DO UNIONS CAPTURE MONOPOLY PROFITS?

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This paper challenges the conclusion reached in recent studies that unions reduce profits exclusively in highly concentrated industries. From their review of previous studies and their analysis of 1977 data on 367 Fortune 500 firms, the authors conclude that there is no convincing evidence that concentration produces monopoly profits for unions to capture. Moreover, they find that the union wage effect is not greater in concentrated industries, as suggested by the hypothesis that unions capture concentration-related profits. Evidence is found suggesting that a firm's market share, its expenditures on research and development, and its protection from foreign competition provide more likely sources for union rents than does industry concentration.

Several recent studies have found that unions reduce profits significantly, and some have concluded that this profit reduction is restricted to highly concentrated industries.¹ Both conclusions are important. The finding that unions reduce profitability indicates that, in general, the cost-increasing effects of unions outweigh any positive productivity effects they may bring to the workplace. Such a net effect may help explain management opposition to unions even in those settings where they produce beneficial productivity effects. The conclusion that profit reduction is restricted to highly concentrated industries suggests to many that unions capture monopoly profits deriving from market power and hence provide a source of countervailing power in the labor market. To the extent that unions capture pure economic profits, they are less likely to threaten firms' survival or to have deleterious effects on long-run economic performance.

Despite the apparent clarity of previous empirical results, we believe the conclusion that union labor captures monopoly profits associated with industry concentration must be reexamined. First, previous papers have not focused on labor market evidence on union-nonunion wage differentials, which may corroborate or refute the monopoly profits hypothesis. Second, evidence that industry concentration provides an important source of above-normal profits for unions to capture is not clear-cut. Third, previous studies have estimated restrictive functional forms that

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¹ Freeman (1983), Karier (1985), Salinger (1984), and Voos and Mishel (1986b) explicitly draw these conclusions (see, also, Voos and Mishel 1986a:109). Studies by Clark (1984), Connolly, Hirsch, and Hirschey (1986), and Domowitz, Hubbard, and Petersen (1986b) conclude that unions reduce profits, but differ in results and interpretation regarding market structure. Ruback and Zimmerman (1984) and Abowd (1985) measure the effect of union representation elections and collective bargaining contracts, respectively, on share prices, but neither study considers market structure. Hirsch and Addison (1986, Chap. 7) provide a survey of the union-profits literature.

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118
effectively force union profit effects to be associated with industry concentration.

In this paper we examine labor market evidence on this issue and the sensitivity of the union-profit relationship to specification. We then present firm-level evidence on the relationship of unionism not only to concentration but also to alternative factors providing sources for union gains, namely, returns associated with market share, R&D, and limited foreign competition.

Unions, Profits, and Market Structure

In the absence of large positive effects of unions on factor productivity, the primary sources of union gains in the long run are likely to be profits accruing to firms from market power and from Ricardian quasi-rents due to firm-specific tangible and intangible capital. Although our primary interest here is on unions and monopoly profits, the model and evidence provided by Connolly, Hirsch, and Hirshey (1986) suggest that the returns on long-lived and nonmarketable intangible capital investments provide an important source of union rents.

The proposition that unions capture a significant portion of above-normal profits resulting from market power has only recently received significant attention. In a widely cited paper, Freeman (1983) examined the relationship between price-cost margins, unionism, and concentration using industry data from the 1958–66 Survey of Manufactures and the 1965–76 Internal Revenue Service returns. He estimated the specification:

\[
P_{CM} = a_1 U + a_2 CR + a_3 U \cdot CR + X \beta + \epsilon,
\]

where \(P_{CM}\) is the industry price-cost margin, which Freeman calculates as value added minus labor and advertising costs, divided by the value of shipments (see Liebowitz 1982); \(U\) is union density; \(CR\) is the four-firm concentration ratio; \(U \cdot CR\) is the interaction of \(U\) and \(CR\); \(X \beta\) represents the control variables and their coefficients, plus a constant; and \(\epsilon\) is an error term. Freeman found a significant positive concentration effect \((a_2 > 0)\), a significant negative union-concentration interaction \((a_3 < 0)\), but no significant effect of unionism on profitability. Based on these and other results, he concluded: “It has been found that unionism reduces profitability and this effect occurs in highly concentrated industries. The effect of unionism is quite substantial in most calculations, suggesting that the fraction organized in a sector be included in standard Industrial Organization profitability calculations in the future” (Freeman 1983:23).

Karier (1985) reached the same conclusion, based on evidence from 1972 industry-by-state manufacturing data. He estimated the following model, in which union effects on profits are calculated from interactions with dummy variables for low (CR1), medium (CR2), and high (CR3) concentration industries:

\[
P_{CM} = a_1 CR_2 + a_2 CR_3 + a_3 U \cdot CR_1 + a_4 U \cdot CR_2 + a_5 U \cdot CR_3 + X \beta + \epsilon.
\]

Karier obtained positive and significant coefficients on CR2 and CR3, and estimates of .006, -.085, and -.146 for \(a_3\), \(a_4\), and \(a_5\), respectively, the latter two being significant. Like Freeman, he concluded that “unions capture a sizable fraction of monopoly profits in concentrated industries and have little effect on profits when markets are more competitive” (Karier 1985:41).

Using firm rather than industry data, Salinger (1984) examined union effects on a market value measure of profitability for
1976 (he presented results from regressions using an accounting profit measure, but did not base his conclusions on these results). Salinger estimated a rather complex nonlinear relationship of the form:

\[ q = (1 - \delta U) c r(ZC) + X\beta + \epsilon, \]

where \( q \) is Tobin's \( q \) (the ratio of the firm's market value to replacement costs), \( Z \) is a vector of variables (minimum efficient scale, capital stock, R&D intensity, and advertising intensity) that affect profits in conjunction with concentration and union-concentration interaction terms, \( C \) is a coefficient vector, and \( X \) is a vector of variables that directly influence profits (variables in \( Z \) plus sales growth and \( cr \)). Note that the union variable (which measures union density in the firm's three-digit industry) enters the equation exclusively through the interaction of concentration with variables in \( Z \). Salinger's estimate of \( \delta \) (the union capture parameter) was positive and significant, and on this basis he concluded: "Indeed, the results suggest that unions do succeed in capturing most of the monopoly rents in the American economy" (Salinger 1984: 160).4

Among the researchers considering how union profit effects differ by market structure, Clark (1984) reported a somewhat anomalous result from his examination of accounting rates of return among product-line manufacturing businesses during 1970–80, using data from the Profit Impact of Market Strategy (PIMS) survey. He did not consider industry concentration explicitly, but, rather, focused on the market share of individual businesses. (He also included a control variable measuring the share of sales by a business's largest three competitors, which we suspect is a close proxy for industry connection.) Surprisingly, Clark found that unions reduced profits sharply among businesses with small market shares but had no effect among those with large market shares, despite the fact that mean profits were three times higher among the latter businesses. Although Clark's results are apparently specific to the PIMS data, they do cast doubt on the generality of conclusions from other studies and suggest that market share as well as industry concentration should be considered in profitability analyses.5

Evidence from the Labor Market

If unions do in fact capture monopoly profits associated with concentration, there should be a larger union-nonunion compensation differential in more highly concentrated industries than in competitive (or less concentrated) industries. This differential would most likely take the form of higher union wages, but it could also be evinced by greater fringe benefits, employment stability, and the like. Alternatively, if union threat effects are strong in concentrated industries, both union and nonunion workers should realize wage premiums as monopoly profits are captured by labor.6

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4 But, Salinger finds little evidence that the monopoly rents associated with concentration are large (i.e., \( cr.Z \) variables are insignificant). Although Salinger obtains a significant union coefficient in his \( q \) equation, this result does not hold when using the rate of return on capital as the profit measure.

