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Introduction

The ability of an economic agent to commit oneself to a credible course of action has been shown to be an important consideration in the design of efficient incomplete contracts (Tirole, 1986; Hart and Moore, 1988), in the vertical and horizontal span of firms (Grossman and Hart, 1986) and, most recently, has been identified as a potential source of contract failure in the market for health insurance (Cochrane, 1995). Although the theoretical relevance of precommitment in contractual settings has been widely demonstrated and is well understood, there has been surprisingly little formal empirical support documenting how variations in the level of commitment affect the structure of contractual agreements. This paper provides such evidence in the context of employer-sponsored health insurance. We examine a theoretical model of insurance contract design in an environment where the insured individuals may vary in the extent to which they can commit to remain in an insurance pool as their health status evolves. Using data on actual insurance plans, we find that the structure of insurance contracts observed in practice is consistent with the predictions of the model, providing empirical documentation for the importance of precommitment in contract design.

Traditional analyses of contracting in insurance markets have tended to emphasize the role of informational asymmetries which engender problems of adverse selection (Rothschild and Stiglitz, 1976; Crocker and Snow, 1986) or moral hazard (Shavell, 1979). In contrast, our approach is closest in spirit to that of Palfrey and Spatt (1985) and Cochrane (1995), and considers an environment of symmetric information in which the purchasers of insurance obtain publicly-observable information about their health status over time.[1] We examine a two-period model in which insureds are identical in period one, but who receive a public signal prior to the second period which affects their expected future health care costs. As a consequence, the risk-averse insureds fact two potential sources of uncertainty: the *financial loss* associated with adverse health outcomes in each period, and the *classification risk* that results when second-period insurance premiums reflect the publicly available information on each individual's likely health-related expenses.

In such a setting, an optimal insurance contract would entail full compensation for all the losses suffered from illness as well as a constant, ex ante actuarially fair, premium charged to all individuals independently of the state or their observed health status. While such a plan provides full insurance against both types of uncertainty, the cross-subsidy from low- to high-risk individuals in the second period, which is inherent in the non-experience-rated premiums required to cover the classification risk, gives those with lower expected health care costs the incentive to exit the insurance pool, and to purchase independent coverage at a price that more accurately reflects their own, observable, expected health care costs. As Cochrane (1995) has noted, the inability of insureds to precommit credibly to remain in the pool in light of favorable information on health status provides and impediment to the insurability of classification risk.[2]

Paradoxically, the ability to insure against such risks is enhanced if there exist obstacles to the mobility of insureds, which mitigates the erosion of the insurance pool caused by the departure of lower-risk individuals. One of the largest impediments to insured mobility is the cost of switching jobs in an environment where employer-sponsored health insurance is the norm. To the extent that health insurance is bundled with employment, any frictions associated with employee mobility across occupations or employers necessarily translate into a more stable and, hence, insurable risk pool. Thus, employee job lock may have heretofore unappreciated beneficent effects through its impact on the insurability of health risks.

The validity of this approach, of course, depends crucially on the requirement that insureds switch jobs in order to obtain alternative insurance coverage. This would appear to be a reasonable proposition in practice since the vast majority of insured individuals receive their health coverage through employer-sponsored plans. The difficulties associated with the offering of private health insurance are well known, and include the traditional problem of adverse selection in non-group plans (Pauly, 1986), as well as the high fixed costs generally encountered in the administration of individual policies (Diamond, 1992). As a result, the terms associated with independently purchased health insurance, to the extent that it is available, are less than attractive when compared to the employer-sponsored alternative (Gruber and Madrian, 1993).

The paper proceeds as follows. In the next section, we examine a two-period model of employer-sponsored health insurance in which the publicly-observed health status of employees changes over time. Under the assumption that the insured workers incur a financial cost when switching jobs to obtain alternative insurance coverage, we characterize the structure of efficient employer-sponsored insurance contracts. We find that when employers offer the same contract to all of their workforce, the optimal contract exhibits a coverage limitation that is inversely proportional to the degree of employee job lock. In addition, if employers are able to offer multiple contracts which experience rate the insureds, the optimal contract exhibits full coverage of medical expenditures, albeit at second period premiums that partially reflect each individual's observable health status.

Section three presents an empirical test of the model's predictions using data on insurance coverages obtained from the 1987 National Medical Expenditure Survey and proxies for job lock provided by the 1977 Dictionary of Occupational Titles. We find that the insurance contracts associated with firms who offer a single policy exhibit coverage limitations which are decreasing in the amount of employee job lock, and that those firms offering multiple plans to their workforce have higher levels of coverage which are insensitive to the degree of job lock. We also find evidence on the incidence of employer-sponsored health plans which strongly supports Cochrane's (1995) conjecture that the ability of insureds to precommitment is an important determinant of the availability of insurance for the chronic conditions covered by health insurance. A final section contains concluding remarks.

II. A Model of Health Insurance

We consider a two-period model of health insurance in which a continuum of individuals face the financial risk of illness in each period with probability p^i, $i \in \{H , L\}$, where $p^H > p^L$ and the proportion of high risk (H-type) agents in the population is denoted as λ. In the first period, all agents are assumed to be uninformed about their types, and therefore face the identical probability $p^1 \equiv \lambda p^H + (1-\lambda)p^L$ of becoming ill. Prior to the second period, however, each individual receives a publicly-observable signal of health status which is fully revealing of type, resulting in second period agent heterogeneity based upon differential health histories.

Each individual is assumed to be risk averse and has the von Neumann-Morganstern utility function $U(W_j)$, where W_j is the agent's wealth in the sick (j=S) and not-sick (j=N) state. An agent's expected utility, given the contingent wealth $W = \{W_S, W_N\}$, and the probability of illness p, is written as

$$v(p,W) \equiv pU(W_S)+(1-p)U(W_N). \tag{1}$$

The informational structure of the model requires that all individuals receive the same contingent wealth allocation W^1 in period one, but allows agents to be treated differently in the second period based upon their observable health status. Letting W^i denote the second period contingent wealth allocation of an i-type agent, the expected utility of an individual over both periods is

$$V\left(W^1,W^H W^L\right) \equiv v\left(p^1,W^1\right)+\lambda v\left(p^H,W^H\right)+(1-\lambda)v\left(p^L,W^L\right) \tag{2}$$

where, in the interests of simplicity, we have assumed that there is no discounting of second-period consumption.

An insurance contract c $\equiv \{Z,R\}$ consists of a premium, Z, paid by the insured individual prior to each period and a reimbursement, R, received by the insured in the event of illness. Letting C^i denote the contract associated with a type i individual for $i \in \{1,H,L\}$, an *insurance plan* $C \equiv \{c^1,c^H,c^L\}$ results in the contingent wealth allocations

$$W_s^i \equiv Y - Z^i - S + R^i \;; \quad \text{and}$$
$$W_N^i \equiv Y - Z^i$$

where Y is an individual's income in each period and S is the financial loss associated with the sick state. Insurance firms are risk-neutral, and the profit associated with the offering of plan C is

$$\Pi(C) = Z^1 - p^1 R^1 + \lambda\left[Z^H - p^H R^H\right] + (1-\lambda)\left[Z^L - p^L R^L\right]. \tag{3}$$

A. *Spot Markets and Efficient Plans*

Before proceeding, we consider two benchmark cases. The first is the equilibrium occurring in the *spot market* when individuals purchase health insurance at the beginning of each period. It is straightforward to demonstrate that the equilibrium is characterized by a solution to the problem of selecting C to maximize the expected utility of insureds (2) subject to the zero profit constraint $Z^i = p^i R^i$ for $i \in \{1, H, L\}$. While the resulting contract provides full insurance against the financial loss generated by an illness, so $R^i = S$ for every i, the insured is completely exposed to the classification risk associated with alternative health outcomes through the experience-rated second period premiums. The spot market contracts are depicted in Figure 1, where in the first period the insureds receive C*, and in the second period the insured receives $\hat{C}^H$ $(\hat{C}^L)$ if she is viewed to be high (low) risk.

