Volume Title: The Role of Health Insurance in the Health Services Sector

Volume Author/Editor: Richard N. Rosett

Volume Publisher: NBER

Volume ISBN: 0-87014-272-0

Volume URL: http://www.nber.org/books/rose76-1

Publication Date: 1976

Chapter Title: Group Health Insurance as a Local Public Good

Chapter Author: Gerald S. Goldstein, Mark V. Pauly

Chapter URL: http://www.nber.org/chapters/c3817

Chapter pages in book: (p. 73 - 114)

3

G. S. GOLDSTEIN
and
M. V. PAULY
Northwestern University

Group Health Insurance as a Local Public Good

1. INTRODUCTION

Group health insurance is an important topic for at least two reasons. First, its quantitative importance is large and growing. Second, the management, level, and form of group insurance are increasingly a matter of concern for public policy, as are other benefits often provided as fringe benefits. For example, the Nixon administration proposed to use health insurance as a fringe benefit as the main vehicle of its national health policy, and employee pensions have recently been the subject of congressional investigation and legislation.

In one of the few papers that deal with fringe benefits (Lester, 1967), the author concludes

> We lack a theory of the collective purchase of insurance-type benefits for employees, either unilaterally by management or through union-management negotiations. Without such a theory one is unable to give an adequate explanation of . . . changes . . . in the wage benefit mix in the American economy. . . .

In this paper, we shall attempt to outline such a theory and provide some empirical tests of parts of it. Data deficiencies prevent a complete test of all implications of the theory. The critical element in this theory is that group insurance has institutional characteristics similar to those of local public goods. There are two important similarities:

1. The level of insurance coverage must, over broad categories of employees, be equal for all, just as the level of the textbook local public good must be shared equally by all.
2. Persons not in the employee group receive no benefits, and benefits can be lost or acquired by "migration" among groups, just as for many local public goods.

These similarities make it possible to use some parts of the theory of local public goods to draw conclusions about group insurance. But they also mean that a theory of fringe benefits will fall prey to the many unsettled theoretical problems of local public goods.

There are differences as well, and they are equally instructive for the light they shed on the question of how analysis of the provision of local public goods might be affected under similar arrangements. For example, one model we shall develop assumes that the employer determines the level of group insurance, without group choice by employees, but with a view toward minimizing his labor costs. The analogous model for the theory of public goods might be a developer of a "new town" choosing the level of local public services so as to maximize his profits from sales or rentals.

2. WHY FRINGE BENEFITS?

The first question to be answered is the most basic one—why fringe benefits exist. Why doesn't the employer pay the equivalent cash wage? Why should either the employer or employees, organized as a union, choose to receive some income in kind as health insurance? There are two elements in any answer. First, group health insurance as a fringe benefit may be cheaper than individual purchases on the market. Second, the configuration of employee preferences may be such as to permit group purchasing of health insurance to be relatively efficient.

Only the first rationale appears to be emphasized in the literature on this subject. Rice, for example (1966), emphasized economies of group purchasing and tax advantages as the major rationales for variations in fringe benefits in general, though he found that group life and health insurance did not seem strongly related to the empirical variables he could find to serve as proxies for these notions. A similar explanation, with particular emphasis on the advantages of group purchases, was given by Phelps (1973). Although their purpose is descriptive rather than analytical, Feldstein and Allison (1974) also emphasize tax advantages, whereas Feldstein (1973) cites, in addition to group purchasing and tax reductions, the supposed desire of unions and employers to provide visible benefits.

The tax laws do impose some restrictions on group insurance. Only certain kinds of insurance benefits qualify for tax exemption. The level of those benefits must, ostensibly at least, be chosen by the employer or through collective bargaining, rather than be subject to the choice of each individual employee.

But it is obviously not true that all employee groups take maximum possible insurance benefits. Even at a net price lowered by tax considerations or the economies of group purchase, a net price that on average may, according to Feldstein and Allison, be below the actuarially fair price, group demand is not infinite, or even as large as the tax laws permit.

The reason for this may be that employees do not necessarily all have the same preferences. Both tax and technological considerations require that group health insurance be uniform over groups of employees, if not over all employees. If employees did have identical preferences, a single level of benefits would be optimal for all. This paper suggests that the dispersion of preferences may help to explain the level of coverage actually chosen by or for a group.

The rudiments of a theory of fringe benefits must include consideration of the problem of combining diverse preferences. In what follows a series of simple models will be developed to illustrate these points.

3. FORMAL MODELS

Model 1: A Tiebout-Type Model

The first model is intended to be analogous to Tiebout's (1956) classic model of providing local public goods. We assume that employees are perfectly mobile, that firms are all at least as large as that size at which the marginal advantage for group purchasing approaches zero,[1] and that workers are perfectly homogeneous with respect to the kind of labor they supply and to their expected medical expenses, but differ in their attitudes toward risk. We shall also assume that the incidence of the cost of fringe benefits falls wholly on the employees of the firm offering those benefits. Finally, we assume (1) that the number of firms is sufficiently "large" that a level of insurance corresponding to any level of employee preferences can be provided, (2) that the number of employees with any set of preferences is at least twice the number needed to exhaust group-purchase economies, and (3) that employees have perfect information.

Employee Equilibrium

We assume a competitive market for labor. Thus, given any method of determining the level of group insurance premiums, it must be true that, in every firm:

$$MRP_L = Y = Y_w + \pi(k) \tag{1}$$

where MRP_L is the marginal revenue product of labor, Y is labor cost per employee, Y_w is the money wage, and π is the premium for whatever level of insurance coverage k is chosen. In effect, Equation (1) defines a supply curve of group insurance to the employee. From the set of all existing insurance-wage combinations satisfying (1), the employee will locate at one that maximizes his utility function.

Here, as in the remainder of the paper, we will consider two possible methods of determining the level of group insurance benefits. Fringe benefits are sometimes determined collectively, by the set of present employees, usually through union bargaining. We call this method "union choice." Sometimes, however, fringe benefits are determined by the employer, with a view toward minimizing his labor cost. We first consider employer choice.

Employer-Choice Equilibrium

Given a distribution of employee preferences and assuming that optimally sized groups can always be created, employers may find it worthwhile to adjust the quantity of insurance they provide. Equilibrium therefore requires that no employer be able to create an excess supply of labor to his firm by altering his wage-fringe benefit package. A sufficient condition for this is that there exists no wage-fringe benefit package that could be offered by any firm that is preferred by any worker to the package he is now receiving.

Suppose, for example, that a subset of all employers is initially providing a subset of employees with a mix of wages and benefits that is not the employees' optimal mix. All other employees are receiving their optimal package from their employers. The employees for whom the level of coverage is not optimal will require a higher money wage to work in those firms than they would for firms offering their optimal quantity. Employers will be able to reduce labor costs by providing a package that is optimal to their employees.

Equilibrium therefore requires that every employee be in a firm that provides a utility-maximizing bundle of the public good. For if this were not so, some employer could reduce his labor cost by offering such a bundle. Thus, in equilibrium all groups will offer the package of insurance that maximizes that utility of all of their employees, and all employees in any group will have identical preferences with respect to insurance.

Union Choice

We assume that union groups are at least as large as the firm (though they can be larger). We first show that the employer equilibrium described above is also a union equilibrium. Union equilibrium is assumed to require that each group (firm) choose a level of coverage equal to the optimum of the median individual. One equilibrium would clearly involve the distribution of employees into groups with homogeneous preferences for insurance. For such homogeneous groups, the optimum of the worker with the median preference is also the optimum of all other group members, so that no worker will be motivated to move. And we have just shown that employer equilibrium occurs when employees are distributed into homogeneous groups. Hence, employer equilibrium is a union equilibrium.

There may be other union equilibria. Some differ from employer equilibrium in that they involve different alternative configurations into homogeneous groups, because a union group can exceed an employer-formed group in size. There also are equilibria in which groups are not homogeneous. But any equilibrium in which any group is not homogeneous is unstable. Suppose that there are two kinds of employees and the optimal number of groups is two, but the types of employees are evenly divided between the groups. The median preferences in both groups will be the same, and so will the levels of coverage. If one group should provide a slightly higher level of coverage than the other group, it will attract one type of employee and repel the other. Equilibrium will be reestablished when groups are homogeneous.

Group-Size Variable

We now relax the assumption that employee group size must be optimal. This seems reasonable. For some industries, premiums appear to fall with group size up to sizes well in excess of the work forces of some firms. One possible solution would be for employee groups to combine for insurance purposes. Practical difficulties may prevent employers from sanctioning this procedure, though we might expect unions to do so. But if there is no combination, it follows that wage costs per employee will initially have to be higher in small firms than in large ones, and that, moreover, the difference will have to be still greater at high levels of coverage than at low levels of coverage. As a consequence, we would not expect to find high levels of coverage as common among small firms as among large firms, under employer or union choice. Conversely, we should expect those employees with strong demands for insurance to be more likely to work for large firms. Prices of the outputs of industries characterized by small firms would rise relative to those of industries characterized by large firms until labor costs and marginal products are equalized.[2]

Adverse Selection

Assume now that not all workers have the same expected medical expenses. Expected expenses can differ either because the incidence of illness differs or because the quantity of care (medical loss) consumed for any given illness differs.[3] It is clear that in such a situation bad risks may find it worthwhile to join groups of good risks. Consequently, exclusionary devices may come into play. Such devices may take the form of medical examinations, or the characteristics of the job itself may be sufficient to exclude bad risks. If adverse selection still remains, one might expect some individuals to be driven out of the group-purchase market altogether, whereas others will pay a "weighted average" rate. The relationship between quantity of insurance and level of risk is likely to be positive.

