# Contracting with Limited Commitment: Evidence from Employment-Based Health Insurance Contracts

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## Abstract

When an individual's health status is observable, but evolving over time, the key to maintaining a successful health insurance arrangement is to have the healthier members of the group cross-subsidize those who experience adverse health outcomes. We argue that impediments to worker mobility may serve to mitigate the attrition of healthy individuals from employer-sponsored insurance pools, thereby creating a de facto commitment mechanism that allows for more complete insurance of health risks than would be possible in the absence of such frictions. Using data on health insurance contracts obtained from the 1987 National Medical Expenditure Survey, we find that the quantity of insurance provided, as measured by lifetime limits on benefits and annual stop-loss amounts, is positively related to the degree of worker commitment. These results illustrate the importance of commitment in the design of long-term contracts, and provide an additional rationale for the practice of bundling health insurance with employment.

*"Shaneen and Tom Wahl were paying $417 a month for health insurance when Mrs. Wahl was diagnosed with breast cancer in 1996. Their premiums began rising steadily, and by August 2000, the Wahls were told that their new rate would be $1,881 a month. Mrs. Wahl, whose cancer is in remission, tried to find out why. Unsatisfied with answers they got on the phone, the…couple visited the…offices of the insurer. There…an executive explained why her premium was soaring: 'because of your dread disease.' It's called re-underwriting.*

*A key challenge in individual health insurance is keeping the healthier people enrolled. Their premiums are needed to subsidize those who get sick. The problem, under the traditional approach, is that the healthiest tend to drop out as rising medical costs gradually drive up premiums…. Advocates of re-underwriting argue that because it gives smaller rate increases to the healthy, it keeps more of them enrolled and paying premiums…"*

Chad Terhune, *Wall Street Journal*, April 9, 2002

## 1. Introduction

The recent debate over the use of annual re-underwriting in the context of individual health insurance policies highlights the difficulties that insurers face when attempting to craft a stable insurance pool. In a setting where an individual's health status is observable, but evolving over time, the key to maintaining a successful insurance arrangement is to have healthier members of the group commit to cross subsidize members who experience adverse health outcomes. In the absence of a precommitment mechanism, however, those who turn out to be healthier than average may find it advantageous to leave the risk pool, and to purchase alternative coverage at a premium that more accurately reflects their own, observable, health status.[1] This erodes the actuarial integrity of the pool and, consequently, the ability of insurers to offer insurance against both the financial losses associated with a particular illness episode, and the classification risk that results when insurance premiums are adjusted to reflect changes in one's health status over time.

This paper examines a theoretical model of insurance contract design in which impediments to worker mobility may serve to mitigate the attrition of healthy individuals from employer-sponsored insurance pools, thereby creating a de-facto commitment mechanism that allows for more complete insurance of health risks than would be possible in the absence of such frictions. We characterize optimal health insurance contracts in an environment where a worker's evolving health status is publicly observable, and in which employees vary in the transactions costs that they must incur when switching to an alternative employer. Using data on employment-based health 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 the design of health insurance contracts.

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). A recent article by Cardon and Hendel (2001), however, finds no evidence of adverse selection in health insurance markets and suggests instead that the lack of commitment in long-term contracts examined by Cochrane (1995) may be a more relevant source of market failure in health insurance settings. Accordingly, we consider a full information model in which insureds are initially identical but anticipate receiving a public signal that will provide information about their expected future health care costs. As a consequence, the risk-averse purchasers of health insurance face two potential sources of uncertainty: the *financial loss* associated with adverse health outcomes, and the *classification risk* that results when their future 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 package provides full insurance against both types of uncertainty, the cross-subsidy from low- to high-risk individuals in the future, 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 others have noted (Cochrane 1995; Pauly, Kunreuther, and Hirth 1995), it is this inability of insureds to precommit to remain in the pool in light of favorable information on health status that provides an 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 that mitigate the erosion of the insurance pool caused by the departure of lower-risk individuals. In an environment where employer-sponsored health insurance is the norm, one of the largest impediments to insured mobility is the cost of switching jobs. To the extent that health insurance is bundled with employment, any frictions associated with employee mobility across occupations or employers necessarily translate into a de-facto commitment to one's employer, which results in a more stable and, hence insurable, risk pool. Thus, the existence of frictions that impede worker mobility between alternative employments 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 with non-group insurance (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 1994).