5 Voos and Mishel (1986b) consider union profit effects with respect to concentration among firms in the super market industry. The conclusion they draw is identical to that drawn by Freeman, Karier, and Salinger. Because of collinearity between their union and concentration measures, however, they do not include both \( U \) and \( U + cr \) in the same equation, but instead obtain negative and significant coefficients on \( U \) and \( U + cr \) entered separately.

6 Salinger (1984:169) briefly mentions the labor market implication of the profits evidence, referencing the well-known Weiss (1966) study that includes in a micro wage equation variables for concentration, industry union density, and their interaction. Weiss obtains an insignificant coefficient on the union-concentration interaction variable when detailed personal characteristics variables are included (and a negative coefficient when they are excluded). Salinger dismisses the Weiss result, arguing that a high correlation between the two industry-level variables makes the estimated coefficient imprecise. This same criticism cannot be applied to recent empirical studies using large samples with information on individual union status. Whereas the labor market evidence on concentration is very weak, there is clear-cut evidence of large threat effects and wage
Our skepticism regarding the conclusion that monopoly profits associated with industry concentration provide the major source for union gains stems in large part from the absence of corroborative evidence from the labor market. There is now considerable micro-level evidence on the effects of union status and concentration on wages. Many of the studies estimate separate wage equations for union and nonunion workers with a concentration variable included in each (e.g., Bloch and Kuskin 1978:190; Freeman and Medoff 1981:567, 569). Positive coefficients on CR in the wage equations would suggest that workers capture returns associated with concentration, and a larger coefficient on CR in the union than in the nonunion equation would indicate a larger union differential in highly concentrated industries.

In these studies, however, coefficients on CR are typically not significant in one or both of the wage equations, and always negative in the union equation. Lewis (1986:154–55), who surveyed seven such studies, found that five of the studies indicate a differential decreasing with concentration, one finds an increasing differential, and one obtains mixed results. Indeed, there does not appear to be strong evidence indicating that either union or nonunion labor captures profits associated with concentration. We believe the lack of such evidence casts serious doubt on the conclusion that unions capture monopoly profits associated with concentration.

Note that the absence of such evidence does not argue that union (or nonunion) labor is unable to capture some share of monopoly or Ricardian rents, where they exist. There are indications, for example, that union labor captures rents resulting from legal restrictions on entry, as evidenced by wages of U.S. Postal Service workers (Perloff and Wachter 1984) and in transportation industries prior to deregulation (Moore 1978; Olson and Trapani 1981). Rather, our conclusion is that there is no labor market evidence of concentration-related rents being generated and captured.

Might union capture of monopoly profits take a form other than compensation? We know of no evidence suggesting that unions improve work conditions or employment stability more in concentrated than in less concentrated industries. On average, union jobs are more dangerous (Leigh 1982) and have less desirable working conditions (Duncan and Stafford 1980) than nonunion jobs; but studies have not related such differences to concentration. In short, we are unaware of any convincing labor market evidence that union members capture monopoly profits associated with concentration.

Specification, Data, and the Union Profit Effect

To examine the question of whether unions capture monopoly profits, we first specify a model that accounts for various determinants of profitability. We subsequently estimate specifications taking the following general linear form:

\[
q_i \text{ or } R(S)_i = (U_i Z_{ij}) C_j + X_{ik} \beta_k + \epsilon_i
\]

where \( i \) indexes the firm, \( q \) is Tobin's \( q \), \( R(S) \) is the rate of return on sales, \( U \) is unionization, \( Z \) is a vector of \( j-1 \) variables plus a constant \( (Z_i=1) \) that influence profitability in conjunction with unionization, \( C \) is a coefficient vector corresponding to \( U \cdot Z \), \( X \) is a vector of \( k-1 \) variables that includes a constant and all variables in \( Z \) \((X_i=1)\) plus those that affect profits independently of unionism, \( \beta_k \) is a coeffi-
cient vector corresponding to \( X \), and \( e \) is an error term with zero mean and constant variance. This general form of the model includes the simple case in which the union variable only enters separately (i.e., \( j = 1 \), with \( Z_1 = 1 \)), as well as more complex specifications in which unionism interacts with other variables.

We examine the relationship of unionism, profits, and market structure using a 1977 sample of 367 Fortune 500 firms, almost exclusively in manufacturing (Appendix A provides a more detailed description). Firms were included in the sample based primarily on the availability of weighted averages of market share and concentration based on each firm’s sales across four-digit SIC industries.\(^8\) Our data, though limited to a single cross-section, contain a somewhat richer set of variables than data sets used in previous studies. For example, in addition to the weighted market share and concentration variables, we include variables measuring R&D, advertising, and foreign competition.

To enhance comparability with prior work, we use both the accounting rate of return on sales, \( R(S) \), and Tobin’s \( q \) to measure profitability. Defined as net income plus interest payments divided by sales, \( R(S) \) is similar although not identical to the industry price-cost margin used in the aggregate studies \( R(S) \) subtracts from earnings depreciation and other expenses costs of capital, whereas the price-cost margin does not). The market value measure \( q \), defined as the market value of the firm divided by the replacement costs of the firm’s physical assets, has been used by Salinger (1984) and in numerous other studies.\(^9\) We prefer the use of a market

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\(^{8}\) The base data set was constructed and furnished to us by Mark Hirschey, with weighted market share and concentration measures calculated by Economic Information Services. The sample used here was limited further by our inability in a few cases to match meaningful union density and import penetration measures.

\(^{9}\) Values of replacement cost are taken from firm 10-K reports provided to the SEC (Securities and Exchange Commission 1976). In practice, firms estimate replacement costs by adjusting historical costs using capital goods price indexes (for a value measure of profitability such as \( q \), which has the advantage of measuring risk-adjusted long-run profitability and is thus forward-looking rather than historical in orientation. The two measures are far from perfectly correlated \( (r = .58) \), since firms with high current earnings need not have high earnings prospects (and vice-versa). There is substantial variability in profits across firms in our sample—\( q \) and \( R(S) \) having coefficients of variation of .40 and .47, respectively.