It is also possible that equilibrium may not exist.[4] For example, suppose that because of an influx of bad risks the price of insurance rises so high that good risks no longer wish to buy insurance. They will gather in a firm or group providing no insurance. But such a group could provide insurance advantageously to its members. Yet if it begins to do so, it will attract bad risks again and all the good risks will again drop out. It may also be worthwhile for the employer to provide less than the amount of insurance that would minimize labor costs, since large quantities of insurance may attract bad risks. Likewise, if the median worker is a good risk, limiting insurance quantities may be worthwhile and may be stable.

Empirical Implications

The purpose of this paper is to estimate a demand-for-insurance equation of the form

$$k = k(x) + e$$

where k is the fraction of expenses covered by insurance, x is a set of independent variables, and e is a random error term. If the conditions above hold, under either method of choice the employees of a firm will be homogeneous with respect to their insurance preferences; their characteristics, part of the set x, will differ only because of the random error e. Hence, it will be appropriate to use mean values of x in the empirical specification.

Another implication of this model is that the method of choice will not affect the quantity of insurance chosen. We will test for this both by including the extent of unionization as an independent variable in a regression using all observations and dividing the observations into predominantly union and nonunion sets, and by testing to see if the estimated coefficients on other independent variables differ.

Model 2: Imperfect Mobility

A model in which the variety of options is sufficiently large to permit homogeneous groups of employees may not be descriptive of the world. Workers in a single group may have heterogeneous preferences for insurance for two reasons. First, efficient production may require the hiring of labor forces that are heterogeneous with respect to characteristics (e.g., education, sex), which might affect the demand for insurance. Although separate groups might be created for some kinds of employees (e.g., separate plans for executives and production workers), it may be too costly or too cumbersome to maintain separate plans for each worker type. Second, the number of groups available to a set of employees may not be large enough to permit the formation of homogeneous groups of sufficient size to capture economies of scale or inhibit adverse selection.[5] Whatever the reason, the result will be the formation of insurance groups in some of which it will be impossible for the quantity provided to be the optimum for all group members.

Heterogeneous Labor

In what follows we analyze both cases. We show that, if groups are heterogeneous for the first reason, employer equilibrium generally will exist but will differ from union equilibrium. In the second case, we show that employer equilibrium is unlikely to exist. We begin with the first case.

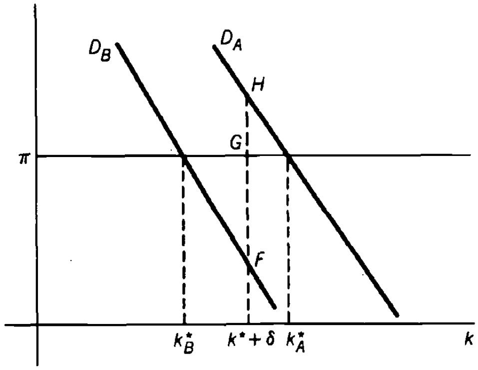
Suppose that there are two kinds of workers, A and B. Each kind of worker provides a qualitatively different type of labor input; each type has a quantitatively different identical-within-type demand for health insurance. Both types of workers are useful in producing output, and there is no perfect substitutability between types. Hence, most firms will end up hiring some of each type of labor. Because of supply and production considerations, we assume that most firms hire more type-A than type-B employees when labor costs per employee equal their relative marginal revenue products. We also assume that different levels of insurance cannot be provided to different types of employees.

Now suppose that the employer can provide health insurance. For each employer, labor supply of each type of employee will be a function of the money wage and the level of fringe benefits offered. Assume that the incidence of fringe benefit payments falls wholly on employees. Then, if their respective demand curves for insurance are like D_A and D_B in Figure 1, A-type workers will optimally want k^*_A units of insurance, and B-type workers, k^*_B units.[6] Each of the optimal quantities is the quantity that would minimize labor cost for that type of employee. At any other level of coverage, a firm could offer a quantity close to k^*, permit the employee to capture some of the utility gain, and recoup the remainder in the form of lower wages.

But the optimal level of coverage for a firm consisting of both types of employees requires a tradeoff between the optimums of both groups. Suppose that firm i's employment of each labor type, L_{A_i} and L_{B_i}, is given. Its wage bill is therefore:

$$W^i = C_A L_{A_i} + C_B L_{B_i}$$

FIGURE 1



where C_A is the labor cost per type-A employee and C_B, the labor cost per type-B employee.

Assume that the wage package available to type-J employees at other firms is (w^{Jo}, k^o). Hours of work are fixed. Workers have utility functions of the form:

$$U = U(w, k) \tag{2}$$

For every type-J employee for firm i, equilibrium requires that $U^J(w^{Ji}, k^i) \geqq U^J(w^{Jo}, k^o)$. If firm i wishes to minimize its labor costs, it will set the wage rate of type-J workers, for a given $k^i = \bar{k}^i$, so that:

$$U^J(w^{Ji}, \bar{k}^i) = U^J(w^{Jo}, k^o) \tag{3}$$

Suppose that the firm is considering offering an increment in k that has a premium cost π. The change in the money wage that permits (3) to continue to hold is given by that decrease in money wages that holds utility constant at the level indicated in (3), or:[7]

$$\frac{dw^{Ji}}{dk^i} = \frac{u_k^J}{u_{w^J}^J} \tag{4}$$

Hence, the change in total labor cost per employee is:

$$\frac{dC_J^i}{dk^i} = \frac{u_k^J}{u_{w^J}^J} - \pi \tag{5}$$

since the firm must pay the premium, π. Minimizing total labor cost for all classes of employees implies:

$$\frac{dW^i}{dk^i} = \frac{dC_A^i}{dk^i} L_{A_i} + \frac{dC_B^i}{dk^i} L_{B_i} = 0 \tag{6a}$$

or

$$(6b) \qquad -L_{A_i}\left[\frac{U_k^A}{U_{w^A}^A}-\pi\right]=L_{B_i}\left[\frac{U_k^B}{U_{w^B}^B}-\pi\right]$$

Thus cost-minimizing equilibrium requires equalizing weighted-average marginal labor cost per employee of each type. Changes in k^i beyond the optimum of type-*B* workers require an increase in their wages, but this increase may be more than offset by the decrease in the wages of type-*A* workers. In terms of Figure 1, increments in coverage beyond k_B^* require an increase in type-*B* employees' wages equal to the difference between D_B and π; e.g., measured by distance *GF* at quantity $k^* + \delta$. If, for example, $L_BGF < L_AGH$, then k should be increased further, whereas if $L_BGF = L_AGH$, $k^* + \delta$ is the cost-minimizing level of the fringe benefit.

Union equilibrium, on the other hand, simply requires that the quantity chosen equal the optimum of the individual with median preferences. Since the median worker is a type-*A* employee, union equilibrium requires equating type-*A* marginal rates of substitution with the premium to be charged per unit of insurance. The employer has an incentive to consider all workers' preferences in a way that the union does not. If type-*A* (union-dominant) workers generally prefer more insurance than type-*B* workers, unions will prefer different quantities of insurance than nonunionized firms. Moreover, the greater the number of type-*B* employees, as long as it is less than half of the total number of workers, the greater will be the difference between employer and union choice.

In particular, suppose that type-*A* employees demand larger quantities of insurance than do type-*B* employees. Unions will cater to the demands of type-*A* employees. Those firms that provide larger quantities of insurance will tend to be unionized. The exceptions would be (1) those firms containing only one type of employee and (2) those firms with more type-*B* than type-*A* employees. With more kinds of employees, it becomes more difficult to predict the direction of the union effect. In general, union choice will differ to the extent that the marginal rate of substitution of the median worker differs from a weighted average of the marginal rates of substitution of all marginal workers.

It is worth mentioning that employer equilibrium is also Pareto optimal, whereas union equilibrium is not. For if we rearrange terms in (6b), we get:

$$L_{A_i} \frac{u_k^A}{u_{w_A}^A} + L_{B_i} \frac{u_k^B}{u_{w_B}^B} = (L_{A_i} + L_{B_i})\,\pi \qquad \text{(6c)}$$

Since the cost of a unit of the "public good" insurance provided equally to all is given by the term on the right, Equation (6c) is equivalent to the Samuelson optimality condition, equating summed marginal rates of substitution with marginal cost.[8]

The preceding model shows that union and employer choice may differ, and that those differences depend on a comparison of the marginal benefit of health insurance to the median voter with the average marginal benefit of all marginal workers. Unions will systematically provide more insurance, *ceteris paribus*, if the former is consistently greater than the latter. If we assume that all employees are equally likely to be marginal, one reason why unions might be expected to provide more insurance is that the median union voter will typically have a higher marginal benefit than the average worker's marginal benefit.

This may occur for two reasons. First, even in unionized firms, not all workers are union members, and yet reasons of administrative economy may well require them to share the insurance package bargained by the union. Those nonmembers tend to be women and low-income and young male workers, all of whom will have low demands for insurance. In addition, it is likely that those workers with low marginal benefits who are union members are less likely to vote in union elections. The constituency of voters to which union leaders respond will therefore be one with a high demand for insurance, whereas the employer, if he chooses the level of coverage, will have an incentive to consider the effect of his choice on the wages he must pay all workers.

Homogeneous Labor

We now turn to the second case, in which labor is homogeneous but in which there are not "enough" groups. Workers are homogeneous with respect to the amount and type of labor they supply and have different preferences with respect to the level of insurance they prefer. These differences might result both from differences in demands at equal prices and from the different prices that tax considerations pose for different income groups. The number of employment opportunities is not sufficiently large to permit formation of homogeneous groups for every employee preference. The supply of labor to any firm, therefore, becomes a function of both its money wage rate and the level of insurance it offers.