The role of precommitment in the design of efficient multi-period contracts has received increasing attention in the literature.[3] The most germane for this study is a recent paper by Hendel and Lizzeri (forthcoming) who, in the context of life insurance, examine the use of "front loaded" premiums as a mechanism through which insureds can commit credibly to remain in the insurance pool. Theirs is a model of symmetric information in which the purchasers of insurance may face classification risk based on their evolving actuarial status, and in which those who turn out to have a lower risk of mortality may, in the absence of precommitment, exit the life insurance pool. While the prepayment of premiums may be an effective tool to "lock-in" customers in life insurance, Cutler and Zeckhauser (2000) note that it is less likely to provide a solution to the commitment problem in health insurance settings due to the greater complexity of that market.[4] Thus, health insurers must use other commitment devices—such as employer sponsorship of health plans—to craft stable insurance pools.

The paper proceeds as follows. In the next section we examine a 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. Our model offers several predictions concerning the relationship between these switching costs, which we term "job attachment," and the amount of insurance coverage available through employment-based groups. We find that when employers offer the same contract to all of their workers, the optimal contract exhibits a coverage limitation that is inversely proportional to the amount of job attachment present in the firm. In addition, if employers are able to offer multiple contracts that induce self-selection by insureds, the contracts exhibit more complete coverage of medical expenditures, albeit at premiums that partially reflect the health status of plan participants.

Section three presents empirical tests of the model's predictions using data on health insurance contracts obtained from the 1987 National Medical Expenditure Survey conducted by the U.S. Department of Health and Human Services, matched to proxies for job attachment from the 1977 *Dictionary of Occupational Titles* (U.S. Department of Labor 1981). Consistent with the predictions of our model, we find that the contracts associated with firms who offer a single health insurance policy exhibit coverage limitations that are decreasing in job attachment while firms offering multiple policies have higher levels of coverage which are less sensitive to job attachment. A final section contains concluding remarks.

## 2. Theoretical Framework

We consider an environment in which a continuum of individuals face the financial risk associated with becoming ill at some future date. All of the agents are assumed to be identical initially and have the same probability, $\overline{p}$, of sickness. Each agent also anticipates receiving publicly observable information about her own health status prior to the state in which illness may occur. Accordingly, an individual realizes that with probability $\lambda$ $(1-\lambda)$ she will turn out to be a high (low) risk with the probability $p^H$ ($p^L$) of suffering illness, where $1 > p^H > p^L > 0$ and $\overline{p} \equiv \lambda p^H + (1-\lambda) p^L$. Individual consumers have an income *Y* and, in the event of sickness, suffer the financial loss *S*. For the purposes of this model, we assume that workers obtain a health benefits package at the time they become employed, but prior to receiving the information on their health status. This package may consist of either a single insurance contract or a menu of potential insurance choices. Prior to becoming ill, however, workers obtain information on their health status, which may affect their incentives to remain in one of the plans offered by their employer, or to select alternative options in cases where multi-plan benefit packages are offered. This sequence of events is illustrated with a timeline in Figure 1.

Each individual is assumed to be risk averse and to possess the von Neumann-Morgenstern utility function $U\left(W_j\right)$, where $W_j$ is the agent's wealth in the sick $\left(j=S\right)$ and not-sick $\left(j=N\right)$ states. An *insurance contract* $c \equiv \left\{Z,R\right\}$ consists of a premium, $Z$, paid by the insured individual prior to the state in which illness may occur, and a reimbursement, $R$, received by the insured in the event of illness. The expected utility of an agent who purchases the insurance contract *c*, and who has the probability of illness $p$, is written as

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

where $W_S \equiv Y - Z - S + R$, and $W_N \equiv Y - Z$. Since public information regarding each agent's type will be available prior to the period in which illness may occur, the information structure of the model permits individuals to be treated differently depending on their publicly-known types. Letting $c^i = \left\{Z^i, R^i\right\}$ denote the contract associated with an individual whose observed health status indicates her to be a type $i \in \left\{H,L\right\}$, a *health insurance benefits package* $C \equiv \left\{c^H, c^L\right\}$ results in an expected utility to an agent (prior to obtaining health status information) of

$$V\left(C\right) \equiv \lambda v\left(c^H; p^H\right) + \left(1-\lambda\right)v\left(c^L; p^L\right). \tag{2}$$

