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UNIONIZED CONSTRUCTION WORKERS ARE MORE PRODUCTIVE*

STEVEN G. ALLEN

This paper presents evidence on the effect of unionism on productivity in construction. The linkages are distinct from those studied previously in industrial settings. Apprenticeship training and hiring halls probably raise union productivity, while jurisdictional disputes and restrictive work rules lower it. Using Brown and Medoff's methodology, union productivity, measured by value added per employee, is 44 to 52 percent higher than nonunion. The estimate declines to 17 to 22 percent when estimates of interarea construction price differences are used to deflate value added. Occupational mix differences and, possibly, apprenticeship training account for 15 to 27 percent of this difference.

I. INTRODUCTION

This paper presents evidence on the effect of unions on productivity in the construction industry. While the previous studies of this issue in other sectors have generally found higher productivity under unionism, they have all focused on the effect of industrial, rather than craft, unions.[1] The institutional setting of the construction industry differs from that of manufacturing and mining in a number of ways. Jobs in the construction industry are generally of short duration because of both technical and economic factors. Beal, Wickersham, and Kinast [1976, p. 10] note that construction "calls for the use of skills *in sequence* . . . the personnel, the skills involved, and the actual crews employed are seldom the same from one week to the next." Market demand fluctuates considerably over time because of (1) seasonality in some types of work and (2) cyclicality resulting from the effect of credit conditions on the demand for housing and industrial capacity.

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1. This evidence is summarized in Freeman and Medoff [1979].

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V. Conclusion

The empirical evidence presented here strongly supports the hypothesis of a large, positive union productivity effect in this sector. One may still argue that these findings result from some unobserved factor. Nonetheless, the controls used in this study must be emphasized: capital-labor ratio, capital recentness, measurable labor quality, scale of production, industry, region, and interstate price differences. We have also presented evidence which counters the claim that differences in the elasticity of output with respect to capital and in hours worked can account for this result.

Through what mechanisms does unionism lead to higher productivity? The most likely factors, based upon the discussion of the case study evidence, were (1) better training at the journeyman level through joint apprenticeship programs, (2) changes in the occupational mix (including reduced use of unskilled labor and lower foreman to journeyman ratios), (3) reduced recruiting and screening costs for contractors, and (4) greater managerial ability.

A rough estimate of the contribution to productivity resulting from the availability of a core of highly skilled craftsmen trained in apprenticeship programs can be obtained as follows. The Bureau of Apprenticeship and Training has maintained records of completed apprenticeships for each construction occupation in each state since the second quarter of 1952, from which total completions for 1953–1972 were tabulated. In the four preceding years there were a sizable number of completions as a result of the surge in enrollments in 1946 and afterwards. Beforehand there were virtually none because of both the war and the depression. The 1953–1972 figure was multiplied by 1.2 to obtain an estimate of total completions for 1949–1972, which should include nearly every journeyman working in 1972 who was trained in this fashion. The ratio of this estimate to total construction employment in each state was added to the production function as an estimate of the percentage of apprentice graduates in the construction labor force. It is by no means an accurate measure because it ignores attrition or growth resulting from employment in other industries, interstate migration, and exit from the labor force. In the last years covered it may also include some graduates of open-shop programs.

To explore the effect of changes in the occupational mix resulting from unionism, the ratio of production to total employment was calculated from CCI for each sector in each state. A more detailed breakdown would be desirable, particularly across various skill levels of production workers. The 1970 Census of Population and tabulated May 1973–75 CPS breakdowns seem untrustworthy on this count, however. A vast majority of those employed as production workers in construction describe themselves as craftsmen; virtually none as laborers. The sign of this coefficient is uncertain. Substitution of semiskilled and unskilled labor increases the proportion of production workers, leading one to expect a negative sign. The simultaneous increase in supervisory personnel operates in the same direction if working foremen are used (who are considered production workers), but in the opposite direction if foremen do not use the tools of the trade. In other words, a high percentage of production workers could reflect either intensive use of unskilled labor, which reduces productivity, or a high ratio of employees per supervisor, which increases it. Regardless of the sign of this coefficient, inclusion of this variable permits one to adjust better for changes in deployment by occupation occurring under unionism and thus possibly to obtain further insights into the sources of the union-productivity effect.

If part of the higher productivity in the union sector results from apprentice programs or changes in the occupational mix, inclusion of these variables in the production function will result in (1) a positive coefficient for the apprenticeship variable and (2) a reduction in the percent union coefficient. The results for the apprenticeship variable in Table IV are quite sensitive to whether the dependent variable is deflated or not. In the undeflated specification, the apprenticeship coefficient is much larger than the percent union coefficient. The coefficient implies, however, that those who completed apprenticeships are at least twice as productive as other workers, a figure that is probably too high.[21] The apprenticeship variable is not significant in the deflated specification.

Changes in the ratio of production to total employment seem to be an important mechanism through which productivity is affected by unionism. The key factor here is most likely reduced use of unskilled labor. Concurring evidence on this point can be found in the Construction Labor Requirements studies of private multifamily housing, sewer works, and public housing.[22] In the South where unionism is relatively low, the percentages of labor hours for semiskilled and unskilled workers were 36.4, 36.8, and 38.2 percent, respectively. The corresponding percentages for the North Central region are 22.0, 26.9, and 28.7.

21. I am grateful to Gregg Lewis for bringing this to my attention.
22. See U.S. Department of Labor [1974b, 1976, 1979].

TABLE IV

PRODUCTION FUNCTION ESTIMATES FOR CONSTRUCTION WITH APPRENTICESHIP AND OCCUPATIONAL MIX VARIABLES

Dependent variable	Percent union members	Coefficient (S.E.) of completed apprenticeships/L	Production employment/L	Standard error	R^2
Undeflated	0.259 (0.074)	0.934 (0.410)	—	0.064	0.922
Undeflated	0.288 (0.064)	—	−0.922 (0.244)	0.060	0.931
Undeflated	0.244 (0.068)	0.662 (0.388)	−0.836 (0.245)	0.059	0.934
Deflated	0.159 (0.065)	0.010 (0.361)	—	0.056	0.895
Deflated	0.139 (0.058)	—	−0.499 (0.220)	0.054	0.903
Deflated	0.150 (0.063)	−0.158 (0.357)	−0.519 (0.226)	0.054	0.904

Note. Each equation also contains the following independent variables: ln(K/L), recentness, ln(L/Establishments), labor quality factor, and industry (2) and region (8) dummies. The Dodge cost index was used as the deflator in rows 4 through 6.

These two factors account for 27 percent of the undeflated union productivity effect and 15 percent of the deflated effect. Another factor that could conceivably contribute to higher productivity in the union sector is managerial efficiency. One indicator of this is the wage paid to managers in the union sector. While managers in the CPS do not report whether they are employed by a union or nonunion contractor, a rough estimate of this effect can be obtained by regressing managers' wages on percent union in their state and two-digit industry. An equation estimated over managers in the May 1973–75 CPS (who are not union members) showed no significant relationship between percentage of production workers who are union members and the log of average weekly earnings. The percent union coefficient (standard error) was 0.151(0.203). An even smaller coefficient (0.111) was obtained when percent union across all occupations was used instead. Of course, even though managerial efficiency, as measured by salary, is not significantly higher in areas where percent union is high, it remains possible that consideration of bonuses, stock options, or executive perks could lead to a different conclusion. Economies of recruiting and reduced qualitative uncertainty in the union sector and unobserved labor quality undoubtedly account for some of the union productivity effect. Further work pursuing the magnitudes of their impact would surely be worthwhile.