In order for equilibrium to exist in this market, the quantity of insurance being provided to the members of a group must be an equilibrium under the choice rule being used for that set of individuals. In addition, given the quantity of insurance chosen, each firm or group must be an equilibrium location for the members of the group; employee equilibrium must prevail.

In employee equilibrium, no employee may confront a wage-fringe benefit package in some other firm that he prefers to the one he is now receiving. The characteristics of this equilibrium depend on whether or not the employer can adjust the money wage of each employee individually. If he cannot, but must (for practical or institutional reasons) pay the same money wage to each employee, employee equilibrium would require that the employee at the margin be indifferent between the wage-insurance package of this employer and that of his next best alternative.

Call $w_{ij}|k = \bar{k}$ worker i's reservation wage for working at firm j. This is the minimum money wage at which, given the level of insurance coverage, worker i would be willing to work for firm j. Call $\bar{w}_j|k = \bar{k}$ the actual money wage being paid by firm j. For simplicity, the level of insurance coverage will be suppressed in what follows. Obviously, if $w_{ij} < \bar{w}_j$, the worker will work for firm j, and vice versa. Obviously, too, w_{ij} depends on worker i's alternative opportunities. Thus, employee equilibrium is characterized by:

(7) $$w_{ij} \leq \bar{w}_j | k_j = \bar{k}_j$$

for all workers who work at any firm j.

Equilibrium with respect to the employer's insurance decision requires two conditions to apply. First, no firm can alter its labor cost per employee by slight changes in its level of coverage. Assume that each firm believes that other firms' levels of coverage will not change in response to changes in its level of coverage. Let π be the cost per unit of insurance k. If a unit change in coverage is made, a worker who formerly did not do so will choose to work for firm j if, and only if:

(8a) $$\frac{u_k^i}{u_{w'}^i} - \pi > w_{ij} - \bar{w}_j$$

Conversely, a worker who works for firm j will leave if, and only if:

(8b) $$\frac{u_k^i}{u_{w'}^i} - \pi < w_{ij} - \bar{w}_j$$

Equilibrium requires that the number of workers for which (8a) holds equal exactly the number of workers for which (8b) holds.

The second employer equilibrium condition is that no firm be able to make a nonmarginal change in coverage such that it can hire the same number of employees at a lower labor cost. If this number is $\bar{L}$, this means that the number of workers for which (9a) and (9b) hold must be less than $\bar{L}$ for all j:

$$U(\bar{w}_j, \bar{k}_j) \leqq U(w, k) \tag{9a}$$

and

$$w\bar{L} + \pi k\bar{L} < \bar{w}_j\bar{L} + \pi\bar{k}_j\bar{L} \tag{9b}$$

Conditions 9 require that there be no set of $\bar{L}$ workers who can obtain as much as or more utility from hypothetical package (w, k) than they are now getting, if the hypothetical package has a lower labor cost than the package they are presently receiving. The actual number of workers $\bar{L}$ to be hired would then be determined in the usual way by equating marginal factor cost to marginal revenue product of labor.

To show that the two conditions (8) and (9) are unlikely to be satisfied simultaneously, let us begin with the case in which the supply of labor to the market as a whole is perfectly inelastic with respect to the real wage. The only function of the level of fringe benefits is then to determine for which employer a worker will work. At the margin, given any set of levels of insurance k being offered by a given number of firms, $\bar{w}_j = w_{ij}$. A slight alteration in k will bring the level of coverage closer to the optimums of the employees at one margin and move it further away from the optimums of the employees at the other margin. Suppose that we have a frequency distribution of the optimums of workers in the labor market. Call $f(m_1)$ the frequency of optimums of employees who are at the one margin and $f(m_2)$ the frequency of employees at the other margin. To make (8a) = (8b) therefore requires that $f(m_1) = f(m_2)$. This can happen only if the distribution contains a mode between m_1 and m_2, or if it is rectangular over the interval m_1 to m_2. For unimodal distributions, the only level of coverage satisfying marginal equilibrium occurs at a mode.

However, if all firms offer the level of coverage at the mode, persons whose optimums are not close to the mode will be willing to work at lower wages for firms that offer levels of coverage nearer their optimums. Hence, conditions (9) may well not hold. If the only points that satisfy (8) do not satisfy (9), no equilibrium exists.

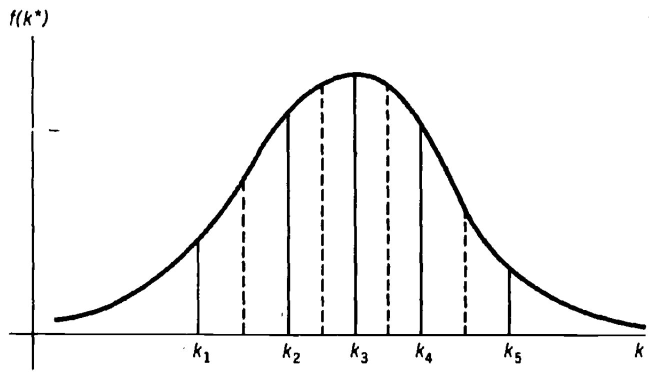
This problem is formally similar to Hotelling's locational problem, and a brief geometric exposition may help to explain the foregoing discussion and to make the similarity clear. It is assumed that, marginal labor cost held constant, workers will choose to work for the firm whose level of k is closest to their optimum. If five firms offered the levels of coverage k_1 through k_5, respectively, the margins would be at the point indicated by the dashed lines in Figure 2. For simplicity, these positions have been chosen so that each firm has the same number of employees (i.e., the integrals between the margins are the same). It is apparent that these firms are not in marginal equilibrium; movements toward the mode gain more workers than they lose for all firms except firm 3. But if all firms locate at the mode, dividing the total labor supply into five parts, it is obvious that a firm that took up, say, position k_2 could attract an excess supply of labor, since it would lure all the workers from the left tail up to the margin m. Hence, marginal and global equilibrium cannot coexist.

Although it will not be proved here, it can be shown that if the labor supply is not perfectly inelastic with respect to the real wage, equilibrium by chance may occur even in situations with "large" unimodal distributions. But such occurrences would not be particularly likely.

It is worth pointing out that these conclusions about the nonexistence of equilibrium can be generalized to the local public goods case as well. Questions are raised about the existence of equilibrium if property owners are thought of as choosing the level of local public goods to maximize rents. For the purpose of characterizing reality, the foregoing model is somewhat unsatisfactory.

Union equilibrium obviously requires that the employees be in equilibrium and that the employer be in equilibrium with respect to the number of employees he hires, given the level of insurance

FIGURE 2



coverage and the supply of labor function. The level of insurance coverage, however, is set at the level of the optimum of the individual with median preferences in the present group of workers.

Two observations are relevant here. First, it is clear that there can be multiple equilibria. It may be, for example, that *every* employee-employer equilibrium is also the optimum of the individual with median preferences. But second, it is also clearly possible that no equilibrium exists. Suppose that every individual's utility depends in a linear way on the difference between his optimum and the level of coverage chosen for the group. Suppose that the distribution of individual optimums is as in Figure 3. Finally, suppose that there are three firms.

The conditions for equilibrium are the following, where $f(x)$ is the distribution of optimum quantities and it is assumed that the wage costs per worker are the same in all firms:

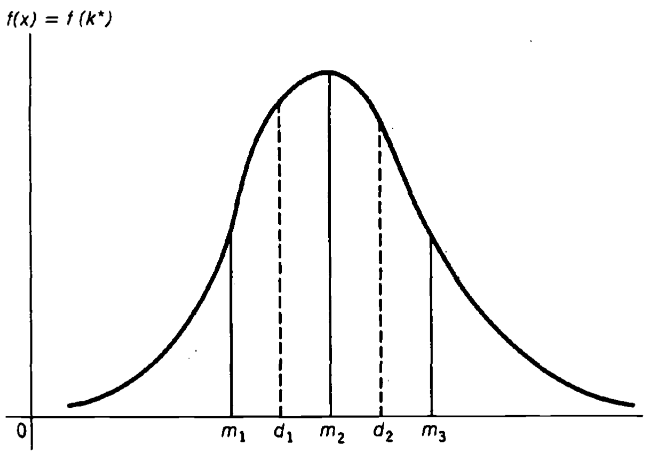
(10) Employee equilibrium $m_1d_1 = d_1m_2$
$m_2d_2 = d_2m_3$

(11) Union-choice equilibrium $\int_0^{m_1} f(x)dx = \int_{m_1}^{d_1} f(x)dx$

$$\int_{d_1}^{m_2} f(x)dx = \int_{m_2}^{d_2} f(x)dx$$

$$\int_{d_2}^{m_3} f(x)dx = \int_{m_3}^{\infty} f(x)dx$$

FIGURE 3



The positions of d and m in Figure 3 are drawn to satisfy these conditions. However, it is also clear from that figure that the number of employees in each firm is not equal. But at equal wage cost per employee, each firm will want to hire the same number of employees. Hence, no equilibrium exists. If the marginal wage cost per employee differs across firms (because elasticities of supply differ), firms may not all want to have the same size labor forces. But whatever pattern they choose, it need not correspond with the numbers that satisfy (10) and (11).[9]

Empirical Implications

Without a robust characterization of equilibrium, it is difficult to specify *a priori* what one would expect to find from empirical data. What we can say is that under either equilibrium notion presented above, the level of coverage an employer would choose will tend to be related more to the characteristics of all employees in a given labor market than to the characteristics of those particular employees he hires, whereas union choice will tend to be related only to characteristics of the median person. Insofar as the employer is in marginal equilibrium, what will be relevant are the characteristics of his marginal employees. Union choice, on the other hand, should still be related to the individual with median preferences.