Since we assume that insurance firms are risk-neutral, we may write the profit associated with the offering of package $C$ as

$$\Pi(C) \equiv \lambda\pi(c^H; p^H) + (1-\lambda)\pi(c^L; p^L) \tag{3}$$

where the profit earned on an individual of type $i$ is $\pi(c^i; p^i) \equiv Z^i - p^i R^i$.

### A. Spot Markets and Efficient Benefit Packages

Before proceeding, we consider two benchmark cases. The first is the equilibrium that would occur in the *spot market* were insurance not bundled with employment, and workers were to purchase actuarially fair insurance after their health status had been observed. 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 each $i \in \{H, L\}$. While the resulting contract provides full insurance against the financial loss generated by an illness, so $R^i = S$ for each $i$, the insured is completely exposed to the classification risk associated with alternative health outcomes through the experience-rated (future) premiums, $Z^i$. The spot market contracts are depicted in Figure 2, where the insured receives $\hat{c}^H$ $\left(\hat{c}^L\right)$ if she is viewed to be high (low) risk.

As an alternative to the spot market, insureds could opt for a contract negotiated prior to receiving knowledge of their health status. Such a *full commitment* insurance package 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 2 and results in full coverage of all illness-related expenses $\left(R^H = R^L \equiv S\right)$ as well as a constant, ex ante actuarially fair, premium which does not depend on revealed health status $\left(Z^H = Z^L \equiv \overline{p}S\right)$. Although the full commitment package completely insulates insureds from both the financial risk of illness and the classification risk associated with observable changes in health status, the premium structure entails a cross-subsidy in which low-risk (high-risk) individuals pay a premium which is above (below) their publicly-known actuarially fair rate. Since the courts will not generally enforce long-term contracts against insurance purchasers, the low-risk ($p^L$-type) insureds may successfully renege on their promise to pay the pooling premium $\overline{p}S$ unless other mechanisms to enforce compliance can be implemented. [5]

**B. Partial Commitment Through Employment Bundling**

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 those individuals who find that they are low-risk from leaving the insurance pool. To investigate the extent to which such mobility frictions can serve as such a precommitment device, we assume that the low-risk workers can obtain full, and actuarially fair, health insurance after their health status is revealed, but in so doing must incur a switching cost, $K$, of moving to an alternative employer. Accordingly, the extent to which an insurance package can insure against classification risks is limited by the following feasibility constraint

$$v(c^L; p^L) \geq U(W_O) \tag{4}$$

where $W_0 = Y - K - p^L S$, which guarantees that a low-risk individual prefers their current insurance plan to the (actuarially fair, full insurance) outside option.

The existence of the worker attachment 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 requires that insurers offer the same contract to all insureds independently of their revealed health status, while the second permits insurers to design benefit packages which induce the members of the pool to voluntarily select insurance contracts that result in experience-rated premiums.[6]

**B.1 Single-Contract Benefit Packages.** One method of mitigating classification risk is by offering an insurance package that does not take into account each insured's evolving health status. Let $C^P$ denote a pooling package in which $c^H = c^L \equiv c^P$. The optimal pooling package consists of the contract $c^P \equiv \{Z^P, R^P\}$ that maximizes (2) subject to the zero profit (3) and feasibility (4) constraints. The contract associated with the optimal pooling package is formally characterized by Theorem 1 in the Appendix, and may be described with reference to Figure 3.