Unionization is measured by the proportion of eligible workers who are union members in the firm’s primary 3-digit Census industry during the 1975–77 period (Kokkelenberg and Sockell 1985). This measure is similar to that used by Salinger in his firm-level study. We interpret the union variable \( U \) as representing the expected proportion of each firm’s workers who are union members, since most firms in our sample will not have either an all-union or all-nonunion work force. Although use of a firm-level union measure would be preferable, such data are not publicly available.

Most of the other variables are standard in the industrial organization literature. Variables included in \( Z \) and \( X \) include concentration, market share, import penetration, R&D intensity, advertising intensity, firm growth, capital intensity, and two-digit industry dummy variables.\(^{10}\) Features that distinguish our analysis from prior union studies are, however, worth noting. In the industry-level studies and in Salinger’s firm-level analysis, industry con-

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\(^{10}\) In results not shown, we included variables measuring risk (the firm’s stock market beta), firm size, diversification, and technological maturity. These variables were never significant in regressions including all of the above variables, and none of the conclusions in our paper is affected by their exclusion.
centration—the share of industry sales accounted for by the four largest firms—is employed as the sole measure of market structure, and the market shares of individual firms have been ignored. Yet, these two market structure measures are conceptually distinct and not highly correlated.11 Moreover, increasing statistical evidence, particularly from the FTC Line of Business program, suggests that market share is a more important determinant of profits than concentration and that the concentration variable included in industry-level studies has served as a proxy for market share (e.g., Ravenscraft 1983). As previously mentioned, Clark (1984) unexpectedly found the union impact on profits to be restricted to businesses with small market shares. Hence, we believe specifications including both market structure measures should be examined before drawing inferences about the union-profits—market structure relationship.

An additional feature of our model is the explicit consideration of the impact of R&D and import penetration on profitability and the interaction of these variables with union coverage. The exclusion of R&D from models estimated in previous studies is quite serious, in our view. Unionized firms engage in significantly less R&D investment than do nonunion firms; thus, some of the lower profitability associated with unionism results from differences in the R&D capital stock.12 As for foreign competition, although its restraint on profits deriving from market

11 In this data set concentration and market share have a simple correlation of \( r = .36 \). Both measures, provided by Economic Information Services (EIS), are weighted to reflect firms’ sales across different product markets. The weights themselves were not made available by EIS; hence, the union density variable is assigned on the basis of the firm’s primary 3-digit industry (as determined by the firm’s primary 4-digit SIC code reported by Standard & Poor’s).

12 Connolly, Hirsch, and Hirschey (1986) provide theory and evidence suggesting that unionism lowers the market valuation of long-lived firm-specific capital investments and that firms, in response, reduce expenditures in R&D. A related finding by Hirsch and Link (forthcoming), who examine a sample of New York State firms, is that product innovative activity is less important for union establishments than for their nonunion competitors.

power is widely acknowledged, the profit impact of import penetration into U.S. markets is often ignored.13 We examine the effect of foreign competition on profits and on unions’ ability to capture profits.

We also explicitly consider the possibility of bias arising from the simultaneous determination of profits and unionization. Because the industries in which unions are likely to organize have higher potential profits than other industries, \textit{ceteris paribus}, the negative union coefficient in a profit equation may be biased toward zero. (Voos and Mishel [1986a], using aggregate manufacturing data, find evidence of just such a bias.) Finally, industry-level control variables have been included in some but not all the previous studies. We believe their inclusion is potentially important, even in studies using 3-digit industry data. Not only may industry-specific effects be important determinants of firm-level profitability (Schmalensee 1985), but industry variables may help to account for the nonrandom distribution of unionism across industries, particularly when OLS estimation is used.

To acquire an overview of the relationship between unionism, profits, and market structure, we first provide some descriptive evidence. We divide our sample of firms into low- and high-union samples, cross-classified with low and high levels of industry concentration (cr) and firm market share (ms). We use approximate median values of \( U \), cr, and ms to divide the sample into similar-sized cells (these values are \( U = .37 \), cr = .45, and ms = .05). The evidence presented in Table 1 appears reasonably clear-cut. Firms in the high-union cells exhibit lower rates of profit than do firms in the low-union cells, regardless of whether profits are measured by \( q \), \( R(S) \), or alternatively, the rate of return on capital, \( R(K) \) (defined in

13 Clark (1984) and Voos and Mishel (1986a) include import penetration variables in their profit equations, but do not examine how the union profit effect varies with penetration. Caves (1985) provides a survey of studies examining the relationship between price-cost margins, concentration, and foreign competition.
Table 1. Profits by Union, Concentration, and Market Share Class.

<table>
<thead>
<tr>
<th></th>
<th>Concentration</th>
<th></th>
<th>Market Share</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Union</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>$q = .933$</td>
<td>$q = .985$</td>
<td>$q = .950$</td>
<td>$q = .976$</td>
</tr>
<tr>
<td></td>
<td>$R(S) = .068$</td>
<td>$R(S) = .076$</td>
<td>$R(S) = .070$</td>
<td>$R(S) = .072$</td>
</tr>
<tr>
<td></td>
<td>$R(K) = .092$</td>
<td>$R(K) = .091$</td>
<td>$R(K) = .091$</td>
<td>$R(K) = .092$</td>
</tr>
<tr>
<td></td>
<td>$n = 102$</td>
<td>$n = 86$</td>
<td>$n = 79$</td>
<td>$n = 109$</td>
</tr>
<tr>
<td>High</td>
<td>$q = .768$</td>
<td>$q = .789$</td>
<td>$q = .758$</td>
<td>$q = .797$</td>
</tr>
<tr>
<td></td>
<td>$R(S) = .059$</td>
<td>$R(S) = .057$</td>
<td>$R(S) = .057$</td>
<td>$R(S) = .059$</td>
</tr>
<tr>
<td></td>
<td>$R(K) = .083$</td>
<td>$R(K) = .086$</td>
<td>$R(K) = .086$</td>
<td>$R(K) = .084$</td>
</tr>
<tr>
<td></td>
<td>$n = 80$</td>
<td>$n = 99$</td>
<td>$n = 82$</td>
<td>$n = 97$</td>
</tr>
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</table>

Notes: Low union is $U < .37$; otherwise high union.
Low concentration is $CR < .45$; otherwise high concentration.
Low market share is $MS < .05$; otherwise high market share.

Appendix A). Industry concentration and market share appear to add relatively little to profits, however; there is at most only weak evidence that unions reduce profits more in the high-concentration (market share) sample than in the low-concentration (market share) sample.

