

## Labor union effects on innovative activity

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### **Abstract:**

Union rent-seeking is considered a tax on firm returns from investments in innovative activity. We examine this proposition by considering the responses of firms in a 1985 survey on R&D and product innovation. Consistent with our model, we find that innovative activity is significantly less important for union than for similar nonunion firms. We conclude that innovative activity may be an important route through which union rent-seeking affects the long-run performance of firms.

**Keywords:** product innovation | innovative activity | firm investment | labor unions | union rent-seeking

### **Article:\***

## **I. Introduction**

Recent studies examining the effect of labor unions on firm and industry profitability find profits to be significantly lower under unionism.<sup>1</sup> Largely absent from this literature, however, is an analysis of firms' responses in the face of effective union rent-seeking. We examine this issue by investigating the effects of unions on firm investments in a form of intangible capital, namely, product innovative activity. Our principal finding is that innovative activity is significantly less important for union than for nonunion firms.

We argue in Section II that union rent-seeking acts as a distortionary tax on firm investments in product innovation. In Section III and Section IV, we present data and empirical results that support this proposition. Section V provides concluding remarks.

## **II. Union Rent-Seeking and Innovative Activity**

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\* We appreciate the helpful assistance and suggestions received from our colleague Terry Seaks, Barry Bozeman at Syracuse University, and participants in the Vanderbilt Microeconomics Workshop.

<sup>1</sup> Hirsch and Addison (1986, Chapter 7) provide a review of the literature examining union effects on profits. Among the more frequently cited empirical studies are Freeman (1983), Salinger (1984), Ruback and Zimmerman (1984), Clark (1984), Karier (1985), and Voos and Mishel (1986).

In the absence of sufficiently large union productivity effects, union compensation gains must in the long run come at the expense of above-normal profits, presumably resulting from some form of market power, and from the returns associated with quasi-fixed physical or intangible capital investments.<sup>2</sup> Although previous research has addressed the union capture of profits associated with market power (see, for example, Freeman, 1983; Clark, 1984; Salinger, 1984; and Karier, 1985), the effect of unions on returns from tangible and intangible capital investments has received much less attention. Noteworthy is Baldwin's (1983) work, which follows an earlier line of reasoning suggested by Simons (1944) and develops a theoretical model in which unions capture a portion of the returns from long-lived capital investments. Where firms and unions are unable to construct incentive-compatible contracts, firms decrease their investments in plant and equipment in order to avoid union capture.

More recently, Lawrence and Lawrence (1985) have applied similar arguments to analyze economic performance in manufacturing, with specific application to the steel industry.<sup>3</sup> Connolly, Hirsch, and Hirschey (1986) analyze union effects on firm investments in intangible capital, particularly R&D. They contend that the returns from nontransferable R&D (that is, R&D whose output cannot be licensed profitably) are vulnerable to union capture and, in response, unionized firms invest less in such activity. We follow their arguments in our discussion below.

To the extent that unions act as a distortionary tax on the returns from investments in intangible capital (in this case, innovative activity), the firm's investment strategy will be distorted. This results from an inefficient bargaining relationship between the union and the firm. By contrast, efficient bargaining might entail no real effect of the union on the firm's investment activities.<sup>4</sup> Both parties would agree to maximize the present value of the enterprise, comprised of shareholder plus union wealth (Abowd, 1985), and bargaining would then occur over the division of the wealth. While the union would still capture rents for their members (and, hence, decrease the firm's market value), the union tax would be lump-sum rather than distortionary. Efficient bargaining and the cooperative behavior it entails seem unlikely where there are long-lived tangible or intangible capital investments. Once such investments are in place, a rationally myopic union (rational from the point of view of its senior members) is likely to try to capture resulting quasi-rents. Over the very long run, any reduction in profitability is likely to have real effects on resource allocation.

To the extent that the return streams from investments are short-lived or that firms can license new product or process innovations, firms can partially escape this union tax. For example, licensing may permit the firm to receive a return on its investment even if the union were to exercise the strike weapon, whereas realization of a return on immobile physical or intangible capital requires the firm to maintain operations. While the firm can protect, in part, its investment in innovative activity from union capture through licensing, such activity is costly and entails the

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<sup>2</sup> In addition, industry-wide unionization, coupled with the absence of an entry threat, makes possible supra-competitive wage gains.