As an alternative to the sequential spot market, insureds could opt for a two-period contract negotiated prior to period one. Such a *full commitment* insurance plan is characterized by a solution to the problem which maximizes insured utility (2) subject to $\Pi(C) \geq 0$, which is depicted as C* in Figure 1 and results in full coverage of all illness-related expenses $\left(R^1 = R^H = R^L \equiv S\right)$ as well as a constant, ex ante actuarially fair, premium which does not depend on revealed health status $\left(Z^1 = Z^H = Z^L \equiv p^1 S\right)$. Although the full commitment plan completely insulates insureds from both the financial risk of illness and the classification risk associated with observable health status, the premium structure in the second period entails a cross-subsidy in which low-risk (high-risk) individuals pay a premium which is above (below) their actuarially fair rate. Since the courts will not generally enforce long-term contracts against insurance purchasers, the low-risk insureds may successfully renege on their second-period obligations unless other mechanisms to enforce compliance can be implemented.

B. *Partial Commitment Through Job Lock*

When health insurance is provided only as part of an employment package, frictions associated with movement to alternative employers may serve to impede the ability of low-risk individuals to migrate from the insurance pool. To investigate the efficacy of such job lock as a precommitment device, we assume that the low-risk workers can obtain full, and actuarially fair, health insurance in the second period, but in so doing must incur a financial cost, K, of moving to an alternative employer. Accordingly, two-period insurance plans are feasible if they satisfy the constraint

$$p^L U\left(Y - Z^L - S + R^L\right) + \left(1 - p^L\right) U\left(Y - Z^L\right) \geq U\left(Y - K - p^L S\right) \quad (4)$$

which guarantees that the low-risk individual would prefer to remain in the insurance plan rather than exercising the (actuarially fair) outside option.

The existence of the job lock conferred by the switching cost K permits some degree of commitment on the part of insureds to remain in the insurance pool even if they turn out to be healthier than average. We will examine the effect of this ability to precommit in two insurance settings, the first of which permits insurers to experience-rate the members of the pool, and the second requires that insurers offer the same contract to all insureds independently of their revealed health status.

Theorem 1: If insurers are permitted to experience rate insureds, then, for sufficiently small values of K, the optimal insurance contract is characterized by:

(*i*) $R^H = R^L = R^1 = S$;
(*ii*) $Z^1 = Z^H > p^1 S > Z^L$;
(*iii*) $U(Y - Z^L) = U(Y - K - p^L S)$

Proof: An optimal contract is a solution to the maximization problem associated with the Lagrangean expression

$$L = V(W^1, W^H, W^L) + \alpha\Pi(C) + \beta\{v(p^L W^L) - U(Y - K - p^L S)\}$$

where α and β are undetermined multipliers. The first order conditions for an interior maximum are

$$\frac{\partial L}{\partial Z^1} = -p^1 U'(Y - Z^1 - S + R^1) - (1 - p^1)U'(Y - Z) + \alpha = 0; \qquad (5)$$

$$\frac{\partial L}{\partial R^1} = p^1 U'(Y - Z^1 - S + R^1) - p^1\alpha = 0; \qquad (6)$$

$$\frac{\partial L}{\partial Z^H} = -\lambda p^H U'(Y - Z^H - S + R^H) - (1 - p^H)U'(Y - Z^H)\lambda + \alpha\lambda = 0; \qquad (7)$$

$$\frac{\partial L}{\partial R^H} = \lambda p^H U'(Y - Z^H - S + R^H) - \alpha\lambda p^H = 0; \qquad (8)$$

$$\frac{\partial L}{\partial Z^L} = -[1 - \lambda + \beta][p^L U'(Y - Z^L - S + R^L) + (1 - p^L)U'(Y - Z^L)] + \alpha(1 - \lambda) = 0; \qquad (9)$$

$$\frac{\partial L}{\partial R^L} = [1-\lambda+\beta]p^L U'(Y - Z^L - S + R^L) - \alpha(1-\lambda)p^L = 0. \tag{10}$$

Solving (6) for α and substituting the results into (5) yields $R^1 = S$. Similar operations on the other equations yield part (i) of the Theorem.

To show part (ii), note that (6) and (8) imply $R^1 - Z^1 = R^H - Z^H$, and that (6) and (10) give

$$\left[1+\frac{\beta}{1-\lambda}\right]U'(Y - Z^L - S + R^L) = U'(Y - Z^1 - S + R^1) \tag{11}$$

from which it follows that $R^1 - Z^1 < R^L - Z^L$ when $\beta > 0$. These results, in conjunction with part (i) of the theorem, imply part (ii).

Finally, part (iii) is a simplification of constraint (4), which must bind for sufficiently small K, implying $\beta > 0$.

Q.E.D.

When insurers are permitted to treat individuals differently based upon their observable health status, the optimal insurance plan provides full coverage of health care expenses (part (i)), but only partial protection from classification risk (part (ii)). An optimal plan for this case is illustrated in Figure 2, where all insureds in period one, and high risk individuals in period two, receive the contract $\tilde{C}$, while low-risk insureds are given $\tilde{C}^L$. As indicated by part (iii) of the theorem, the magnitude of the cross-subsidy that can be extracted from the low-risk individuals in the second period and, hence, the amount of insurance that can be provided against classification risk, is positively related to the amount of job lock through the switching cost K. On the one hand, if workers can move to alternative employers quite easily, the premium changed to low risk workers,

Z^L, must be close to their actuarially fair rate $p^l S$, which provides little room for classification insurance. On the other hand, as K increases, the low-risk insureds can be assessed a higher premium, thereby effecting a larger cross-subsidy and reducing insureds' exposure to second-period classification risk. For sufficiently large values of K, the no-exit constraint (4) no longer binds, and the full commitment contract C* is attainable.

In many cases, employers do not offer plans that treat workers differently but, rather, opt for an arrangement in which all employees receive the same coverage irrespective of their health status or tenure with the firm. Letting C^P denote a pooling arrangement for which $c^i = c$ for every $i \in \{1, H, L\}$, the following theorem characterizes an optimal pooling plan.

Theorem 2: There exist K_1 and K_2, where $K_2 > K_1 > 0$, such that

(i) for $K < K_1$, low-risk workers always exit any pooled plan in period two;

(ii) for $K_2 > K > K_1$, an optimal pooling plan attracts low-risk workers in the second period, and is characterized by the following conditions:

a) $Z^P = p^1 R^P$;

b) $R^P < S$;

c) $p^L U(Y - Z^P - S + R^P) + (1 - p^L) U(Y - Z) = U(Y - K - p^L S)$;

d) $\dfrac{dR^P}{dK} > 0$;

(iii) for $K > K_2$, the full commitment contract C* is attained.

Proof: An optimal pooling contract is obtained by maximizing the following Lagrangean expression with respect to Z^P and R^P:

$$L = V(W,W,W) + \alpha\Pi(C^P) + \beta\{v(p^L, W) - U(Y - K - p^L S)\} \tag{12}$$

where α and β are undetermined multipliers and W is the contingent wealth associated with the pooling plan C^P. The first order conditions for an interior maximum are given by

$$\frac{\partial L}{\partial Z} = -U'(Y - Z^P - S + R^P)[2p^1 + \beta p^L] \\ - U'(Y - Z^P)[2(1 - p^1) + \beta(1 - p^L)] + 2\alpha = 0; \tag{13}$$

$$\frac{\partial L}{\partial R} = U'(Y - Z^P - S + R^P)[2p^1 + \beta p^L] - 2\alpha p^1 = 0. \tag{14}$$

Assuming, for the moment, that an interior solution to (12) exists, equation (14) implies $\alpha > 0$, from which (ii)(a) follows. Also, solving (13) for α and substituting the result into (14) yields

$$U'(Y - Z^P)[2 - 2p^1 - \beta p^L + \beta] = U'(Y - Z^P - S + R^P)[2 - 2p^1 - \beta p^L + \beta p^L / p^1]. \tag{15}$$

Since $p^L < p^1$, $\beta > 0$ implies (ii)(b) and (ii)(c).

To establish (ii)(d), totally differentiate (a) and (c) to obtain

$$dR^P\{U'(W_S)[p^L - p^1 P^L] - U'(W_N)(p^1 - p^1 p^L)\} = -U'(Y - K - p^L S)dK \tag{16}$$

where $W_S \equiv Y - Z^P - S + R^P$ and $W_N \equiv Y - Z^P$. Solving (15) for $U'(W_S)$ and substituting the result into (16) yields, after simplification,

$$\frac{dR^P}{dK} = \frac{U'(Y - K - p^L S)}{2(1 - p^1)(p^1 - p^L)} \tag{17}$$

which is positive.

