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Union–nonunion compensation differentials and industry structure

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This paper examines the impacts of industry output and labor (input) market structures on workers' *total compensation* in U.S. manufacturing. For empirical analysis, CPS May 1983 data were matched with 1982 Census of Manufacturing. Results indicate that employees in highly concentrated product markets [proxied by four-firm concentration ratio (CRR)] earn more, independent of their union membership. Second, union members in the smaller plant sizes have the most to gain and the 'union advantage' disappears for medium to large plants. Third, and perhaps most important, the joint effects of unionism and CRR on earnings depend on the size of the manufacturing plant. In conclusion, the paper finds support for Dowrick's (1989) conjecture, that profits-enhancing product market conditions generally tend to increase earnings.

1. Introduction

Past studies relied on three specific variants of the monopoly wage hypothesis to rationalize the inverse empirical relationship they detected between union–nonunion wage [Mellow (19821, Podgursky (1986)], benefits [Freeman (1981), Bramley et al. (1989)], or total compensation [Okunade et al. (199011 differentials across establishment sizes. These theories include the union wage dispersion effects [Freeman and Medoff (198211, union threat effects [Podgursky (198611, and efficiency wage effects [Lindbeck and Snower (1987)]. The seminal objective of this study is to investigate the compatibility of union–nonunion total compensation effects across plant sizes, with the Galbraithian countervailing power thesis.

Research on the union wage (or total compensation) issue is of current interest in its own right. However, past analyses, which relied on an input index of employer size, [1] may be limited by not

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[1] Input measures of establishment size include: kilowatt hour usage, asset size or capital stock, spatial square footage, and number of operatives or total employees [Florence (1954)]. Suggested indices on the output side [Florence (1954), Bain (1956)] include: physical output volume [Scherer (1973)] or value added. Some attempts at a weighted combination of both input and output dimensions of size have been used to test for consistency of the measures [Jewkes (1952)]. While time series of alternative measures of size are highly correlated [Smythe et al. (1977), McCarty et al. (1978)], these measures are '... not interchangeable unless stricter conditions than correlation are met' [Shalit and Sankar (1977, p. 290)].

also considering the relation between union impact and output market structure. Moreover, with the exception of Mellow (1982), no empirical study has utilized the CPS data tapes, to examine the potentially important effects which the output dimension of employer size (market structure) may have on the estimated union–nonunion total compensation differentials across plant sizes in U.S. manufacturing. [2] Therefore, this study seeks to quantify the impact of employers' product market power on the estimated union compensation and wage dispersions. Thus, for the first time, we propose to advance Galbraith's hypothesis of countervailing power in explaining union wage and compensation differentials across firm sizes.

The potential fruitfulness of this research endeavor is echoed by most models of bargaining [Clark (1984), Mishel (1986), Svejnar (1986)], which suggest that product market performance (e.g., profitability) should influence labor market (compensation or wage) outcomes, and that labor market characteristics (such as unionism or bargaining strength) should affect product market outcomes. One logical extension of this argument is that non-competitive product market (structural) conditions would appear more conducive to the generation of economic rents (performance) over which firms and unions can bargain [Dowrick (1989)].

2. Employer size, union countervailing power, and the output market structure

Consideration of the output market structure of the industries with which the unions bargain appears important in obtaining improved estimates of the unions' compensation effects across firm (plant) sizes. Particularly, a simultaneous consideration of both labor input and product market structures allows a more complete assessment of the union wage (compensation) differential within a bilateral monopoly scheme. There is evidence that strong unions bargaining with large employers appear to make larger compensation (or wage) gains, by capturing some of the monopoly rents accruing to large firms (plants) selling outputs in highly concentrated product markets.

In effect, a bilateral monopoly model, which incorporates both (labor) input and product (output) market structures in the estimation of union total compensation effects across employer sizes, is useful for: (i) understanding the microeconomics of oligopoly–union inter-relationship from the twin perspectives of industrial organization and labor economics; (ii) assessing the robustness of previously estimated union (total compensation and wages-only) effects when industry output market structure is incorporated; (iii) testing the prediction of Dowrick's (1989, p. 1138) theoretical proposition, that profits-enhancing product market structural conditions (such as seller concentration [3]) will generally tend to increase wages; and (iv) the proper evaluation of both the equity and equity consequences of the bilateral monopoly arrangement, and how this may impact on the estimated dead weight loss of an imperfect market arrangement.