For sufficiently low levels of worker commitment $K$, the indifference curve associated with the feasibility constraint, $\overline{V}^L = U(W_O)$, lies everywhere below the pooling zero-profit locus, $\overline{p}R$. In such a setting, there is no pooling contract acceptable to low-risk individuals, so that a pooling package cannot be implemented. As $K$ becomes larger, resulting in higher degrees of employee commitment, eventually a critical value ($K_1$) is reached at which the indifference curve associated with the feasibility constraint intersects the pooling zero profit locus, resulting in a feasible pooling insurance package. Further increases in $K$ cause the contract $c^P$ to migrate up the zero-profit pooling locus, which is the situation depicted in Figure 3. As $K$ continues to increase, eventually the critical value $K_2$ is reached that permits the contract $C^*$ to be achieved. The implication is that firms offering a single health insurance plan should have coverage limitations that are decreasing in the degree of worker commitment, $K$.

**B.2 Multi-Contract Benefit Packages.** In some cases, firms may offer multiple choices to workers, who choose their preferred coverage from amongst the various insurance options. While employer-sponsored insurance plans rarely engage in mandatory experience rating of individual participants in an insurance pool,[7] some benefit designs provide the mechanism by which a form of voluntary experience rating can be effected through the offering of insurance contracts that induce self-selection by the insureds. Formally, an insurance package $\left\{c^H, c^L\right\}$ can discriminate based upon health status as long as

$$v\left(c^H; p^H\right) \geq v\left(c^L; p^H\right) \tag{5}$$

which requires that high-risk individuals prefer the insurance contract $c^H$ to $c^L$.[8] An *optimal multi-contract benefit package*, which is formally characterized in Theorem 2 of the Appendix, is a solution to the problem that selects $\left\{c^H, c^L\right\}$ to maximize (2) subject to the zero profit (3), feasibility (4) and self-selection (5) constraints.[9]

An optimal insurance package with multiple contracts is illustrated as $\left\{c^H, c^L\right\}$ in Figure 4, where the efficient pooling contract, $c^P$, has been included for comparison purposes. The locus $AC^*$ depicts the set of contracts sold to low-risk individuals which, when coupled with a full-coverage $\left(R^H = S\right)$ contract that is equally valued by high-risk individuals (so $v\left(c^H; p^H\right) = v\left(c^L; p^H\right)$), satisfies the aggregate zero profit constraint (3) with equality.[10] In the absence of the feasibility constraint imposed by the potential exit of low-risk individuals, the optimal contract would be the full commitment package $C^*$. When that feasibility constraint binds, however, the closest the insurer can get to the full-commitment contract is the multi-contract package depicted as $\left\{c^H, c^L\right\}$ in the figure, which exposes the low-risk insureds to a financial loss in the event of illness, and the high-risk insureds to some classification risk.

There are several aspects of the optimal multi-contract package that are worthy of note. First, $\left\{c^H, c^L\right\}$ represents a Pareto improvement over the pooling contract $c^P$, since high risks are strictly better off and low risks no worse.[11] Second, the multi-contract package provides some insurance against classification risk, although that protection is not complete due to the need to keep the low risks in the insurance pool.[12] Third, the optimal pooling contract always provides less coverage than do *either* of the contracts offered under the multi-contract package ($R^P < R^L < S = R^H$). Finally, since $c^P$ and $c^L$ both converge to $C^*$ as $K$ increases (and coincide with $C^*$ at $K_2$), the effect of increased worker commitment on coverage limitations is more pronounced in the optimal pooling package than in *either* of the contracts offered in the efficient multi-contract package. These results will be useful when we implement our empirical tests because they eliminate the need to identify which type of contract ($c^H$ or $c^L$) is held by survey respondents in firms that offer multi-contract insurance packages. We therefore have the following testable implication of the theory.

*Theorem 3:* Firms which offer a single insurance contract to their workforce should have lower levels of coverage that are more sensitive to worker commitment than firms which offer multi-contract packages. Thus, $R^p < R^i$ , and $\frac{dR^p}{dK} > \frac{dR^i}{dK}$ , for $i \in \{H, L\}$.

*Proof*: Contained in the Appendix.

The importance of job attachment $(K > 0)$ is that it permits a limited degree of cross subsidization from the low-risk to the high-risk customers to be implemented, without inducing the former to leave the insurance pool. This allows the health benefits package to provide some insurance against the classification risk faced by the insureds. In settings with no job attachment $(K = 0)$, there is no way of effecting such a subsidy, which is exactly the situation encountered in the individual heath insurance market and the reason that insured individuals end up exposed to classification risk. We now turn to an examination of the data.

