Unions, productivity, and productivity growth

By: Barry T. Hirsch and Albert N. Link

Hirsch, B.T., Link, A.N. Unions, productivity, and productivity growth. *Journal of Labor Research* **5**(1), 29–37 (1984). https://doi.org/10.1007/BF02685068

Abstract:

An important recent development has been the emergence of a body of literature by Harvard economists emphasizing a collective voice/institutional response (CV/IR) view of unionism. Possibly the most controversial aspect of this literature (hereafter, the Harvard studies) concerns the effects of unions on labor productivity. Utilizing a production function approach, Brown and Medoff (1978), Clark (1980a, 1980b), and Allen (forthcoming), among others, find that unions increase labor productivity even after accounting for the microeconomic responses of firms to union wage premiums. While the collective voice view of unionism has not gone unchallenged, there is relatively little empirical evidence that seriously questions these results.

Keywords: labor productivity | unionism | collective voice

Article:

I. Introduction

An important recent development has been the emergence of a body of literature by Harvard economists emphasizing a collective voice/institutional response (CV/IR) view of unionism.[1] Possibly the most controversial aspect of this literature (hereafter, the Harvard studies) concerns the effects of unions on labor productivity. Utilizing a production function approach, Brown and Medoff (1978), Clark (1980a, 1980b), and Allen (forthcoming), among others, find that unions increase labor productivity even after accounting for the microeconomic responses of firms to union wage premiums. While the collective voice view of unionism has not gone unchallenged, there is relatively little empirical evidence that seriously questions these results.[2]

[1] This new (or old) view of unionism is most closely associated with Richard Freeman and James Medoff (1979b) and their students at Harvard. Freeman and Medoff (1982) provide an extensive survey of the existing empirical literature.

[2] All of the productivity studies carefully discuss potential weaknesses, however. For a survey of the productivity studies, see Addison and Hirsch (1983). Recently, Clark (1982) has provided evidence showing that unions have little effect on productivity among 902 product-line businesses in manufacturing over the 1970-80 period, while Ehrenberg, Sherman, and Schwartz (1983) obtain a similar finding for 260 public libraries for 1977.

Concurrently, another body of literature has focused on the determinants of the slowdown in labor productivity growth since the mid-1960s.[3] Although methodologies differ, most researchers conclude that only a small portion of the slowdown can be explained by changes in the quantity, quality, and utilization of factor inputs. In response, others have analyzed the correlates of total factor productivity growth, the major focus being on research and development (R&D) expenditures. In marked contrast to the findings of the Harvard studies, the works of Terleckyj (1974, 1980), Kendrick and Grossman (1980), Mansfield (1980), Link (1981, 1982), and Sveikauskas and Sveikauskas (1982) (hereafter, the R&D studies) consistently report that total factor productivity growth is negatively associated with the level of unionism.

This paper compares these two literatures and provides additional evidence on the union-productivity issue. We first argue that the findings of the Harvard studies are not necessarily inconsistent with the findings of the R&D studies. However, additional empirical analysis, which relates total factor productivity growth to both the level and changes in unionism, provides no supporting evidence for the view that the net effect of unionism is to increase productivity.

II. Existing Theory and Evidence

The Harvard studies provide relatively complete discussions of two views of unionism. Briefly, the CV/IR view suggests that unionism may increase labor productivity in those work environments characterized by imperfect monitoring, worker complementarities, and attendant public good and externality problems. Unions act as perfect agents for average workers by providing a collective voice in bargaining. Productivity may be enhanced through decreased turnover and the establishment of grievance procedures, seniority systems, work rules, and the like. In addition, unionization "shocks" management so that existing X-inefficiency is reduced. Thus, the CV/IR view predicts that unionism may increase productivity, even after accounting for the microeconomic adjustments made by firms in response to union wage gains (in particular, an increase in the capital/labor ratio and the selection of higher quality workers).

The alternative monopoly view of unionism predicts that unionism per se will decrease productivity. Not only will union wage gains lead to an inefficient factor mix, but unions will also lower productivity by reducing management flexibility, introducing inefficient work rules, and limiting compensation based on individual productivity. Because of these conflicting effects of unionism, empirical evidence is essential to appraise their relative importance.[4]

The Harvard studies utilize a Cobb-Douglas production function that allows for differences in union and nonunion labor. Following Brown and Medoff (1978), let

$$Y = AK^{\alpha}(L_n + cL_u)^{1-\alpha} \qquad (1)$$

[3] See, for example, Denison (1979) and papers in Kendrick and Vaccara (1980) and Federal Reserve Bank of Boston (1980).