<sup>3</sup> Specifically, they argue that decreasing demand lowers the elasticity of substitution and may increase a union's short-run bargaining power or ability to capture quasi-rents.

<sup>4</sup> See McDonald and Solow (1981) and MaCurdy and Pencavel (1986) for the development of models with efficient bargaining outcomes off the labor demand curve. Of course, inefficiency associated with imperfect competition in the product market still obtains.

risk associated with losing trade secrets. Thus, the firm will only protect its return stream from union capture to the point where the marginal protection cost is equal to the marginal benefit, implying a minimization of the sum of its protection cost and its loss to the union.

This argument leads to the testable proposition that, in general, union firms will engage in less innovative activity than similar nonunion firms. That is, because the union tax on investment results in a lower rate of return, union firms will invest less intensively in innovative activity. As mentioned, this prediction assumes that nondistortionary bargaining outcomes do not obtain. It also rests on the assumption that innovations are not highly labor-saving. That is, to the extent that tangible and intangible capital is labor-saving, a union tax may *increase* investment. This is the firm's expected micro-theoretic substitution effect in response to higher wages (overall investment, of course, will still decrease if scale effects are dominant). Increases in investment seem most likely in the case of physical capital and labor-saving process innovations and much less likely in the case of product innovations that are unlikely to have a large impact on factor mix.

### III. Data and Empirical Analysis

The empirical implications discussed in Section II are tested using a unique set of microdata on a sample of 315 manufacturing firms (or business units of larger firms) operating in central New York state. These 1985 data come from an industrial technology survey conducted by the Technology and Information Policy Program group at Syracuse University for Niagara Mohawk Power Corporation.<sup>5</sup>

As dependent variables, we consider two measures of product innovative activity. Both variables are obtained from the survey and reflect an ordered qualitative response corresponding to some underlying continuous measure of innovative activity that remains unobserved. *INNOV1* measures the firm's response to the following statement:

Different companies attribute their profitability to different factors. Please indicate your company's comparative advantage or disadvantage relative to your competitors in product-related technological innovation. Respond with "major disadvantage," "minor disadvantage," "minor advantage," or "major advantage."

*INNOV2* measures the firm's response to the following statement:

As compared to our competitors, we are a leader in developing innovative new products. Respond with "strongly disagree," "disagree somewhat," "agree somewhat," or "strongly agree."

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<sup>5</sup> A survey questionnaire was mailed to the 1,070 Niagara Mohawk industrial customers in central New York state. From this mailing 477 questionnaires were returned. First, respondents with more than 10 percent missing data were eliminated from the data base. Second, of those remaining, only 315 reported complete data on both of our dependent variables. A very small number of observations had values assigned to some right-hand side variables based on sample means or inferred from responses to other survey questions. Results are not sensitive to inclusion of these firms. Tests for non-response bias indicated that respondents were not significantly different from non-respondents with respect to such characteristics as size, SIC code, and location within the region. More detailed information is available on request.

*INNOV1* and *INNOV2* are subject to the usual caveats regarding Likert-scale response data. However, because the questions asked for a comparison of the firm's position or strategy with respect to its competitors, our measures do have the advantage of indirectly holding constant unmeasured industry or product-line specific differences in innovative activity, allowing us to more accurately distinguish union effects from other determinants of innovative activity.<sup>6</sup>

Our focus is on the effect of unions on interfirm differences in innovative activity. The union status measure, *UNION*, is a binary variable constructed on the basis of the proportion of each firm's work force reported as unionized. Firms reporting 50 percent or more unionization are categorized as union, *UNION* = 1; otherwise, firms are categorized as nonunion, *UNION* = 0. Virtually all respondents categorized as nonunion reported zero union coverage. This measure of unionization is superior to publicly available measures of coverage, which can be calculated in no greater detail than the three-digit industry level.