## 3. Empirical Analysis

In the previous section we demonstrated that with limited commitment efficient health insurance contracts cannot fully insure both the financial risk associated with adverse health 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, workers are fully protected against classification risk, but remain uninsured against large losses due to the imposition of coverage limitations. Conversely, in firms offering multiple (separating) contracts, workers benefit from more generous loss insurance, but at the cost of receiving only partial insurance against the prospect of health-related increases in premiums. In practice, both distortions represent a major source of uninsured risk for consumers. As discussed in Cochrane (1995), the imposition of lifetime benefit caps and the lack of protection against health-related increases in premiums prevent agents from fully insuring themselves against the often catastrophic medical expenditures associated with chronic illnesses such as diabetes, cancer, or organ failure.

From an empirical perspective, the main testable implication of the model is the finding that the amount of insurance contained in employment-based health insurance contracts should be positively related to agents' ability to precommit to remain in a particular insurance pool. Because workers often must change jobs to obtain more favorable health insurance coverage, measures of the transactions costs associated with moving among employers can be used to proxy for insured commitment, thereby permitting a direct test of the effect of precommitment on the design of contractual agreements.

### A. Data

Our empirical analysis is conducted using detailed employment and health insurance data from two components of the 1987 National Medical Expenditure Survey (NMES): The Household Survey and the Health Insurance Plans Survey (HIPS), matched to proxies for job attachment from the 1977 *Dictionary of Occupational Titles*. The DOT provides information on the physical demands, environmental conditions, and educational and vocational preparation associated with each of 12,000 occupations.

The NMES Household Survey is a stratified random sample of the civilian non-institutionalized 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 individuals) were re-interviewed in the HIPS to obtain more detailed information on their type and level of coverage, premiums, deductibles, maximum benefits and covered illnesses. The 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.

The 1987 NMES is well suited for our purposes because it contains data from a period when managed care organizations were relatively minor players in the health insurance market (HMOs comprise only about 1 percent of our estimation samples). This is important because we need easily quantifiable measures of the overall amount of insurance contained in each contract, something that is considerably harder to measure when insurers and health care providers are vertically integrated.

One disadvantage of the HIPS data is that it yields a fairly small sample when one restricts attention to workers who hold employment-based health insurance polices who also meet other necessary criteria and provide complete data on all relevant variables. These small sample sizes limit the statistical power of our analysis, leading to less precision in our estimates that one would like. However, to our knowledge, the NMES/HIPS surveys are the only data sets available that would allow us to link measures of job attachment with detailed information on employment-based health insurance contracts. Given this limitation, our objective is to uncover consistent patterns in the data that are congruent with the predictions of our theoretical model. If the model's predictions are upheld across a variety of specifications and dependent variables, this should bolster confidence that the effects we find are genuine, despite their being less precisely estimated than would be possible with a larger sample.

### B. Measuring Commitment / Job Attachment

To test the predictions of our model, we require an observable proxy for the degree of job attachment present in firms. A number of impediments to job mobility have been identified in the literature, with particular attention being focused on human capital specialization, 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.[13] Alternatively, when skills are occupation- or industry-specific, the transactions costs of changing employers 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. In the latter case, the costs of moving among employers may be high even in the absence of firm-specific training.[14]

To proxy for job attachment (and by implication, the degree of commitment to a particular employment-based insurance pool), we use a measure from the DOT of the training specificity required in various occupations. The variable, known as "Specific Vocational Preparation" (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," and is based on the nine categories of vocational preparation shown in Table 1.[15] Note that SVP was not designed to measure the *general* educational requirements of jobs, because a separate variable ("General Educational Development") is provided for that purpose.

A proxy for worker-level job attachment was obtained by imputing an SVP value to each worker in the Household Survey. Because the Household Survey occupation codes are based on the occupation codes used in the 1980 Census (U.S. Department of Commerce, Bureau of the Census 1987), it was possible to impute an SVP value to each worker using the Commerce Department's Standard Occupational Classification (SOC) codes as a crosswalk.[16] The DOT provides a finer occupational classification than the Census, so there were often multiple SVP values associated with each Census occupation code. To impute a unique SVP value to each Census occupation code, we took a simple average of the SVP values associated with each Census occupation. A list of representative occupations for each SVP quartile is provided in Table 2.