Contributory Plans

Up to this point, the only choice available to union or employers is to decide how much tax-free fringe benefit to offer. But many firms have so-called contributory plans, in which the employer does not "pay" the entire health insurance premium. The employees pay all or part of the premium as an explicit and voluntary payroll deduction. The critical differences are that those employees who choose not to participate in the plan can retain their share of the premium and that the employee's share is taxed as ordinary income.

We first show, in the context of the two-employee-types model, how a contributory plan can be preferred by an employer to a noncontributory plan. We also show that a union will in general *not* choose a contributory plan. Then we indicate how the employer chooses the optimal share-coverage combination. For simplicity, we consider a model in which the same contributory share applies to all units of coverage.

Why Contributory Plans?

Suppose that a firm has exactly twice as many type-*A* employees as type-*B* employees and that their demand curves are as shown in Figure 4, where π is the unit premium for group insurance. The noncontributory equilibrium package is at k_n^*, where $GH = 2HF$. The total welfare loss suffered by a type-*B* person is given by area *JHG*.

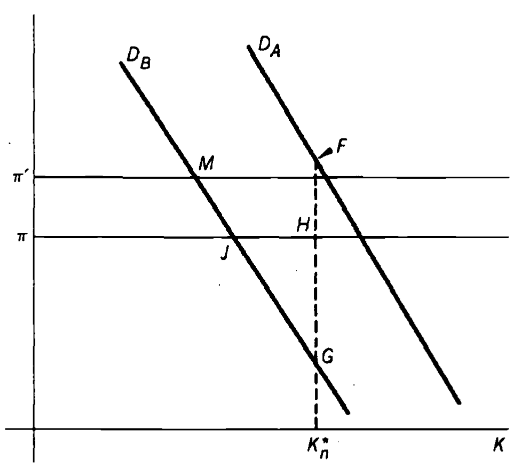
The line π' represents the cost to type-*B* employees for individual insurance. Type-*B* employees will be better off dropping out of the group plan if the effects of extra premium costs for an individual plan, or area $J\pi\pi'M$, are less than the welfare loss from group insurance.

When is an employer more likely to offer a contributory plan? Such a plan is more likely to materialize if the costs imposed on type-*A* persons are low, i.e., if their marginal income tax rate is relatively low. It is also more likely to be advantageous if the welfare loss of type-*B* persons under a noncontributory plan is relatively high, which tends to occur if the optimums of both groups are widely separated.

Optimal Employee Share

In the two-type model, a contributory plan will make all employees who take the maximum amount of insurance worse off, relative to a noncontributory plan, because it subjects a part of the

FIGURE 4



premium to income taxation. Hence, a noncontributory plan can benefit type-*B* workers only if they are induced to opt out of the group insurance plan. Then they save the employer the total amount of the premium that would have been paid for them. Suppose that a contributory plan is introduced, with a given employer share s. There are two equilibria possible. On the one hand, if type-*B* employees do not drop out, the optimal k is analyzed as in the noncontributory case. On the other hand, if type-*B* employees do drop out, k is set at the optimum of type-*A* individuals, and the money wages of type-*B* workers are increased to make up for the loss of insurance. If they are worse off with insurance than without it, the employer would want to set w^B at such a level that $U^B(w^B, 0) = U^B(w^{Bo}, k^o)$ and set w^A such that $U^A\{[w^A - t(1-s)k_A^* \ \pi], k_A^*\} = U^A(w^{Ao}, k^o)$. Notice that $k_A^{*\prime}$ will differ from k_A^*, since the increase in the fraction of premium that is taxable income raises the net price of insurance to type-*A* employees. Clearly, w^A is minimized if s is as large as possible, and w^B does not vary with s once type-*B* employees have dropped out. Hence, the optimal s would appear to be the largest s at which opting out is legal.

But this assumes that type-*B* workers will indeed opt out. From the viewpoint of any individual worker, his money wage will not depend on whether he chooses insurance or not (for if it did, the employer payment would not be tax free). He will not be likely to opt out at a high s, since his *perceived* benefit from doing so is $(1-s)k\pi$, whereas his perceived cost is the loss of the entire insurance package k. The employer may need to lower s much below 1 to induce type-*B* employees to opt out. The cost of providing this inducement is the extra tax on the income of type-*A* workers.

The type-*B* worker's *perceived* utility level, if he opts out, is $U^B\,[w^B + (1-s)k_n\pi, 0]$, and he compares it to $U^B\,(w_i^B, k_n^*)$, where k_n^* is the optimal mixed equilibrium. (We assume here that the firm does not "force" him out by providing, say, k_A^* units, although the analysis would be roughly similar.) The firm's problem is to choose the largest s such that opting out occurs. The lower the evaluation the worker puts on the k_n units of insurance (i.e., the greater the welfare loss he bears at k_n), the higher this s can be, as long as s is less than 1.

There is a fundamental difference in the effect of worker characteristics on premiums. For noncontributory insurance, the lower B's demand relative to A's demand, the lower k_n, and hence the lower the premium. For contributory plans, the lower B's demand, the *higher* will be optimal s. If the B's do not participate, k_n can be higher. Premiums can increase, decrease, or be unaffected by changes in variables related to B's demand.

Unions and Contributory Plans

It would appear that a union should never choose a contributory plan, for the optimum of the median worker always involves a noncontributory (fully tax free) plan providing his optimal level of coverage. Of course, if the employer has some influence in the decision, or if vote-trading or consideration of the effect of worker group characteristics induces the union to consider the preferences of other employees, unions may be associated with contributory plans. But in general we should expect unions to be less likely to have contributory plans.

General Equilibrium

The world that we will be analyzing empirically is one in which group insurance is provided in many firms and the quantity is sometimes chosen by unions and sometimes by employers. The supply curve of labor to a particular firm depends both on the wage-insurance package of that firm and also on that of all other firms. But, assuming that a general equilibrium exists, the partial equilibrium conditions outlined above must be satisfied for every firm, the particular set of conditions depending on whether the employer or the employee chooses the quantity. In addition, it requires that wage cost per employee be equated across firms. This means that those firms which are prevented from offering the labor-cost minimizing insurance package will sustain losses and will go out of business. If they are concentrated in particular industries, and if new nonunionized firms cannot be formed, average firm size must shrink until marginal products are equalized.

Empirical Specification

The empirical models of union choice that we test are similar to studies of the demand for local public goods by Borcherding and Deacon (1972) and by Bergstrom and Goodman (1973). Both of these studies rely on the proposition that, in a majority rule model, the group choice is identical with the optimum of the individual with median preferences. Coupled with the assumption (implicit in Borcherding and Deacon and explicit in Bergstrom and Goodman) that the median quantity is demanded by the citizen with the median income, they provide an empirical estimate of the price and income elasticities of demand as well as an estimate of a "crowding" or "(dis)economy of scale" parameter.

There are three major empirical variables in both of these studies. Both use median income. In addition, quantity of the public good is regressed on a measure of the price of the public good and the number of persons in the sharing group.

We have mentioned above that for group insurance, the loading is likely to vary inversely with group size up to some limit. The extent to which it does so would correspond to the "crowding" notion. Unfortunately, it does not appear that we will be able to use an independent measure of price. Insurance is produced in a national market, so there seems to be no reason to expect prices for a given group size to differ across areas or industries. And it seems reasonable to assume that all employees pay equal shares of the total cost, so "tax shares" will not differ. One could argue that differential concentrations of bad risks might affect the price paid by a representative median individual, but to get a measure of the actual price variation we need to know by how much, e.g., a larger proportion of high-risk blacks raises the premium per individual for a given level of coverage.

Thus we are limited to estimating the effects on quantity of insurance demanded of income and group size alone. Data limitations will require us to work with average pay, rather than median income. A further difficulty is that we do not have a measure of k, the fraction covered by insurance. Instead, we get a measure of total premiums. This means that, since we do not know price, we are estimating an expenditure equation rather than a demand equation. And since total premiums depend on expected losses as well as on the fraction of those losses covered by insurance, we either need to find a way of removing influences on losses in order to determine what affects choice of coverage for a given loss or need to interpret our coefficients as including both effects. After the empirical results are presented, some illustrative calculations directed at removing these effects will be presented.

4. DIFFERENCES BETWEEN UNION CHOICE AND EMPLOYER CHOICE

We will be able to estimate separate demand relationships for industries in which the choice method is primarily by unions and industries in which it seems reasonable to think of the employer as choosing insurance. The hypothesis that employers choose differently from unions for a given set of employee characteristics might be extended to include the premise that employers are likely to respond differently from unions to *differences* in the set of employee characteristics. In particular, since the employer responds to characteristics of the marginal worker, we would expect the mean income to have less of an effect on employer-chosen insurance than it does on union-chosen insurance. For mean and median incomes are likely to be highly correlated, whereas the relationship between mean income and the income and other characteristics of the marginal worker is likely to be relatively weaker.

In addition, the finding that union choice leads to larger total premiums is consistent with the notion that the union's choice is more likely to ignore the strong preferences of those who would want less insurance. Finally, to the extent that those union members whose preferences are relevant tend to be higher risks than employees in general (because they tend to be older and have larger families or higher incomes), we would also expect to find unions choosing higher levels of health insurance. No recourse to a "union leader" or "visibility" argument is necessary.