[4] Several recent papers (for example, McDonald and Solow, 1981) emphasize that where unions simultaneously bargain over wages and employment rules the "efficiency" contract curve will lie to the right of the labor demand curve (a point off the demand curve is preferred by both the union and firm but is not necessarily globally efficient). Because it is so difficult to say much about bargaining outcomes, *a priori,* the need for empirical evidence is obvious. Also, largely unexplored in previous literature is the political "face" of unionism and its effects on productivity from union influence on public policies.

where Y is output, K is the stock of physical capital, L_u and L_n are union and nonunion labor, α is the output elasticity of capital, and A is a constant of proportionality. The parameter c reflects differences in productivity between union and nonunion labor (more precisely, the ratio of union to nonunion marginal products), union labor being more productive if $c > 1$. For purposes of estimation, Brown and Medoff show that equation (1) is approximated by:

$$\ln(Y/L) = \ln A + \alpha \ln(K/L) + (1 - \alpha)(c - 1)P, \quad (2)$$

where $L = L_u + L_n$ and $P = L_u/L$. Estimation of such a model allows inferences regarding union productivity effects. If the coefficient on P, the proportion of union labor, is positive, then $c > 1$ and union labor is more productive.

Using cross-sectional state by manufacturing data (20 two-digit SIC manufacturing industries for 29 state groups), Brown and Medoff estimate versions of equation (2). Output is measured by value added, labor is" corrected" for quality differences, the variable *ln* (labor per establishment) is added to the equation to allow for non-constant returns to scale, a "recentness" variable is included to measure more accurately capital stock, and regional and industry dummies are included as controls. The estimated coefficients on P are consistently positive and significant, leading Brown and Medoff to conclude that union workers (establishments) are more productive (by a magnitude roughly corresponding to estimated union wage effects).

As impressive as the Brown-Medoff and similar studies are, a number of problems prevent their findings from being conclusive (they elaborate on most of the problems in admirable detail). Among the most serious problems are that (1) the use of value added as an output measure confounds price and quantity effects (Brown and Medoff, 1978, pp. 371-73) and crudely tracks the relative union wage effect (Addison and Hirsch, 1983) and (2) union and nonunion production functions are restricted to having the same parameters (Brown and Medoff, 1978, pp. 369-71). Two subsequent studies by Clark (1980a, 1980b), however, using plant data from the cement industry, avoid some of these problems. Clark, like Brown and Medoff, concludes that unions increase productivity; however, his evidence is less conclusive and is based on a sample containing a small number of nonunion plants. In addition, as Clark is careful to point out, it is not known to what extent findings from the cement industry can be generalized. Subsequent work by Clark (1982) supports the view that unions have no effect on productivity or sales growth, but they do decrease profitability.

Despite the contribution made by these studies, the union-productivity question remains open. Surprisingly, the Harvard papers have not cited any of the several R&D studies that find growth rates in total factor productivity to be negatively related to unionism. Briefly, these R&D studies assume a three-factor Cobb-Douglas production function written in terms of output (Y), physical capital (K), and technical capital (T):

$$Y = Ae^{\lambda t}K^{\alpha}L^{(1-\alpha)}T^{\beta}, \quad (3)$$

where A is a constant, λ is a disembodied rate of growth parameter, α and β are output elasticities, and t represents time. Defining total factor productivity as a Solow-type residual, $TFP = [lnY - \alpha lnK - (1-\alpha)lnL]$ and ϱ as its time derivative leads to the specification

$$\varrho = \lambda + \delta(R\&D/Y) \tag{4}$$

where $\delta = (\partial Y/\partial T)$ is interpreted as the marginal product of technical capital and $R\&D = \partial T/\partial t$ approximates net investments into stock T.

In Terleckyj (1974), and the work that followed, equation (4) is estimated using cross-sectional data with the level of unionization, *inter alia,* appended to the regression model as a control variable. Estimated union effects, while not always significant, are consistently negative.

III. A Synthesis and Additional Evidence

Despite apparent differences in conclusions, the findings from the Harvard and R&D studies are not necessarily inconsistent. To demonstrate, we subtract *αln(K/L)* from both sides of equation (2), yielding

$$lnY - \alpha lnK - (1-\alpha)lnL = TFP = lnA + (1-\alpha)(c-1)P. \tag{5}$$

Within the Cobb-Douglas framework, a positive coefficient on *P* from equation (2), showing higher labor productivity, also implies from equation (5) that unionized establishments have higher total factor productivity. Thus, the Harvard studies could just as easily be interpreted as showing the effects of unions on *TFP* as on labor productivity.