The SVP variable, although perhaps not familiar to many readers, offers several advantages over other possible measures of job attachment. First, unlike job tenure or turnover, it is not a function of the quality of health insurance offered by the respondent's employer. Second, we are not using the actual amount of training received by a particular worker, which is also potentially endogenous, but rather the amount of training typically required in the worker's *occupation*. These observations suggest that one can plausibly treat SVP as exogenous when considering the amount of insurance offered by a particular firm.

At the level of an individual worker, SVP would appear to be a good proxy for job attachment. However, because decisions regarding health insurance are made at the firm level, the best conceptual measure for our purposes is one that measures job attachment *at* the firm level; that is, one measuring the average amount of job attachment in a particular firm. Given the need to obtain a firm-level measure, there were two ways in which we might have proceeded. One possibility was to simply use the SVP value assigned to each worker as a proxy for the average degree of employment specialization in that worker's firm. This approach would have been desirable if we believed that within-firm human capital heterogeneity was not very large. An alternative approach, and the one adopted in this paper, was 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, as appears likely, there is less skill heterogeneity across firms (in narrowly defined industries) than within firms.

To construct a measure of job attachment at the firm level, we first computed the average SVP value in each worker's industry (labeled *Industry SVP 1980*) by averaging the SVP values by industry for all employed persons in the 1980 Census PUMS (5 percent sample). To control for income differences at the industry level, which may confound *Industry SVP 1980* if more specialized training is associated with higher earnings, we also computed average income in each industry using the PUMS data. Because the industry codes in the NMES Household Survey are at the three-digit level (representing some 230 distinct industries), we believe that *Industry SVP*

*1980* is likely to provide a good measure of the average amount of job attachment present in individual firms.

One problem with this measure is that it is based on the distribution of occupations existing in 1980. If between 1980 and 1987 (the year of the NMES survey) there were important changes in the distribution of occupations within industries then *Industry SVP 1980* will be subject to measurement error. To avoid this problem, we calculated a second job attachment variable, *Industry SVP 1987*, using the 18,000 persons in the NMES Household Survey who reported a Census occupation code.[17] This variable captures the within-industry distribution of occupations that existed at the time of the survey. However, unlike *Industry SVP 1980*, which is based on millions of observations (and therefore thousands of observations per industry), *Industry SVP 1987* is based on only 18,000 observations in total, so the number of observations per industry is quite small in some cases. As a result, *Industry SVP 1987* may also be subject to measurement error. Since these two potential sources of measurement error should be unrelated, we will use both measures of job attachment in our analysis and examine the robustness of our findings across the two variables. In addition, we will re-estimate each model using *Industry SVP 1980* as an instrument for *Industry SVP 1987*. It is well known that the instrumental variables estimator remains consistent in the presence of a mis-measured explanatory variable, even in cases where the instrument itself is measured with error, provided there is not a common component to the measurement error across the two variables.

### C. Measures of Insurance

We use two standard contract provisions as measures of the amount of insurance available through each policy. The first is the *lifetime limit on benefits*, which is positively related to the amount of insurance coverage specified in a plan, and probably the best overall measure of the extent to which long-term, costly medical conditions are insured. The second is the *annual stop-loss*, defined as the threshold level of medical expenditures above which the policyholder is no longer required to make co-payments. In contrast to the lifetime benefit caps, the annual stop-losses are less closely tied to catastrophic medical expenditures, but are more likely to be reached, and could therefore be viewed as a more immediately relevant measure of the amount of insurance contained in a plan.

