua Schwarz are graduate students at the New York State School of Industrial and Labor Relations, Cornell University. This research was supported by the National Science Foundation. An earlier version of the paper was presented at the Winter 1981 Econometric Society meetings. Without implicating them for what remains, the authors are grateful to Daniel Hamermesh and the discussants at those meetings for their comments on earlier drafts.

[1]A good, nontechnical treatment of their views is found in Richard B. Freeman and James L. Medoff, "The Two Faces of Unionism," *Public Interest*, No. 57 (Fall 1979), pp. 69–93.

[2]See, for example, Charles Brown and James L. Medoff, "Trade Unions in the Production Process," *Journal of Political Economy*, Vol. 86, No. 3 (June 1978), pp. 355–78, for evidence on manufacturing; Kim B. Clark, "The Impact of Unionization on Productivity: A Case Study," *Industrial and Labor Relations Review*, Vol. 33, No. 4 (July 1980), pp. 451–69, for evidence on the cement industry; and Steven G. Allen, "Unionized Construction Workers are More Productive," mimeograph (Washington, D.C.: Center to Protect Worker Rights, 1979) for evidence on construction. Lest one conclude that these researchers always find that unions increase productivity in the private sector, see Marie Connerton, Richard B. Freeman, and James L. Medoff, "Productivity and Industrial Relations: The Case of Bituminous Coal," unpublished mimeograph (Cambridge, Mass.: Harvard University, 1979).

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neglect is understandable, since the concepts of output and productivity in the public sector are often not well defined, and the difficulties inherent in trying to measure productivity are consequently large. Nevertheless, the growing financial difficulties of state and local governments suggest that this important problem can no longer be ignored. Most studies of public sector wage determination have indicated that unions have had only modest effects on their members' compensation;[3] studies of public-employee unions' effects on productivity are now required to complete our understanding of the effects these unions have had on municipal finances and service flows.

This paper therefore develops, and illustrates the use of, methodologies to analyze the effects of unions on productivity in the public sector. The methodologies discussed can be applied to a wide variety of public sector functions such as education, police, fire protection, and sanitation; but the focus here is on municipal libraries. This focus was chosen in part for expository reasons, since considerable effort has been devoted to conceptualizing productivity measures for libraries, and in part because relevant data are available for libraries.[4] Thus, although the issue of productivity in municipal libraries is important in its own right, we would stress the more general purpose of the paper.

Analytic Framework

Municipal libraries produce a variety of outputs, such as circulating books, periodicals, and other audio-visual materials; responding to requests for information and interlibrary loans; and providing reference facilities. These outputs can, in theory, be evaluated both quantitatively and qualitatively. One could, for example, simply count circulation figures or the number of information requests, but a more sophisticated valuation of library output would focus on such questions as "What proportion of information requests were answered correctly?" or "How long did the typical borrower have to wait for a book that he or she wanted?"

For now, we shall ignore the fact that libraries can be thought of as multiproduct firms, and throughout the paper, because of data limitations, we are forced to ignore the quality dimension of the services libraries provide. Instead, we treat library output (Q) as a single variable. The community *demand function* for library services can then be specified as:

$$D = D(P|V_1,V_2). \tag{1}$$

Here, P is the "price" the community must pay for a unit of library services; other things equal, the higher the price, the fewer the library services demanded. The position of the demand curve will depend on both community income or wealth, with higher income areas demanding more library services, and on the size of the community (V_1). It will also depend on the community's "tastes" for library services (V_2). More highly educated communities, for example, may demand more library services, as may communities with a relatively large proportion of school-aged children.

The second element of our model is the following production function for library services:

$$Q = F(K,L|V_3,U). \tag{2}$$

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[3]See, for example, Orley Ashenfelter, "The Effect of Unionization on Wages in the Public Sector: The Case of Firefighters," *Industrial and Labor Relations Review*, Vol. 24, No. 2 (January 1971), pp. 191–202; Ronald G. Ehrenberg and Gerald S. Goldstein, "A Model of Public Sector Wage Determination," *Journal of Urban Economics*, Vol. 2, No. 2 (July 1975), pp. 223–45; and Hirschel Kasper, "The Effects of Collective Bargaining on Public School Teachers' Salaries," *Industrial and Labor Relations Review*, Vol. 24, No. 1 (October 1970), pp. 57–72.