Finally, it is straightforward to demonstrate that, for sufficiently small values of K, there exist no pooling plans preferred by the low-risk agents to their outside option, and that, for sufficiently large amounts of job lock, $\beta=0$ and the full commitment contract solves (12).

QED

The contract associated with the optimal pooling plan is depicted as C^P in Figure 2. For low levels of job lock K, the $\bar{v}^L = U\left(Y - K - p^L S\right)$ indifference curve lies everywhere below the pooling fair-odds line p^1R, so that there is no pooling contract that will be accepted by the low risk individuals in period two. As K increases, eventually a critical value, denoted K_1, is reached at which $\bar{v}^L$ is just tangent to the zero-profit locus p^1R, resulting in a feasible pooling insurance plan. For $K > K_1$, C^P migrates up the pooling fair odds line until C* is achieved for $K \geq K_2$. Thus, Theorem 2 implies that firms offering a single policy to all their employees should have insurance plans with coverage limitations that are decreasing in the amount of job lock. Alternatively, firms that offer multiple plans that permit employees to be treated differentially should, according to the results of Theorem 1, have full coverage for medical claims independently of the magnitude of job lock.

We now turn to an examination of the evidence.

III. Evidence from Employment-Based Health Insurance Contracts

In the previous section we demonstrated that, with incomplete commitment efficient health insurance contracts cannot fully insure both the financial risk associated with adverse medical outcomes *and* the classification risk arising from the ex post categorization of agents into risk classes. Where only a single insurance policy is offered by firms, imperfect commitment leads to the adoption of coverage limitations, while in firms offering multiple plans, full loss insurance is maintained, but insureds receive only partial insurance against the prospect of health-related increases in premiums.

From an empirical perspective, the main testable implication of the model is the finding that coverage caps in employment-based health insurance contracts should vary inversely with the ability of agents to precommit to remain in a particular insurance pool. Because in practice insureds must change employers to obtain more favorable coverage, determinants of the average cost of changing employers can be used to proxy for insured commitment, thereby permitting a direct test of the insureds' ability to precommit on the design of contractual agreements. The tests presented in this section will examine the extent of coverage in existing health insurance polices, and so presupposes that a sufficient level of commitment is present to warrant the provision of *some* level of coverage. In the next section, we take up the issue of provision directly, and present evidence that the ability to precommit is also an important determinant of the overall availability of health insurance.

A. *The Data*

Our empirical analysis was conducted using detailed employment and health insurance data from two components of the 1987 National Medical Expenditure Survey (NMES): (1) The NMES Household Survey; and (2) The NMES Health Insurance Plans Survey (HIPS). The NMES Household Survey is a stratified random sample of the civilian noninstitutionalized population of the United States containing primarily individual-level data on the medical expenditures, demographic characteristics, employment status, and health insurance coverage of some 35,000 individuals in 14,000 households. Household Survey respondents who reported coverage from private insurance (6549 persons with employment-related insurance and 1992 persons with coverage obtained directly from insurers) were re-interviewed in the HIPS to obtain more detailed information on their type and level of coverage, premiums, deductibles, and covered illnesses. HIPS was designed to provide a random sample of all private health insurance policyholders in the civilian population of the United States at the end of 1987. The data available in HIPS further supplements the Household Survey data by providing detailed firm-level information on the characteristics of respondents' employers as well as their employer-sponsored health insurance plans. Taken together, the Household Survey and HIPS permit nationally representative estimates of both the cross-sectional incidence of various types of health insurance coverage and the specific characteristics of privately held plans.

B. *Measuring Commitment*

To test the predictions of our model, we require an observable proxy for the costs of changing employers. A number of impediments to job mobility have been identified in the literature, with particular attention being focused on human capital specialization[3], which refers to the subset of a worker's knowledge or skills which are differentially valued by a particular firm, or within a particular occupation or industry. In general, the more specialized one's skills become, the costlier it will be to change employers. In the case of firm-specific training, these costs reflect reductions in productivity and earnings at rival firms. In cases where skills are occupation- or industry-specific, switching costs may reflect either reduced productivity (if the switch entails leaving one's occupation or industry), or simply the increased costs of finding a job as employment becomes more specialized. Available evidence suggests that the returns to specific training are substantial. Topel (1991), for example, finds that, "10 years of job seniority raise the wage of the typical male worker in the United States by over 25 percent relative to what he could obtain elsewhere." Analogous returns have been documented for skills which are occupation[4] or industry[5] specific, as well[6].

To proxy for worker switching costs (and by implication, the degree of insured commitment) we use a direct measure of the training specificity required in various occupations. Such a measure is provided in the 1977 Dictionary of Occupational Titles[7] (DOT) in the form of an index of the "Specific Vocational Preparation" (SVP) associated with each of 12,000 occupations. SVP is defined as "the amount of time required to learn the techniques, acquire information, and develop the facility needed for average performance in a specific job-worker situation[8]," and is based on the nine categories of vocational preparation shown in Table 1 (a more complete definition is provided in the Appendix). Note that SVP was not designed to measure the *general* educational requirements of jobs, since a separate variable (General Educational Development) is provided for that purpose.

A proxy for *worker* level commitment was obtained by imputing an SVP value to each worker in the Household Survey based on their Census occupation code[9]. However, because decisions regarding insurance provision are made at the firm level, the best conceptual measure for our purposes is one which measures commitment at the *firm* level, that is, one measuring the average degree of employee commitment in a particular firm. Given the need to obtain a firm-level measure, there are two ways in which one might proceed. One possibility is to simply use the SVP value assigned to each worker as a proxy for the average degree of skill specialization in that worker's firm. This approach would be desirable if one believes that within-firm human capital heterogeneity is not very large. An alternative approach, and the one adopted in this paper, is to construct a measure of the average degree of specialization in various *industries*, and use this as a proxy for the typical amount of specialization arising in particular firms within those industries. This latter approach will be preferable if there is less skill heterogeneity *across* firms (in narrowly-defined industries) than *within* firms.

To construct a proxy for firm level commitment, we computed the average SVP value in each worker's industry (labeled INDSVP) using the 18,000 persons in the Household Survey who reported a Census occupation code. Because the industry codes in the Household Survey are at the three digit level, (representing some 230 distinct industries), we believe that INDSVP is likely to provide a good proxy for the average degree of employee commitment in individual firms.

C. *Empirical Framework*

The effect of commitment on health insurance coverage can be estimated from a simple reduced-form regression of the type shown below:

$$MAXCOV_i = \beta_0 + \beta_1 INDSVP_i + \gamma' \mathbf{x}_i + \varepsilon_i \qquad (18)$$

where $\mathbf{x}_i$ is a vector of employer and insurance plan characteristics, ε_i is a normally and independently distributed error term, and $INDSVP_i$ is the proxy for the average job lock faced in the industry that employs worker *i*. The dependent variable in our analysis, $MAXCOV_i$, is the maximum lifetime dollar benefit policyholder worker *i* is entitled to receive under the major medical portion of their policy[10], and represents the total amount of coverage available to the insured. The estimated value of β_1 provides a direct measure of the effect of commitment on contract structure, which allows one to access the magnitude of distortions induced by limitations on insured commitment.

The samples used in this section were created by applying a common set of restrictions to the 6549 HIPS respondents reporting employment-related coverage. The base sample was selected by deleting: any person who was classified as unemployed, or for whom a link to a "current main job" was unavailable; any person who did not hold an employer (or union) - sponsored plan, and anyone whose employer did not offer *group* coverage. We also deleted 48 persons employed in sub-chapter S corporations, as well as approximately 30 persons who held policies from more than one employer. For now, we restrict attention to firms which offer a single health insurance plan; later, we will consider a test which utilizes data from both single and multiple plan firms. These restrictions, coupled with observations lost from missing or incomplete data, resulted in a final sample of 1205 policyholders of employment-based health insurance. Results were also obtained for a smaller sample (722 observations) to allow for the inclusion of additional explanatory variables.

To control for influences other than commitment, we selected two sets of control variables, corresponding to the two samples mentioned above. In Sample 1, we include as controls the type of coverage (single, two-party, family, and "other"), the insurance status of the firm (self-insured, mixed, or not self-insured), the type of insurer (traditional or HMO), the type of employer (for-profit, nonprofit, government, or "other"), the number of employees (less than 10, 10-25, 26-100, 101-500, and over 500), and the union status of the employer (nonunion, partially unionized, or fully unionized). Sample 2 adds to this set firm ownership type (sole proprietorship, partnership, or corporation), the percentage of part-time workers, and the percentage of workers earning less than $5.00 per hour. Exact definitions of these variables, as well as descriptive statistics, are provided in Tables 2 and 3, respectively.