The Harvard results suggest that unionized establishments are more productive or, alternatively, that output per unit of total inputs is greater within more highly unionized industries. The R&D studies, by contrast, find that *growth* in *TFP* has been slower in more highly unionized industries. These findings are not mutually exclusive. One possible interpretation is that it is initial unionization that increases the level of productivity, presumably by providing an effective voice and reducing X-inefficiency. However, productivity growth in unionized industries is slowed, possibly due to the effects of monopoly unionism in restricting management flexibility and entrepreneurial activities or from decreased long-run profit expectations.[5]

The findings of the Harvard studies suggest that estimation of equations (2) or (5) in log-difference form would result in a positive relationship between total factor productivity growth and the change in the proportion unionized. In an attempt to synthesize the two groups of studies, we posit the following Cobb-Douglas production function:

$$Y = Ae^{\lambda t}L^{\alpha}(L_n + cL_u)^{1-\alpha}T^{\beta} \tag{6}$$

[5] Ruback and Zimmerman (1983) provide evidence showing significant decreases in equity values resulting from union wins in certification elections. For an excellent discussion of the relationship between the firm's internal environment and productivity, see Klein (1979).

Equation (6) is identical to equation (3) except for dichotomizing union and nonunion labor. For purposes of estimation, equation (6) in difference form is approximated by

$$\varrho = \lambda + (1 - \alpha)(c - 1)\Delta P + \delta(R\&D/Y), \tag{7}$$

where ϱ is the change in total factor productivity, approximately $(TFP_t - TFP_{t-1})$; λ is the rate of disembodied growth, approximately $(lnA_t - lnA_{t-1})$; ΔP is the change in proportion unionized, $(P_t - P_{t-1})$; and $(R\&D/Y)$ is the R&D to output ratio. Equation (7) is equivalent to those estimated in the R&D studies except that ΔP replaces P on the right-hand side.

To reexamine the union-productivity question, we estimate several versions of equation (7) using a sample of 19 two-digit SIC manufacturing industries.[6] The use of two-digit aggregate industry level, necessitated by the need for data on the *change* in proportion unionized, provides too few observations to allow a detailed examination of union productivity effects. Rather, the purpose of our empirical work is to see if the seeming inconsistency between the Harvard and R&D studies can be easily resolved. Unlike previous studies, we are able to relate changes in productivity to changes in unionism without restricting our analysis to a single industry.

The dependent variable, ϱ, is measured as the average annual rate of growth in total factor productivity between 1957 and 1973, as separately calculated by Kendrick and Grossman (1980), ϱ(*KG*), and by Gollop and Jorgenson (1980), ϱ(*GJ*).[7] Unionization data on the proportion of production workers covered by collective bargaining agreements in each industry come from Douty for 1958 (as reported in Freeman and Medoff, 1979a, Table 9, p. 173) and from Freeman and Medoff for 1968-72 (1979a, Table 9, p. 173). The variable ΔP is simply the difference between the proportions covered in 1968-72 and 1958.[8] Data on $R\&D/Y$ for 1958 come from Terleckyj (1974, Table 1, p. 13). Following the other R&D studies, additional control variables are included in the empirical specification of equation (7): *CR58,* the industry four-firm concentration ratio for 1958 (Shepherd, 1979, Table 10-5, p. 202); *PVTS,* the proportion of sales by each industry to nongovernmental buyers in 1958 (Terleckyj, 1974, Table 3, p. 18); and *CYC,* an index of cyclical instability of industry output (Terleckyj, 1974, Table 3, p. 18).

The least-squares results from estimating equation (7) are reported in Table 1. The results in columns (1) and (2) indicate a negative, although not significant, coefficient on ΔP rather than a positive one, as would be consistent with the CV/IR view.[9] Thus, estimates from equation (7)

---

[6] Excluded is miscellaneous manufacturing (SIC 39) for which we do not have complete data on R&D expenditures.

[7] The productivity measures are calculated from Kendrick and Grossman (1980, Table 3-7, p. 46) and Gollop and Jorgenson (1980, Table 1.30, pp. 118-19). Gollop and Jorgenson use a translog framework in estimating their total factor productivity indices and also adjust for input quality more extensively than do Kendrick and Grossman. The simple correlation between these two series is .56, indicating substantial differences.

[8] Since unionism is believed to affect the work environment, data measuring collective bargaining coverage, as opposed to union membership, is preferable. We also constructed alternative union variables measuring the proportion of both production and nonproduction workers covered by collective bargaining agreements. The 1958 coverage data were obtained from Lewis (1963, Table 78, p. 260), and 1968-1972 data were calculated from Freeman and Medoff (1979a, Table 1, pp. 148-53). Results using these data were quite similar to those presented in the paper.