We make use of these two contract provisions, in lieu of others (such as the annual deductible or the plan actuarial value) because we believe they map most directly to our theoretical model, which is fundamentally a model of *insurance* provision. We emphasize the word “insurance” because many health insurance plans combine prepaid medical care (i.e., care for common, low cost afflictions) with true “insurance,” by which we mean protection against less common, but significantly more costly, medical conditions. In particular, because our paper deals with the role of precommitment in maintaining viable risk pools, we would expect our measure of job attachment to matter most for insuring losses that require large, foreseeable cross subsidies from other members of the insurance pool. This is most likely to occur in cases where a coworker develops a serious medical condition that is both chronic in nature and costly to treat, such as diabetes, cancer, or heart disease. For such conditions, we would expect that the overall amount of financial protection conferred by the plan would be determined disproportionately by contract provisions that apply to the “right tail” of the loss distribution.[18]

### D. Estimation Samples

To create our samples we applied a common set of restrictions to the 6549 HIPS respondents reporting employment-related health insurance coverage. Specifically, we dropped any person who was classified as unemployed, or for whom a link to a “current main job” was unavailable. We also dropped any person who did not hold an employer- (or union-) sponsored plan, and anyone whose employer did not offer group coverage, or who was employed by a sub-chapter S corporation.[19] We also deleted a small number of persons who held policies from more than one employer. These restrictions, coupled with observations lost from missing or incomplete data, resulted in final samples of 2038 policyholders for the lifetime benefit sample and 1898 policyholders for the annual stop-loss sample.

To control for factors other than job attachment which might affect the level of coverage provided under employment-based health insurance contracts, we include controls for type of coverage (single, two-party, family, or other), self-insurance status of the employer (fully self-insured, partially self-insured, or commercial insurance), type of insurance (HMO or indemnity), type of employer (for profit, nonprofit, government, or other), region of the country (northeast, midwest, south, or west), urban location (SMSA or non-SMSA), firm size (indicator variables for: fewer than 10 employees, 10-25 employees, 26-100 employees, 101-500 employees, more than 500 employees), employer unionization (fully unionized, partially unionized, or non-union), and industry income.[20] We include a measure of average industry income in all of our regressions to ensure that *Industry SVP* is not simply picking up income differences across industries that are potentially correlated with insurance purchases. In the stop-loss samples, we also include controls for whether the stop-loss applies to all covered expenses (or only the policyholder's out-of-pocket expenses), and whether the annual deductible is counted toward the stop-loss.

Summary statistics for the lifetime benefit and annual stop-loss samples are displayed in Tables 3 and 4, respectively. The mean lifetime benefit in 1987 was approximately $850,000, and there is substantial variation in these benefits; in our sample the range runs from a low of $10,000 to a high of $25,000,000. Although amounts below $50,000 may seem unusual, we have only included lifetime maximums that apply to coverage categories likely to yield high expenses, such as hospital room and board charges, inpatient surgical benefits, and inpatient physician fees. We imposed this restriction to ensure that these lower limits were limits for the policy as a whole and not for specialized types of care that sometimes have their own maximum benefits (such as mental health or substance abuse treatment). Nonetheless, our results do not change if we eliminate maximum benefits below $50,000 or $100,000.

The mean annual stop-loss is approximately $2400 and there is considerable variation in this variable as well. Here we have less reason to worry that the reported stop-losses do not apply to the policy as whole because there is generally only one stop-loss reported for each policy. Again, our results do not change if we drop potential outliers, such as values below $500 or above $25,000.

There are a few other characteristics of the samples that are worth mentioning. For both the lifetime benefit and stop-loss samples, we see that roughly 60 percent of employers offer only one health insurance policy. About 45 percent of firms self-insure to some degree, and only about 1 percent of health plans are classified as HMOs. Approximately 70 percent of the firms are for-profit firms, roughly half have more than 500 employees, and about one third are either fully or partially unionized.

## E. Empirical Results

The effect of job attachment on the amount of insurance coverage available from employment-based health insurance contracts can be estimated from a simple OLS regression of the type shown below:

$$Insurance_i = \beta_0 + \beta_1 \, Industry\ SVP_i + \gamma' X_i + \varepsilon_i \qquad (6)$$

where $X_i$ is a vector of employer and insurance plan characteristics for worker $i$, $Industry\ SVP_i$ is a proxy for the average degree of job attachment in the firm that employs worker $i$ (either *Industry SVP 1980* or *Industry SVP 1987*), and $\varepsilon_i$ is a random error term. The dependent variable in our analysis, $Insurance_i$, is a measure of the total amount of insurance coverage provided by the policyholder's insurance contract (either the maximum lifetime benefit or the annual stop-loss).[21] In terms of (6), the estimated value of $\beta_1$ provides a direct measure of the effect of commitment on the amount of insurance provided by a given employment-based health insurance policy. To address the possibility that either *Industry SVP 1980* or *Industry SVP 1987* could be measured with error, we estimate equation (6) using each variable separately and also using an instrumental variables (IV) procedure in which *Industry SVP 1980* is used as an instrument for *Industry SVP 1987*.