[2] Focus on manufacturing industries is legitimized for several reasons. First, while employment in U.S. manufacturing declined more than nine percent between 1979 and 1987, manufacturing real output increased nearly seventeen percent and its share in real GNP has remained stable in nearly fourty years [Mandelbaum (1987)]. Second, unionism is more prevalent in manufacturing, where the most successful unions have bargained with concentrated industries [Rees (1988, p. 77)]. Third, the manufacturing sector was the most frequently analyzed in past wage studies [Mellow (1982, p. 499)].

[3] Seller concentration ratio is one of several numerical indices of output market structure [Shughart (1990, pp. 65–79)]. No summary measure of industrial concentration is flawless. The four-firm seller concentration ratio (CRR), however, is the most popular measure used for public policy purposes (such as for evaluating a proposed merger between two firms). CRR is the share of total sales (output) accounted for by the four largest firms in the relevant market and is usually computed on the basis of: share of value added, value of shipments, total employment, payroll, and new capital expenditures. The positive correlation typically found between high concentration ratio and profitability, could arise from both monopoly power and cost-reducing factors of large firms [Peltzman (1977)].

Thus, union countervailing power (on the labor input market side) may have strengthened in response to the original power of business monopolies (on the output market side). More precisely, 'as a common rule, we can rely on countervailing power to appear as a curb on economic power' [Galbraith (1956)]. Evidence from U.S. manufacturing shows industries in which the top four firms accounted for all sales had 15% greater incidence of unionism (and higher wages) compared to industries where the top largest four firms sold 50% of the output [Ashenfelter and Johnson (1972)].

Past studies detecting significant and positive correlations between seller concentration (output market structure), unionism, and higher wage [Mellow (1982), Kwoka (1983), Salinger (1984), Karier (1985), Rees (1989)] did not focus on total compensation, were unable to explore how the differential varies across firm or plant sizes, or could not isolate the independent effect of union membership from that of union density because aggregated data were used. [4] The total compensation framework is important because it is a more complete measure of labor remuneration. Thus, recent shifts in the benefits–wage mix of workers' total compensation appear to distort wages-only differentials [Okunade et al. (1990)]. However, the hypothesis that profits deriving from market power in highly concentrated industries is a primary source for union gains, was not supported by Hirsch and Connolly (1987), Domowitz et al. (1986) and Hirsch (1989). These studies are based on wage-only models.

For the first time, so we propose to advance the Galbraithian hypothesis of countervailing power discipline provided by strong unions in large establishments relative to smaller plants, when explaining the union wage and compensation differentials. In large firms, union countervailing power compels a large (monopsonistic) employer to bargain with the monopolistic supplier of resources (labor union). This bilateral monopoly model predicts that strong labor unions in highly profitable firms are capable of sharing in the economic returns to firm-specific intangible assets. Supports for this hypothesis are the recent findings of Connolly et al. (1986), indicating organized labor both reduces the returns to R&D and exerts a limiting influence on further R&D investments of large firms. Thus, higher wages (compensation) for union (relative to nonunion) workers in the large firms are likely to increase the large employers' wage bill and dampen the channeling of their output-market monopoly rents to R&D efforts.

The view that monopoly rents tend to be shared with unionized workers [Schmalensee (1988)] is further supported by the findings of Voos and Mishel (1986), which controlled for worker attributes and still found wage rates to be higher in industries with high concentration and monopoly rents. These findings appear consistent with the countervailing power argument that workers in large unionized firms would tend to receive relatively larger wages. More specifically, U.S. organized labor, on average, captures in excess of two-thirds of the larger employers' monopoly returns to market power in the product market [Schmalensee (1988)]. However, unions' compensation effects are likely to vary across plant sizes, for union-specific strategies tend to influence the allocation of the shared monopoly rent between wage and benefits.