5. THE DATA

The Bureau of Labor statistics periodically conducts a survey of employer expenditures for supplementary compensation.[10] The data used in this study are drawn from a 1971 survey of 3,772 establishments across the United States. The questionnaire distinguishes between the records of office and nonoffice employees and asks whether union-management agreements covered a majority of either group of workers. The questions concerning fringe benefit plans distinguish among health, life, and accident insurance. Specifically, the questionnaire asks whether or not an establishment had a health, life, or accident insurance plan, and if so whether the plan (or plans) was (were) noncontributory or contributory. Unfortunately, the question about employer expenditures for these private welfare plans asked only for the total expenditure on all plans together. Other information drawn from the survey for this study includes gross annual payroll, total employment, the SIC code, the region in which the establishment was located, and a further geographical code distinguishing metropolitan from nonmetropolitan locations.[11] For purposes of this study, annual employer expenditures per worker for health, life, and accident insurance and total payroll per worker were calculated separately for the office and nonoffice divisions of establishments.

6. THE EMPIRICAL WORK

We are unable to directly examine all the distinctions suggested by the theory between employer-choice and union-choice models. Ideally, we would need data on the characteristics of workers in each establishment. We would then attempt to show that premiums in the employer-choice model respond to selected measures of dispersion of the various employee characteristics, whereas in the union-choice model premiums would be expected to be related only to selected characteristics of the median worker.

The data restrict us considerably since there is no information on the distribution of characteristics of the workers. So the model to be estimated is basically of the following form:

$$\text{Premium} = a + b \text{ pay} + c(\text{size of group}) + d(\text{size of group})^2 + \sum_{i=1}^{7} g_i$$

(seven binary variables representing the types of plans) + $\sum_{i=1}^{32} f_i$ (thirty-two binary variables representing SIC codes) + s(binary variable for the South) + t(binary variable for unionization) + V(binary variable for office worker group).

The variables will be discussed individually. The "pay" variable is simply the annual wage and salary payment per worker. The "size" variable is used as a proxy variable for the price of the plan. The price per unit of group insurance is expected to decline with the size of the group. The quadratic term, "(size)^2," is used to pick up any nonlinearity between size and price per unit of group insurance.

As mentioned, the survey asks about health, life, and accident insurance plans. Since the size of the premium is related to the combination of plans offered, we must control for this variation. There are twenty-six possible combinations of plans. It was felt that the accident insurance component of fringe benefit payments was likely to be insignificant, and as a result this component was ignored in the empirical work. The eight possible combinations of plans are presented in Table 1 of Appendix 1.

The binary variables for the SIC codes are presented in Table 2 of Appendix 1. These are designed to capture the industry-specific characteristics that might affect the size of the premium. They will be discussed further below.

The binary variable for location in the South is entered to control for the lower costs of medical services in the South, and a negative sign for the coefficient of this variable is expected.

The union variable takes the value of 1 if the group is covered by a collective bargaining agreement, and premiums are expected to be positively related to this variable for reasons discussed above.

Finally, there is the binary variable that takes the value of 1 if the group is made up of office workers. This is a control variable to account for possible different attitudes toward these fringe benefits, *ceteris paribus*, on the part of office workers.

There are several possible samples that can be used to calculate the regression above. The decision unit could be all office and nonoffice groups in the sample considered individually. This would be reasonable if office and nonoffice groups were always covered by their own separate plans. If the two groups were sometimes covered by the same plan, then using simply the pay of one group in an establishment to explain the premium for that group alone would be misleading. The pay figure that would be relevant would be some combination of the pay of this group and the pay of the other group in the establishment. A similar argument applies to the union variable. As for the size variable, clearly the size of the entire insurance group is the desired variable. The sample that will be used therefore includes only those firms for which the office and nonoffice groups have different plans, and for which it is legitimate to conclude that employee groups were not pooled. The decision units are the office and nonoffice groups of these firms.[12]

In Appendix 2, Table 1, we summarize the results of the initial regression, with union and nonunion observations pooled. As expected, premiums are positively related to pay, with the income elasticity of demand at the mean being 0.64. Premiums are positively related to the size of the group, but negatively related to the quadratic term for size as hypothesized. If the establishment is located in the South, the premium per worker is \$28 less, *ceteris paribus*, than outside the South. The sets of binary variables for types of plans and industry classification are often statistically significant, whereas the binary variable for office workers is not.[13] Finally, the union variable is positively related to premiums as hypothesized. The presence of a union-management agreement adds $81 to the premium per worker, *ceteris paribus*.

We have demonstrated thus far that unions do indeed make a difference in the premium and coverage per worker. The theoretical discussion above, however, suggested that unionized groups act differently from nonunionized groups in making a decision on premiums. The sample was subdivided into unionized and nonunionized groups, and the same model was tested on each subgroup (with the exclusion, now, of the union variable, of course). An F test rejected the hypothesis of equality between the sets of coefficients in the two regressions at the 1 per cent level of significance.

In Appendix 2, Tables 2 and 3, we present the regression results for unionized groups and for nonunionized groups, respectively. The most important difference between the two groups is in the income elasticity of demand for premiums. For the unionized groups, the elasticity is now 0.87, whereas for the nonunionized group it is 0.45. Of significance also is the fact that the coefficient of size is statistically insignificant in the nonunion results, whereas the coefficient of the quadratic term is insignificant in both cases.[14] Furthermore, in the nonunion results, the binary variable for office workers is now significant and positive. Being in an office group, *ceteris paribus*, adds $86 to the premium.

The sample can be further subdivided on the basis of type of plan. In Appendix 3, Tables 1 through 4, we present the results of regressions calculated for unionized establishments with noncontributory plans, unionized establishments with contributory plans, nonunionized establishments with noncontributory plans, and nonunionized establishments with contributory plans.[15] For unionized establishments with noncontributory plans, the income elasticity of demand for premiums is 0.90; for nonunionized establishments with noncontributory plans, only 0.17. For unionized establishments with contributory plans, the income elasticity of demand for premiums is 0.67; for nonunionized establishments with contributory plans, the figure is 0.70. To discuss these results further, it is useful to briefly present some other results on choice of plan.

In Appendix 4, results are presented for a regression using only groups with plans in which the dependent variable is a binary variable that takes the value of 1 if the establishment has a noncontributory welfare plan, and 0 if the plan was contributory.[16] *Ceteris paribus*, unionized establishments are 28 per cent more likely to have a noncontributory welfare plan than nonunionized establishments, following the argument presented in the theoretical section.

It is difficult to find a rationale for the lower income elasticity of contributory as compared to noncontributory plans among unionized groups, since the theory does not predict that unionized groups will have contributory plans. A somewhat plausible argument can be suggested for the nonunionized group. In this case the income elasticity of demand for premiums in the contributory subsample is larger than in the noncontributory subsample. In nonunionized establishments the employer must respond to varying preferences, not just to the median individual. If a noncontributory plan is chosen, then the employer must be careful not to provide too much in the way of benefits relative to pay, because no one can opt out. In the contributory case, however, the employer has much more freedom to vary benefits since individuals may opt out. The level of benefits will be more responsive to income in the contributory case than in the noncontributory case.

7. ILLUSTRATIVE CALCULATIONS OF PRICE AND INCOME ELASTICITIES OF DEMAND FOR INSURANCE

The elasticity estimates of the preceding section are only estimates of the response of gross premiums to income and group size. To estimate the parameters of the demand for insurance, we need to introduce some additional information.

Assume that insurance is sold at a constant price Φ per unit of coverage. Then the elasticity of premiums with respect to the size of the group, s, can be defined as:

$$\eta_{\pi s} = (\eta_{k\Phi} + 1)\eta_{\Phi s} \tag{12}$$

where $\eta_{k\Phi}$ is the price elasticity of demand and $\eta_{\Phi s}$ is the elasticity of price with respect to the size of the group (i.e., a measure of the rate at which changes in group size reduce the premium). Clearly, to estimate $\eta_{k\Phi}$, one needs to know $\eta_{\Phi s}$.

Similarly, the net (of tax advantages) premium $\tilde{\pi}$ can be defined as:

$$\tilde{\pi} = (1 - t)\lambda(s)kE(x) \tag{13}$$

where t is the marginal income tax rate, λ is the loading (a function of group size), and $E(x)$ is expected medical expenses. The elasticity of gross premiums with respect to income is therefore:

$$\eta_{\pi y} = \eta_{k\Phi}\eta_{ty} + \eta_{E(x)y} + \eta_{ky} \tag{14}$$

where η_{ty} is the income elasticity of marginal tax rates and $\eta_{E(x)y}$ is the income elasticity of demand for medical care. To estimate η_{ky}, one must have estimates of the other elasticities. This formulation ignores the effect that increased losses arising from increased income might have on the level of coverage chosen.

We use some estimates of the missing elasticities that, although not precise, should give some idea of the magnitudes involved. A schedule of group health premium discounts with size, presented in Dickerson (1968), has an elasticity of loading with respect to firm size of approximately −0.031. If the elasticity of premiums with respect to size is 0.03, the price elasticity is approximately −2.0. If the average loading is about 0.2, this yields an estimate of the elasticity with respect to *loading* of approximately −0.33.