Other variables in our analysis measure firm size, profitability, foreign competition, labor-management relations, industry concentration, R&D activity, and the two-digit SIC industry of operation. *SIZE*, measured by the natural logarithm of total personnel, is included to control for scale, scope, and appropriability effects on innovative activity, key topics in literature examining aspects of the Schumpeterian hypothesis (see, for example, Link, 1980). *PROFIT* is a binary variable equaling 1 if the firm made "good" or "excellent" profits in 1984 and 0 if it made "modest" profits or sustained "modest" or "severe" losses. This variable is included because profits provide a major source for investment in innovative activity, particularly if capital markets are less than perfect. *FORCOMP* is a binary variable equaling 1 if the firm believes that it faces "severe" foreign competition or that foreign competition "threatens its survival" and 0 if there is "no significant foreign competition" or if it is "not severe." The qualitative effect of foreign competition on innovative activity is ambiguous. On the one hand, increased competition may spur investment in new product innovation; on the other hand, foreign competition may indicate a mature domestic industry in which the returns to investment in innovative activity are relatively low or, alternatively, earnings from which investment funding takes place are more seriously constrained. Finally, *LABMGT* is a binary variable equaling 1 if the firm "agrees" or "strongly agrees" that its labor-management relations "are smooth and marked by a spirit of cooperation" and 0 if it "disagrees" or "strongly disagrees" with that statement. Each of these four firm-specific variables comes from survey responses.

The variable *R&D* is a binary variable equaling 1 if the firm responds that it engages in \$10,000 or more of R&D and 0 otherwise. While R&D activity is to some extent reflected in the *INNOV1* and *INNOV2* measures, *R&D* is included in selected specifications to control for unmeasured differences between R&D-active and non-active firms. *CR* measures the 1982 four-firm concentration ratio and *CR*<sup>2</sup> measures its square in the firm's reported primary four-digit SIC industry (U.S. Department of Commerce, 1986). *IND*, a vector of two-digit SIC industry binary variables (the sample contains firms in all two-digit industries except SIC 21), is included to

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<sup>6</sup> We find relatively little across-industry variability in average levels of *INNOV1* and *INNOV2*, supporting our belief that respondents evaluate their activity relative to their competitors. These measures also reflect both R&D and non-R&D innovative activity among large and small firms, whereas the previous study by Connolly, Hirsch, and Hirschey focused exclusively on R&D investment intensity among Fortune 500 firms.

control for any industry-specific influences on innovation not measured elsewhere. Because *INNOV1* and *INNOV2* measure innovative activity relative to their competitors, the inclusion of *IND* is not expected to be important.

#### IV. Empirical Results

The model estimated is:

$$\left. \begin{array}{l} INNOV1 \\ INNOV2 \end{array} \right\} f(UNION, SIZE, PROFIT, FORCOMP, LABMGT, CR, CR^2, R\&D, IND).$$

Because *INNOV1* and *INNOV2* are qualitative variables measured by four ordered responses, the empirical model is estimated using an ordered probit model developed by McKelvey and Zavoina (1975; see also Maddala, 1983, pp. 46-49). Let the true but unobserved response model be  $y = XB' + u$ , where  $y$  is the underlying response,  $X$  is a set of explanatory variables,  $B'$  is the column vector of coefficients associated with  $X$ , and  $u$  is the error term normalized as  $-N(0,1)$ . We do not observe  $y$  but rather values of  $z$  falling into one of four ordered response categories -- in this case 0, 1, 2, or 3.

Letting  $c$  represent a set of  $(m - 1)$  free threshold parameters with  $c_2 > c_1 > c_0 = 0$ , individual observations on  $z$  are predicted to fall into response categories so that  $z(0) = 1$  if  $XB' \leq 0$ ,  $z(1) = 1$  if  $0 < XB' \leq c_1$ ,  $z(2) = 1$  if  $c_1 < XB' \leq c_2$ , and  $z(3) = 1$  if  $XB' > c_2$ . The probabilities for each response category are:  $P_0 = 1 - F(XB')$ ,  $P_1 = F(XB') - F(XB' - c_1)$ ,  $P_2 = F(XB' - c_1) - F(XB' - c_2)$ , and  $P_3 = F(XB' - c_2)$ , where  $F$  is the cumulative standard normal density function. The McKelvey-Zavoina method uses the Newton-Raphson iterative technique to search for maximum likelihood estimates of  $B'$ ,  $c_1$ , and  $c_2$  that maximize the probability of obtaining the observed sample frequency of responses.

The probit coefficients and standard errors for the *INNOV1* and *INNOV2* equations, as well as descriptive statistics on the right-hand side variables, are presented in Table 1. Results are presented for specifications with and without the R&D and industry dummy variables. The partial derivatives for the specifications with R&D included and *IND* excluded (see Table 2) indicate the effect of the independent variables on the likelihood of a response in each of the four categories.