3. The empirical model and results

Data for analysis are random samples of white-male-fulltime workers employed by the private U.S. manufacturing sector, and are from the May 1983 CPS. The CPS contains worker-specific hourly wage rate, characteristics of industry and establishment of employment, and a host of human capital/personal attributes of workers. However, separate imputations of dollar values had to be

[4] One notable exception is Mellow (1982).

made for non-wage benefits (pension, health, holidays, and vacations) for those workers reporting participation (on a 'yes'/'no' basis) in the CPS. [5] Thus, each worker's total hourly compensation is approximated by augmenting the hourly pecuniary wages with imputed dollar values for these four major employer-paid non-wage benefits.

The following is the basic empirical model based on the total compensation rather than the traditional wage specification:

$$\text{Ln THC} = \boldsymbol{X}\beta_x + \boldsymbol{UNION}_i\beta_u + \beta_{crr}CRR + \epsilon, \tag{1}$$

where Ln THC is the natural log of total hourly compensation, which comprises hourly pecuniary wage (plus imputed values for pension, health benefits, holidays and vacations); X is a vector controlling for education, experience (experience square), tenure (tenure square) and dummies for *four* different plant sizes; UNION, is a vector of *five* union-plant size dummies (with UNION, = 1 for union employee in the smallest plant size and 0 otherwise, etc.); *CRR* is the worker's three-digit industry group four-firm concentration ratio [6]; and ϵ is the random error term. The empirical model (1) also includes vectors of occupational, and regional dummies. The variables used in the estimation are defined in table 1. Regressions results [7] for *four* different variations (i.e., I through IV) of the above model are reported in table 2. Briefly, the only difference between models I and II is that *CRR* is omitted in the former, while model III allows for interaction between plant specific union dummies (UNION,, $_{1,\ldots,5}$) and *CRR*. On the other hand, model IV is relatively more exhaustive as it allows for not only the interactions between plant specific union dummies and CRR as specified in model III, but also interactions between CRR and plant size dummies ($NUMEMPL_{i=2,\ldots,5}$).

The education, experience, tenure, and plant size variables are expected to have positive effects on workers' total compensation. Squared terms for experience and tenure, capturing their potential nonlinearities, are expected to be negatively signed, due to decreasing returns. Theoretically, we expect the magnitude of union plant specific dummies (UNION,$_{=1,\ldots,5}$) to decline due to union threat effects. Based on limited insights from wages-only research, we expect a positive effect of concentration (*CRR*) on total compensation, holding constant plant size. The complexity of the concentration–compensation relationship is investigated further, by interacting the concentration effect with that of union plant size dummies. Mellow (1982) provides a limited perspective on this interaction in a wages-only specification, by detecting higher negative effects as four-firm seller concentration ratio increases for union workers, holding constant plant size. In this study, however, the pattern of this effect is captured with variation in plant sizes based on the (more appropriate) total compensation framework.

The effects of worker's personal attributes, and occupational and regional controls on earnings are consistent with past results. The coefficients of union membership from smallest to largest plant sizes (UNION,, ..., UNION,) show union–nonunion earnings differential to decline with establishment size across all specifications. For example, model I (which does not control for *CRR*) indicates that the union–nonunion compensation gap is inversely related to the plant size. This finding that

[5] Okunade et al. (1990) detail the imputation procedures. Ross (1989) provides econometric proofs supporting the asymptotic consistency of the OLS estimates when each worker's non-wage benefits expenditures are imputed from establishment data.

[6] U.S. Bureau of Census (1986, table 5: 7-6 to 7-50) contains four-digit SIC industry CRR ratios for 1982 while the CPS 1983 coded workers' responses using the three-digit SIC classification. Conversion of Bureau of Census's four-digit CRR to CPS's three-digit CRR was accomplished by weighting the four-digit SIC CRR by the value of industry shipments. These estimates can be obtained from the authors upon request.

[7] Regression results based on wage specification are somewhat similar and can be obtained upon request.

Table 1
Variable descriptions.