In order to examine the overall union-profit relationship, we first present in Table 2 regression results using simple specifications in which $U$ enters the profits equation without interaction. We vary the specifications by including and excluding R&D/$S$ and the vector of industry dummies, IND, and check for potential simultaneity problems by reporting 2SLS as well as OLS estimates. Focusing first on the equations using our preferred profit measure, $q$, we find the estimated union effect is highly sensitive to these variations. Inclusion of IND reduces (in absolute value) the union coefficient from $- .396$ to $- .293$, and the addition of R&D/$S$ reduces it further to $- .143$. When Hausman’s (1978) specification test is used, the null hypothesis of no misspecification from using OLS cannot be rejected in the equation including R&D/$S$ and IND (the null hypothesis is rejected in the simpler specifications). As found by Voos and Mishel (1986a), however, the union effect appears larger after accounting for simultaneity ($- .189$ versus $- .143$).\[14\]

Results are similar, although less dramatic, when the accounting profit measure, $R(S)$, is used as the dependent variable. The magnitude (and significance) of $U$ is sensitive to the inclusion of the industry dummies and R&D/$S$. 2SLS estimates are, however, similar to OLS estimates. Judging by the $q$ and $R(S)$ results presented in Table 2, we concur with the conclusion of previous studies that unionization is a potentially important determinant of profitability; but we find the magnitude of the estimated effect to be sensitive to specification and estimation technique.

Variables other than unionism warrant mention. The concentration, market share, and domestic share variables ($CR$, $MS$, and $DSH$) are generally regarded as market structure measures. To the extent that these variables are market power proxies and are associated with increased profits, they provide a potential source for union rents. The evidence available from the simple specifications in Table 2, however, suggests that these factors are not consistently important determinants of profitability and that $CR$ is, if anything, negatively related to profitability. We will return to the evidence on this issue. The R&D and advertising investment intensity variables percentage female, percentage nonwhite, mean schooling, mean experience, and the regional distribution of workers. All of the industry-level instruments are significant. The use of instrumental variables may help account not only for simultaneity but also for measurement error owing to the use of an industry-level rather than firm-level union variable.
Table 2. Regression Estimates of Simple Profit Models: 367 Fortune 500 Firms, 1977.
(\(|q| \) or asymptotic \(|q| \) in parentheses)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>OLS (1)</th>
<th>OLS (2)</th>
<th>OLS (3)</th>
<th>2SLS (4)</th>
<th>2SLS (5)</th>
<th>2SLS (6)</th>
</tr>
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<td>Specification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>U or ( \hat{U} )</td>
<td>-0.396*</td>
<td>-0.293*</td>
<td>-0.143</td>
<td>-0.487*</td>
<td>-0.429*</td>
<td>-0.189</td>
</tr>
<tr>
<td></td>
<td>(4.27)</td>
<td>(2.50)</td>
<td>(1.25)</td>
<td>(4.63)</td>
<td>(2.86)</td>
<td>(1.27)</td>
</tr>
<tr>
<td>CR</td>
<td>0.061</td>
<td>-0.087</td>
<td>-0.170</td>
<td>0.079</td>
<td>-0.075</td>
<td>-0.165</td>
</tr>
<tr>
<td></td>
<td>(0.48)</td>
<td>(0.56)</td>
<td>(1.14)</td>
<td>(0.62)</td>
<td>(0.48)</td>
<td>(1.10)</td>
</tr>
<tr>
<td>MS</td>
<td>0.176</td>
<td>0.285</td>
<td>0.194</td>
<td>0.180</td>
<td>0.275</td>
<td>0.192</td>
</tr>
<tr>
<td></td>
<td>(0.65)</td>
<td>(1.02)</td>
<td>(0.72)</td>
<td>(0.65)</td>
<td>(0.98)</td>
<td>(0.72)</td>
</tr>
<tr>
<td>DSH</td>
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<td>0.176</td>
<td>0.181</td>
<td>0.309</td>
<td>0.179</td>
<td>0.182</td>
</tr>
<tr>
<td></td>
<td>(2.74)</td>
<td>(1.40)</td>
<td>(1.50)</td>
<td>(2.80)</td>
<td>(1.42)</td>
<td>(1.51)</td>
</tr>
<tr>
<td>R&amp;D/S</td>
<td>- -</td>
<td>6.584*</td>
<td>- -</td>
<td>- -</td>
<td>6.286*</td>
<td>- -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.83)</td>
<td></td>
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<td></td>
<td>(5.72)</td>
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<td>(5.16)</td>
<td>(5.53)</td>
<td>(5.07)</td>
<td>(5.13)</td>
</tr>
<tr>
<td>GR</td>
<td>1.190*</td>
<td>1.377*</td>
<td>1.235*</td>
<td>1.164*</td>
<td>1.363*</td>
<td>1.235*</td>
</tr>
<tr>
<td></td>
<td>(4.40)</td>
<td>(4.92)</td>
<td>(4.60)</td>
<td>(4.50)</td>
<td>(4.87)</td>
<td>(4.59)</td>
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<tr>
<td>K/S</td>
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<td>0.117</td>
<td>0.025</td>
<td>0.118</td>
<td>0.109</td>
<td>0.024</td>
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<tr>
<td></td>
<td>(1.71)</td>
<td>(1.45)</td>
<td>(0.31)</td>
<td>(1.58)</td>
<td>(1.94)</td>
<td>(0.30)</td>
</tr>
<tr>
<td>IND</td>
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<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Constant</td>
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<td>0.525</td>
<td>0.559</td>
<td>0.449</td>
<td>0.577</td>
<td>0.575</td>
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<tr>
<td>R²</td>
<td>0.299</td>
<td>0.324</td>
<td>0.385</td>
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<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Significant at the .05 level.

Notes: All variables are defined in Appendix A. \( U \) is included in the OLS equations, and endogenous \( \hat{U} \) is included in the 2SLS equations.
(R&D/S and AD/S) are typically treated as proxies for stocks of value-enhancing intangible capital. In contrast with the market structure variables, both of these variables are found to be important determinants of profitability whose omission from a profits equation is likely to result in statistical bias.

The capital intensity variable, K/S, must be included in the R(S) equation to account for differences in firm returns due to differences in capital intensity. Its inclusion in a q equation is more speculative, since the replacement cost of capital is measured in the denominator of q. In fact, we find that K/S does not have a significant effect on q. The growth variable, gr, highly significant here as in most studies, serves as a proxy for changes in firm-level demand and thus captures both disequilibrium and firm-specific factors not measured elsewhere. The industry dummies are likely to capture industry-level differences in equilibrium and disequilibrium profits due to unmeasured factors associated with aggregate industry groupings (say, a depressed automobile market due to high short-term interest rates). As evident in Table 2, inclusion of the industry dummies decreases the magnitude of the estimated union profit effect.