D. *Econometric Issues*

Relationship (18) can be estimated by ordinary least squares to obtain efficient and unbiased estimates of the parameters of interest, provided that the error term is homoskedastic, uncorrelated across observations, and orthogonal to the included regressors. The first condition is easily checked using the generic test proposed by White (1980). However, the second requirement - that the error term be uncorrelated across observations - may be problematic in models (such as ours) where group level variables are merged with individual-level data. Moulton (1986) shows that when group level variables are used in conjunction with individual level observations, significant within-group error correlation can arise, resulting in OLS-estimated standard errors which are biased downward. In the present case, such a problem might arise from the inclusion of an industry level variable (INDSVP) in a regression in which all other variables are measured at the firm level. To test for this possibility, we calculated the Lagrange Multiplier (LM) and the Standardized Lagrange Multiplier[11] (SLM) tests described in Moulton and Randolph (1989). Note that both tests are conducted under the null hypothesis of no within-group error correlation.

E. *Empirical Results - Single Plan Firms*

Ordinary least squares estimates of (E1) are reported in Table 4. Across both specifications, we find that INDSVP has a large and statistically significant effect on coverage levels. This finding provides tentative support for the hypothesis that departures from complete commitment lead to distortions in the total amount of insurance coverage available to employment-based pools. Furthermore, total coverage increases sharply with the degree of insured commitment. Focusing on Sample 1, we find that on the margin, a one unit increase in INDSVP increases total coverage by approximately $118,000 dollars. To better appreciate the magnitude of this effect, consider a representative worker who is employed in the for-profit sector by a nonunion firm with less than 10 employees, and who purchases a health insurance policy specifying single coverage from a traditional insurer, (neither an HMO nor a self-insured firm). Based on the estimates contained in Table 4, the total amount of insurance coverage available to such a person would increase from $392,900 to $866,724 as INDSVP varies over its sample range (from roughly 3 to 7). If we extrapolate this result outside the sample, we find that total coverage varies from $155,988 to $1,103,636 as INDSVP increases from its lowest possible value (SVP=1) to its theoretical maximum (SVP=9).

The diagnostic tests presented at the bottom of Table 4 indicate that our standard errors are not biased by either heteroskedasticity or within-group error correlation, as neither the White statistic, nor the LM and SLM statistics, are significant at conventional levels. To check for possible specification error, we estimated a number of different versions of (18) incorporating various combinations of explanatory variables. The results indicate that the underlying relationship between MAXCOV and INDSVP is not sensitive to the particular set of control variables employed[12].

F. *Commitment vs. Inter-Industry Income Differentials*

Although the findings presented above are suggestive of a relationship between commitment and contract structure, they are not decisive because one could argue that the use of a training time variable to proxy for employee commitment confounds the pure commitment effect of specialized human capital with an unmeasured industry income effect. According to this argument, workers who are better trained (as a group) are also likely to have higher (group) earnings. This raises the possibility that the significance of INDSVP in our previous regressions may simply reflect across-industry differences in worker incomes, rather than differences in the degree of worker commitment[13]. We now address this issue directly.

Recall from our theoretical model that differences in worker commitment should have little or no effect on coverage levels in firms offering more than a single insurance plan. This follows from the ability of multiple plan firms to experience rate their pools, thereby reducing the need to distort coverage levels. As a result, the theory offers the specific prediction that multiple plan firms should have high average coverage levels, with no increase in coverage attributable to increases in worker commitment (INDSVP), while in single plan firms, coverage levels should start out low and rise with the degree of commitment (INDSVP). On the other hand, if INDSVP measures only an industry income effect, it should not exhibit a significantly different effect on coverage levels in single vs. multiple plan firms. Thus, it is possible to determine the extent to which INDSVP captures differences in worker commitment by comparing its impact on coverage levels in single vs. multiple plan firms.

To discriminate between the "commitment" and "group income" hypotheses, we estimated the following regression on a merged sample of single and multiple plan firms:

$$
\begin{aligned}
MAXCOV_i = \beta_0 + \beta_1 \, INDSVP_i + \beta_2 \, ONEPLAN_i \\
+ \beta_3 \, (ONEPLAN_i * INDSVP_i) + \gamma' \mathbf{x}_i + \varepsilon_i
\end{aligned}
\tag{19}
$$

where $ONEPLAN_i$ takes the value one if the respondent's firm offers a single health insurance plan, and zero otherwise, and all other variables are as defined previously. As before, we consider two samples, corresponding to the two sets of explanatory variables used previously. Descriptive statistics for the merged samples are provided in Table 5. Note that the restrictions which defined the base sample for the single plan regressions apply here as well.

In terms of (19), a discriminatory test of the commitment and group income hypotheses can be implemented through a comparison of the different slope and intercept terms associated with single- and multiple-plan firms. For example, our prediction that multiple plan firms should have high average coverage levels (irrespective of worker commitment) can be tested by examining whether there is a significant difference between the intercept terms associated with single vs. multiple plan firms. Because these intercepts are given by $(\beta_0 + \beta_2)$ and β_0 respectively, a standard t-test of $\beta_2 = 0$

suffices to identify a significant difference between the two. Similarly, the hypothesis that INDSVP increases coverage levels more in single plan firms than in multiple plan firms can be tested through a t-test of $\beta_3 = 0$.

OLS estimation results for (19), which are reported in Table 6, confirm all of the predictions of the commitment hypothesis: INDSVP exerts a large and significant influence on coverage levels in single, but not multiple, plan firms; and as predicted, multiple plan firms have higher average coverage levels (as reflected in a significantly larger intercept term)[14]. Taken together, these results provide strong evidence that INDSVP *does* capture differences in worker commitment across firms. Moreover, these differences are reflected in the structure of observed contracts in the way predicted by our theory. We conclude that the ability to precommit is an important factor in the design of contractual agreements, and that limitations on commitment can result in substantial losses in efficiency.

IV. Evidence on Insurance Provision

In the previous section, we presented evidence that variations in the ability of insureds to commit play a significant role in limiting the total amount of insurance coverage provided under employment-based health insurance contracts. The estimates presented in section III were conditional on there being a sufficient level of commitment present to warrant the provision of *some* level of coverage. In this section, we examine the provision decision itself, presenting evidence that the ability to precommit is an important determinant of the overall availability of health insurance. That this is likely to be the case is suggested by Theorem 2, which demonstrates that a minimum level of commitment (represented by an amount of job lock above the threshold K_2) is required before employer-sponsored health insurance is feasable.

The evidence we develop concerning the incidence of employer-sponsored insurance provides an indirect test of a conjecture put forward by Cochrane (1995) that commitment problems underlie the effective absence of a market for *long-term* health insurance. Cochrane argues that it is precisely the inability of insureds to precommit to remain with a particular insurer which has prevented insurers from providing long-term health insurance to individuals[15]. Cochrane argues that legal impediments to insured commitment are particularly detrimental to the insurability of chronic medical conditions, such as cancer and heart disease, for which losses are highly correlated over time.

To gain some perspective on the role of incomplete commitment in the individual health insurance market, we examine whether variations in commitment have a significant impact on the provision of insurance amongst employment-based groups. If limitations on commitment were a principal cause of the absence of long-term health insurance, then one would expect that the degree of commitment present in employment-based pools should be a key determinant of whether or not firms offer health insurance. In addition, the ability to offer coverage for chronic illnesses should require still higher levels of worker commitment.

A. *Empirical Specification*

The nature of the above hypothesis suggests the use of an ordered probit specification:

$$INSUR_i = \begin{cases} 2 & if \quad y_i^* > \mu \\ 1 & if \quad 0 \le y_i^* < \mu \\ 0 & if \quad y_i^* < 0 \end{cases} \tag{20}$$

where $INSUR_i$ is an indicator variables taking the value zero if the respondent does not have access to employment-based insurance, the value one if the respondent has employment-based insurance, (but without coverage for chronic conditions), and the value two if the respondent has employment-based insurance which includes coverage for chronic conditions, and y_i^* is a latent index of the "net benefit" of providing health insurance, which is a function of a vector of observable variables (Z_i) and a normally distributed error term (ε_i):

$$y_i^* = Z_i\beta + \varepsilon_i \quad . \tag{21}$$

B. *The Data*

We estimated (20) using a sample of 8191 employed persons with definitive insurance classification from the NMES Household Survey.[16] Unfortunately, since the Household Survey only indicates whether a worker actually *holds* an employment-based policy, in many cases we had to make an *a priori* judgment regarding the likelihood a person was *offered* employment-based coverage based on their reported insurance status. In doing so, we decided to proceed conservatively and to eliminate from the sample anyone whose access to employer-sponsored insurance could not be deduced with a high degree of confidence. Although this resulted in the deletion of a fairly large number of observations, it leaves one with a clear comparison between those who were offered coverage and those who (almost certainly) were not.