[4]For previous discussions of library productivity, including its quality dimension, see Malcolm Getz, *Public Libraries: An Economic View* (Baltimore, Md., Johns Hopkins University Press, 1980); Karen Feldstein, *The Economics of Public Libraries*, unpublished Ph.D. dissertation (Cambridge, Mass.: Massachusetts Institute of Technology, 1977); F. W. Lancaster, *The Measurement and Evaluation of Library Services* (Washington, D.C.: Information Resources Press, 1977); and Ernst R. DeProspo, Ellen Altman, and Kenneth E. Beasley, *Performance Measures for Public Libraries* (Chicago, Ill.: Public Library Association, 1973).

collective bargaining coverage is positively associated with the number of interlibrary loans, other things equal, neither the number of borrowers nor the library's circulation of books and other materials is related to collective bargaining coverage.[26]

The production-function approach to estimating the effects of unions on productivity in the public sector is more direct than the first approach described and thus might seem to be preferable. Such an approach, however, requires the researcher to have data on full-time and part-time employment levels of various categories of public employees and to make assumptions about the elasticities of substitution among different labor inputs. As noted in Table 6, the lack of the necessary employment data reduced our sample sizes to roughly 100 observations when we used this approach. Because of these problems, many researchers may find the indirect approach to be preferable.

Concluding Remarks

This paper has presented two analytic frameworks that can be used to analyze the effects of collective bargaining on productivity in the public sector. The first involves estimating reduced-form output equations, based on a model of the equilibrium level of public services in a community. The second involves direct estimation of public sector production functions. Both frameworks allow for the treatment of collective bargaining coverage as endogenous and for controls for selectivity bias.

The frameworks were illustrated using cross-section data for a sample of 256 municipal libraries in 1977. The estimates obtained suggest that collective bargaining coverage for library employees is *not* associated with higher wage rates or with higher (or lower) levels of library circulation and borrowers. Both approaches do suggest, however, that the number of interlibrary loans is larger in unionized libraries. Since this category of library output is not a major one, collective bargaining coverage, on balance, does not appear to affect significantly library output or library employees' wages. Our estimates also suggest that both the overall level of local-government unionization in a state and the state's laws governing collective bargaining in local government are significant determinants of whether any given municipal library is organized.

Although output measures are often difficult to quantify for other local-government functions, our approaches, in principle, can be implemented for a variety of functions, including those in which public sector unions might, a priori, be expected to have larger effects (education, police, firefighters, and sanitation, for example). The approaches could also be extended by using longitudinal data to ascertain the extent to which changes in collective bargaining status are associated with changes in employee productivity.[27] Finally, with suitable data on the provisions of collective bargaining agreements, rather than data on their mere existence, one could attempt to trace the routes by which unions influence productivity in the public sector; that is, one could attempt to ascertain directly how grievance resolution procedures, the role of seniority in layoffs and promotions, and restrictive work rules affect productivity.

[26]Two alternative specifications warrant mention here. We relaxed the assumption of a Cobb-Douglas technology and attempted to ascertain if collective bargaining coverage affects the elasticity of substitution between capital and labor (using a CES production function) or the elasticities of substitution among different categories of library employees (using a translog cost function). Neither of these alternative approaches indicated any significant relationships between collective bargaining coverage and the elasticities of substitution. For a discussion of how unionization affects elasticities of substitution in the private sector, see Richard B. Freeman and James L. Medoff, "Substitution Between Production Labor and Other Inputs in Unionized and Nonunionized Manufacturing," *Review of Economics and Statistics*, Vol. 64, No. 2 (May 1982), pp. 220–33.

[27]See Clark, "The Impact of Unionization on Productivity: A Case Study," for an application of this approach to the private sector.

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COOPERATION, PRODUCTIVITY, AND PROFIT SHARING*

FELIX R. FITZROY AND KORNELIUS KRAFT

Firm-specific assets generate an ex post bargaining problem over surplus-division, and rational workers may collude to obtain a surplus-share in nonpecuniary form through restriction of effort. Conversely, profit sharing should motivate cooperation to increase productivity when work organization facilitates interaction and horizontal monitoring, since productive effort yields positive externalities to workers under contractual surplus sharing. In simultaneous Tobit estimates we find a strong influence of profit sharing on factor productivity in a sample of medium-sized metalworking capitalist firms in West Germany. Proxies for human capital and organizational factors were included.