Dependent variable: ln *THC* = natural log of total hourly compensation (i.e., the hourly wage plus estimated pension, health benefits, holidays and vacations)

Plant size dummies (omitted Size = if employees are less than 25)
$NUMEMPL_2$ = if 25 to 99 employees (= 1,0 otherwise)
$NUMEMPL_3$ = if 100 to 499 employees (= 1,0 otherwise)
$NUMEMPL_4$ = if 500 to 1000 employees (= 1,0 otherwise)
$NUMEMPL_5$ = > 1000 employees (= 1,0 otherwise)

Union-plan/size dummies
$UNION_1$ = if union member in the first plant size (= 1, 0 otherwise)
$UNION_2$ = if union member in the second plant size (= 1, 0 otherwise)
$UNION_3$ = if union member in the third plant size (= 1, 0 otherwise)
$UNION_4$ = if union member in the fourth plant size (= 1, 0 otherwise)
$UNION_5$ = if union member in the fifth plant size (= 1,0 otherwise)

CRR = four-firm concentration ratio recomputed for the three-digit SIC codes from 1982 Census of Manufacturing

Four-firm concentration ratio–plant size interactions
$CRREMP_1 = CRR * NUMEMPL_1$, $CRREMP_2 = CRR * NUMEMPL_2$, $CRREMP_3 = CRR * NUMEMPL_3$,
$CRREMP_4 = CRR * NUMEMPL_4$

Four-firm concentration ratio–union-plant size interactions
$CRUNION_1 = CRR * UNION_1$, $CRUNION_2 = CRR * UNION_2$, $CRUNION_3 = CRR * UNION_3$,
$CRUNION_4 = CRR * UNION_4$, $CRUNION_5 = CRR * UNION_5$

Standard human capital variables
EDUCAT = years of education
EXP = age-years of education – 6
EXPSQ = (*EXP* * *EXP*)/100
TENURE = number of years on the current job
TENURESQ = (*TENURE* * *TENURE*)/100

Occupational dummies (omitted occupation = *OCC6* i.e., Handlers–equipment cleaners)
OCC1 = Executive, administrative, and managerial
OCC2 = Professional speciality
OCC3 = Technicians and related support
OCC4 = Sales
OCC5 = Administrative support and clerical
OCC7 = Protective service
OCCR = Other service
OCC9 = Farming, forestry, and fishing
OCC10 = Precision production, craft, and repair
OCC11 = Machine operators, assemblers, and inspectors
OCC12 = Transportation and material moving

Regional dummies (omitted region = Pacific)
DIV1 = New England (= 1,0 otherwise)
DIV2 = Middle Atlantic (= 1, 0 otherwise)
DIV3 = East North Central (= 1,0 otherwise)
DIV4 = West North Central (= 1, 0 otherwise)
DIV5 = South Atlantic (= 1,0 otherwise)
DIV6 = East South Central (= 1,0 otherwise)
DIV7 = West South Central (= 1,0 otherwise)
DIV8 = Mountain (= 1,0 otherwise)

Table 2
Regression results: Dependent variable = ln THC.