The evidence surveyed and reported here indicates that Freeman and Medoff's "collective-voice–institutional-response" model of unionism must be extended somewhat in order to understand fully the role of unions in the construction industry. The basic element of that model, that unionism is a necessary condition for the production of certain collective goods at the workplace, still applies. The role of union "voice," however, must be de-emphasized in a labor market with such short employer-worker attachments. The construction worker under unionism is attached to his trade, not any particular employer. Nonetheless, construction unions produce a number of services that are useful to both workers and contractors. The uniform wage rate and the hiring hall economize on search time for both parties. Employer uncertainty about the qualifications of any particular journeyman is reduced as long as union membership standards are maintained, making union status a productive "signal" or "trademark."

Of course, construction unions also possess market power that can be used to bargain for wages above the value of labor's contribution to the value of output. The critical issue in evaluating the overall economic impact of unions in construction is whether the union wage effect exceeds the union productivity effect. Since interarea differences in goods prices are correlated with percent union in construction, it is not appropriate to compare the undeflated 54 percent wage effect for men obtained in Section III to the deflated productivity effects reported in Section IV. Wages of individuals in thirty-seven cities identified on the May 1973 CPS were deflated by the BLS index of the annual intermediate budget for a four-person family in autumn 1973 and Bloch and Kuskin's [1978] procedure of estimating separate wage equations for union and nonunion workers (so that unions affect both the intercept and the slope) was used to obtain an estimate of the "real" union wage effect. The coefficients of the nonunion equation imply a real wage effect of 45 percent; the union equation, 35 percent.[23] Since these figures are larger than all but one of the deflated estimates of the productivity effect (the hours adjusted estimate of 39.2 percent), the wage difference between union and nonunion labor in construction probably does not result entirely from a productivity difference. Given the decline in percent union in this industry since the late 1960s, further work in this area should focus upon whether this is a transitory or permanent phenomenon.

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23. As in Bloch and Kuskin [1978] and other studies of union wage effects where the hypothesis of unequal slopes has been tested, the return to schooling is lower in the union sector. However, the age-wage profile is steeper in construction, whereas other studies have found flatter profiles for union workers. This result is even more surprising in light of the practice of paying all journeymen in the same trade the same wage. Conceivably the training differences between the two sectors are so large that they override the flattening effects of the common wage rate to produce a steeper age-wage profile.

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WHY CONSTRUCTION INDUSTRY PRODUCTIVITY IS DECLINING

Steven G. Allen*

Abstract—The sources of productivity change in the construction industry between 1968 and 1978 are examined. Production function analysis indicates that productivity should have declined by 8.8%, representing 41% of the observed decline. The biggest factor in this decline was the reduction in skilled labor intensity resulting from a shift in the mix of output from large scale commercial, industrial, and institutional projects to single-family houses. The difference between the official deflator and the new deflator proposed here accounts for an additional 51% of the reported productivity decline, leaving only 8% of the decline unexplained

I. Introduction

ACCORDING to unpublished data compiled by the Bureau of Labor Statistics (BLS), productivity in the construction industry reached a peak in 1968 and, except for a brief and small upturn between 1974 and 1976, has been falling ever since. Real output (value added) per hour in construction fell at an annual rate of 2.4% between 1968 and 1978. In contrast, between 1950 and 1968 real output per hour rose at an annual rate of 2.2%. This amounts to a decline in the annual average rate of productivity growth of 4.6 percentage points.

Because construction accounts for 5% of employment and output, this productivity decline has had a nonnegligible effect on the slowdown in aggregate productivity growth over this period. The annual growth rate of output per hour in the nonfarm business sector dropped from 2.4% between 1950 and 1968 to 1.5% between 1968 and 1978. If productivity in construction had continued at the same rate as in the 1950–1968 period, aggregate productivity growth would have fallen to 1.7%. Viewed in this way, roughly 22% of the decline in aggregate productivity growth over these periods can be attributed to the construction industry.[1]

A study by Stokes (1981) of the U.S. Department of Commerce is, to my knowledge, the only careful analysis of the sources of the productivity decline in construction. Stokes found slower growth in capital per worker responsible for a 0.8% decline in the growth rate of productivity. No other factor accounted for more than 0.2 percentage points and all factors combined accounted for a mere one-fourth of the change in the growth rate. Stokes' analysis implies productivity should have continued to grow at a slower rate rather than declining.

A more recent study by Schriver and Bowlby (1985) examines changes in real unit cost in building construction between 1972 and 1982. They obtain these estimates through hedonic price equations deflated into 1972 dollars with a weighted average of a price index for single-family homes and the cost indexes published by the Turner Construction Company and American Appraisal Company. They find that changes in the mix of output within building construction explain over one-third of the observed increase in building costs.

This paper takes two new approaches to explaining this decline in productivity. First, instead of using the conventional growth accounting framework, I use production function estimates to assign weights to various factors responsible for productivity change. This approach allows me to estimate the impact of two variables that generally are excluded in the growth accounting approach: the extent of unionization and the mix of output.

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[1] Even before 1968 many observers felt construction lagged behind the rest of the economy in terms of productivity growth. Data on productivity change by industry reported in Baily (1981) do not bear this out. Between 1948 and 1968 labor productivity grew more rapidly in construction than in manufacturing, finance, retail trade, and services. However, while productivity continued to grow in most other sectors of the economy between 1968 and 1978, it was falling in construction. Only the mining industry had a worse productivity performance over this period.

It also allows me to test whether the weight given by Stokes to changes in the capital–labor ratio is appropriate.

Second, the price deflator used in the national income accounts is upwardly biased because it is still based largely on cost data for labor and materials rather than on prices of actual projects. I derive a new deflator for nonresidential building construction based largely upon F. W. Dodge data on the value and square footage of various types of projects. Since the appropriateness of this deflator depends upon the assumption that square footage is a reasonable proxy for output, I use micro data on contract amounts, square footage, and building characteristics for four samples of buildings to assess its validity.

II. Production Function Estimates

To determine the impact of the capital–labor ratio, economies of scale, labor quality, percentage union, the composition of output, and the distribution of construction projects across regions, I estimated a Cobb-Douglas production function over data from the 1972 and 1977 Censuses of Construction Industries (CCI). There is a separate observation for each state in each year. This level of aggregation was selected because it allowed me to estimate the effect of interstate variations in the composition of output on measured productivity. The dependent variable is the log of the ratio of output per employee. The output measure is value added divided by an employment-weighted average of the cross-section Dodge Cost Index for all cities in each state (New York City in 1972 = 100). Since this index is based heavily on union wages, this procedure introduces downward bias in the union coefficient if union wages are correlated with productivity.

The independent variables are the ratio of capital input to employees, the ratio of employees to establishments, predicted earnings based on the occupational distribution in each state (all of the above in logs), percentage union, three region dummies, and the ratios of receipts from three different types of construction (single-family homes, office and industrial buildings, and educational and hospital buildings) to total construction receipts.[2] Capital input equals the sum of (1) gross capital stock at year end divided by 15.15 (the average economic life of capital in construction as reported in Allen (1984)) and (2) rental payments for capital. Values for 1977 are deflated to 1972 dollars with a weighted average of the implicit price deflators for structures and each type of durable equipment, using the shares of total capital expenditures for construction reported by Boddy and Gort (1971) as weights. Data on the occupational distribution by states and mean national earnings by occupation come from the 1970 Census of Population. Percentage union for 1972 comes from the May 1973–75 Current Population Survey micro files; for 1977, the May 1977–78 files. All other variables come from CCI.