I. INTRODUCTION

Motivating work effort in the firm has traditionally been regarded as a matter of providing adequate individual incentives. This task was facilitated by the scientific management movement and collective bargains in which precise, formalized job descriptions allowed fairly objective evaluation and reward of individual performance [Hill, 1981]. Subjective effort and disutility of work are of course difficult to estimate for management, and workers have an obvious interest in exaggerating disutility to gain compensating differentials. Collusive restriction of output to maintain earnings with less effort is well documented [Gordon et al., 1982; Frank, 1984] and can be regarded as an attempt by workers to obtain a share of enterprise surplus[1] in a nonpecuniary or unobservable form. Scientific management can also be regarded in part as an attempt to inhibit unproductive collusion through appropriate job design and organization of work [Gordon et al., 1982], a "bonus" for employers that accompanied the direct reduction in skill requirements and labor costs through carefully subdivided and routinized

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1. Even in perfect competition the existence of firm-specific investments and mobility costs is likely to create an ex post enterprise surplus above total factor opportunity costs and hence give rise to the bargaining problem [Aoki, 1984; FitzRoy and Mueller, 1984].

tasks which was already observed by Adam Smith and Charles Babbage [1835].

The relative decline of traditional mass production, and the growth of specialized production, with rapid technological and market change, have all imposed increasing demands of adaptability and skill on the modern work force. Cooperation, communication, and human capital have become increasingly important "factors" of production that are less easily monitored and motivated with traditional individual incentives and work organization [Reich, 1983; Piore and Sabel, 1984]. Declining productivity growth and stagflation have also stimulated a growing interest in improving traditional adversarial industrial relations through more flexible work organization and various forms of worker participation and profit sharing [*Business Week*, 1983]. Long-standing opposition to such potentially productive alternatives to formalized collective bargains has begun to recede, as the positive role of cooperative labor relations in such countries as Japan and West Germany attracts increasing attention [Gordon, 1982; Ouchi, 1981]. However, no generally accepted microeconomic foundation for group incentives and cooperative behavior has yet emerged, and some economists still see only a distributive role for the "voice" of labor or sharing "surplus."[2]

While these issues have been considered in the context of cooperatives and trade unions,[3] there has been very little rigorous theoretical or empirical study of group incentives and "cooperation" in the very different environment of capitalist firms.[4] In the

2. Alchian and Demsetz [1972] base their theory of the firm on perfect mobility of labor and absence of firm-specific human capital, and although they emphasize team-work, monitoring costs, and the importance of "Team spirit and loyalty," they entirely miss the connection with "voice" and participation, which was developed earlier by Hirschman [1970]. Alchian [1984] admits that costless mobility is unrealistic, but still regards "worker participation" as "a wealth confiscation scheme" [p. 46], in spite of his own recognition, two paragraphs earlier, that "any persons . . . who have human capital specific . . . to the firm will demand some control and monitoring *via* representation . . . or some other form of protection from expropriation of their specialized investment's quasi rent" [p. 46]. Similarly, Jensen and Meckling [1979] reveal no awareness of the efficiency-voice argument (based on mobility costs) for the sharing of various "rights" including team-specific surplus, or of the many ways in which Nash equilibria can deviate from Pareto efficiency.

3. See Bradley and Gelb [1981, 1983]; Bonin and Putterman [1984]; Drèze [1985]; Jones and Svejnar [1984]; Defourney, Estrin, and Jones [1985]; and Jones and Svejnar [1985] on cooperatives, and FitzRoy and Kraft [1985a, c] and Freeman and Medoff [1984] on the "voice" of organized labor and formal institutions for intrafirm cooperation.

4. Basic economics of cooperation and "horizontal monitoring" were developed in FitzRoy and Hiller [1978] and FitzRoy and Mueller [1984]. Regression results in Cable and FitzRoy [1980] were based on single-equation OLS estimates and are thus subject to simultaneity bias as well as to problems of omitted variable bias due to absence of proxies for human capital, and to difficulties with comparability across

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UNION DENSITY AND ECONOMIC PERFORMANCE

An analysis of U.S. States

Richard FREEMAN*
Harvard University, Cambridge, MA 02138, USA

1. Introduction

In recent years the economies of unionised areas of the U.S. have not performed as well as those of non-unionised areas. Economic growth and investment have been lower and unemployment higher in the unionised North than in the less unionised South, even with diverse other factors held fixed (Olson; McGee; Browne, Mieskowski and Syron; Summers; Freeman and Medoff; Montgomery), leading some to argue that unionism has been bad for the nation's economy.

And yet ... national economic performance did not improve as union density dropped in the 1970s and 1980s ... the economies of several unionised states such as New York or Massachussetts performed better than those of weakly unionised states such as Texas or the Carolinas ... the level of productivity is relatively high in unionised states (Brown and Medoff) ... and productivity growth barely differs between more and less unionised industries (Allen).