The income elasticity of marginal income tax rates, at the average income in our sample, is approximately 0.07. Feldstein (1973) has estimated the income-elasticity of demand for medical care to be 0.54. Using a price elasticity estimate of 2.0 and our income elasticity estimate of 0.64, and ignoring the payroll tax, one obtains an income elasticity of demand for insurance of −0.04. This very low estimate is consistent with Feldstein's finding, in cross-sectional state-aggregated data, of no pure effect of income on the demand for health insurance. However, there is a positive income elasticity of demand for unionized groups, whereas the elasticity for nonunionized groups is negative, although small.

8. CONCLUSION

The theory developed in this paper has some important implications for empirical work, although the possibility of the nonexistence of equilibrium raises difficulties. The data available did not permit direct testing of all of these implications. What tests we were able to perform confirm the predictions of the theory, in that they show that unions and employers behave differently in their choice of group insurance levels. Data on the distribution of firm characteristics will be necessary for more direct empirical testing.

APPENDIX 1

TABLE 1 Fringe Benefit Plan Binary Variables

	HOLC	no health plan, contributory life insurance plan
	HOLN	no health plan, noncontributory life insurance plan
	HCLO	contributory health plan, no life insurance plan
	HCLC	contributory health plan, contributory life insurance plan
	HCLN	contributory health plan, noncontributory life insurance plan
	HNLO	noncontributory health plan, no life insurance plan
	HNLC	noncontributory health plan, contributory life insurance plan
Reference group:	HNLN	noncontributory health plan, noncontributory life insurance plan

TABLE 2 SIC Code Binary Variables

Reference group:	1	Construction, special trade contractors
	2	Agricultural services, forestry, fishing
	3	Mining
	4	General building construction, other construction
	5	Ordnance
	6	Food
	7	Tobacco, textiles, apparel
	8	Lumber
	9	Furniture
	10	Paper
	11	Printing and publishing
	12	Chemicals
	13	Petroleum refining, rubber
	14	Leather
	15	Stone
	16	Primary metal
	17	Fabricated metal
	18	Machinery except electrical
	19	Electrical machinery
	20	Transportation equipment
	21	Instruments
	22	Miscellaneous
	23	Railroads

TABLE 2 (concluded)

Reference group:	24	Local and interurban transportation, other transportation
	25	Motor freight
	26	Electric, gas, and sanitary services
	27	Wholesale trade
	28	Retail building, retail general merchandise apparel, furniture
	29	Retail food
	30	Automobile dealers and service stations
	31	Eating and drinking establishments
	32	Finance
	33	Services

APPENDIX 2

TABLE 1

Variable	Coefficient	Standard Error
Pay[a]	$.2360 \times 10^{-1}$	$.1902 \times 10^{-2}$
Employ[b]	$.3117 \times 10^{-1}$	$.1708 \times 10^{-1}$
$(\text{Employ})^{2}$[c]	$-.2270 \times 10^{-5}$	$.1704 \times 10^{-5}$
South[b]	−28.0705	16.6032
Union[a]	81.5864	20.5623
Office	14.8572	22.2622
HCLO	−113.2745	37.4564
HCLC	−86.5932	17.4216
HCLN	−59.3872	31.7672
HNLO	−32.0808	28.4242
HNLC	−9.1734	32.2892
IND. 3	262.7475	30.4385
IND. 4	−4.0026	37.6809
IND. 5	85.1385	123.3323
IND. 6	51.8220	30.0988
IND. 7	−11.7399	37.0554
IND. 8	102.7528	60.0224
IND. 9	35.1830	71.6291
IND. 10	47.2370	46.2737
IND. 11	−72.5394	71.8307
IND. 12	−124.9947	69.0594
IND. 13	163.4320	61.0997

TABLE 1 (concluded)

Variable	Coefficient	Standard Error
IND. 14	−89.7814	150.8334
IND. 15	71.6416	43.1703
IND. 16	187.7605	27.0916
IND. 17	165.4972	42.8687
IND. 18	138.7482	33.6760
IND. 19	31.6347	53.3250
IND. 20	70.4452	47.0344
IND. 21	46.2840	124.2524
IND. 22	102.5244	55.1915
IND. 24	−11.1063	67.7551
IND. 25	48.1036	43.5189
IND. 26	−76.6522	149.8810
IND. 27	16.8561	41.5541
IND. 28	−40.1884	48.3839
IND. 29	11.7315	56.8736
IND. 30	27.9368	66.1347
IND. 31	−7.7350	42.9379
IND. 32	−17.0243	49.1655
IND. 33	6.9831	30.4050
Constant	50.0110	25.5113

$N = 1139$
$R^2 = 0.3378$
$F = 13.6479$
[a] Significant at the 1 per cent level of significance using a one-tailed test.
[b] Significant at the 5 per cent level of significance using a one-tailed test.
[c] Significant at the 10 per cent level of significance using a one-tailed test.

TABLE 2 Unionized Groups

Variable	Coefficient	Standard Error
Pay[a]	$.3841 \times 10^{-1}$	$.3232 \times 10^{-2}$
Employ[c]	$.3247 \times 10^{-1}$	$.2085 \times 10^{-1}$
(Employ)^2 [b]	$-.2211 \times 10^{-5}$	$.1993 \times 10^{-5}$
South	−44.6729	26.2218
Office	−76.9843	66.0872
HCLO	−62.9760	78.4928
HCLC	−103.4328	34.4361
HCLN	−95.7251	62.2356
HNLO	.8046	47.7489

TABLE 2 (concluded)

Variable	Coefficient	Standard Error
HNLC	−110.5753	79.0453
IND. 3	370.4995	42.4451
IND. 4	−18.9182	53.0407
IND. 5	116.5961	225.7463
IND. 6	36.4339	42.4022
IND. 7	−15.4366	59.8475
IND. 8	61.0942	84.5065
IND. 9	8.4334	109.7024
IND. 10	94.5771	68.5686
IND. 11	−172.1880	114.5963
IND. 12	−133.8114	112.2699
IND. 13	197.8371	92.1663
IND. 14	39.9854	162.0159
IND. 15	95.8523	73.1455
IND. 16	192.3440	38.0959
IND. 17	209.6347	67.2601
IND. 18	176.8147	51.5436
IND. 19	38.8871	91.1344
IND. 20	74.0772	67.7042
IND. 21	30.1787	157.2047
IND. 22	−40.2380	92.3222
IND. 24	36.1261	92.1104
IND. 25	6.8042	64.3555
IND. 27	49.8022	74.0300
IND. 28	−123.5410	100.0552
IND. 29	71.5459	78.4637
IND. 30	115.7510	217.5840
IND. 31	−34.0095	126.8290
IND. 32	−14.0974	127.1777
IND. 33	−8.3702	63.1849
Constant	9.8736	32.0272

$N = 572$
$R^2 = .3950$
$F = 8.9078$
[a] Significant at the 1 per cent level of significance using a one-tailed test.
[b] Significant at the 5 per cent level of significance using a one-tailed test.
[c] Significant at the 10 per cent level of significance using a one-tailed test.

TABLE 3 Nonunionized Groups

Variable	Coefficient	Standard Error
Pay[a]	$.1325 \times 10^{-1}$	$.2288 \times 10^{-2}$
Employ	$.1129 \times 10^{-1}$	$.3553 \times 10^{-1}$
$(\text{Employ})^2$	$-.1523 \times 10^{-5}$	$.4096 \times 10^{-5}$
South	−20.5244	20.4538
Office[a]	85.7691	23.2286
HCLO	−108.0411	40.6329
HCLC	−37.9779	20.6210
HCLN	−21.7960	36.0258
HNLO	−17.6038	34.8915
IND. 3	104.8398	42.3542
IND. 4	71.2975	51.8767
IND. 5	45.9567	139.0909
IND. 6	62.1844	41.6817
IND. 7	−13.7153	45.0955
IND. 8	170.9656	81.8337
IND. 9	59.9171	89.2962
IND. 10	15.8361	61.2696
IND. 11	17.7774	88.8277
IND. 12	−121.4522	83.0313
IND. 13	131.0928	77.6114
IND. 15	53.1949	50.8759
IND. 16	170.0372	36.9433
IND. 17	127.7391	53.0766
IND. 18	120.1987	43.2132
IND. 19	32.2442	62.0061
IND. 20	107.2002	63.8566
IND. 21	58.2886	198.6398
IND. 22	190.8957	65.0109
IND. 24	40.3944	99.1579
IND. 25	83.4148	58.9521
IND. 26	−48.3575	138.1063
IND. 27	−14.2430	47.7058
IND. 28	−31.4968	52.1833
IND. 29	−35.0852	81.2892
IND. 30	11.5089	65.1347
IND. 31	−8.3230	43.7159
IND. 32	−48.0040	50.9116
IND. 33	−4.5165	34.1299
Constant	73.9285	29.8791

$N = 567$
$R^2 = .3350$
$F = 6.8078$

[a] Significant at the 1 per cent level of significance using a one-tailed test.