Unions, Profits, and Concentration: Econometric Evidence

We argue in this paper that the conclusion that unions capture monopoly profits associated with concentration is suspect. This judgment stems partly from the lack of corroborative labor market evidence, but we also find the econometric evidence less than compelling. First, it is not clear from the industrial organization literature that concentration produces monopoly profits for unions to capture, although certainly Freeman and Karier are correct that unionism is a potentially important factor omitted from such analyses. It is certainly clear that in our data set industry concentration is, if anything, negatively associated with profitability. Also, we are hardly alone in finding the link between profitability and concentration a weak one (Ravenscraft 1983; Bothwell, Cooley, and Hall 1984; Connolly and Hirshey 1985; Mueller 1986); and even where stronger evidence is found, the interpretation of this relationship is not straightforward (Demsetz 1973; Clarke, Davies, and Watson 1984). In short, the conclusion that unions capture monopoly profits associated with concentration assumes that concentration produces monopoly profits to capture, and the evidence for that assumption is shaky at best.

Second, we are bothered by the overly restrictive specifications estimated previously, wherein the union variable enters primarily through interactions with concentration. Hence, union-concentration interaction estimates may reflect union profit reduction occurring via other routes. Omitted variables, too, may be affecting results in previous union-profit studies. In particular, failure to consider returns associated with R&D investments (see Connolly, Hirsch, and Hirschey 1986) or, in firm-level studies, market share, may affect inferences with respect to industry concentration. Finally, possible bias resulting from the simultaneous determination of unionism and profitability (Voos and Mishel 1986a) may affect inferences regarding the sources of union rents. We turn below to econometric evidence on how the union-profits relationship varies with industry concentration.

If we estimate sufficiently restrictive specifications, we also find at least weak evidence consistent with the proposition that concentration provides a route through which unions capture rents. For example, estimating the Freeman-type specification, which includes the variables U, CR, and U·CR, with R&D/S excluded, we obtain:

\[ q = .174U + .311CR - 1.011U\cdot CR \]

(5)

\[ R(S) = .018U + .018CR - .059U\cdot CR \]

(6)

where MS, DSH, AD/S, growth, K/S, and IND are included as control variables (all ratios in parentheses; full results available on request). But when we add R&D/S and the
interaction of unionism with R&D/s (Connolly, Hirsch, and Hirschev 1986), we obtain:

\[ q = 0.269U + 0.028CR - 0.492U\cdot CR \]
\[ \begin{array}{c}
0.80 \\
0.09 \\
0.67 \\
10.06_{R&D/S} - 2.78U_{R&D/S} \\
4.90 \\
2.09
\end{array} \]

\[ R(S) = 0.023U + 0.006CR - 0.36U\cdot CR \]
\[ \begin{array}{c}
0.91 \\
0.24 \\
0.66 \\
0.46U_{R&D/S} - 0.560U_{R&D/S} \\
3.00 \\
1.23
\end{array} \]

Although our qualitative results are identical to Freeman’s, the magnitude and significance of the coefficients are sensitive to the inclusion of the R&D variables. Our results do not support the contention that unions capture concentration-related profits.

Karier’s model also restricts union interactions to occur through concentration. Estimating the Karier specification with the R&D variables excluded, we obtain:\(^{15}\)

\[ q = 0.125CR^2 + 0.198CR^3 - 0.022U\cdot CR^1 \]
\[ \begin{array}{c}
1.26 \\
1.65 \\
1.11 \\
0.334U\cdot CR^2 - 0.533U\cdot CR^3 \\
2.16 \\
2.60
\end{array} \]

\[ \begin{array}{c}
R(S) = 0.010CR^2 + 0.002CR^3 + 0.010U\cdot CR^1 \\
1.42 \\
1.20 \\
0.74 \\
-0.024U\cdot CR^2 - 0.002U\cdot CR^3 \\
2.12 \\
1.16
\end{array} \]

suggesting, as Karier concludes, that unions capture profits in high- but not low-concentration industries. Adding the R&D/s and U*R&D/S variables, however, produces:

\[ q = 0.052CR^2 + 0.121CR^3 + 0.187U\cdot CR^1 \]
\[ \begin{array}{c}
0.55 \\
0.99 \\
0.98 \\
0.16U\cdot CR^2 - 0.185U\cdot CR^3 \\
0.09 \\
0.75
\end{array} \]

\[ + 9.60_{R&D/S} - 11.24U_{R&D/S} \\
4.68 \\
1.83
\]

\[ R(S) = 0.006CR^2 - 0.003CR^3 + 0.021U\cdot CR^1 \]
\[ \begin{array}{c}
0.88 \\
0.36 \\
1.50 \\
-0.005U\cdot CR^2 + 0.018U\cdot CR^3 \\
0.39 \\
1.01
\end{array} \]

\[ + 0.495_{R&D/S} - 0.718U_{R&D/S}. \\
3.25 \\
1.58
\]

Again, we find no evidence that concentration affects profits or that there exists a significant union-concentration relationship.

Finally, Salinger estimates a nonlinear profit function (equation 3) in which a union capture parameter interacts with concentration and profit-enhancing variables. Using nonlinear least squares, we estimate a nonlinear equation similar to Salinger’s in which \( Z \) (which interacts with the product of \( U \) and \( CR \)) includes \( MS, DSH, R&D/S, \) and \( A/D/S, \) and \( X \) includes a constant, \( CR, GR, K/S, \) and \( IND. \)

\[ q = (1 - \delta U_{CR}(ZC) + \chi\beta + \epsilon. \]

Nonlinear least squares results are presented in Table 3. Like Salinger, we obtain an estimate of a significant union capture parameter (\( \delta = 0.569; t = 2.02 \)). We also obtain a positive union capture parameter (\( \delta = 0.368; t = 1.28 \)). When we estimate our equation using \( R(S) \) as the dependent variable (Salinger obtains a negative estimate of \( \delta \) when using the rate of return on capital as a profit measure). In order to test whether the Salinger specification is measuring a true union-concentration interaction, however, we segment equation (3) to allow two union parameters—one that operates via concentration (\( \delta_1 \)) as in Salinger, and one that does not (\( \delta_2 \)):

\[ q = (1 - \delta_1 U_{CR}(ZC) + \chi\beta + \epsilon. \]

where \( Z \) and \( X \) are as above, and \( C \) and \( D \) are the coefficient vectors corresponding to \( U_{CR}Z \) and \( U_{Z}, \) respectively. When we estimate (14) with \( q \) as the dependent variable we find \( \delta_1 = 0.480 (t = 1.50) \) and \( \delta_2 = 0.791 (t = 3.26). \) With \( R(S) \) as our profit measure we obtain \( \delta_1 = 0.457 (t = 1.92) \) and \( \delta_2 = 0.611 (t = 1.82). \)