Cross-section estimates from 1972 and 1977 and pooled time-series–cross-section estimates for both years are reported in table 1. The F-statistic for the hypothesis that all coefficients except the intercept are identical in both years was 0.703, well below the 95% critical value. Since I cannot reject the hypothesis that all coefficients except the intercept are the same, I will use the pooled time-series–cross-section results to analyze the sources of the productivity decline in construction.

Except for the employees per establishment coefficient, the results are fairly close to those obtained in Allen (1984) for 1972 with the same variables aggregated by two-digit SIC and states or regions. Whereas my earlier estimates showed no economies of scale, the results in table 1 show a strong positive correlation between employees per establishment and productivity. This seems to have resulted from the different ways in which the samples were aggregated. The capital–labor ratio coefficient of 0.24 is very close to the 0.20 assumption used by Stokes.

Interstate differences in the composition of construction output are strongly correlated with measured productivity. A 10 percentage point increase in the share of single-family homes is associated with a 2.7% decrease in productivity. The same increase in the share of office and industrial buildings is associated with a 3.4% increase in productivity; educational and hospital buildings, a 4.5% increase.

One possible interpretation of the coefficients of the composition of output variables is that they

[2] These variables were chosen because the shares of each of these categories changed considerably between 1968 and 1978. Variables representing other types of construction were also examined but are not included in the specification because their coefficients were estimated with very little precision.

TABLE 3.—COEFFICIENTS AND STANDARD ERRORS OF HEDONIC PRICE EQUATIONS FOR COMMERCIAL OFFICE BUILDINGS, ELEMENTARY AND SECONDARY SCHOOLS, HOSPITALS AND NURSING HOMES, AND FEDERAL BUILDING CONSTRUCTION

Sample	Commercial Office Buildings		Elementary and Secondary Schools		Hospitals and Nursing Homes		Federal Buildings	
Intercept	3.221	3.876	2.490	3.200	4.637	5.959	5.210	5.806
	(0.264)	(0.556)	(0.510)	(0.660)	(0.596)	(0.754)	(0.552)	(0.635)
ln (square feet)	0.995	0.868	1.058	0.961	0.941	0 696	0.895	0.886
	(0.024)	(0.056)	(0.049)	(0.049)	(0.051)	(0.073)	(0.046)	(0.055)
Northeast		0.351		0.411		0.442		−0.032
		(0.132)		(0.064)		(0.112)		(0.137)
North Central		0.109		0.102		0.083		−0.118
		(0.102)		(0.063)		(0.091)		(0.096)
West		−0.050		0.243		0.264		0.071
		(0.142)		(0.076)		(0.114)		(0.180)
SMSA		0.068		0 139		0.062		−0.119
		(0.110)		(0.056)		(0.102)		(0.108)
Building characteristics included	No	Yes	No	Yes	No	Yes	No	Yes
σ	0.357	0.310	0.287	0.182	0.322	0.188	0.286	0.168
R^2	0.954	0 973	0.891	0.963	0.889	0.978	0.944	0.990
N	83	83	68	68	44	44	24	24

Note. The dependent variable is ln (contract amount) Its mean (S D) is 13 883 (1 649) for commercial office buildings, 14 310 (0 862) for schools; 15 543 (0 985) for hospitals and 15 816 (1 185) for federal buildings Building characteristics used in the office building equation include percentage of interior completed and dummy variables indicating number of stories above and below ground, type of heat, interior wall, roof base, and presence of elevators or escalators Characteristics used in the school equation include ratio of classroom to total square footage and dummy variables indicating elementary schools, number of stories, use of prefabricated components, type of interior wall, and presence of a swimming pool Characteristics in the hospital equation include number of beds (in logs), number of stories, and dummy variables indicating type of heat, type of foundation, use of pile footings in the foundation, and presence of a cafeteria Characteristics in the federal building equation include number of stories and dummy variables indicating type of heat and the use of pre-cast concrete walls, plumbing pipe "trees" and electrical conduit "trees," and movable or demountable wall partitions Other building characteristics were not included because either (1) the coefficients had a sign different than that implied by engineering data in 1977 *Dodge Construction Systems Costs* or (2) the coefficients were smaller than their standard errors

and 1978, 10.9 percentage points less than the decline in productivity as measured by BLS. Thus, overdeflation of nominal output could account for 51% of the measured productivity decline.

This new price index admittedly is ad hoc with respect to nonbuilding construction other than highways; there is no way to determine whether this component of the index is biased in either direction. However, the cost indexes currently used in the NIPA deflator overstate the rate of price increase, which suggests that an index that grows at a 0.9 to 1.4 percentage point slower rate should not be rejected out of hand. As for its other components, this new index probably overstates the rate of price increase. There is no adjustment for likely increases in amenities or improved design in the proposed index for non-residential buildings. As noted earlier, the urban highway construction index does not control for changes in highway characteristics within urban areas over time. The new index admittedly is no substitute for a complete and careful revision of the NIPA deflator based on micro data on a variety of different types of projects over the entire period, but it seems difficult to claim it is not preferable to the official deflators for the purposes of this analysis.

V. Conclusion

This study's two major findings are summarized in table 4. First, labor productivity in the construction industry should have declined by 8.8% between 1968 and 1978. The biggest factor in this decline is the reduction in the skill level of the average worker resulting from the shift in the mix of output from large scale commercial, industrial, and institutional projects to single-family houses. Other important factors include declines in the average number of employees per establishment, the capital–labor ratio, percentage union, and the average age of workers. Second, growth in real output in construction is considerably greater than indicated by the national income accounts. The difference between the official deflator and the alternative deflator proposed in section IV accounts for about half of the observed productivity decline. After making adjustments for all these factors, the predicted decline in measured produc-

TABLE 4 — SUMMARY OF ANALYSIS OF PRODUCTIVITY CHANGE

Predicted productivity change from production function estimates	−8 8%
Adjustment for bias in price deflator	−10.9
Sum of predicted productivity change and adjustments for bias in price deflator	−19 7
Reported productivity change	−21.4
Percentage of reported productivity change explained	92.0

tivity is 19.7%. This accounts for 92% of the reported productivity decline.

Although this approach quite successfully explains productivity changes between 1968 and 1978, it does not do as well over the 1950–1968 period. As outlined in detail in an appendix available from the author, the model predicts a 34.4% increase in productivity, whereas BLS reports a 48.9% increase. The actual productivity increase was no doubt higher because of upward bias in the price deflator. Based upon the same adjustment outlined in section IV, my estimate is that productivity actually grew by 52.4%. While the sources of almost two-thirds of this productivity growth are identified by the model, a substantial residual remains. This could result from omission of variables from the analysis. For instance, there are no data, to my knowledge, on research and development expenditures for the construction industry. If there were a great deal of R & D spending in the 1950s and 1960s but relatively little in the 1970s, then the productivity changes for both the 1950–1968 and 1968–1978 periods might be explained fully by the model. Trends in the ratio of new construction to alteration and repair construction may have varied between these two periods as well.[8] Changes in the production function and errors in measuring changes in the levels of the independent variables may also account for the relatively poorer performance of the model in this earlier period. Whatever the reason, this analysis suggests that the real productivity puzzle in construction is not the negative residual between 1968 and 1978, but the positive residual between 1950 and 1968.

[8] This was suggested by an anonymous referee.