[9] The simple correlation of ΔP with ϱ(*KG*) is -.11, and with ϱ(*GJ*) it is -.37. The *R&D/Y* variable is less significant when using ϱ(*GJ*) as the dependent variable, reflecting the more precise adjustments made for capital (and labor) quality by Gollop-Jorgenson. See Terleckyj (1980) for a similar finding.

provide no support for the proposition that unions increase productivity, independent of their effects on the measured quantity and quality of factor inputs.

The results in columns (3) and (4) of Table 1 correspond to equation (7) when the level of unionism, P (the proportion of covered production workers in 1958), is also held constant. We find that total factor productivity growth is negatively and significantly related to both the level and growth of unionism. This suggests that unionism not only reduces total factor productivity (as seen from the negative coefficient on ΔP), but also slows the rate of productivity increase.[10] While these empirical results are hardly conclusive, they cast reasonable doubt on many of the conclusions reached in the Harvard studies.

Table 1. Estimates of Union Effects on Productivity Growth[a]

	Dependent Variable			
	(1) $\varrho(KG)$	(2) $\varrho(GJ)$	(3) $\varrho(KG)$	(4) $\varrho(GJ)$
ΔP	–.022	–.048	–.051	–.070
	(.030)	(.026)	(.026)	(.023)
P	—	—	–.044	–.036
			(.015)	(.014)
$R\&D/Y$	.178	.050	.213	.078
	(.087)	(.075)	(.071)	(.063)
Constant	–11.274	–.015	–12.271	–.023
R^2	.474	.316	.601	.559
F	2.34	1.20	3.01	2.54

[a] Other included variables are *CR*58, *PVTS*, and *CYC*.
Note: Standard errors are in parentheses.

IV. Conclusion

We have shown that findings from the Harvard studies showing that labor productivity is positively related to unionism need not be inconsistent with findings from the R&D studies showing that total factor productivity growth is slower in more highly unionized industries. However, our empirical analysis indicates that productivity growth decreases with respect to both the growth and level in the proportion unionized. In our opinion, these findings cast doubt on the generality and robustness of the results reported in the Harvard studies.

---

[10] These findings are not sensitive to our measures of unionization. Whether we use alternative data (see note 8) and measure P by the average proportion organized between 1958 and 1968-72 or use $\%\Delta P$ rather than ΔP, similar results are obtained. Likewise, the results are not very sensitive to specification. As expected, we consistently find positive coefficients on *CR58* and *PVTS* and a negative coefficient on *CYC,* though these were not generally statistically significant. All results and data are available on request.

Kendrick and Grossman (1980) have estimated a similar model for 1948-76, including variables measuring the level of unionism in 1958 and the percentage change in unionism between 1958 and 1972. They obtain a negative coefficient on P and a positive coefficient on $\%\Delta P$. However, their unionism variables (kindly provided by the authors) are derived from noncomparable surveys, the Douty figures from a 1958 BLS establishment survey and the 1972 membership data reported by unions in the *Directory of National and International Labor Unions in the United States* (available for all two-digit manufacturing industries only since 1968). It is generally believed that the latter figures are unreliable. When we include ΔP, as measured by Kendrick and Grossman, we obtain a coefficient of virtually zero, using $\varrho(KG)$ as the dependent variable, but negative and significant using $\varrho(GJ)$.

A possible explanation for our lack of empirical support for the CV/IR view of unionism is that increases and decreases in unionism have an asymmetrical effect. One interpretation of the CV/IR view is that it is the change from nonunion to union status that increases productivity through the introduction of voice and the reduction in X-inefficiency. It need not follow, however, that stagnating or declining union representation leads to decreased productivity through poorer communication and increased X-inefficiency. The work environment, communication channels, and formalized work rules can be regarded as a stock of capital, and decreased unionism need not destroy this stock. While increased unionism conceivably may have the positive effects emphasized in the Harvard studies, it does not follow that declines in unionism will lead to productivity decreases of an equal magnitude. Because our study covers a period during which overall private-sector unionism was falling, it may not be surprising that we do not observe a positive relationship between ϱ and ΔP.[11]

However, our repeated finding of productivity growth being slower in industries with a greater proportion of union coverage and with faster union growth (or a slower decline) is suggestive. We believe that the monopoly effects of unions on productivity are probably more substantial and the positive productivity effects less substantial than the Harvard studies would suggest. At a minimum, the results presented here indicate that the complex relationship between unionism and productivity is not yet well understood.

REFERENCES

Addison, John T. and Barry T. Hirsch. "Do Unions Really Raise Productivity? Alternative Views and Evidence." University of North Carolina at Greensboro, 1983.