APPENDIX 3

TABLE 1 Noncontributory Union

Variable	Coefficient	Standard Error
Pay	$.4152 \times 10^{-1}$	$.3879 \times 10^{-2}$
Employ	$.1635 \times 10^{-1}$	$.1604 \times 10^{-1}$
South	−42.3737	30.6757
Office	.8947	150.9988
IND. 3	379.0296	45.1782
IND. 4	−16.2282	59.8149
IND. 6	32.8301	54.5310
IND. 7	77.9837	80.2042
IND. 8	98.8492	105.3201
IND. 9	67.3969	134.2085
IND. 10	150.3697	96.8831
IND. 11	−165.6497	231.1611
IND. 12	−147.7895	163.9522
IND. 13	215.7386	119.4212
IND. 15	153.5582	90.7415
IND. 16	203.6861	44.0708
IND. 17	261.0186	83.3650
IND. 18	220.3621	62.9921
IND. 19	53.9260	117.5788
IND. 20	61.9820	94.4213
IND. 21	101.2534	231.3503
IND. 22	−50.5028	134.2346
IND. 24	−100.4000	231.9547
IND. 25	−53.2847	98.7247
IND. 27	27.1488	88.5110
IND. 28	−114.9369	134.3569
IND. 29	135.5957	104.5338
IND. 30	123.6867	232.5082
IND. 31	−49.0194	165.0196
IND. 32	−21.7028	164.7800
IND. 33	−9.8884	91.6538
Constant	−21.1256	37.9593

$N = 454$
$R^2 = 0.3827$
$F = 8.4402$

TABLE 2 Contributory Union

Variable	Coefficient	Standard Error
Pay	$.2216 \times 10^{-1}$	$.8539 \times 10^{-2}$
Employ	$-.3030 \times 10^{-2}$	$.1593 \times 10^{-1}$
South	124.6589	72.7539
Office	−111.9219	91.8847
IND. 4	−225.0749	154.0686
IND. 6	114.3624	91.7063
IND. 7	−284.3558	123.0155
IND. 8	−4.1756	128.9841
IND. 10	−.5782	115.0574
IND. 11	−93.1873	182.7301
IND. 12	−69.6146	128.0180
IND. 13	156.6614	112.7175
IND. 14	−137.3590	156.2430
IND. 16	154.5355	72.6874
IND. 17	94.8389	115.2763
IND. 18	103.7329	168.0169
IND. 19	−62.9834	157.3418
IND. 20	189.6651	169.7042
IND. 21	.1941	163.0831
IND. 24	−50.9480	95.0793
IND. 25	204.7270	175.5142
IND. 29	−107.7528	175.4910
IND. 31	−88.8023	156.8024
IND. 33	−165.6519	154.0572
Constant	99.8306	73.9427

$N = 56$
$R^2 = 0.5580$
$F = 1.6304$

TABLE 3 Noncontributory Nonunion

Variable	Coefficient	Standard Error
Pay	$.5338 \times 10^{-2}$	$.3752 \times 10^{-2}$
Employ	$-.3001 \times 10^{-2}$	$.4095 \times 10^{-1}$
South	−84.2868	38.8259
Office	146.9658	42.2269
IND. 3	93.2499	199.8618
IND. 4	−31.7060	96.4642
IND. 6	87.9809	118.3455

TABLE 3 (concluded)

Variable	Coefficient	Standard Error
IND. 7	−82.9149	75.8292
IND. 8	188.9954	102.2741
IND. 10	−46.1270	93.2270
IND. 11	66.9251	119.3414
IND. 12	−347.3340	203.8687
IND. 13	65.4376	200.8328
IND. 15	−97.0990	142.1633
IND. 16	70.2285	77.6841
IND. 17	−3.5564	119.2246
IND. 18	41.3707	77.7683
IND. 19	132.8449	199.4682
IND. 20	64.7879	114.7006
IND. 22	1597.8103	200.6054
IND. 24	51.7718	119.4195
IND. 25	40.7810	87.2553
IND. 26	−98.4091	199.3910
IND. 27	−45.4775	103.8643
IND. 28	−64.9899	102.8961
IND. 29	−130.4693	117.9913
IND. 30	−33.9875	142.8651
IND. 31	−110.3982	80.3047
IND. 32	−181.0119	79.9211
IND. 33	−58.6157	58.2030
Constant	159.1605	47.7670

$N = 165$
$R^2 = 0.5200$
$F = 4.8388$

TABLE 4 Contributory Nonunion

Variable	Coefficient	Standard Error
Pay	$.1966 \times 10^{-1}$	$.3923 \times 10^{-2}$
Employ	$.7432 \times 10^{-1}$	$.6341 \times 10^{-1}$
$(\text{Employ})^2$	$-.7667 \times 10^{-5}$	$.6409 \times 10^{-5}$
South	23.4893	30.2928
Office	48.6150	36.6571
IND. 3	109.5375	45.8571
IND. 4	13.9091	108.7873

TABLE 4 (concluded)

Variable	Coefficient	Standard Error
IND. 5	232.1925	185.4734
IND. 6	125.2553	57.5479
IND. 7	29.3740	74.1326
IND. 9	182.3184	132.2361
IND. 10	55.4584	110.8921
IND. 11	−316.7350	193.4660
IND. 12	76.3260	133.3111
IND. 13	251.2017	117.8779
IND. 15	133.0822	70.4645
IND. 16	184.0137	45.2669
IND. 17	131.1661	79.0090
IND. 18	211.3406	77.8495
IND. 19	1.3106	96.0196
IND. 20	160.8269	96.1539
IND. 22	63.2844	95.0369
IND. 25	95.7776	94.9226
IND. 26	−36.3840	186.9200
IND. 27	−37.3047	86.6681
IND. 28	−34.7703	77.3517
IND. 29	67.2898	132.4986
IND. 30	24.7555	96.1113
IND. 31	82.3387	68.8227
IND. 32	−6.4284	89.3205
IND. 33	34.8311	57.9816
Constant	−39.2046	47.1898

$N = 240$
$R^2 = 0.3676$
$F = 3.900$

APPENDIX 4

TABLE 1

Variable	Coefficient	Standard Error
Employ	-2.4995×10^{-5}	1.6441×10^{-5}
Union	.2835	3.8577×10^{-2}
Office	−.1679	3.9066×10^{-2}
IND. 3	-9.8381×10^{-2}	5.9778×10^{-2}
IND. 4	7.2523×10^{-2}	7.5004×10^{-2}

TABLE 1 (concluded)

Variable	Coefficient	Standard Error
IND. 5	−.3149	.2460
IND. 6	-9.8988×10^{-2}	5.8525×10^{-2}
IND. 7	-7.2216×10^{-2}	7.2542×10^{-2}
IND. 8	.1385	.1198
IND. 9	.1098	.1431
IND. 10	−.1328	9.1344×10^{-2}
IND. 11	-8.3941×10^{-2}	.1435
IND. 12	-2.2569×10^{-2}	.1371
IND. 13	-4.7230×10^{-2}	.1206
IND. 14	−.3088	.3014
IND. 15	−.2239	8.5211×10^{-2}
IND. 16	-8.8429×10^{-2}	5.3201×10^{-2}
IND. 17	-1.7157×10^{-2}	8.4889×10^{-2}
IND. 18	6.6508×10^{-2}	6.4383×10^{-2}
IND. 19	−.1595	.1056
IND. 20	-8.1747×10^{-2}	9.3898×10^{-2}
IND. 21	-4.4670×10^{-2}	.2471
IND. 22	−.2000	.1085
IND. 24	−.1204	.1359
IND. 25	-2.2485×10^{-4}	8.6189×10^{-2}
IND. 26	−.1184	.3022
IND. 27	9.9731×10^{-2}	8.2196×10^{-2}
IND. 28	−.1388	9.6017×10^{-2}
IND. 29	-4.0330×10^{-2}	.1128
IND. 30	−.2500	.1316
IND. 31	−.1293	8.4508×10^{-2}
IND. 32	8.2696×10^{-2}	9.6228×10^{-2}
IND. 33	1.0251×10^{-2}	5.8155×10^{-2}

Dependent Variable: Occurrence of a noncontributory welfare plan.
$N = 1139$
$R^2 = 0.22$
$F = 9.6910$
Constant is 0.6188.

NOTES

1. An illustrative schedule of the variation in premiums with group size is presented in O. D. Dickerson, *Health Insurance*, 3rd ed. (Homewood, Illinois: Richard D. Irwin, 1968), p. 592. This schedule indicates that group size economies would be exhausted at a group size of about 500 employees, assuming a monthly premium per employee family of $50.

2. This assumes that small firms are more efficient in the production of outputs in particular industries.
3. Moral hazard is obviously ignored here.
4. In a more general context, Rothschild and Stiglitz have shown that no equilibrium may exist in cases of adverse selection. See M. Rothschild and J. Stiglitz, "Equilibrium in Insurance Markets: The Economics of Imperfect Information," unpublished manuscript, Yale University, 1973.
5. In equilibrium, the number of firms will be such that no firm will have a work force homogeneous with respect to health insurance preferences or risk of illness. In other words, the distribution of preferences and/or risk over the labor force is such that the frequency of workers at any preference or risk level is insufficient to permit a firm to operate profitably with only these workers. There is then some minimal size needed to operate profitably, and this requires attracting more workers than there are at any given preference or risk level.
6. These demand curves make quantity of insurance a function of gross (of tax savings) price. In part, the differences in demands at a given gross price could be caused by differential tax advantages that cause net prices to differ.
7. Here again, marginal utilities depend in part on tax savings. Thus, u_k^j is not equal to $\partial U^j/\partial k$, but also includes a utility valuation of the reduction in taxes which occurs when k increases and taxable (money) income declines.
8. The critical assumption is that an employer can separate workers of different types. He can then pay each group a different money wage to ensure that, given the level of health insurance, each group is at the margin (Equation (4)). If it is too costly to separate all types of workers, then it is certainly possible that some workers will not be at the margin, and yet will still be better off in their job than in alternatives currently available for a range of values of health insurance benefits. The employer will not need to take their preferences into account in choosing the level of health insurance. Consequently, there is no presumption that such a situation will be Pareto optimal.
9. The earlier assumption about the incidence of fringe benefits falling wholly on employees is actually a consequence of the free entry and mobility assumptions. With free entry of firms, if one employer tries to shift more than the cost of the fringe benefits onto his workers, some potential employer can offer a slightly higher wage, attracting all the employees of the former and still being able to operate profitably.
10. For a description of this data, see *Employee Compensation in the Private Nonfarm Economy, 1970*, Washington, D.C., 1973.
11. The four-digit SIC code for each establishment is given. The regional code takes on four values, for Northeast, South, North Central, and West.
12. This procedure obviously sacrifices some observations. There will be firms in which the office and nonoffice workers have the same type of plan, but in which the plans are separate. Our procedure is a conservative one that cuts the sample from almost 7,000 observations to just over 1,600 observations. Moreover, if union-wide contracts cover more than one firm, again we will have imprecise measurement of group characteristics. Use of the SIC code may help to control this. Our procedure also eliminates all groups providing no insurance whereas a more reasonable procedure would involve using a Tobit form of analysis on all observations.
13. F-tests indicated that both the plan classification and the industry classifications added significantly to the explanation of premiums at the 1 per cent level.
14. The elasticity of premiums with respect to the size of the group in Table 1 is 0.02, whereas the elasticity in Table 2 is 0.03. In the unionized subsample, 3

per cent of the workers are office workers; in the nonunionized subsample, 71 per cent are office workers.