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The Effect of Unionism on Productivity in Privately and Publicly Owned Hospitals and Nursing Homes

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This paper examines the effect of unions on productivity within a sample of publicly and privately owned hospitals and nursing homes to determine whether public ownership influences union behavior. The results show that the productivity of union contractors is much greater in private than in public projects. Within the sample of private projects, the estimates of the union-nonunion productivity difference are generally positive but very imprecise.

I. *Introduction*

Allen (1986) compared the productivity of union and nonunion contractors using two samples of construction projects: commercial office buildings and elementary and secondary schools. Measuring output both in terms of dollar value and square footage, productivity was at least 30 percent higher for union contractors in the commercial office building sample. In the school sample, however, there was no strong evidence of any union-nonunion productivity difference.

These conflicting results can be rationalized in two ways. First, it is possible that the technologies for school and office building construction are different and that nonunion labor has a comparative advantage in the former and union labor has a comparative advantage in the latter. This could arise because of the difference in the size or complexity of the projects. The mean square footage of the union projects in the office building sample is 208,815, which is much larger than the 27,319 square feet of the nonunion projects in that sample. In contrast, there is very little difference in the mean size of the union (98,108) and nonunion (85,250) projects in the school sample. Furthermore, the union projects in the office building sample are much larger than the union projects in the school sample. These size differences may result in biased estimates because there are much

*Financial support was provided by the U.S. Department of Labor and the National Science Foundation. Steve Margolis gave me some helpful comments on an earlier draft. Katherine Foote provided excellent research assistance, and Jim Comer once again did a masterful job in getting the data set in shape.

greater economies of scale in the union projects in both samples (but not in the nonunion projects).[1] Thus, the appearance of a union productivity advantage in office building construction may result from the greater union-nonunion difference in project size. In the school sample, however, the union and nonunion buildings are of similar size, so that neither scale economy differences nor productivity differences between union and nonunion contractors are observed.

The other possibility focuses on differences in ownership between the two samples. The office buildings are privately owned and the schools are owned by state or local governments. This can have two types of effects. First, state and local governments impose a number of restrictions on materials and techniques that are not present in the building codes for private projects. These restrictions may limit the ability of union and nonunion contractors to choose the optimal mix of inputs, causing any private sector productivity differences to vanish. This is essentially a technological argument as well, with the focus being on regulation instead of size.

Second, ownership affects incentives. State and local governments have less incentive to minimize costs than do the owners of commercial office buildings. This lack of incentive, combined with prevailing wage laws that prevent nonunion contractors from entering union strongholds and bidding practices that facilitate collusion, allows unions and contractors to collect rents in public construction.[2]

A data set that holds technology constant but that contains both publicly and privately owned projects is needed to determine which set of interpretations — the former focusing on technology, the latter focusing on economics — is correct. This paper examines such a data set, a sample of 44 hospitals and nursing homes completed in 1976. These projects are covered by the same building regulations, as all were funded under the Hill-Burton program. This permits a direct test of the hypothesis that the effect of unions on productivity in construction varies between publicly and privately owned projects. One complicating factor is that the privately owned hospitals and nursing homes in this sample are non-profit organizations, so the focus is on the effects of differences in ownership rather than on the effects of the incentive of profit maximization. Clearly, it would be desirable to compare the effects of unions on productivity in private for-profit, private non-profit, and public construction.

II. *Empirical Specification and Data*

The effect of unions on productivity is estimated by allowing the intercept of a Cobb-Douglas production function to vary by union status. The specification includes a control for labor quality and allows for nonconstant returns.[3] Capital,

[1]Evidence on union-nonunion differences in economies of scale is reported in Allen (1984).

[2]This argument is more fully stated in Allen (1984; 1986).

[3]The specification is identical to that in equation (3) in Allen (1986).

that controlling for detailed occupation, union workers receive 17 percent higher wages than nonunion workers. This estimate of the wage gap in construction is smaller than those I have obtained elsewhere. The most likely explanation is that the entire hospital and nursing home sample was funded under the Hill-Burton program, which means that minimum wages on each project must be set by the Department of Labor, as required by the Davis-Bacon Act. Since the Department of Labor frequently tends to set minimum wages for federally funded building construction at union levels, one would naturally expect a rather small union-nonunion wage gap. The relative magnitude of the union-nonunion wage and productivity gap estimates implies that union contractors compete on near equal terms with nonunion contractors in private hospital construction. This is not the case in public hospital construction. The higher wages paid by union contractors are not offset by higher productivity. This increase in costs implies that either union contractors receive lower profits for public hospital construction or the price of public hospitals to state and local governments will be higher when they are built by union contractors.

IV. *Conclusion*

Over a sample of publicly and privately owned hospitals constructed with similar technologies and covered by the same types of building regulations, the productivity of union contractors is much greater in private than in public projects. This finding suggests that it is the pattern of ownership rather than technological or regulatory factors that accounts for my earlier findings of higher union productivity in private office building construction but no union-nonunion productivity difference in public school construction. The bottom line seems to be that the behavior of unions and union contractors is quite different in public and private construction, the consequence of which seems to be vastly inflated construction costs for public projects.

The evidence reported here on union-nonunion productivity differences is much weaker. Clearly, there is no such difference in public hospital and nursing home construction. In private projects, the productivity of union contractors does seem to be higher, especially in terms of square footage per hour, but the hypothesis of no union-nonunion productivity difference can be rejected at no better than an 87 percent confidence level. This will probably not change anyone's opinion on the matter.

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(4)

UNIONIZATION AND PRODUCTIVITY IN OFFICE BUILDING AND SCHOOL CONSTRUCTION

STEVEN G. ALLEN*

This study examines the difference in productivity between union and nonunion contractors in the construction industry within two samples, one of 83 commercial office buildings completed in 1973–74 and the other of 68 elementary and secondary schools completed in 1972. An analysis that includes controls for differences in capital-labor ratios, observable labor quality, region, and building characteristics shows that union productivity in the office building projects was at least 30 percent higher than nonunion productivity, measured in terms of square feet of floor space completed per hour worked; and from zero to 20 percent higher in school projects, measured in physical units and value added, respectively.

A number of recent controversial studies have found that productivity frequently is higher in union establishments than in otherwise identical nonunion establishments in the same industry.[1] Critics such as Addison (1982) have used two arguments to claim that none of these studies really shows higher productivity in the union sector. First, data limitations are severe enough in each study to leave lingering doubts about the results. For instance, when productivity is measured in terms of value added, cross-section deflators are needed to distinguish between price and output differences. Some studies do not deflate at all, and in other studies the deflators are far from ideal. Also, broad geographic and industry aggregates are used in many of these same studies, which may mask considerable market segmentation and again bias estimates upward. Second, the sources of the estimated union productivity advantage remain largely unidentified. In their study of manufacturing, for example, Brown and Medoff (1978) could identify only lower turnover as a source of higher union productivity.

Both of these problems were present in a 1984 paper in which I used data from the 1972 Census of Construction Indus-

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[1] References to most of the studies examining the effect of unions on productivity are reported in Freeman and Medoff (1984:162–80). Two of the more recent studies are Allen (1984) and Clark (1984).

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tries (CCI) to estimate the effect of unions on productivity in construction (Allen 1984). The most serious data limitation in that paper was the use of value added as a measure of output. Without any controls for differences in the average price of construction across states and regions, I found value added per hour was 44 to 52 percent higher in the union sector. When three different estimates of interarea construction price differences were used to deflate value added, the estimate fell to 17 to 22 percent. With better deflators, the estimates could have been much lower. Another serious data limitation was aggregation by two-digit SIC codes across states and regions, which may also have biased the estimates upward. As for the sources of the estimated productivity advantage in the union sector, occupational mix differences and, possibly, apprenticeship programs accounted for no more than a fourth of the estimated productivity difference between union and nonunion contractors.