Allen, Steven G. "Unionized Construction Workers Are More Productive." *Quarterly Journal of Economics,* forthcoming.

Brown, Charles and James Medoff. "Trade Unions in the Production Process." *Journal of Political Economy* 86 (June 1978): 355-78.

Clark, Kim B. "The Impact of Unionization on Productivity: A Case Study." *Industrial and Labor Relations Review* 33 (July 1980a): 451-69.

———. "Unionization and Productivity: Micro-Econometric Evidence." *Quarterly Journal of Economics* 95 (December 1980b): 613-39.

———. "Unionization and Firm Performance: The Impact on Profits, Growth, and Productivity." Harvard University, 1982.

Denison, Edward F. *Accounting for Slower Economic Growth.* Washington, D.C.: The Brookings Institution, 1979.

[11] Too few industries showed an increase in unionism to allow precise estimation of separate effects from a positive ΔP and a negative ΔP. Brown and Medoff (1978, p. 376n) attempted to examine the effects of ΔP from 1929 to 1953 (when unionism was increasing) on the change in *ln*(value added/labor); however, they report inconclusive results. Clark (1980a, 1980b) uses time-series data on six firms in the cement industry, which underwent unionization from 1953 and 1976. No data were apparently available on firms changing from union to nonunion status.

Ehrenberg, Ronald G., Daniel R. Sherman, and Joshua L. Schwartz. "Unions and Productivity in the Public Sector: A Study of Municipal Libraries." *Industrial and Labor Relations Review* 36 (January 1983): 199-213.

Federal Reserve Bank of Boston. *The Decline in Productivity Growth.* Boston: The Federal Reserve Bank of Boston, 1980.

Freeman, Richard B. and James L. Medoff. "New Estimates of Private Sector Unionism in the United States." *Industrial and Labor Relations Review* 32 (January 1979a): 143-74.

———. "The Two Faces of Unionism." *The Public Interest 57* (Fall 1979b): 69-93.

———. "The Impact of Collective Bargaining: Can the New Facts Be Explained by Monopoly Unionism?" NBER Working Paper No. 837, January 1982.

Gollop, Frank M. and Dale W. Jorgenson. "U.S. Productivity Growth by Industry, 1947-73." In Kendrick and Vaccara (eds.), *New Developments in Productivity Measurement and Analysis.* Chicago: The University of Chicago Press, 1980, pp. 17-124.

Kendrick, John W. *Postwar Productivity Trends in the United States.* New York: National Bureau of Economic Research, 1973.

Kendrick, John W. and Elliot S. Grossman. *Productivity in the United States: Trends and Cycles.* Baltimore: The Johns Hopkins University Press, 1980.

Kendrick, John W. and Beatrice N. Vaccara (eds). *New Developments in Productivity Measurement and Analysis.* Chicago: The University of Chicago Press, 1980.

Klein, Burton H. "The Slowdown in Productivity Advances: A Dynamic Explanation." In C. T. Hill and J. M. Utterback (eds.), *Technological Innovation for a Dynamic Economy.* New York: Pergamon, 1979, pp. 66-117.

Lewis, H. G. *Unionism and Relative Wages in the United States." An Empirical Inquiry.* Chicago: The University of Chicago Press, 1963.

Link, Albert N. "Basic Research and Productivity Increase in Manufacturing: Some Additional Evidence." *American Economic Review* 71 (December 1981): 1111-12.

———. "Productivity Growth, Environmental Regulations and the Composition of R&D." *The Bell Journal of Economics* 13 (Autumn 1982): 548-54.

Mansfield, Edwin. "Basic Research and Productivity Increase in Manufacturing." *American Economic Review* 70 (December 1980): 863-73.

McDonald, Ian M. and Robert M. Solow. "Wage Bargaining and Employment." *American Economic Review* 71 (December 1981): 896-908.

Ruback, Richard and Martin B. Zimmerman. "Unionization and Profitability: Evidence from the Capital Market." Massachusetts Institute of Technology, 1983.

Shephard, William G. *The Economics of Industrial Organization.* Englewood Cliffs, N.J.: Prentice-Hall, 1979.

Sveikauskas, Catherine Defina and Leo Sveikauskas. "Industry Characteristics and Productivity Growth." *Southern Economic Journal* 48 (January 1982): 769-74.

Terleckyj, Nestor E. *Effects of R&D on the Productivity Growth of Industries: An Exploratory Study.* Washington, D.C.: National Planning Association, 1974.

———. "What Do R&D Numbers Tell Us About Technological Change?" *American Economic Review* 70 (May 1980): 55-61.