Because the four categories exhaust the possible responses, the partial derivatives must sum to zero.<sup>7</sup>

*INNOV1* measures firms' comparative advantage, relative to their competitors, in profitability resulting from product-related technological innovation. The results in Table 1 indicate that union firms rank themselves significantly lower in this dimension of technological innovation than do similar nonunion firms. Much the same story is evident from the ordered probit results for *INNOV2*, which measures firms' responses to a statement about their leadership in developing

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<sup>7</sup> The sign of the probit coefficient necessarily implies the signs of the partials in the first and fourth response categories but not in the second and third. We thank Jonathan Silberman and Jim Long for providing the computer program calculating the partial derivatives.

innovative products. We find that union firms are significantly less likely than similar nonunion firms to perceive themselves as leaders in such activity. The *UNION* coefficients in both the *INNOV1* and *INNOV2* equations differ little across specifications.

**Table 1.** Ordered probit results *INNOV1* and *INNOV2*<sup>a</sup>

	Mean (s.d.)	<i>INNOV1</i>			<i>INNOV2</i>		
		(1)	(2)	(3)	(1')	(2')	(3')
<i>UNION</i>	.425 (.495)	-.436 (.142)	-.419 (.143)	-.407 (.162)	-.425 (.140)	-.408 (.141)	-.435 (.148)
<i>SIZE</i>	4.450 (1.390)	.165 (.053)	.075 (.058)	.100 (.065)	.184 (.051)	.074 (.057)	.098 (.062)
<i>CR</i>	30.503 (19.332)	.002 (.011)	.007 (.011)	.005 (.013)	.005 (.011)	.010 (.011)	.006 (.014)
<i>CR</i> <sup>2</sup> / <i>100</i>	13.030 (16.236)	-.000 (.013)	-.006 (.013)	-.004 (.015)	.002 (.013)	-.005 (.013)	.002 (.016)
<i>PROFIT</i>	.325 (.459)	.150 (.142)	.170 (.143)	.237 (.152)	-.039 (.138)	-.018 (.139)	-.013 (.149)
<i>FORCOMP</i>	.355 (.478)	-.236 (.135)	-.268 (.135)	-.309 (.154)	-.120 (.132)	-.160 (.133)	-.155 (.151)
<i>LABMGT</i>	.821 (.383)	.067 (.172)	.074 (.173)	.077 (.192)	.354 (.169)	.375 (.170)	.423 (.188)
<i>R&amp;D</i>	.578 (.495)	—	.538 (.146)	.548 (.165)	—	.672 (.144)	.731 (.159)
<i>IND</i>		—	—	Included	—	—	Included
constant		1.359	1.424	1.245	.271	.329	.132
log likelihood		-345.18	-338.34	-329.94	-388.73	-377.69	-370.48
-2(log likelihood ratio)		22.459	36.135	52.925	31.248	53.322	67.755

<sup>a</sup> Standard errors in parentheses; *n* = 315

*INNOV1* measures comparative advantage relative to competitors in profitability resulting from product-related technological innovation. Responses, coded 0 to 3, are major disadvantage (*n* = 9), minor disadvantage (*n* = 53), minor advantage (*n* = 137), and major advantage (*n* = 116).

*INNOV2* measures response to statement on firm strategy that, relative to competitors, the firm is a leader in developing innovative new products. Responses, coded 0 to 3, are strongly disagree (*n* = 34), disagree somewhat (*n* = 66), agree somewhat (*n* = 132), and strongly agree (*n* = 83).

**Table 2.** Partial Derivatives by Response Category — Ordered Probit Results<sup>a</sup>

	<i>INNOV1</i> =				<i>INNOV2</i> =			
	0	1	2	3	0	1	2	3
<i>UNION</i>	.0212	.0881	.0471	-.1564	.0645	.0771	-.0141	-.1275
<i>SIZE</i>	-.0038	-.0158	-.0084	.0280	-.0117	-.0140	.0026	.0232
<i>CR</i>	-.0003	-.0014	-.0007	-.0025	-.0016	-.0019	.0003	.0031
<i>CR</i> <sup>2</sup> / <i>100</i>	.0003	.0013	.0007	-.0023	.0008	.0009	-.0002	-.0015
<i>PROFIT</i>	-.0086	-.0357	-.0191	.0634	.0029	.0034	-.0006	-.0056
<i>FORCOMP</i>	.0136	.0564	.0301	-.1001	.0253	.0303	-.0056	-.0500
<i>LABMGT</i>	-.0037	-.0155	-.0083	.0276	-.0592	-.0707	.0130	.1169
<i>R&amp;D</i>	-.0272	-.1132	-.0605	.2010	-.1062	-.1270	.0233	.2099

<sup>a</sup> partial derivatives derived from ordered probit equations (2) and (2') in Table I. *INNOV1* and *INNOV2* are defined in Table 1 and text.