Is the tendency for unemployment to be higher and economic growth to be lower in unionised as opposed to non-unionised states a causal connection, or is it a spurious one?

This paper presents evidence that the cross-section link between union density and economic performance is more likely to be spurious than real. It replicates previous research that found unemployment to be high and economic growth to be low in highly unionised states, but also finds that these states have wages and per capita income markedly higher than is explicable by union wage premia, finds no consistent relation between union density and the proportion of the working-age population that is employed, and finds that the relation between density and performance disappears when one controls for omitted state variables in a longitudinal analysis. The

*With the assistance of Alida Castillo.

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Unionization and Productivity in Commercial Banking

DUANE B. GRADDY and GARY HALL
Middle Tennessee State University, Murfreesboro, TN 37132

This paper examines the net effect of unions on productivity in the commercial banking industry. The focus of the study is on three methodological issues. First, an attempt is made to determine whether individual unions have a differential impact on banking productivity. The influence of unions on output per man-hour was initially estimated by including a union dummy variable in a Cobb-Douglas formulation of bank production. Separate binary variables were then entered into alternative specifications of the model to test the heterogeneity hypothesis. This hypothesis postulates differential productivity effects among the individual unions operating in the commercial banking sector. Second, the sample banks were paired on a case-by-case basis to assure the homogeneity of the two groupings: i.e., union and nonunion. Sample homogeneity is necessary because of the assumptions of identical production functions and output prices between the groups. Third, a complete covariance model was specified in order to estimate the impact of unionization on each parameter of the production function. In general, the unionized banks were less productive than their nonunion peers. It should be noted, however, that the standard errors were large in all the specifications. Moreover, the labor relations problems associated with one union had a large impact on the sector results.

I. *Introduction*

The effect of unions on productivity has been widely discussed by both labor relations practitioners and scholars. While elaborate theoretical arguments support both sides of the issue,[1] only recently have researchers attempted to make statistical estimations of the impact of unions on the firm's production function. The methodological focus has been on a homogeneous union dummy variable that is included among the regressors of either a Cobb-Douglas or a CES production function. The sign and significance of this variable provide a basis for determining whether or not unions induce changes in productivity.

This general approach has been used to estimate the influence of unions on productivity in the cement, underground bituminous coal, construction, librar

[1]For a comparison of neoclassical theory to the collective voice approach, see Freeman and Medoff (1979).

services, and all 2-digit SIC manufacturing industries.[2] These studies, however, have yielded mixed results with respect to both the magnitude and the direction of the union productivity effect. The present paper suggests three possible reasons for the discordant findings. First, no one has addressed nonhomogeneity within the unionized sector itself.[3] To the extent that managers interact differently with various unions, it may be unrealistic to treat all unions as members of a single, homogeneous group. That is, it is possible that differences among the objective functions of the participating unions may be off-setting, making it difficult to portray the full impact of unionization on productivity by using a single binary variable.

Second, most studies assume that unionized and nonunionized firms (or sectors) have identical production functions (Addison, 1981, pp. 14-15). Furthermore, in studies using value-added as a measure of output (e.g., Brown and Medoff, 1978), there is a general presumption that the productivity and price effects are not compounded. Yet it is rare for such studies to analyze the sample characteristics that lead to these conclusions. Of course, a lack of firm specific data has precluded such an examination in most cases. Nevertheless, ambiguities introduced by interfirm differences in technology and market structure can confound the unionization effect making interpretation of the statistical results difficult.

Third, past studies (see Brown and Medoff, 1978, and Ehrenberg, Sherman, and Schwarz, 1983) have analyzed the impact of unionization on productivity through induced organizational changes or the so-called "shock theory."[4] However, a more comprehensive comparison of the productivity of unionized vis-a-vis nonunionized firms dictates the examination of not only differences in intercepts, but differences in the entire systemic relationship among the variables in the production function. Estimation of a complete covariance model may produce results that are fundamentally different from those revealed when only an intercept dummy is included in the equation (Kmenta, 1971, pp. 451-466).

The production function methodology will be used in this paper to estimate the union productivity effect in the commercial banking industry. This sector seems particularly appropriate for analysis because *several* unions are vying for organizational opportunities among the more than 1.2 million nonsupervisory employees (Brand and Duke, 1982, pp. 21-22).[5] The primary focus of the study is on the three methodological issues mentioned above. First, the possibility of heterogeneity across unions in their effects on labor productivity is accounted for

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[2]Addison (1981) provides a critique of these studies.