Based on parameter estimates from profit equations (13) and (14), one cannot conclude, as does Salinger, that unions capture monopoly rents associated with concentration. In both the \( q \) and \( R(S) \) equations, estimates of \( \delta_1 \) are smaller than \( \delta_2, \) suggesting that unions capture returns

\(^{15}\) CR1 = 1 if CR<.40; CR2 = 1 if .40 < CR ≤ .55; and CR3 = 1 if CR > .55.
from variables in $Z$ independent of concentration. Inspection of parameter estimates in $D$ suggests that R&D and advertising provide profits vulnerable to union capture. Parameter estimates of $c_4$ are consistent with the conclusion by Caves (1985) that weak import penetration combined with high concentration provides a source of profits. The negative and significant coefficient on $CR$ (equations 14) and 14') is consistent with that found by Grabowski and Mueller (1978) and Connolly and Hirschey (1984) in support of their "R&D rivalry" hypothesis (i.e., concentration increases interfirm rivalry in, among other things, R&D, and hence reduces profitability). The strength of this relationship may in fact be responsible for the $\delta$ result in (3) and the $\delta_1$ result in (14). In short, though we find the Salinger-type equations to be a useful way to model union tax effects, we do not believe such models provide evidence that unions capture monopoly profits associated with concentration.

The empirical results provided above lead us to conclude that extant estimates of the interactive union-concentration effect on profits are particularly sensitive to specification and that the best-known studies have either omitted important variables or forced the union-profit effect to take place via concentration. In work reported in an earlier version of this paper (available on request) and in a brief appendix, we calculate minimum and maximum bounds on $\partial \pi / \partial CR$ and $\partial^2 \pi / \partial U \partial CR$ (where $\pi$ is the relevant profit rate measure) using the extreme bounds analysis developed by Leamer (1978). That analysis provides a formal method by which the impact of specification uncertainty on the bounds of coefficients or partial derivatives can be examined. Based on that analysis, the bounds on the $CR$ partial derivative are negative and those on the $U$-$CR$ coefficient cross zero.

Hence, little about the union-profit-concentration relationship can be established unless strong prior restrictions are imposed in estimation. When that fact is combined with the absence of corroborating evidence from variables in $Z$ independent of concentration, it is clear that the union-profit effect is likely to be a significant force in determining profits.
tive labor market evidence, our best judgment is that concentration does not provide a source of monopoly profits and therefore such profits are not a major source of union wage gains. At the very least, it is clear that such a relationship has not yet been shown to exist.

Alternative Sources of Union Wage Gains

We have shown above that concentration is not likely to be the major source of union gains. Since both market power and firm-specific capital investments potentially provide rents for union capture, it is important to examine alternative profit determinants that may serve as sources of union gains. Unions are most likely to bargain successfully for wage gains when the sources of the returns are relatively long-lived, immune to entry, and costly to license or shift to a nonunion environment (Baldwin 1983; Connolly, Hirsch, and Hirshey 1986). Mueller (1986), as well as others, has demonstrated that profits are correlated over time and that companies with persistently high profits tend to have large market shares and sell differentiated products. The finding that there are few union gains associated with concentration must then indicate either that concentration is a poor proxy for profit-enhancing forms of market power or that any profits associated with concentration are relatively short-lived.\(^{16}\) We suspect the former explanation is the more important one, although Domowitz, Hubbard, and Petersen (1986a) have found that the effect of concentration on industry price-cost margins has decreased over time and is sensitive to fluctuations in demand.

Our preferred approach for examining alternative sources of union gains is to estimate a general model such as (4), in which the union capture parameter is free to vary across all profit sources. Unfortunately, we find coefficient estimates from a model with so many interactions seriously degraded by collinearity (see Belsley, Kuh, and Welsch [1980] for a description of the collinearity diagnostics). Based on our own expectations, preliminary statistical analysis, and use of Leamer’s extreme bounds analysis (see Appendix B), however, we find that market share, import competition, and R&D intensity appear most likely to be important sources of union gains. We therefore focus attention briefly on these factors.

Among the major papers cited in the literature, only Clark (1984) has examined how the union-profit relationship varies with market share (see, also, Connolly, Hirsch, and Hirshey 1986). Although Clark found that businesses with large market shares realize significantly larger profits than other businesses, he also obtained the surprising finding that unions decrease profits only among those businesses with small market shares. We believe, as do others (Freeman 1983:22), that this result is specific to the PIMS data set. As seen in Table 4, we consistently find that market share increases profits, but by lower amounts among firms in more highly unionized industries (i.e., we find a positive coefficient on MS and a negative one on U·MS). Such evidence is particularly strong in the R(S) equations; evidence is much weaker in the q equations. This pattern suggests that although a large market share increases current accounting profits and provides a target for union labor, long-run competitive forces limit the impact of MS on market value.

Evidence that low import penetration (a high dsh) increases profits (a positive coefficient on dsh) and provides a source for union wage gains (a negative coefficient on U·dsh) is much weaker. As seen in Table 4, although we find weak evidence supporting this relationship in the R(S) equations when R&D/S and the industry dummies are excluded, we find no significant relationship when they are included. The sensitivity of the dsh coefficients to the inclusion of IND is consistent with the position that import penetration is a significant determinant of interindus-

\(^{16}\) Mueller (1986, Chap. 4) argues that higher industry concentration increases interfirm rivalry (or equivalently, lessens cooperation), thus leading to lower profits.
<table>
<thead>
<tr>
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<td>(0.89)</td>
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<td>-0.99</td>
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<td>-0.99</td>
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<tr>
<td></td>
<td>(1.53)</td>
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<td>3.84</td>
<td>-2.03</td>
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<td>0.31</td>
<td>0.101</td>
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<td>no</td>
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<td>-1.46</td>
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<td>-1.29</td>
<td>-1.29</td>
<td>-1.29</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>(2.14)</td>
<td>-1.29</td>
<td>0.65</td>
<td>0.31</td>
<td>0.101</td>
<td>0.34</td>
<td>0.101</td>
<td>0.34</td>
<td>no</td>
</tr>
</tbody>
</table>

Note: All regressions include a constant. A/D, CR, KS, Variables are defined in Appendix A. * Significant at the 0.05 level.
try differences in profit rates. Following the Caves view that domestic share increases price-cost margins only in highly concentrated industries, we also include interactions between CR and DSH. We find the CR:DSH interaction variable to be a significant determinant of R(S); but we find no evidence that unions capture these profits.17

We find strong evidence in the q equations that the returns from R&D provide an important source of union gains. Evidence of such a relationship is much weaker in the R(S) equations. A negative \( U^{R&D}/S \) coefficient indicates that R&D capital adds less to the market value of firms in highly unionized industries than to the market value of those in low-union industries. Connolly, Hirsch, and Hirschey (1986) interpret this finding as supportive of their rent-seeking model, in which unions capture a portion of the returns associated with relatively immobile intangible capital investments.18

Finally, in work not shown we examined all of the above relationships within an instrumental variables framework in which unionization was treated as endogenous. As seen in Table 2, the use of such a technique produces results indicating a somewhat larger profit effect on q than that suggested by OLS. We believe our instruments (see fn. 14) are of sufficient quality to render our inferences, based on the regressions in Table 2, legitimate. To examine the interactions of U with CR, MS, DSH, or R&D/S, however, it is necessary to estimate reduced form equations in which \( U \) and all union interactions are a function of polynomials of the remaining exogenous variables and additional instruments (Kelejian 1971). When \( U \) and \( U^{CR} \) are treated as endogenous, we obtain a negative coefficient on CR and a positive coefficient on \( U^{CR} \). Not only are these results counter to those in Freeman, Karier, and Salinger, they are also counterintuitive.