Individuals are classified as *having access* ($INSUR_i = 1$ in equation (20)) if they reported holding an employer (or union) sponsored plan. Persons who were either uninsured, or reported holding a nongroup plan, were classified as *not having access* to employer-sponsored insurance ($INSUR_i = 0$ in equation (20)). Note that anyone who reported holding both an employment-based policy and a nongroup policy were classified in the first category. Deleted from the sample were all Medicare recipients, CHAMPUS and CHAMPVA beneficiaries, and holders of "other group" policies. We also deleted anyone who reported having coverage from, but not *holding*, an employment-based policy. Finally, we deleted all persons who received coverage from Medicaid or other forms of public assistance, as well as a small number of persons who showed up as multiple records.

One difficulty with implementing an estimation of relationship (20) is that it is often hard to determine whether certain types of health insurance should be thought of as providing coverage for "chronic" conditions. To get around this problem, we focus on three medical conditions (alcoholism, substance abuse, and mental illness) which are almost universally viewed as chronic in nature. Thus, a respondent is classified as having coverage for a chronic condition ($INSUR_i = 2$ in equation (20)) if their policy covers treatment for alcoholism, drug abuse, or mental health. The exact definition of the dependent variable, along with its sample proportions, are provided in Table 7.

To control for influences other than commitment which might influence the probability that a given worker has employment-based health insurance, we include as controls a number of individual level variables from the Household Survey which may be indicative of the propensities of various workers to self-select into firms offering health insurance. These include the respondent's sex, age, race, family size, education, hourly wage, job tenure, and union status. In addition, we also include an estimate of the number of persons employed at the respondent's workplace[17] to investigate the extent to which scale considerations enter into the decision to provide health insurance. Exact definitions and summary statistics for these variables are provided in Tables 8 and 9.

C. *Empirical Results*

Ordered probit estimation results for (20) are reported in Table 10. Across a variety of specifications (only one of which is reported) INDSVP demonstrates a significant influence on both the incidence of employment-based health insurance and, conditional on such insurance being available, on the probability that coverage for chronic conditions is present as well. These effects remained after controlling for the influence of sex, age, race, family size, education, wages, job tenure, and firm size[18].

These results provide support for Theorem 2 (i), which predicts that a minimal level of worker commitment is required before firms can even provide health insurance. Our results also support the general view, first espoused by Cochrane (1995), that limitations on insured commitment are a significant impediment to the provision of health insurance for chronic conditions to individuals.

To illustrate this point, we simulated the probabilities of both obtaining employment-based health insurance, and of having coverage for chronic conditions, as the degree of worker precommitment (INDSVP) varies over its natural range. In doing so, we considered two specifications. The first corresponds to the traditional simulation exercise in which all explanatory variables, except the variable of interest, are held at their sample means. In addition, to more closely approximate conditions in the individual health insurance market, we also simulated the effects of INDSVP in firms having fewer than 10 employees (with all other variables held at their mean values).

The results of these experiments, which are reported in Tables 11 and 12, indicate that commitment has a quantitatively large impact on both the likelihood an individual will have access to employment-based insurance and the probability that coverage will extend to chronic conditions. Moreover, these effects become significantly more pronounced when the scale advantages of employer-sponsorship are netted out. Focusing on firms with fewer than 10 employees, we find that only about one third of workers in "low commitment" employee groups have access to health insurance, while over 80 percent of workers in "high commitment" groups do. Table 12 demonstrates an analogous relationship for the decision to insure chronic illnesses. Taken together, the findings presented in this section provide strong evidence that limitations on insured commitment play an important role in the absence of health insurance for chronic, long-term, conditions

V. Conclusions

This paper provided empirical documentation supporting the importance of precommitment in the design of optimal contractual agreements. Using data on actual health insurance contracts, we have shown that, when such insurance is bundled with employment, frictions in mobility between alternative jobs allow workers to commit, credibly, to remain in the insurance pool as their publicly-observable health status evolves. We find that the coverage limitations associated with employer-sponsored health insurance increase as the level of insured job lock declines, which is consistent with the predictions of the theoretical model. Moreover, we find evidence consistent with Cochrane's (1995) conjecture that precommitment is an important determinant of the availability of insurance for chronic, long-term, health problems.

APPENDIX

The complete definition of SVP contained in the DOT is as follows:

> This [SVP] represents the amount of time required to learn the techniques, acquire information, and develop the facility needed for average performance in a specific worker-job situation. The training may be acquired in a school, work, military, institutional, or vocational environment. It does not include orientation training required of even every fully qualified worker to become accustomed to the special conditions of any new job. Specific vocational training includes training given in any of the following circumstances: (a) Vocational education (such as high school commercial or shop training, technical school, art school, and that part of college training which is organized around a specific vocational objective); (b) Apprentice training (for apprenticeable jobs only); (c) In-plant training (given by an employer in the form of organized classroom study); (d) On-the-job training (serving as learner or trainee on the job under the instruction of qualified worker); (e) Essential experience in other jobs (serving in less responsible jobs which lead to the higher grade job or serving in other jobs that qualify).

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TABLE 1 - Specific Vocational Preparation (SVP)

Value	Definition
1	Short demonstration.
2	Anything beyond a short demonstration up to and including 30 days.
3	Over 30 days up to and including 3 months.
4	Over 3 months up to and including 6 months.
5	Over 6 months up to and including 1 year.
6	Over 1 year up to and including 2 years.
7	Over 2 years up to and including 4 years.
8	Over 4 years up to and including 10 years.
9	Over 10 years.

TABLE 2 - Definitions of Variables

Variable	Definition
TWOPARTY	= 1 if policyholder carries two-party coverage = 0 otherwise
FAMILY	= 1 if policyholder carries family coverage = 0 otherwise
OTHCOV	= 1 if policyholder carries "other" coverage = 0 otherwise
SELFINS	= 1 if the policyholder's employer is completely self-insured = 0 otherwise
MIXED	= 1 if the policyholder's employer is partially self-insured = 0 otherwise
HMO	= 1 if coverage is received through an HMO = 0 otherwise
NONPROF	= 1 if the policyholder's employer is classified as a nonprofit organization = 0 otherwise
GOVT	= 1 if the policyholder's employer is a state or local government = 0 otherwise
OTHORG	= 1 if the policyholder's employer is classified as an "other" organization = 0 otherwise
SMALFRM	= 1 if the policyholder's employer has between 10 and 25 employees = 0 otherwise
MEDFRM	= 1 if the policyholder's employer has between 26 and 100 employees = 0 otherwise
BIGFRM	= 1 if the policyholder's employer has between 101 and 500 employees = 0 otherwise
HUGEFRM	= 1 if the policyholder's employer has more than 500 employees = 0 otherwise
MIXUNION	= 1 if the policyholder's employer is partially unionized = 0 otherwise
ALLUNION	= 1 if the policyholder's employer is fully unionized = 0 otherwise
INDSVP	= the average level of specific vocational preparation in the industry (firm) in which the policyholder is employed
ONEPLAN	= 1 if the policyholder's employer offers a single health insurance plan = 0 otherwise
ONESVP	= INDSVP if the policyholder's employer offers a single health insurance plan = 0 if the policyholder's employer offers multiple health insurance plans
PROP	= 1 if the policyholder's employer is a sole proprietorship = 0 otherwise
PARTNER	= 1 if the policyholder's employer is a partnership = 0 otherwise
PERCNTPT	= the percentage of workers in the policyholder's firm who are employed part-time
PERCLOW	= the percentage of workers in the policyholder's firm who earn less than or equal to $5.00 per hour