[3]One possible exception is Clark's (1980b) use of dummy variables to capture the regional influence of various unions, but this is not a direct test of the heterogeneity hypothesis.

[4]Clark (1980b) is an exception to this statement.

[5]Banks may face increasing organizing efforts in the future as automation eliminates jobs, violating the implicit long-term contract (job tenure) that bank employees have historically accepted as compensation for relatively low pay.

by including a dummy variable for each major union active in the commercial banking sector. Second, great care is exercised in selecting a sample of union and nonunion banks that is homogeneous with respect to market area and input-output characteristics. Third, specification of a model with intercept and interaction terms provides a basis for estimating the impact of unionization on both the technology and efficiency parameters of the production function.

Section II develops an empirical model of bank production and defines the variables used in the regression equations. The sample analyzed in this study is described in Section III. Section IV considers the statistical results, and conclusions are presented in Section V.

II. *An Empirical Model of Bank Production*

As depository intermediaries, commercial banks transform funds acquired from surplus units into loans and discounts that are demanded by deficit units. In performing this transformation function, banks provide financial service flows to both borrowers and lenders. This multifarious aspect of bank operations complicates the definition of bank output and necessitates the development of some criteria for distinguishing between financial outputs and inputs. Conceptually, we follow the approach of Sealey and Lindley (1977) by defining bank production in the economic sense of creating products that are more highly valued than are the original input elements. According to Sealey and Lindley (1977, p. 1253), this means that "the services received by depositors of financial firms are more appropriately associated with the acquisition of economic inputs since these services require the financial firm to incur positive costs without yielding any direct revenue." That is, banks pay for deposit inputs implicitly in the form of nonreimbursed services as well as explicitly through interest payments. In contrast, those services embodied in earning assets or lending products are more highly valued in the market than the original inputs; thus, they are considered outputs of the banking firm.[6]

Generalizing, we can say that bank output is produced with capital, labor, and loanable funds (raw materials) inputs. Stating this relationship in the form of a Cobb-Douglas function with allowances for the distinction between supervisory

[6]This definition of bank output is consistent with contemporary approaches to customer profitability analysis. In general, each loan or loan class is priced to yield a target return over the cost of loanable funds and the net burden (i.e., the cost of capital and labor attributable to the loan less any service charges). Of course, the complete unbundling of a bank's product base might lead one to alter the definition.

opposed it. Thus, as Miller (1981/82, p. 394) concluded, had the NLRB found a systemwide unit appropriate, the union would have lost the representation election. The results for d_{u3} are important because they illustrate the sensitivity of the outcome for the entire sector to the labor relations problems of a few firms.

Equations IV and V consider the influence of the maturity of the labor/management relationship, n, and the size of the bargaining unit, b, on the productivity of the unionized banks.[20] The information in Table 3 shows that neither factor had a relevant impact on the level of productivity.

V. *Conclusions*

The purpose of this paper was to address three methodology issues (heterogeneity effect, sample design, and model specification) that, for the most part, have been neglected by past studies of the impact of unionization on firm productivity. Using data from the commercial banking industry, we attempted to determine if the individual unions operating in this sector had differential impacts on a firm's output per man-hour; that is, whether there was heterogeneity within the union group itself. The influence of unions on firm productivity was initially estimated by including a union dummy variable in a Cobb-Douglas formulation of the banking firm's production process. Separate union dummies were then entered into alternative specifications of the model to test the heterogeneity hypothesis. The sample for this study encompassed almost all of the unionized banks in the U.S. as of year end 1978 plus a peer group of nonunion institutions. The banks were carefully paired on the basis of similarity in both market characteristics and in input-output structures. A complete covariance model was specified to test the systemic relationship between unionization and firm production.

In general, the unionized banks were less productive than were their nonunion counterparts. This finding parallels the results of Ehrenberg, Sherman, and Schwarz (1983) for public libraries and some model specifications in studies of the coal and cement industries. Separation of the productivity effect from the output price effect through sample design may help to explain our statistical findings.

Substantial differences in the magnitude of the coefficients for the individual union dummy variables were revealed by tests of the heterogeneity hypothesis. Moreover, the labor relations problems associated with one union had a large impact on the sector results. That such problems can cause declines in productivity is supported by evidence from the bituminous coal industry (Clark, 1980b, p. 638). Finally, no significant difference in technology was revealed by the analysis of covariance. Of course, these findings must be tempered by the high standard errors evident in all of the regression models.

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[20]Kilgour (1982) implied that the negative impact of unionization on commercial banks may vary with the size of the bargaining unit.