Variable	Model I		Model II		Model III		Model IV	
	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio
Intercept	0.627004	6.815	0.613125	6.635	0.594736	6.391	0.591435	5.871
EDUCAT	0.042838	14.367	0.042654	14.298	0.042905	14.408	0.043051	14.446
EXP	0.039253	9.284	0.039112	9.251	0.039630	9.378	0.039385	9.303
EXPSQ	−0.042275	−8.358	−0.042128	−8.330	−0.042691	−8.446	−0.042408	−8.375
TENURE	0.021359	9.205	0.021161	9.109	0.021120	9.107	0.021185	9.122
TENURESQ	−0.039762	−6.246	−0.039291	−6.167	−0.039064	−6.142	−0.039175	−6.149
NUMEMPL,	0.060674	2.350	0.060235	2.333	0.060362	2.343	0.024750	0.414
NUMEMPL,	0.118234	4.736	0.116991	4.685	0.116938	4.690	0.154613	2.572
NUMEMPL,	0.267552	8.384	0.262503	8.186	0.263091	8.185	0.246810	3.205
NUMEMPL,	0.340129	12.411	0.331815	11.888	0.331967	11.729	0.368502	5.582
UNION,	0.191642	3.919	0.192155	3.930	0.498384	4.711	0.504902	4.513
UNION,	0.102321	3.056	0.103065	3.079	0.178725	2.548	0.220864	2.861
UNION,	0.054431	2.195	0.053415	2.154	0.038537	0.799	0.007587	0.130
UNION,	−0.021227	−0.514	−0.020421	−0.495	−0.130099	−1.532	−0.107096	−1.063
$UNION_5$	−0.000632	−0.024	−0.002635	−0.098	−0.034991	−0.623	−0.064872	−0.955
CRR			0.062953	1.560	0.057140	1.068	0.079925	0.594
CRREMP,							0.112534	0.632
$CRREMP_3$							−0.116890	−0.662
CRREMP,							0.034528	0.174
$CRREMP_5$							−0.089046	−0.534
CRUNION,					−1.030966	−3.262	−1.053899	−3.109
$CRUNION_2$					−0.246645	−1.219	−0.381937	−1.679
CRUNION,					0.045698	0.379	0.139651	0.886
CRUNION,					0.289922	1.480	0.232750	0.977
CRUNION,					0.069880	0.667	0.136101	1.017
DIV1	−0.178658	−6.541	−0.177081	−6.480	−0.173143	−6.339	−0.173610	−6.347
DIV2	−0.100652	−3.823	−0.099298	−3.770	−0.095083	−3.611	−0.094095	−3.571
DIV3	−0.079423	−3.301	−0.080006	−3.326	−0.078675	−3.265	−0.078866	−3.271
DIV4	−0.139430	−4.836	−0.136289	−4.717	−0.133433	−4.621	−0.134575	−4.656
DIV5	−0.145810	−5.529	−0.144166	−5.464	−0.141789	−5.375	−0.142374	−5.383
DIV6	−0.171869	−4.955	−0.170894	−4.927	−0.167248	−4.818	−0.167530	−4.824
DIV7	−0.110414	−3.263	−0.108070	−3.191	−0.101864	−3.008	−0.101940	−3.006
DIV8	−0.115423	−3.304	−0.114347	−3.274	−0.109705	−3.142	−0.109123	−3.124
OCC1	0.403014	10.139	0.403005	10.141	0.406143	10.236	0.405988	10.224
OCC2	0.396094	9.669	0.395091	9.646	0.399061	9.753	0.398436	9.733
OCC3	0.263424	5.828	0.262386	5.806	0.264611	5.866	0.264690	5.861
OCC4	0.302050	5.957	0.301736	5.952	0.313088	6.177	0.310876	6.117
OCC5	0.067564	1.540	0.068574	1.564	0.070472	1.609	0.069985	1.595
OCC7	−0.105040	−0.999	−0.101326	−0.964	−0.102272	−0.974	−0.101372	−0.965
OCC8	−0.019556	−0.314	−0.022230	−0.357	−0.017307	−0.279	−0.018463	−0.297
OCC9	0.199845	1.882	0.200942	1.893	0.202048	1.907	0.201993	1.905
OCC10	0.218088	6.391	0.217282	6.369	0.221148	6.487	0.220351	6.461
OCC11	0.086047	2.543	0.086344	2.552	0.088188	2.608	0.087294	2.579
OCC12	0.086710	2.139	0.087129	2.150	0.092974	2.295	0.094062	2.321
$N = 2418$ Adj. R^2:	0.5189		0.5192		0.5213		0.5211	
F-Ratio:	80.001		77.767		68.501		62.156	

union members in medium-to-large plants do not earn more than non-unionized workers is consistent with previous findings of Podgursky (1986), Okunade et al. (1990). Further discussions pertain to the independent (model II) and joint impacts (models III and IV) of four-firm

Table 2 (continued)