TABLE 3 - Summary Statistics - Single Plan Firms

	SAMPLE 1 (N = 1205)				SAMPLE 2 (N = 722)			
Variable	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
MAXCOV	641,821	969,094	750	25,000,000	670,799	1,174,277	750	25,000,000
TWOPARTY	0.047	0.212	0.000	1.000	0.053	0.223	0.000	1.000
FAMILY	0.544	0.498	0.000	1.000	0.579	0.494	0.000	1.000
OTHCOV	0.014	0.118	0.000	1.000	0.010	0.098	0.000	1.000
SELFINS	0.379	0.485	0.000	1.000	0.385	0.487	0.000	1.000
MIXED	0.020	0.140	0.000	1.000	0.008	0.091	0.000	1.000
HMO	0.007	0.081	0.000	1.000	0.004	0.064	0.000	1.000
NONPROF	0.114	0.318	0.000	1.000	0.000	0.000	0.000	0.000
GOVT	0.127	0.333	0.000	1.000	0.000	0.000	0.000	0.000
OTHORG	0.022	0.148	0.000	1.000	0.000	0.000	0.000	0.000
SMALFRM	0.124	0.330	0.000	1.000	0.148	0.356	0.000	1.000
MEDFRM	0.183	0.387	0.000	1.000	0.199	0.400	0.000	1.000
BIGFRM	0.249	0.433	0.000	1.000	0.211	0.408	0.000	1.000
HUGEFRM	0.377	0.485	0.000	1.000	0.359	0.480	0.000	1.000
MIXUNION	0.222	0.416	0.000	1.000	0.209	0.407	0.000	1.000
ALLUNION	0.010	0.100	0.000	1.000	0.007	0.083	0.000	1.000
INDSVP	5.147	0.768	3.111	7.092	5.037	0.808	3.111	7.092
PROP	-----	-----	-----	-----	0.082	0.274	0.000	1.000
PARTNER	-----	-----	-----	-----	0.057	0.232	0.000	1.000
PERCNTPT	-----	-----	-----	-----	0.083	0.160	0.000	1.000
PERCLOW	-----	-----	-----	-----	0.129	0.222	0.000	1.000

TABLE 4 - OLS Estimation Results
Single Plan Firms

Variable	Sample 1 (N = 1205)		Sample 2 (N = 722)	
	Coefficient	t-ratio	Coefficient	t-ratio
INTERCEPT	37,532	0.16	-203,153	-0.57
TWOPARTY	-108,665	-0.80	-172,304	-0.84
FAMILY	-37,264	-0.63	-50,455	-0.54
OTHCOV	-243,104	-1.01	-563,048	-1.24
SELFINS	-124,923	-1.84*	-216,867	-1.90*
MIXED	-88,237	-0.44	-175,033	-0.36
HMO	10,401	0.03	70,861	0.10
NONPROF	-97,605	-1.06	-----	-----
GOVT	-85,854	-0.98	-----	-----
OTHORG	-116,522	-0.61	-----	-----
SMALFRM	118,108	0.88	165,994	0.87
MEDFRM	173,389	1.37	240,374	1.32
BIGFRM	55,572	0.45	111,951	0.61
HUGEFRM	197,982	1.56	386,698	2.02**
MIXUNION	-155,629	-2.21**	-185,312	-1.61
ALLUNION	-324,760	-1.15	-401,480	-0.75
PROP	-----	-----	38,764	0.24
PARTNER	-----	-----	-88,712	-0.46
PERCNTPT	-----	-----	-209,011	-0.66
PERCLOW	-----	-----	100,307	0.42
INDSVP	118,456	3.11***	161,867	2.78***
R^2	.022		.029	
White Statistic	24.37[a]		16.57[b]	
LM Statistic	-0.93[c]		-1.04[c]	
Moulton SLM Statistic	-0.67[c]		-0.85[c]	
Observations	1205		722	

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.
a Asymptotically distributed as a chi-square with 110 degrees of freedom.
b Asymptotically distributed as a chi-square with 107 degrees of freedom.
c Asymptotically distributed as a standard normal.

TABLE 5 - Summary Statistics - Merged Sample

	SAMPLE 1 (N = 2012)				SAMPLE 2 (N = 1076)			
Variable	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
MAXCOV	606,667	853,623	500	25,000,000	631,963	1,052,656	750	25,000,000
TWOPARTY	0.055	0.228	0.000	1.000	0.058	0.233	0.000	1.000
FAMILY	0.551	0.497	0.000	1.000	0.585	0.493	0.000	1.000
OTHCOV	0.017	0.129	0.000	1.000	0.011	0.105	0.000	1.000
SELFINS	0.405	0.491	0.000	1.000	0.417	0.493	0.000	1.000
MIXED	0.040	0.197	0.000	1.000	0.023	0.151	0.000	1.000
HMO	0.015	0.123	0.000	1.000	0.008	0.091	0.000	1.000
NONPROF	0.118	0.323	0.000	1.000	0.000	0.000	0.000	0.000
GOVT	0.159	0.366	0.000	1.000	0.000	0.000	0.000	0.000
OTHORG	0.024	0.153	0.000	1.000	0.000	0.000	0.000	0.000
SMALFRM	0.085	0.279	0.000	1.000	0.113	0.317	0.000	1.000
MEDFRM	0.141	0.348	0.000	1.000	0.166	0.373	0.000	1.000
BIGFRM	0.212	0.409	0.000	1.000	0.196	0.397	0.000	1.000
HUGEFRM	0.517	0.500	0.000	1.000	0.464	0.499	0.000	1.000
MIXUNION	0.323	0.468	0.000	1.000	0.289	0.454	0.000	1.000
ALLUNION	0.010	0.102	0.000	1.000	0.007	0.086	0.000	1.000
INDSVP	5.224	0.743	3.111	7.092	5.114	0.793	3.111	7.092
ONEPLAN	0.599	0.490	0.000	1.000	0.671	0.470	0.000	1.000
PROP	-----	-----	-----	-----	0.075	0.264	0.000	1.000
PARTNER	-----	-----	-----	-----	0.051	0.220	0.000	1.000
PERCNTPT	-----	-----	-----	-----	0.081	0.158	0.000	1.000
PERCLOW	-----	-----	-----	-----	0.112	0.214	0.000	1.000

TABLE 6 - OLS Estimation Results
Single vs. Multiple Plan Firms

Variable	Sample 1 (N = 2012)		Sample 2 (N = 1076)	
	Coefficient	t-ratio	Coefficient	t-ratio
INTERCEPT	654,606	2.56***	704,855	1.57
TWOPARTY	-66,250	-0.76	-87,545	-0.61
FAMILY	-24,286	-0.60	4351	0.06
OTHCOV	-67,271	-0.45	-280,233	-0.90
SELFINS	-100,006	-2.24**	-129,628	-1.64*
MIXED	-64,373	-0.65	-93,867	-0.43
HMO	39,021	0.25	-101,114	-0.28
NONPROF	-15,192	-0.25	-----	-----
GOVT	-51,056	-0.92	-----	-----
OTHORG	-95,613	-0.76	-----	-----
SMALFRM	109,789	0.99	182,372	1.13
MEDFRM	180,564	1.75*	278,120	1.81*
BIGFRM	69,082	0.69	142,996	0.94
HUGEFRM	118,542	1.19	290,034	1.88*
MIXUNION	-147,531	-3.33***	-232,812	-2.96***
ALLUNION	-103,627	-0.55	-222,427	-0.59
PROP	-----	-----	-29,267	-0.24
PARTNER	-----	-----	-84,822	-0.57
PERCNTPT	-----	-----	-209,199	-0.89
PERCLOW	-----	-----	118,879	0.66
INDSVP	-11,474	-0.26	-40,176	-0.52
ONEPLAN	-565,829	-1.97**	-917,238	-1.91*
ONEPLAN*INDSVP	117,326	2.17**	195,408	2.13**
R^2	.022		.031	
White Statistic	43.94[a]		29.92[b]	
LM Statistic	-1.03[c]		-1.43[c]	
Moulton SLM Statistic	-0.79[c]		-1.22[c]	
Observations	2012		1076	

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.
a Asymptotically distributed as a chi-square with 151 degrees of freedom.
b Asymptotically distributed as a chi-square with 155 degrees of freedom.
c Asymptotically distributed as a standard normal.