The brief evidence presented in this section is not intended to be conclusive. It does suggest, however, that market factors such as market share and, possibly, import penetration, as well as intangible capital stocks of R&D, provide more important sources of profits for unions to capture than does industry concentration.

**Conclusions and Implications**

In this paper, we have challenged the conclusion reached in several recent studies that unions capture a sizable share of monopoly profits associated with industry concentration. We have mounted our challenge on several fronts. Consistent with much of the recent industrial organization literature, we find little basis for the hypothesis that industry concentration is an important source of monopoly profits. Estimates of the relationship of profits to concentration and union-concentration interaction variables are extremely fragile and do not support the strong inferences made in previous studies. Moreover, the absence of corroborative labor market evidence—evidence of larger union relative wage effects in highly concentrated industries—is inconsistent with the hypothesis that unions capture monopoly profits associated with concentration.

Although we are unable to find evidence of a union profit effect with respect to concentration, it does not follow that unions are unable to capture profits associated with market power. We find weak evidence that market share and low import penetration are associated with larger profits to firms and that unions are able to capture some portion of those profits. The implications of these results are ambiguous. If market share and weak foreign competition are simply proxies for monopoly power and potential excess profits, union rent-seeking may have few negative consequences for economic efficiency (beyond those arising already from monopoly power in the product market). If large market shares and low import penetration result primarily from greater

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17 In regressions not shown, the interaction variable \( U^{CR}:DSH \) had coefficients and t-ratios close to zero.

18 They also examine the union interaction with "unanticipated" patents and advertising intensity. Neither of these profit sources is found to provide union gains.
efficiency, however, union effects on profits are more likely to have a deleterious long-run impact.

We find much stronger evidence that unions capture some portion of the returns from R&D investments. To the extent that unionized firms respond by investing less in R&D, union rent-seeking is likely to have a negative impact on their long-run performance.

One of the more important conclusions that might be drawn from our paper is that there is a pressing need for investment in better data to estimate the apparently complex relationships among unionism, profitability, capital investments, and various dimensions of market structure. On the one hand, observations at the individual line-of-business level (such as the data provided by the FTC's LB program) may provide the most meaningful measurement of market structure variables such as market share and concentration. But analysis at the line-of-business level may fail to consider important firm-level determinants of economic performance (such as intermarket complementarities in reputation and distribution). Moreover, neither line-of-business nor industry data allow construction of market value measures of profitability, since only firm shares are regularly valued in capital markets. Because market value measures provide risk-adjusted long-run measures of profitability, which may bear little relationship to accounting profits during any single year, our preference is to examine these issues at the firm level using information on market value. Firm-level data on unionization are not publicly available, however; hence, analyses such as this one have relied on industry union density data. We suspect that significant future progress in the study of the union-profitability relationship awaits the construction of a data set containing joint firm and line-of-business information on unionization, profitability, market structure, and tangible and intangible capital investments.

In summary, we do not doubt that unions affect accounting profits and the market value of firms. Rather, we question the magnitude of that effect and the conclusion that the primary route through which unions capture rents is industry concentration. The union-profitability relationship is significantly more complex than suggested by previous research. Unions appear to capture profits associated with a number of factors, including but not limited to market share, R&D, and possibly the extent of foreign competition. We believe a promising direction for future research is to focus not only on the specific routes through which unions affect firms' financial performance but also on the interactions among financial performance, subsequent investment behavior, productivity, and growth.
### Appendix A

#### Definitions and Sources of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (s.d.)</th>
<th>Definition and Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>q</td>
<td>.870 (.345)</td>
<td>Tobin’s q, defined as the ratio of the firm’s market value to the replacement cost of assets. Data obtained from Standard &amp; Poor’s Compustat tape, Fortune, and 10-K reports to the Securities and Exchange Commission.</td>
</tr>
<tr>
<td>R(S)</td>
<td>.065 (.030)</td>
<td>Rate of return on sales, defined as historical net income (accounting profits plus interest costs) divided by sales; data obtained from Compustat tapes and Fortune.</td>
</tr>
<tr>
<td>R(K)</td>
<td>.088 (.035)</td>
<td>Rate of return on capital, defined as historical net income divided by gross book value of plant; data obtained from Compustat tapes and Fortune.</td>
</tr>
<tr>
<td>U</td>
<td>.391 (.178)</td>
<td>Unionization, defined as the proportion of eligible workers who are union members in the firm’s primary three-digit Census industry. Data are for 1975–77 based on calculations from the May Current Population Survey tapes by Kokkelenberg and Sockell (1985).</td>
</tr>
<tr>
<td>CR</td>
<td>.445 (.138)</td>
<td>Concentration ratio: share of industry sales accounted for by four largest firms, weighted to reflect firm shares in multiple four-digit Census industries. Data obtained from Economic Information Services.</td>
</tr>
<tr>
<td>MS</td>
<td>.072 (.063)</td>
<td>Market share: share of industry sales accounted for by a particular firm, weighted to reflect firm shares in multiple four-digit Census industries. Data obtained from Economic Information Services.</td>
</tr>
<tr>
<td>DSH</td>
<td>.881 (.150)</td>
<td>Domestic Share, defined as 1 minus the share of imports in the firm’s primary four-digit Census industry. The import share was calculated by: [(imports + duties)/(shipments – exports + imports + duties)]. Data obtained from U.S. Commodity Exports and Imports as Related to Output: 1977 and 1976. (Some firms, however, were assigned the sample average due to a lack of complete data.)</td>
</tr>
<tr>
<td>R&amp;D/S</td>
<td>.015 (.018)</td>
<td>R&amp;D intensity, defined as company-financed R&amp;D expenditures divided by sales; R&amp;D data obtained from Business Week.</td>
</tr>
<tr>
<td>AD/S</td>
<td>.007 (.014)</td>
<td>Advertising intensity, defined as expenditures divided by sales; advertising data from National Leading Advertisers.</td>
</tr>
<tr>
<td>GR</td>
<td>.138 (.060)</td>
<td>Growth, defined as the average annual growth rate in sales between 1972 and 1977; Fortune.</td>
</tr>
<tr>
<td>K/S</td>
<td>.734 (.222)</td>
<td>Capital intensity, measured by gross book value of plant divided by sales; Compustat tape, Fortune.</td>
</tr>
<tr>
<td>IND</td>
<td></td>
<td>Industry control dummies for 14 two-digit or combined two-digit industry groupings.</td>
</tr>
</tbody>
</table>