Variable	Model I	Model II	Model III	Model IV
Plant size effect [$= \delta$ ln $THC/\delta\ NUMEMPL_{i=2,\ldots,5}$] [a]				
For size 2	0.06 (2.35)	0.06 (2.33)	0.06 (2.34)	0.065 * (0.51)
For size 3	0.11 (4.73)	0.11 (4.68)	0.11 (4.69)	0.111 * (0.863)
For size 4	0.26 (8.38)	0.26 (8.18)	0.26 (8.18)	0.259 * (1.88)
For size 5	0.34 (12.41)	0.33 (11.88)	0.33 (11.73)	0.279 * (2.10)
Union effects within a given plant size [$= \delta$ ln $THC/\delta\ UNION_{i=1,\ldots,5}$]				
For size 1	0.191 (3.92)	0.192 (3.93)	0.128 * (1.10)	0.118 * (0.75)
For size 2	0.102 (3.05)	0.103 (3.08)	0.088 * (1.15)	0.081 * (0.90)
For size 3	0.054 (2.20)	0.053 (2.15)	0.055 * (0.95)	0.058 * (0.77)
For size 4	−0.021 (−0.51)	−0.020 (−0.49)	−0.023 * (−0.26)	−0.021 * (−0.20)
For size 5	−0.0006 (−0.024)	−0.002 (−0.10)	−0.009 * (−0.14)	−0.015 * (−0.21)

[a] t-ratios in parentheses; * – evaluated at sample means.

concentration ratio (*CRR*, i.e., employer market power) and union power on workers' earnings. The plant size effects [8], and union effects within a given plant size are summarized at the bottom of table 2 for all the four estimated empirical models.

Models II, III and IV show that workers' earnings are somewhat higher when employed by a firm selling in concentrated markets. The estimated independent effect of CRR is to increase workers' earnings in the range of 5.7 to 7.9%. Our estimates [9] are lower than Mellow's estimate of 9.5% (1982, p. 499). The joint effect of CRR with union membership effect must be assessed along with the independent influences of CRR and union membership, in order to more fully infer or deny the existence of monopoly wages in the U.S. manufacturing sector. In a highly concentrated industry (with high wages) unionism may not result in higher wages. This is because a nonunion employer with market power pays higher wages to ward off the threat of unionism. Under this condition, the interaction effect of CRR with unionism would be smaller than the sum of their independent effects [Weiss (1966, p. 98)]. Thus, granted that *CRR* and unionism increase earnings, monopoly earnings in a concentrated and/or unionized industry would exist, under the following conditions:

(a) the coefficient of CRR > 0 and large compared to that of the interaction effect $CRR * UNION_i$ (if negative);
(b) coefficient of CRR and interaction effect CRR $* UNION_i$ are both positive.

The interaction of CRR with $UNION_{i=1,\ldots,5}$ (i.e., the union membership in plant sizes 1 through 5): CRUNION,, CRUNION,, ..., CRUNION, relative to the $UNION_{i=1,\ldots,5}$, in specifications III and IV suggests the existence of monopoly earnings in all but the plant sizes 1 and 2 (i.e., plants with employees less than 100). Interestingly, it appears though, that workers in the same plant sizes 1 and 2 have the most to gain from union membership, independent of their employer's product market power.

[8] Note that large firms pay significantly higher compensation than smaller firms (i.e., the reported results indicate that estimated coefficients of NUMEMPL,, $_{1,\ldots,5}$ exhibit that NUMEMPL, > NUMEMPL, > NUMEMPL, > NUMEMPL,). This result is consistent with the finding of Brown and Medoff (1989).

[9] This could be due to the time period we studied, i.e., the era of Reagan's deregulation advocated in the early 1980s. Recall that large corporations were broken down into several independent firms resulting in weakening of the monopoly power (for example, the break up of AT&T).

4. Summary and conclusion

This paper examined the impacts of industry output and labor (input) market structures on workers' earnings in U.S. manufacturing. Results indicate that employees in highly concentrated product markets earn more, independent of their union membership. Second, union members in the smaller plant sizes have the most to gain and the 'union advantage' disappears for medium to large plants. Third, and perhaps most important, the joint effects of unionism and CRR (i.e., four-firm concentration ratio) on earnings depend on the size of the manufacturing plant. In conclusion, the paper finds support for Dowrick's (1989) conjecture, that profits-enhancing product market conditions generally tend to increase wages.

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