TABLE 7 - Dependent Variable for Ordered Probit Model

Insurance Category (INSUR)	Frequency (N = 8191)	Sample Percentage
= 2 if respondent has employment-based health insurance with coverage for a chronic condition (alcohol abuse, drug abuse, or mental health)	1302	15.9%
= 1 if respondent has employment-based health insurance without coverage for a chronic condition	5028	61.4%
= 0 if respondent does not have employment-based health insurance	1861	22.7%

TABLE 8 - Definitions of Variables for Ordered Probit Model

Variable	Definition
FEMALE	= 1 if the respondent is female = 0 otherwise
BLACK	= 1 if the respondent is black = 0 otherwise
HISPANIC	= 1 if the respondent is Hispanic = 0 otherwise
AGE	= the respondent's age at the end of 1987
FAMSIZE	= the size of the respondent's family at the end of 1987
YRSEDUC	= the respondent's years of education
WAGE	= the respondent's hourly wage rate
TENURE	= the number of years the respondent has worked for their current employer
UNION	= 1 if the respondent belongs to a labor union = 0 otherwise
SMALFRM	= 1 if the estimated workforce at the respondent's workplace is between 10 and 25 = 0 otherwise
MEDFRM	= 1 if the estimated workforce at the respondent's workplace is between 26 and 100 = 0 otherwise
BIGFRM	= 1 if the estimated workforce at the respondent's workplace is between 101 and 500 = 0 otherwise
HUGEFRM	= 1 if the estimated workforce at the respondent's workplace is greater than 500 = 0 otherwise
INDSVP	= the average level of specific vocational preparation in the in the industry (firm) in which the respondent is employed

TABLE 9 - Summary Statistics for Ordered Probit Model

(N = 8191)

Variable	Mean	Std. Dev.	Min.	Max.
FEMALE	0.435	0.496	0.000	1.000
BLACK	0.211	0.408	0.000	1.000
HISPANIC	0.111	0.314	0.000	1.000
AGE	36.891	11.632	17.000	75.000
FAMSIZE	3.131	1.664	1.000	13.000
YRSEDUC	12.756	2.835	0.000	18.000
WAGE	9.416	6.153	1.010	192.310
TENURE	6.572	7.863	0.000	47.000
UNION	0.196	0.397	0.000	1.000
SMALFRM	0.167	0.373	0.000	1.000
MEDFRM	0.248	0.432	0.000	1.000
BIGFRM	0.214	0.410	0.000	1.000
HUGEFRM	0.200	0.400	0.000	1.000
INDSVP	5.146	0.764	2.738	7.037

TABLE 10 - Ordered Probit Estimation Results

Variable	Coefficient	t-ratio
INTERCEPT	-3.639	-29.15***
FEMALE	-0.038	-1.36
BLACK	-0.140	-4.15***
HISPANIC	-0.205	-4.55***
AGE	0.002	1.36
FAMSIZE	-0.032	-3.94***
YRSEDUC	0.039	7.22***
WAGE	0.019	7.88***
TENURE	0.028	13.24***
UNION	0.362	10.30***
SMALFRM	0.479	10.39***
MEDFRM	0.693	16.11***
BIGFRM	1.051	23.24***
HUGEFRM	1.078	23.03***
INDSVP	0.179	9.63***
Threshold Parameter	2.099	83.29***
Log-likelihood (unrestricted)	-6478.17	-----
Log-likelihood (all slope coefficients = 0)	-7606.14	-----
Likelihood ratio statistic (all slope coefficients = 0)	2255.92***	-----
Observations	8191	-----

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

TABLE 11 - Effect of INDSVP on the Probability of Employment-Based Coverage

INDSVP	Other Explanatory Variables	Predicted Probability of Coverage	Other Explanatory Variables	Predicted Probability of Coverage
1	Fixed at Sample Means	.567	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.300
3	Fixed at Sample Means	.700	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.434
5	Fixed at Sample Means	.812	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.576
7	Fixed at Sample Means	.893	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.709
9	Fixed at Sample Means	.945	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.818

TABLE 12 - Effect of INDSVP on the Probability of Coverage for Chronic Conditions

INDSVP	Other Explanatory Variables	Predicted Probability of Coverage	Other Explanatory Variables	Predicted Probability of Coverage
1	Fixed at Sample Means	.047	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.014
3	Fixed at Sample Means	.083	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.027
5	Fixed at Sample Means	.138	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.049
7	Fixed at Sample Means	.219	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.086
9	Fixed at Sample Means	.327	Firm Size = Tiny; All Other Variables Fixed at Sample Means	.143

[1] In addition to public learning about an individual's type, Palfrey and Spatt also permit the insured to take an observable action ("care") that affects the probability of illness. They find that, when competitive markets preclude cross—subsidization, of the diffe3rent classes of insureds, individuals may take inefficiently *high* levels of care.

[2] To mitigate this problem, Cochrane proposes the use of a medical savings account into which consumers who find out that they are healthier than average pay an amount equal to the resulting expected decline in their future health care expenditures, while those receiving adverse health news receive a lump sum subsidy from the fund equivalent to the present value of their increased health care costs. As long as theses severance payments are enforceable, the result is that all consumer pay the same present value of premiums and, at each point in time (after the lump sum payment shave been implemented), the insureds face a premium equal to their expected actuarial cost.

[3] Pensions and other forms of deferred compensation have also been cited as an important source of employment stability.

[4] See Shaw (1984).

[5] See Neal (1995).

[6] One objection to this line of reasoning is that workers change employers all the time, so the costs of doing so must not be very high. However, it is important to remember that this observation is colored by a form of selection bias; namely, that the set of workers who voluntarily changed jobs in a given period was, *by definition*, the subset of the population for whom switching was most advantageous. Furthermore, the observation that workers change jobs "all the time" does not withstand serious scrutiny. Using data from the Current Population Survey, Hall (1982) finds that job durations are longer than is commonly believed, with a significant fraction of the population enjoying near lifetime employment (see Hall, 1982, pp. 716-717, 720-722). More recently, Diebold, Neumark, and Polsky (1994) reach similar conclusions using data from the 1980s (see Diebold, Neumark, and Polsky, 1994, pp. 17-18). In our view, it is precisely this stability which has made the employment relationship a useful vehicle for forming and maintaining insurable pools.

[7] The DOT provides information on the physical demands, environmental conditions, and educational and vocational preparation associated with each of 12,000 occupations.

[8] It is not clear from the definition whether SVP captures specialization at the firm, occupation, or industry level. Because SVP is imputed to occupations, it is tempting to conclude that it should be thought of as a measure of specialization at the occupation level. On the other hand, it can be argued that what is actually measured is the degree of firm (or industry) - specific human capital *associated* with a given occupation. For our

purposes, the precise type of specificity captured is unimportant; specialization at any level is likely to increase the cost of switching employers.

[9] Because the Household Survey occupation codes are based on the occupation codes used in the 1980 Census, it was possible to impute an SVP value to each worker in the Household Survey through a series of links to other occupation codes. The data acquired from the DOT provided a link from each DOT code (roughly 12,000) to the Standard Occupational Classification (SOC) codes used by the Commerce Department. Because the DOT provides a finer classification of occupations, there were often multiple DOT codes associated with each SOC code. To obtain a unique SVP value for each SOC code, we took a simple average over all the DOT codes associated with a particular SOC code. We then repeated this process, averaging over the SOC codes associated with each Census code. This lead to the assignment of an SVP value for almost every Census occupation code (approximately 500).

[10] We focus on major, as opposed to basic, medical coverage because the former often provides coverage after the benefits payable under basic medical plans have been exhausted. As a result, the bulk of the cost of insuring long-term illnesses will typically fall on the major medical portion of an insured's policy. Recall that it is precisely these types of chronic conditions which require precommitment to insure. In addition, many employers no longer offer separate basic and major medical plans, but instead offer a single comprehensive package in which all coverage is provided under major medical (Beam and McFadden, pp. 161-199).

[11] The SLM test has been shown by Moulton and Randolph (1989) to outperform the LM test in finite samples. Note that both tests are cast in terms of the variance of the group level error component, and as such, should be conducted as one-tailed tests.

[12] We have deliberately excluded other features of health insurance contracts, (such as premiums, deductibles, and copayments), which are likely to be jointly determined with the level of coverage. The omission of these variables would be problematic if our focus was on the endogenous variables per se, (as would be the case if we were interested in estimating the premium-deductible schedule, for example). However, because our interest is solely in the relationship between coverage levels and INDSVP, (which is itself, clearly exogenous), there is no need to estimate a structural model. Instead, unbiased estimates of the parameters of interest can be obtained from simple reduced form regressions.

[13] This assumes, of course, that health insurance is a normal good.