15. The sets of coefficients calculated using the nonunion subsample are statistically significantly different from each other at the 1 per cent level. In the union case, the two sets are not significantly different at the 10 per cent level.
16. Use of a binary dependent variable makes the assumption of homoscedasticity untenable. The OLS estimator is unbiased, but the estimates of the standard errors of the regression coefficients are biased and inconsistent.

REFERENCES

1. Bergstrom, Theodore, and Robert Goodman, "Private Demands for Public Goods," *American Economic Review*, 63 (June 1973), pp. 280–296.
2. Borcherding, Thomas A., and Robert Deacon, "The Demand for the Services of Non-Federal Governments," *American Economic Review*, 62 (December 1972), pp. 891–901.
3. Feldstein, Martin, "The Welfare Loss of Excess Health Insurance," *Journal of Political Economy*, 81 (March–April 1973), pp. 251–280.
4. ______, and Elizabeth Allison, "Tax Subsidies of Private Health Insurance." In *The Economics of Federal Subsidy Programs*, A Compendium of Papers Submitted to the Subcommittee on Priorities and Economy of Government of the Joint Economic Committee, Part 8—Selected Subsidies, July 29, 1974 (Washington, D.C.: U.S. Government Printing Office, 1974).
5. Lester, R. A., "Benefits as a Preferred Form of Compensation," *Southern Economic Journal*, 34 (April 1967), pp. 488–495.
6. Phelps, Charles, "The Demand for Health Insurance," R–1054–OEO, The Rand Corporation, July, 1973.
7. Rice, Robert D., "Skill, Earnings, and the Growth of Wage Supplements," *American Economic Review, Papers and Proceedings*, 56 (May 1966), pp. 583-593.

3 COMMENTS

Donald Richter
University of Rochester

Professors Goldstein and Pauly should be complimented on their effort to construct a theory of the collective purchase of insurance-type benefits, and more important, on deriving some very interesting implications of their theory that are in principle subject to empirical test. Their paper is a refreshing change from much other empirical work in that they take some care in developing the theory that underlies their empirical hypotheses. My comments will be confined primarily to the theoretical part of their paper, in particular to the two general types of equilibria discussed—employer-choice equilibrium and union-choice equilibrium.

I will first discuss the concept of employer-choice equilibrium. In order to facilitate comparison with analogous equilibrium concepts in the theory of public goods, and because the precise requirements of employer-choice equilibrium were a bit obscure to me from reading the paper, I will restate its definition in the following terms. An employer-choice equilibrium is a set of employee groups, each with a wage-fringe benefit package, such that:

1. producers maximize profits;
2. no employee wishes to switch to another group;
3. there is no other conceivable set of groups and associated wage-fringe benefit packages that could make all employees better off.

Notice that the authors introduce condition (3) by saying that employers choose their wage-fringe benefit package so as to minimize their labor cost. This requirement implies that the equilibrium is Pareto optimal.

Let me compare this equilibrium concept with two equilibrium concepts relevant to the theory of value with public goods. The consumers of the economy are partitioned into a set of governmental jurisdictions, which provide public goods to their residents and collect taxes so as to balance their respective budgets. The consumers are assumed to maximize their utility over their private goods bundles, given the amounts of public goods provided by their jurisdictions and subject to their after-tax budget constraint. For simplicity, assume that each jurisdiction can levy a proportional wealth tax, whose rate varies across jurisdictions.

The partition of consumers into jurisdictions and the provisions of public and private goods, the tax rates, and private goods prices are endogenous and determined by the following equilibrium concepts. The first, which I will refer to as a "local mobility equilibrium," requires that the supply and demand for private goods be equated such that:

1′. producers maximize profits;
2′. no consumer wishes to move to another existing jurisdiction;
3′. for any of the existing jurisdictions, there is no alternative provision of public goods and taxes to pay for them which can make everyone better off.

The other equilibrium concept, which I will refer to as a "global mobility equilibrium," replaces (3′) with the following condition (3″): there is no other set of jurisdictions and associated public goods provisions and taxes that will make everyone better off.

Condition (3′) amounts to what Ellickson (1973) has referred to (in a somewhat different context) as Pareto optimality relative to a partition. It simply means that the equilibrium is Pareto optimal when compared to all other attainable allocations consistent with the endogenously determined partition. Condition (3″) is a much stronger condition, which implies (3′) but also requires that there be no Pareto superior allocation among the class of attainable allocations corresponding to all conceivable partitions of the consumers, not just the equilibrium one.

The global mobility equilibrium is the direct analogue of the Goldstein-Pauly employer-choice equilibrium. It is an extremely strong equilibrium that is unlikely to exist under general conditions. On the other hand, the local mobility equilibrium can, I think, be shown to exist under rather general conditions. It also seems like an interesting equilibrium concept in the public goods context. In particular, it seems reasonable that consumers will shop around among the various existing jurisdictions, comparing public goods-tax packages, but there does not seem to be a compelling decentralized mechanism that would lead to a global Pareto optimum. This suggests that perhaps the authors should use the analogue of the local mobility equilibrium in their arguments. The advantage is that their equilibrium is then likely to exist. The disadvantage is that one loses the interpretation that sees the employer as choosing the wage-fringe benefit package with an eye to minimizing labor cost.

The other equilibrium concept discussed in the paper—the union-choice equilibrium—would correspond in the public goods context to determining the amount of public goods in each jurisdiction according to the median voter's preferences. Again, existence is likely to be a problem. Models demonstrating the existence of a general economic equilibrium wherein public goods provisions are determined by some (highly simplified) type of political behavior are precious few.

Let me close by pointing out that it is very unfortunate that the empirical implications that really draw on the richness of the authors' model are precisely the ones that the authors have not been able to test because of data limitations. Future relaxation of these data limitations would be very interesting indeed.

REFERENCES

1. Ellickson, B., "A Generalization of the Pure Theory of Public Goods," *American Economic Review*, 63 (June 1973), pp. 417–432.

William Vickrey
Columbia University

I have only a few rather peripheral remarks to add to this paper. One is that the use of medical examinations as an exclusionary device is likely to be somewhat less important than might at first appear. One of the motives for group insurance is precisely the savings in underwriting costs, of which the medical examination is an important element. Underwriters of group plans generally expect to encounter a certain proportion of risks that would be selected out or subjected to higher premiums if insured on an individual basis. They protect themselves against an undue amount of adverse selection, in the case of contributory optional plans, by requiring the inclusion in the plan of a certain minimum proportion of the eligible risks before the plan will be put into effect. In the case of plans with compulsory participation, whether noncontributory or otherwise, the limited elasticity of substitution among jobs will ordinarily be sufficient to limit the inclusion of bad risks to a tolerable level. To be sure, employers often require a medical examination prior to employment, but it is not clear to what extent such examinations are a means of protecting insurance programs against bad risks and to what extent they are intended to protect the employer from workmen's compensation claims based on preexisting conditions, or to ensure that the employee will be physically capable of performing the required work, or to weed out employees likely to leave after too short a period to yield a return on their initial on-the-job training and recruitment costs.

Another point is that to treat a union as a mechanism for making decisions on the extent of insurance according to majority rule, with the decision according with the preferences of the median "voter," is, I think, a grossly unrealistic approach. At best the union leadership is elected on the basis of a large number of issues, the most salient of which is probably the degree of general militancy and skill evinced in dealing with employers; and the particular issue of how much insurance to include in the wage package would be considered only in conjunction with a large number of other matters. In the union's decision on the package to bargain for, there would be considerable scope for weighing intensity of individual preferences concerning the relative amounts of insurance against other elements of the package, so that the median voter rule would be inapplicable. In practice, rather than being an ideal democracy, the typical union has a leadership that is to a large extent self-perpetuating and subject to serious challenge only under very unusual circumstances. Such a leadership would tend to make decisions that are fairly strongly biased toward the preferences of the senior members with the longest tenure, which in turn is likely to be a preference for larger amounts of insurance, since the older members are likely to have the higher risk. This is to me a more persuasive explanation of the statistical findings that premiums are higher if unions exist.

Finally, it is perhaps worth mentioning that among the industry coefficients the only ones that appear to have substantial statistical significance levels are those for mining, primary metal, fabricated metal, and machinery, except electrical, all of which have positive coefficients with t ratios ranging from about 4 to 8. There may be some significance to the fact that only industries in this rather closely interconnected group show insurance levels above the general run.