The partial derivatives in Table 2 clearly indicate that the primary effect of union coverage is to decrease the number of firms reporting that product innovation is a major advantage (*INNOV1* =

3) and the number strongly agreeing that they are leaders in developing new product innovations ( $INNOV2 = 3$ ). The partial union effect exhibits relatively smaller differences across other response categories. We believe the results presented in Table 1 and Table 2 lend substantial support to the union rent-seeking model.

In addition, alternative specifications of the model were examined. The union coefficient was insensitive to the inclusion and exclusion of other righthand side variables. Among the possibilities examined was the addition of a variable measuring union coverage at the three-digit industry level. Its sign was negative but was never close to significance, while the coefficient on *UNION* was scarcely affected. We also examined the union interactions with other independent variables, in particular with *LABMGT* and *R&D*. No significant interactions were found, although the estimates were degraded somewhat by collinearity. Finally, we identified several "influential" observations during preliminary OLS analysis based on values of the *DFBETAS*, *DFFITs*, and the leverage statistic *h* (Belsley, Kuh, and Welsch, 1980, Chapter 2). Excluding these observations from the ordered probit estimation led to a slightly larger and more significant estimated union effect on innovative activity.

The variable *R&D* was included in some specifications to control for the possible unmeasured differences between firms engaging in R&D and those not engaging in R&D. As seen in Table 1, its inclusion had little effect on the other coefficients apart from that on *SIZE*, which fell substantially. The negative union effect on innovative activity was estimated to be similar among the samples of R&D and non-R&D firms. In addition, our findings are consistent with the Schumpeterian hypothesis: product-related technological innovation is more likely to be important in larger-sized firms, as seen in both the *INNOV1* and *INNOV2* results (firm size in our sample ranges from 5 to 20,000 employees). Finally, the vector of industry dummies is not found to be jointly significant in the *INNOV1* or *INNOV2* equations.<sup>8</sup>

No clear-cut findings emerge with respect to industry concentration, owing perhaps to measurement error in our concentration measure (because it could not be adjusted for regional sales or foreign competition), a lack of importance of industry concentration for the relatively small-sized firms in our sample, or because concentration in this sample is not a meaningful proxy for the appropriability of investment returns (see Levin, Cohen, and Mowery, 1985). Also, we find no statistically significant influence of *FORCOMP* and *LABMGT*, although qualitative results suggest that foreign competition is associated with a decreased importance of product innovation in our sample and good labor relations increase the willingness of firms to engage in innovative activity. No inferences can be made with respect to the *PROFIT* variable.

Our finding that product innovative activity is significantly less important among union than among nonunion firms complements and extends the earlier finding of Connolly, Hirsch, and Hirschey that large firms in highly unionized industries have significantly lower R&D investment intensities. This lends further support to the union rent-seeking model. We also find both the likelihood of engaging in R&D and R&D intensity are lower among union firms in our sample, although these results generally are not significant. We place relatively little weight on these latter results, however, because most firms in our sample are not major R&D investors; nor

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<sup>8</sup> Appropriate chi-square tests do not allow us to reject the null hypothesis that the industry dummies have no joint effect on *INNOV1* ( $X^2 = 16.79$ ) or *INNOV2* ( $X^2 = 14.43$ ). The critical  $X^2$  value at the .05 level with 18 *d.f.* is 28.87.

does our data set include a rich set of variables measuring financial and appropriability characteristics.

## V. Conclusion

Recent attention has focused on the dynamic effects of labor unions on economic performance. While there is mixed evidence of union effects on productivity levels, most available evidence on productivity growth suggests that unions have deleterious long-run effects (see, for example, Hirsch and Link, 1984, and footnote 1). Largely unexplored, however, are the routes through which unions affect the long-run performance of firms. Our model of union rent-seeking focuses on the possibility that unions "tax" returns associated with quasi-fixed tangible and intangible capital investments.

We have provided evidence that various aspects of product innovative activity are significantly less important for union than nonunion firms. Our findings are broadly supportive of the union rent-seeking model. Based on these results, we believe that the impact of labor unions on economic performance warrants continued exploration.

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