This paper reexamines the question of how unions affect productivity in construction by analyzing two unique sets of construction data: one sample of 83 commercial office buildings completed in 1973–74 and another of 68 elementary and secondary school buildings completed in 1972. These data sets have the advantage of permitting output to be measured in terms of physical units—square feet of space and, in the school sample, student capacity. When the dependent variable is expressed in physical units rather than value added, the union coefficient in the production function can be interpreted solely as a productivity effect, not as a wage effect.[2] Also, these estimates are free of aggregation bias because the units of observation are separate construction projects rather than state or regional totals containing various types of structures and markets with various levels of unionization.

Use of these two data sets also allows an unusually in-depth examination of the sources of estimated union-nonunion productivity differences. Hours worked are reported by detailed occupational categories with separate entries for journeymen and apprentices. Those data permit a test of whether, as many believe, unions improve productivity by raising the ratio of skilled to unskilled production hours and lowering the ratio of supervisory to production hours. Each data set also provides some background information on the general contractor for each project, such as his annual volume and the extent to which he specializes in a particular type of construction; this information should provide better controls for entrepreneurial efficiency.

Also, each contractor in the office building sample was asked whether strikes, weather, building codes, skilled labor supply, apprenticeship programs, and prefabricated or standardized components had any effect (positive, zero, or negative) on productivity during construction of the building. The influence of these factors on the union productivity effect can be gauged by incorporating the contractors' impressions as separate variables in the quantitative analysis.[3]

Finally, a comparison of results in the two samples will provide a test of whether the effect of unions on productivity varies across different types of construction.

Unions in the Construction Industry: Background

I have discussed the mechanisms through which unions influence productivity in the construction industry elsewhere and will provide only a brief summary here.[4] Basic price theory predicts observed labor productivity will be higher in the union sector because higher union wage rates lead employers to screen workers more carefully to obtain higher quality labor and to

[2] The use of value added as a measure of output will produce upward bias in the union coefficient in a production function when two conditions both hold: higher union wages are passed on to customers in the form of higher prices (for instance, in markets where there is no nonunion competition) and product demand is inelastic.

[3] Major studies reporting union-nonunion differences in training, occupational structure, work rules, hiring procedures, and other work practices in construction include Haber and Levinson (1956), Mandelstamm (1965), Northrup and Foster (1975), and Bourdon and Levitt (1980).

[4] Complete references are reported in Allen (1984).

(5)

DECLINING UNIONIZATION IN CONSTRUCTION: THE FACTS AND THE REASONS

STEVEN G. ALLEN*

This paper examines the forces behind the decline in the union share of construction employment from almost one-half in 1966 to less than one-third in 1983. The percentage of construction workers employed by union contractors has declined even further because the fraction of union members working in the open shop sector rose from 29 to 46 percent between 1973 and 1981. The growth of the union-nonunion wage gap between 1967 and 1973 contributed to the initial decline in the percentage unionized, but that gap did not widen after 1973 and actually has narrowed substantially since 1978. Probably more influential has been the erosion of the productivity advantage of union contractors, which dropped substantially between 1972 and 1977 and vanished by 1982.

decline in productivity

THE reasons for the decline in the union share of the labor force remain largely a matter of conjecture. Some studies, for example, stress the effects of structural changes in worker and job characteristics, such as the growth of the service sector and the rise in the proportion of female workers, but that argument does not address the question of why the share of union workers has changed within particular groups of workers. Other studies stress that the percentage of nonunion workers organized through NLRB elections has dropped substantially. This argument is more illuminating, as it pinpoints a major source of the decline in unionism within particular sectors, but research on this subject has not yet explained just why organizing campaigns are bearing so little fruit.

This paper represents a first attempt to bring the economic forces behind both the structural change and organizing success arguments to the forefront in explaining changes in the percentage unionized over time. The focus is on a single sector of the economy—the construction industry. This focus has three distinct methodological advantages. First, most of the structural change factors likely to contaminate a broader analysis are removed. Second, short job durations make NLRB elections largely irrelevant to union organizing efforts in construction, thus eliminating to a great extent the impact of legal factors.

Third, it is quite unlikely there is a single all-purpose explanation of the decline in the percentage unionized that

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applies to all sectors of the economy. Instead, the answer is probably sensitive to variations across sectors in such factors as government regulation, import competition, and the structure of collective bargaining. Focusing on specific sectors is therefore likely to lead to a richer and more accurate explanation of unionism's decline than attempting to analyze experience in the entire economy. Although the results of this study may very well be specific to construction, the procedures used here can be applied easily to other industries.

Theoretical Framework

The results reported below are to be interpreted in terms of the following simple theoretical model. The union unilaterally sets the wage for work covered by collective bargaining agreements. The wage maximizes the union's objective function subject to the constraints outlined below. Analytically, this assumption eliminates the bargaining process itself from the model. In addition, it serves as a fairly close approximation to reality in the construction industry, as acknowledged by both critics of the building trades (Northrup 1984:321–28) and more sympathetic observers (Mills 1972:61–71).

Given the union wage, contractors determine whether it is more profitable to hire union or nonunion labor. This decision hinges on expected wage and productivity differences between union and nonunion labor for each particular contractor. These differences are likely to vary with such factors as project size, location, and type of construction. Contractors who used union labor in the previous period must also take into account costs associated with switching to nonunion labor. These costs are similar to the fixed costs of union avoidance described by Lazear (1983). In practice, they may represent the legal costs of establishing a separate nonunion subsidiary (referred to as "going double-breasted") or the risk of strikes or violence. The initial distribution of union status is assumed to be exogenous.

Once the union wage and the number of establishments in the union sector have been set, union employment is demand-determined. Not all of the union members will be employed unless full employment for its membership is the only objective of the union (in which case unions are unlikely to exist). Union members who do not get jobs covered by collective bargaining agreements either work for nonunion contractors or drop out of the labor force. The market for nonunion labor operates in textbook fashion, conditional on the union wage.

In this simple model, declines in unionization result whenever the profitability of operating under collective bargaining agreements falls, which happens when (1) the union-nonunion wage gap increases, (2) the union-nonunion productivity gap decreases, or (3) the cost of switching from union to nonunion construction decreases. For lack of information on the last factor, the focus here will be on changes in wage and productivity gaps. Before looking at that evidence, I begin with the facts on trends in the share of construction employees who say they are union members, focusing on data for the last twenty years that have not been reported together previously. I also present the first set of estimates of the percentage of union members working in nonunion construction.