**Note:** All data are for 1977 unless otherwise indicated.

### Appendix B

#### Extreme Bounds on Selected Coefficients and Partial Derivatives

In work available on request, we have used Leamer’s (1978) extreme bounds analysis to place bounds on estimated coefficients and partial derivatives in the face of specification uncertainty. Regressors are divided into two general classes: “important” variables, which we believe should be included in the model, and “doubtful” variables, which may be included or excluded. A prior mean of zero is implicitly attached to the doubtful variables, whereas a diffuse prior is attached to the important variables. Leamer's SEARCH program combines this prior information with information from the data to calculate minimum and maximum values of the coefficients. This procedure is roughly the same as presenting the bounds on coefficients over the range of all possible regressions. Such an analysis provides a formal compact way to present regression results where there is specification uncertainty.

In the results presented below, the variables U, CR, U-CR, MS, U-MS, DSH, U-DSH, R&D/S, U-R&D/S, AD/S, GR, and IND are treated as important variables in both the q and R(S) equations; K/S is important in the R(S) and doubtful in the q equations; the stock market beta is important in the q and doubtful in the R(S) equations; and size, diversification, technological maturity variables, CR-R&D/S, and MS-R&D/S are treated as doubtful in both sets of regressions. Below are the expected signs, the least squares estimates in
<table>
<thead>
<tr>
<th>Selected Partial Derivatives</th>
<th>Expected Sign</th>
<th>( q )</th>
<th>( R(S) )</th>
</tr>
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<tbody>
<tr>
<td>( \partial \Pi/\partial U )</td>
<td>(-)</td>
<td>-.151</td>
<td>-.173</td>
</tr>
<tr>
<td>( \partial \Pi/\partial U \partial CR )</td>
<td>(-)</td>
<td>-.550</td>
<td>-.700</td>
</tr>
<tr>
<td>( \partial \Pi/\partial U \partial MS )</td>
<td>(-)</td>
<td>-.598</td>
<td>-.199</td>
</tr>
<tr>
<td>( \partial \Pi/\partial U \partial DSH )</td>
<td>(-)</td>
<td>.184</td>
<td>.071</td>
</tr>
<tr>
<td>( \partial \Pi/\partial U \partial R&amp;S )</td>
<td>(-)</td>
<td>-1.15</td>
<td>-.137</td>
</tr>
<tr>
<td>( \partial \Pi/\partial CR )</td>
<td>(+)</td>
<td>-.198</td>
<td>-.265</td>
</tr>
<tr>
<td>( \partial \Pi/\partial MS )</td>
<td>(+)</td>
<td>.340</td>
<td>.156</td>
</tr>
<tr>
<td>( \partial \Pi/\partial DSH )</td>
<td>(+)</td>
<td>.162</td>
<td>.103</td>
</tr>
<tr>
<td>( \partial \Pi/\partial R&amp;S )</td>
<td>(+)</td>
<td>5.89</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Note: Extreme bounds are calculated using a 100% confidence interval constraint. LS refers to the least squares estimates or 0% confidence interval constraint. MIN and MAX are the lower and upper bounds, respectively. Profits, \( \Pi \), are measured alternatively by \( q \) and \( R(S) \). See Appendix A for variable definitions.

the case where all important and doubtful variables are included, and the lower (MIN) and upper (MAX) bounds on the relationships. Lines 1 and 5–8 are partial derivatives, calculated at the mean values for all relevant variables. Lines 2–5 are mixed partial derivatives and represent the bounds on the coefficients of the respective union interaction terms.

Based on the extreme bounds estimates presented here, we conclude that the union effect on profits (line 1), measured alternatively by \( q \) and \( R(S) \), is consistently negative. The effects of \( R&S \), \( MS \), and \( DSH \) on profitability (lines 7–9) are consistently positive, whereas the effect of \( CR \) is negative. The bounds on the union interaction terms allow the inference that \( MS \) and \( DSH \) provide sources for union gains in the case of \( R(S) \) (lines 3–4), but not in the case of \( q \); the \( U/R&S \) interaction (line 5) is consistently negative; and the bounds of the \( U/CR \) interaction (line 2) cross zero in both sets of regressions. Based on the bounds estimates of \( \partial \Pi/\partial U \) and \( \partial R(S)/\partial U \) (line 1), the estimated effect of 100 percent union coverage is to reduce \( q \) by between 13 and 20 percent and \( R(S) \) by between 11 and 17 percent. The results from the extreme bounds analysis support the inferences made in the paper based on conventional econometric techniques.

REFERENCES

Abowd, John M.

Baldwin, Carliss Y.

Belsley, David A., Edwin Kuh, and Roy E. Welsch

Bloch, Farrell E., and Mark S. Kuskin

Bothwell, James L., Thomas F. Cooley, and Thomas E. Hall

Caves, Richard E.

Clark, Kim B.

Clarke, Roger, Stephen W. Davies, and Michael Waterson

Connolly, Robert A., Barry T. Hirsch, and Mark Hirshey

Connolly, Robert A., and Mark Hirshey

Demsetz, Harold

Domowitz, Ian, R. Glenn Hubbard, and Bruce C. Petersen
1986a “Business Cycles and the Relationship Be-


Duncan, Greg J., and Frank P. Stafford

Freeman, Richard B.

Freeman, Richard B., and James L. Medoff


Grabowski, Henry G., and Dennis C. Mueller

Hausman, Jerry A.

Hirsch, Barry T., and John T. Addison

Hirsch, Barry T., and Albert N. Link

Karier, Thomas

Kelejian, Harry H.

Kokkelenberg, Edward C., and Donna Sockell

Lawrence, Colin, and Robert Z. Lawrence

Leamer, Edward E.

Leigh, J. Paul

Lewis, H. Gregg

Liebowitz, S. J.

Long, James E., and Albert N. Link

MacRury, Thomas E., and John H. Pencavel

Martin, Stephen, and Cynthia Rence

Mellow, Wesley

Moore, Thomas Gale

Mueller, Dennis C.

Olson, C. Vincent, and John M. Trapani, III

Perloff, Jeffrey M., and Michael L. Wachter

Ravenscraft, David J.

Ruback, Richard S., and Martin B. Zimmerman

Salinger, Michael A.

Securities and Exchange Commission

Schmalensee, Richard

Spiller, Pablo T.

Voos, Paula B., and Lawrence R. Mishel


Watts, Ross L., and Jerold L. Zimmerman

Weiss, Leonard W.