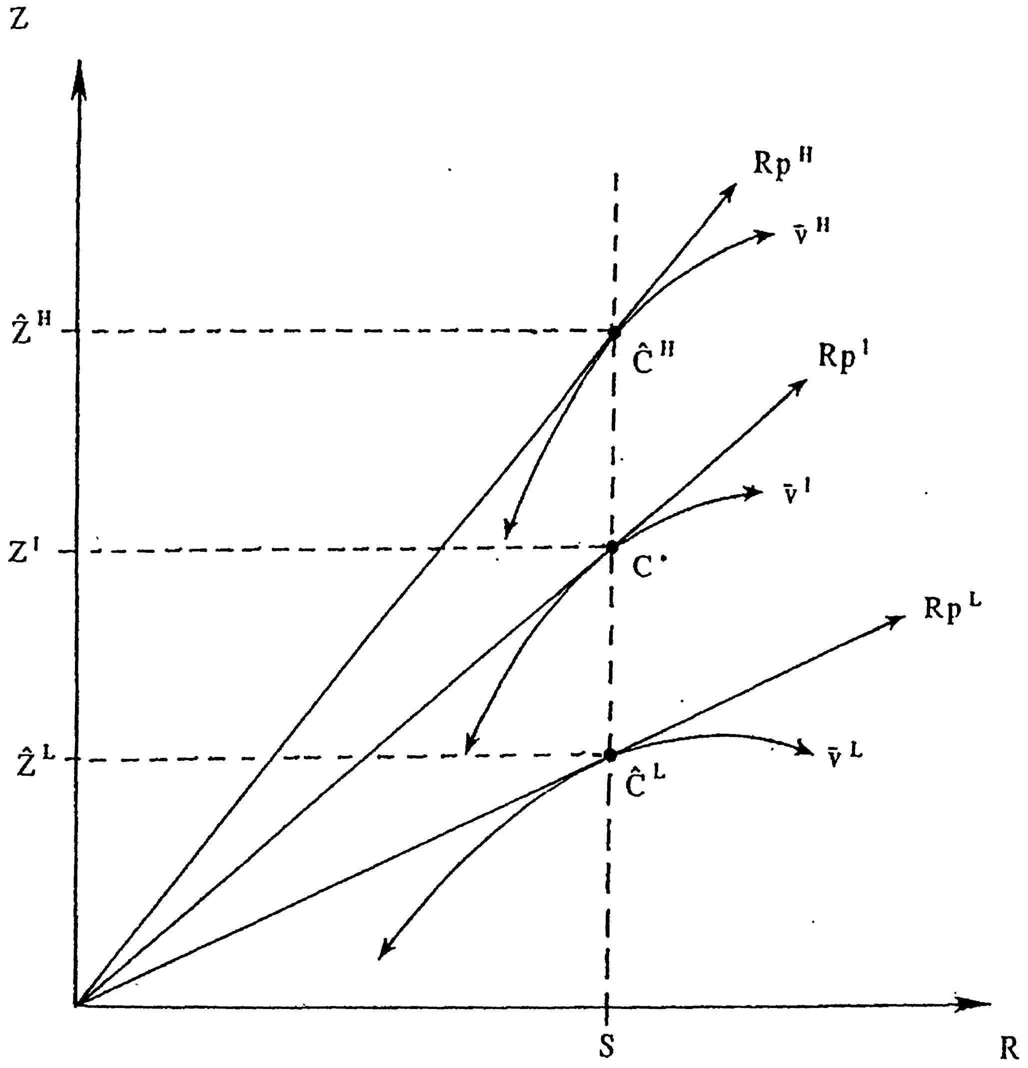
[14] As in our single plan regressions, there is no evidence of either heteroskedasticity or within-group error correlation.

[15] Instead, those who purchase health insurance in the individual market are faced with the prospect of sizable increases in premiums, or the denial of coverage altogether, following the occurrence of a long-term illness.

[16] Note that HIPS variables cannot be used as explanatory variables in (20) because HIPS data were collected only for those respondents in the Household Survey who presently have health insurance.

[17] Note that this variable differs in two ways from the employer size variable used in the coverage regressions: first, it pertains only to the number of employees at the respondent's workplace, and not to the total number of workers employed by their firm; and second, it provides only an *estimate* of the actual number.

[18] Interestingly, we find that the decision to offer health insurance to employment-based groups is strongly related to the size of the group, evidence which is consistent with previous findings concerning economies of scale in insurance provision.


Z
$\hat{Z}^H$
Z^I
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Rp^I
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C^*
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S
R

Figure 1

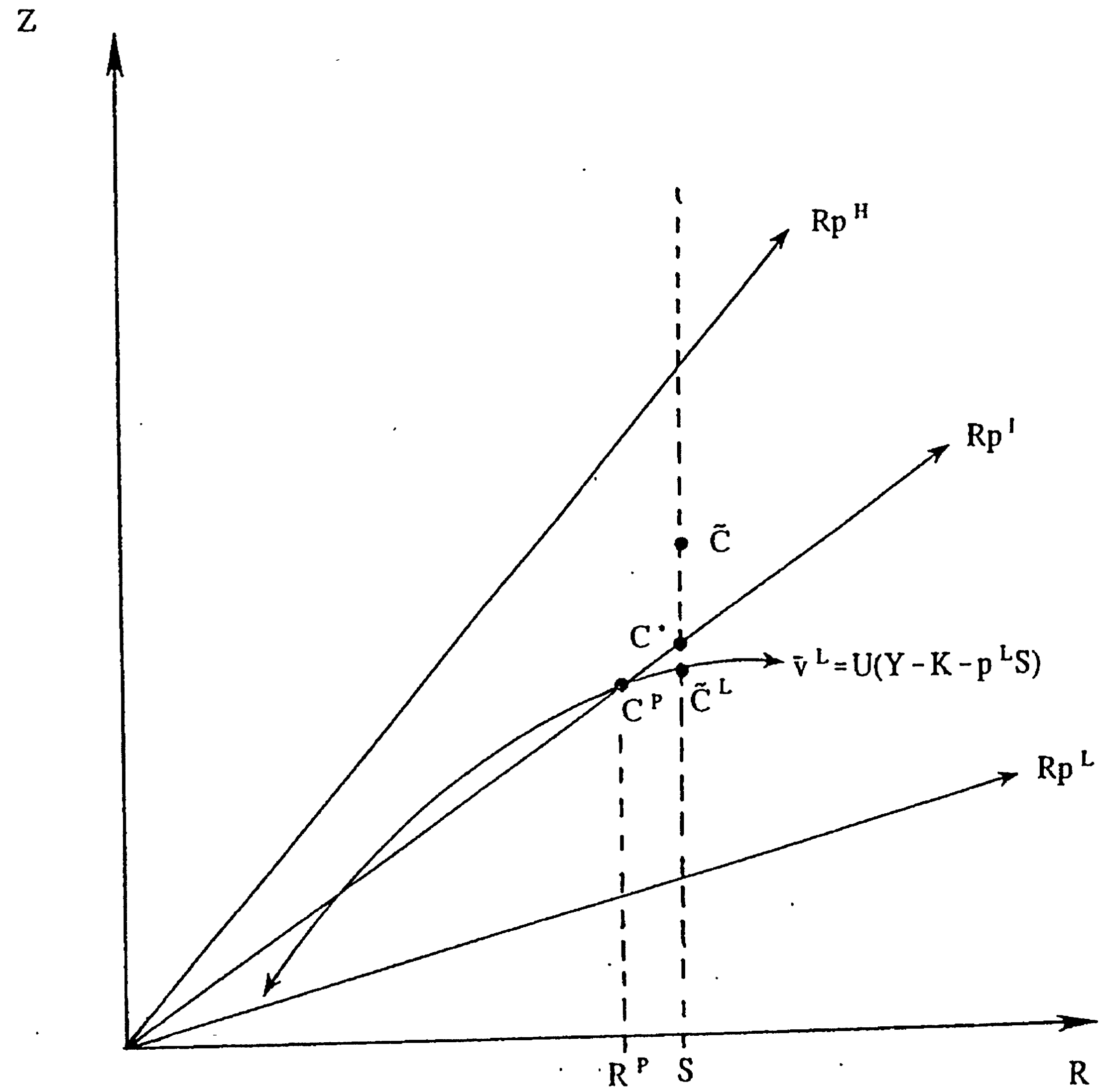

Figure 2