The Facts on Unionization in Construction

Everyone affiliated with the construction industry knows that the market share of union contractors has declined substantially over the last twenty years. There is no consensus on the magnitude of the decline or the current market share. For instance, Robert Georgine, president of the Building and Construction Trades Department of the AFL-CIO, claimed in 1981, "The percentage of unionized construction is much higher than the 40% everyone talks about and is higher than 50%" (*Engineering News-Record* 1981). On the other hand, the Associated Builders and Contractors (ABC), an open shop trade association, claimed a 20 percent market share for the open shop in 1969, a 30 percent share in 1973, and a

This result is not as strong in other specifications. For instance, the coefficient (S.E.) of the interaction term in the undeflated specification is only −.225 (.170). Also, when the proportion unionized is defined as the share of blue-collar construction workers in each state who are union members and are working at union scale (and the interaction term and the ratio of union members working in the open shop are dropped from the model), the union coefficient drops by more than .3 between 1972 and 1982—a bigger decline than that reported in Table 7. In summary, the increased proportion of union members working in the open shop probably is partially responsible for the disappearance of the union productivity advantage, but the lack of robustness in the results using this variable suggests that other forces are at work.[9]

Another possible explanation for the disappearance of the union sector's productivity advantage is the increased experience open shop contractors have obtained in doing larger-scale projects. The open shop initially was concentrated in residential and small commercial projects. Many open shop contractors got their first experience with larger projects in the late 1960s and early 1970s. If there is a learning curve in construction management, these contractors would have had much lower productivity initially than union contractors, even with access to the same skilled labor force. Eventually the productivity gap would have narrowed as nonunion contractors gained experience in larger projects. The validity of this argument cannot be tested empirically.

A final possible explanation of the gap's disappearance is that the search economies obtained from the use of union hiring halls vanished in the face of high unemployment rates. Unemployment rates in the construction industry rose from 10.3 percent in 1972 to 12.7 percent in 1977 and 20.0 percent in 1982. The validity of this argument is also impossible to assess. The rise in unemployment between 1972 and 1977 does not seem to be large enough to account for the drop in the union productivity advantage over that period, but the massive unemployment observed in 1982 may have been enough to eliminate the search economies of hiring halls. Northrup's (1984:379–80) surveys indicate that open shop contractors' reliance on informal contacts and advertising as hiring sources did not change over this period.

Regardless of the reasons for the decline in the productivity gap, it seems quite clear that it was a major factor behind the reduction in the percentage unionized after 1973. Even though the wage gap did not change between 1973 and 1978, the reduced productivity gap gave owners and contractors tremendous incentives to switch from union to nonunion labor. It also seems plausible that the reduction in the wage gap in 1979 and later years could have been a response to competitive pressures generated by the declining productivity gap.

Conclusion

The major findings of this study are:

1. The proportion of blue-collar con-

[9] The validity of this result was questioned by a referee on the following grounds. In 1973, the figures in Table 3 show that the employment share of the nonunion sector was 68.4 percent, 12.8 percentage points of which consists of union members working in the nonunion sector, implying that union members represent 18.7 percent (12.8 ÷ 68.4) of nonunion sector employment. In 1981, union members represented 22.6 percent of nonunion sector employment, which is only 3.9 percentage points greater than in 1973. It is questionable whether such a small change in the composition of nonunion employment would generate a 6.6 percentage point drop in the difference between union and nonunion productivity.

The actual impact of the growing share of union members working in the open shop on the union-nonunion productivity advantage depends on a number of factors. One is the skill differences among union members working for union contractors, union members working for nonunion contractors, and nonunion workers who are not union members. Another is the skill complementarity between union members and nonunion workers when they are working together in the nonunion sector. The union-nonunion wage and benefit comparisons in Tables 5 and 6 suggest that the skill differences could be quite substantial. If, in addition, nonunion workers turn out to be much more productive when working with union members than when working with other nonunion workers, then the estimate of a 6.6 percentage point drop in the union-nonunion productivity gap could be a very accurate reflection of reality.

struction workers belonging to unions declined from slightly less than one-half in 1966 to less than one-third in 1983. The decline seems to have started after 1970 and continued at a very gradual rate through 1977. The sharpest drops took place between May 1977 and May 1978 and between May 1981 and 1985.

2. The employment share of union contractors declined to an even greater extent than the percentage of union members because of the rising share of union members working for nonunion contractors. This share grew from 29 to 46 percent between 1973 and 1981. Although these estimates are highly sensitive to assumptions about union wage rates, they suggest that the employment share of union contractors fell 10 percentage points between 1973 and 1981 and that only one of five construction workers in 1981 was a union member working for a union contractor.

3. The decline of unionism in construction is unrelated to changes in worker characteristics and changes in the mix and location of construction activity.

4. An important factor behind the initial decline in the percentage unionized is the growth in the union-nonunion wage gap between 1967 and 1973. But that gap did not widen after 1973 and actually narrowed substantially after 1978. Unless market adjustment lags were quite long, the declines in the percentage unionized after 1973 must have been caused by other factors.

5. A key factor is the erosion of the productivity advantage of union contractors, which dropped substantially between 1972 and 1977 and vanished by 1982. This erosion most likely resulted from the rising share of union members working for nonunion contractors and the impact of high unemployment rates on the search economies associated with union hiring halls.

I have focused on two of the three forces predicted by the theoretical framework to determine levels of unionization. The third force—changes in the cost of switching from union to nonunion construction—may also be quite important, as reflected by the growth in the number of large union contractors who have gone double-breasted over the past ten years. A crude estimate of the growth of double-breasting can be calculated from Northrup's (1984:191–209) summary of the *Engineering News Record*'s annual survey to find the 400 largest construction firms. Of the 731 firms surveyed for 1975, 57 (7.8 percent) were double-breasted. By 1982, 17.1 percent of the top 400 contractors were double-breasted.

The reasons behind the growing share of double-breasted firms are not yet clear. That trend may simply be a response to the changing wage and productivity gaps described above rather than a consequence of lower costs of switching from union to nonunion workers. Going double-breasted could also be a mechanism for diversification. On the other hand, unions have argued that double-breasting is a recent legal innovation designed to meet the letter if not the spirit of federal labor legislation. The open shop branch of a double-breasted firm is supposed to be a separate concern, with its own offices, management, and payroll. Unions have charged that in many cases these distinctions are artificial and that the union contract legally applies to the nonunion subsidiary. Legal outcomes depend on the evidence about the degree of separation in operations between union and nonunion branches.[10] It would be useful in future work to examine this phenomenon more closely to see if double-breasting has done to unionization in construction what employer unfair labor practices apparently have done to union organizing success in other industries.

The results of this study show that economic forces have played a significant role in the decline of unionism in construction. Methodologically, they point to the need to examine both wage and productivity (or cost or profitability) evidence in analyzing the sources of changes in unionization over time. A key reason behind the decline in the productivity advantage of union contractors seems to be the rising share of union members working in the

[10] For a discussion of the legal issues associated with double-breasting, see Northrup (1984:607–41).

open shop. This study has not addressed the issue of why more union members are working in the nonunion sector. A strong possibility is that the shortage of union jobs became more severe as high interest rates and severe recessions shifted the demand curve for union labor leftward in the late 1970s and 1980s. In response, union members took nonunion jobs because they were the only jobs available.

The findings of this study have an important implication for the future of unionism in construction. Wage givebacks are not likely to help restore much of the market share lost in recent years to the open shop. The productivity advantage of union contractors has eroded to such a degree that the size of wage cuts needed to restore a balance between the wage and productivity gaps is unlikely to be acceptable to the rank-and-file. Instead, the focus of both union leaders and unionized contractors must be on rebuilding the union productivity advantage.

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6

Further Evidence on Union Efficiency in Construction

Steven G. Allen*

This study examines the impact of unions on efficiency in retail construction in the late seventies. Square footage put in place per hour is 51 per cent greater for union than nonunion contractors. The study finds no difference in mean cost per square foot and offers mixed econometric evidence on translog cost functions. There is also no difference in profit rates or prices between union and nonunion contractors.

PREVIOUS ESTIMATES OF CONSTRUCTION union productivity on projects built in the early seventies showed 30 per cent greater productivity for union compared to nonunion contractors in commercial office building construction, but there was no union-nonunion difference in school construction (see Allen, 1986a).[1] This note helps resolve two issues left unanswered by the earlier study:[2] (1) why does the impact of unionism on productivity vary across different types of construction and (2) do the results still hold in light of the declining percentage of construction workers belonging to unions? Here the impact of unions on productivity is examined using a sample of 42 retail stores and shopping centers built in the late seventies. This paper assesses a wider range of measures of economic efficiency, including costs, prices, and profits, in order to establish the robustness of the results. The productivity of union contractors in retail construction in the late seventies is found to be significantly greater than that of nonunion contractors. U > N

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[1]Other studies examining the effects of unions on productivity are summarized in Freeman and Medoff (1984).

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actually higher for union contractors, one would also expect them to have either lower profits, higher prices, or both. If costs are nearly equal on average for union and nonunion contractors, then prices and profits should either be equal or offsetting.

Price comparisons based on the union coefficient of hedonic price functions in Table 1 show the price of each project as 1.5 per cent lower for union than nonunion contractors. Because this estimate is not significantly different from zero and the coefficient is quite small in absolute value, it seems safe to conclude that there is no price difference between union and nonunion contractors in the sample.

Profit comparisons. Because employee benefits and off-site costs are not reported, comparing union and nonunion profits is difficult. To adjust for employee benefits, profit rates are calculated under two assumptions—no employee benefits for either union or nonunion contractors and no employee benefits for nonunion contractors only. Employee benefits are imputed for union contractors using the same technique as in Allen (1987). Under the first assumption, profits have a 2.6 percentage point greater share of the project price for union contractors (28.0 versus 25.4); under the second assumption, a 1.1 percentage point lower share (24.3 versus 25.4). In neither case can the hypothesis of no profit share difference be rejected. This evidence on profits and prices is consistent with costs being nearly equal for union and nonunion contractors at most ranges of output.

Conclusions

A comparison of productivity for union and nonunion contractors in retail store and shopping center construction in 1977 shows that square footage put in place per hour is 51 per cent greater for union than nonunion contractors. Indirect support for this result is also found in cost, profit, and price comparisons for the sample. Thus, despite a moderate decline in market share, the productivity of union contractors in retail construction in the late seventies was much greater than that of nonunion contractors. Whether this remains true today, after a more rapid decline in unions' market share, cannot be determined with available data.

Viewing these results along with earlier findings based on public (schools, hospitals) and private (office buildings, hospitals) construction, it is clear that the behavior of unions and union contractors varies tremendously with the market environment. In each case where the union-nonunion comparisons are made over a sample of privately owned structures, the productivity of union contractors emerges as higher than that of nonunion contractors and the productivity difference is large enough to offset the difference in wages, making unit costs comparable. In each case where the comparisons are made over a sample of publicly owned structures, there is no union-nonunion productivity difference and the greater cost of union labor is passed on to the government. The most likely explanations for this pattern of behavior are that government managers lack adequate incentives to take steps which would change the behavior of unions and unionized contractors, and that prevailing wage laws prevent the market from creating those incentives by effectively banning nonunion contractors from public sector projects in many areas.

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EFFECTS OF HUMAN RESOURCE SYSTEMS ON MANUFACTURING PERFORMANCE AND TURNOVER

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Using an empirical taxonomy identifying two types of human resource systems, "control" and "commitment," this study tested the strategic human resource proposition that specific combinations of policies and practices are useful in predicting differences in performance and turnover across steel "minimills." The mills with commitment systems had higher productivity, lower scrap rates, and lower employee turnover than those with control systems. In addition, human resource system moderated the relationship between turnover and manufacturing performance.

Long a concern among organizational contingency theory researchers, the concept of the congruence, or fit, between diverse sets of organizational policies and practices has recently emerged as an important subject of study for human resources management researchers. This new strategic, macro, human resource management perspective differs markedly from the more traditional approach focusing on the effects of separate human resource practices on individual-level outcomes (Butler, Ferris, & Napier, 1991; Jackson, Schuler, & Rivero, 1989; Mahoney & Deckup, 1986; Snell, 1992). In contrast, the strategic human resource management perspective integrates macro-level theories and concepts to explore the impact of specific configurations, or systems, of human resource activities on organization-level performance outcomes (Dyer & Holder, 1988; Fisher, 1989; Wright & McMahan, 1992).

Dobbins, Cardy, and Carson pointed out that although a macro approach to studying human resource issues appears promising and conceptually very rich, "the validity of its propositions is ultimately an empirical question" (1991: 33). Empirical evidence demonstrating the predictive value of the strategic human resource perspective, however, has not been forthcoming. Conceptual typologies abound in this literature, but empirically based taxonomies of human resource strategies are rare. As a result, basic hypotheses concerning the implications for firm performance that flow from the strategic human resource perspective have generally not been tested. A recent

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review of strategic human resource management, for example, concluded that "there is little empirical evidence to suggest that strategic HR directly influences organizational performance or competitive advantage" (Lengnick-Hall & Lengnick-Hall, 1988: 468).

In this study, I addressed this important gap in the existing literature by empirically testing specific organizational performance hypotheses flowing from a strategic human resource management perspective. To accomplish this, I drew on the results of a previous study that used a cluster analysis technique to empirically identify two types of human resource systems, labeled "control" and "commitment" systems, in a sample of steel minimills (Arthur, 1992).[1] I developed and tested propositions regarding the utility of this human resource system taxonomy for predicting both manufacturing performance, measured as labor efficiency and scrap rate, and the level of employee turnover in steel minimills. In addition, I tested the proposition that the relationship between turnover and manufacturing performance differs significantly across the two systems.

THEORETICAL DEVELOPMENT AND HYPOTHESES

Testing the strategic human resource perspective first requires categorizing organizations into a meaningful typology of human resource systems. Using the strategic perspective, a number of authors have suggested typologies (e.g., Dyer & Holder, 1988; Miles & Snow, 1984; Osterman, 1987; Schuler & Jackson, 1987; Walton, 1985). Underlying the use of these typologies is the proposition that organizations differ in their basic approaches or objectives in managing human assets. These objectives, often stated in terms of desired employee characteristics, attitudes, and behaviors, are (or should be) derived from a firm's overall business goals and may be moderated by factors internal and external to the organization (Schuler, 1992; Wright & McMahan, 1992). However, because these typologies have not been consistently measured, their validity and predictive power have not been assessed.

Control and Commitment Human Resource Systems

My earlier research (Arthur, 1992) is one of the first published attempts to develop an empirical classification of firms based on human resource system characteristics. Applying a cluster analysis technique to data from human resource managers, I found that the variety of human resource policies and practices in 30 U.S. steel minimills could be meaningfully described by six clusters, or systems. Further, I grouped those systems into two broad categories based on their characteristics and the functions they served and labeled them "cost reducers" and "commitment maximizers." To maintain consistency with previous research on human resource strategy (Lawler,

[1] Minimills are relatively small steel-producing facilities in which metal scrap is melted in electric furnaces and continuously cast into a variety of shapes and grades of steel. Detailed discussion of minimills can be found in Barnett and Crandall (1986) and Hogan (1987).

nal evaluation of the evidence for the human resource strategy perspective will need to await the accumulation of results from studies conducted in multiple industry contexts.

In addition, although the findings of this study are consistent with a conceptual model in which the choice of human resource system leads to changes in manufacturing performance, the cross-sectional data used here did not permit any tests of the causal ordering between effects of system and performance. It is possible that better performing mills also have additional resources that facilitate management's choosing commitment systems.

Further, research progress on the human resource strategy perspective depends critically on the development of conceptually and methodologically sound measures of the human resource system construct. Although the taxonomy used in this study shows some conceptual and predictive promise, much more work needs to be done concerning definition and measurement of the dimensions of human resource systems. A key related issue is the performance implications of mixed systems. A premise of this work is that control and commitment represent conceptually distinct ideal systems and that any deviation from the ideal types will weaken performance. Alternatively, control and commitment can be conceptualized as the opposite ends of a continuum of possible human resource systems and the most effective system seen as existing somewhere between the two extremes.[5] Empirical tests are needed to determine which conceptualization more accurately describes the construct.

Other parts of the human resource strategy model are also in need of empirical investigation. For example, because of sample size limitations, I was unable in this study to test for the performance effects of the fit between business strategy and human resource strategy. Finally, there is a need to demonstrate that certain combinations of human resource programs, policies, and practices lead to specific employee attitudes, such as trust in management or organizational commitment, that in turn lead to specific employee behaviors beneficial to effectively implementing a given business strategy. Exploring these intermediate links explicitly will undoubtedly lead to further refinements and insights into the process by which combinations of human resource activities can lead to competitive advantages for firms (e.g., Cappelli & Singh, 1992).

Conclusions

In spite of its limitations, this research shows that a number of insights can be gained through the use of a human resource strategy perspective and methodology. By empirically testing whether certain combinations of activities are associated with higher manufacturing performance, this study provides one of the first pieces of empirical evidence with which to evaluate the prescriptions in the human resource strategy literature. Many authors have

[5] I would like to thank an anonymous reviewer for drawing my attention to this point.

called for such evidence (Dobbins et al., 1991; Fisher, 1989; Jackson et al., 1989; Lengnick-Hall & Lengnick-Hall, 1988; Snell & Dean, 1992; Wright & McMahan, 1992). In addition, the study has shown that identification of human resource systems promises to add significantly to understanding the relationship between turnover and organizational performance. Although these results should be seen as preliminary because of data limitations, this study provides future researchers with some empirical evidence supporting a promising new perspective with which to study important human resource and organizational outcomes.

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BALDWIN '92

INTRODUCTION

Most studies of industry performance ignore the existence and diversity of the productivity of firms within an industry. For example, productivity growth is generally measured at the industry level with almost complete disregard for the underlying production entities. This habit is probably the result of the widespread acceptance of the concept of a representative or average firm. As Reid (1987) has pointed out, in industrial organization, the Vinerian concept of the representative firm has dominated the more complex notion of the diversity of firm performance stressed by Marshall. As a result, the mainstream of industrial organization has had trouble in coming to grips with the reality of firm heterogeneity.

One of the few strands of applied industrial economics to face the existence of firm heterogeneity is the X-inefficiency literature. On the one hand, are those like Leibenstein (1966) who argued, from observation, that this phenomenon deserved attention. On the other are economists like Stigler (1976) who argued that profit maximization made it unlikely that inefficiency could exist for long, and that observation of the phenomenon had to be based on incorrect measurement.

Despite this existential debate, econometricians who were working on the estimation of frontier production functions, began to investigate how the error structure of these production functions could be used to characterize the degree of efficiency in an industry. The resulting literature has now developed an impressive body of empirical evidence on the nature and correlates of efficiency.[1]

Many articles have focused on methodology. Empirical applications have often been limited to a small number of industries, until the recent work of Caves and Barton (1990) that looked at a broad cross-section of U.S. manufacturing industries in the 1970s. But until now, there have been few studies that would allow an assessment of how fleeting the phenomenon is--thereby answering one of Stigler's criticisms--or the causes of changes in the level of efficiency over time that result from more efficient firms replacing the less efficient. This study uses a longitudinal panel of Canadian manufacturing firms in the 1970s to investigate both issues.

The first section of this paper outlines the methodology to be used to measure industry efficiency in this study. The second section examines certain characteristics of the measure. The third section investigates the extent to which this measure is related to the same industry characteristics that were found to be important determinants of efficiency in the U.S. study. The fourth section explores the dynamics of industry change, focusing on the role of turnover with respect to changes in efficiency. The fifth section uses regression analysis to examine the industry determinants of the forces that reduce turnover and examines the commonalities between the determinants of cross-industry variability in efficiency levels and the forces that lead these levels to change over time.

The only component that is found both in the formulation of the turnover equation reported in column 2 and in the efficiency equation and whose coefficient has the same sign is component five. However, this formulation does not allow for interaction effects. It may be that the effect of the industry characteristic was to reduce the effect of the technological conditions represented by the productivity variables. This was examined by entering interaction effects between the relative productivity components three and six and the components that had a negative effect on efficiency--two, four, five, nine, and eighteen. Individual terms entered on their own showed significance, but because of multicollinearity, this was not the case when several were entered simultaneously. In the end, components two, three and five were summed and used interactively with the third productivity component to form the variable INTER. The results with INTER added are reported in column 4. In this formulation, the productivity component itself loses some of its significance but the interaction term is significant and becomes even more so if the productivity component is removed--column 5. The important conclusion is that the multiplant component (#2), the import-advertising-suboptimal capacity component (#3) along with component five serve to reduce the effect of productivity on turnover. These are the same characteristics that are found in industries with lower levels of efficiency.

VI) CONCLUSION

Analysis of turnover process can contribute in important ways to our understanding of the nature of the competitive process. First, it can be used to provide a measure of the intensity of the competitive process. The extent to which market shares are changing provides an alternate and more direct measure of the intensity of the competitive process than do concentration measures. Secondly, an examination of the links between turnover and productivity change serves to emphasize the connection between productivity progress and the extent to which the new supplant the old.

This paper adds another dimension to our understanding of the turnover process. It has shown that turnover directly contributes to reductions in industry efficiency. Moreover, turnover is affected by many of the same set of variables that affect the level of industry efficiency. Thus, this study provides a bridge between two different sets of studies.

Until now, the efficiency literature has relied mainly on cross-sectional studies at one point in time. It was, therefore, difficult to ascertain whether the variables that were found to be related to efficiency were chance correlates. One method of contributing to this debate is to attempt to replicate the results for similar economies. This was done in the first section of this study where it was demonstrated that efficiency in Canadian and U.S. manufacturing industries in the 1970s was related to many of the same industry characteristics.

Even more important is the link between turnover and efficiency that is provided. If the causes of efficiency are to better understood, the forces that cause some firms to move ahead and others to fall behind need examination. When technical change causes this process to occur, efficiency falls if the less efficient are not eliminated. This paper has documented how important this turnover process is in reducing inefficiencies that develop. More importantly, it has demonstrated that the same forces that lead some industries at a point in time to be less efficient are contained in the set of forces that reduce the amount of turnover. That they can also be found to restrain the turnover process that has been demonstrated to reduce the level of inefficiency lends credence to the cross-sectional results.

BALDWIN (9)

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Productivity Gains from the Implementation of Employee Training Programs

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Abstract

This study uses data on the personnel policies and economic characteristics of businesses in the manufacturing sector to measure the impact of formal training programs on labor productivity. The major finding is that businesses that were operating below their expected labor productivity levels in 1983 implemented new employee training programs after 1983 that resulted in significantly larger increases in labor productivity growth between 1983 and 1986. This higher rate of productivity growth was sufficient to bring these businesses up to the labor productivity levels of comparable businesses by 1986.