To examine the main predictions from our theoretical model, which concern the differential effects of job attachment in firms offering a single health insurance plan ("single-plan firms") relative to firms offering multiple plans ("multiple-plan firms"), we will run (6) separately for both types of firms. To test for significant differences between the two, we will also run a difference-in-differences model on the pooled sample of all firms, as shown in equation (7) below

$$\begin{aligned} Insurance_i = \beta_0 + \beta_1\, Industry\ SVP_i + \beta_2\, Single\ Plan_i \\ + \beta_3 (Single\ Plan_i \times Industry\ SVP_i) + \gamma' X_i + \varepsilon_i \end{aligned} \tag{7}$$

where $Single\ Plan_i$ is a dummy variable indicating that worker $i$'s employer offers a single health insurance policy.[22] Observe that $\beta_2$ captures the mean difference in insurance coverage between single- and multiple-plan firms, while $\beta_3$ measures the differential effect of job attachment in firms offering a single policy relative to firms offering multiple policies. When the lifetime maximum benefit is the dependent variable, our theoretical model implies that $\beta_2 < 0$ since, all else equal, single-plan firms should offer less insurance than multiple-plan firms. More importantly, we would expect $\beta_3 > 0$ since the effect of job attachment on the quantity of insurance should be larger in firms offering a single policy than in firms offering multiple policies.[23] Notice that these predictions are reversed when the annual stop-loss is the dependent variable because a *lower* stop-loss translates into *more* insurance coverage.

**E.1 Lifetime Benefits.** Results for lifetime benefits are presented in Table 5. Columns (1)-(6) display estimates of Equation (6); Columns (1)-(3) are based on a sample of firms offering a single health insurance plan, while Columns (4)-(6) pertain to firms offering multiple plans. In each case, separate estimates are presented for *Industry SVP 1980* and *Industry SVP 1987* to provide a check on the robustness of our results with respect to the two potential sources of measurement error discussed earlier. In addition, in Columns (3) and (6) an instrumental variables model is estimated in which *Industry SVP 1980* is used to instrument for *Industry SVP 1987*.

Looking at single- and multiple-plan firms separately, we see that the data are consistent with the predictions of our theoretical model. Focusing on the results for *Industry SVP 1980*, we see that a one-unit increase in job attachment increases the lifetime maximum benefit by approximately $122,000 in single-plan firms, but by only $20,000 in multiple-plan firms. For single-plan firms, this effect is statistically significant at the 11 percent level, [24] while in multiple-plan firms the hypothesis that the effect of job attachment is zero cannot be rejected with any reasonable level of confidence. As can be seen from Column (2), results are similar, but more precisely estimated, when *Industry SVP 1987* is used to proxy for job attachment. A similar, albeit less precisely estimated, coefficient is obtained using the IV model shown in Column (3).[25] The consistency of the point estimates across these alternative specifications, (in both the single- and multiple-plan samples), suggests that measurement error is not a large problem in this case.

To gain some perspective on the magnitude of these effects, observe that in single-plan firms a one standard deviation increase in *Industry SVP 1980* raises the maximum lifetime benefit by roughly $88,000. Relative to the mean lifetime benefit in our sample, this represents a 10 percent increase in available health insurance benefits over one's lifetime.

To further examine the predictions of our theoretical model, we next turn to the difference-in-differences models shown in Columns (7) and (8). Again focusing on *Industry SVP 1980*, we can check for consistency between the results from this specification, which pools single- and multiple-plan firms, and the more general (but less efficient) specifications that examine each type of firm separately. First, note that given the way the difference-in-differences model is specified, the intercept in Column (7) corresponds to the mean lifetime benefit in multiple-plan firms and is virtually identical to the corresponding estimate from Column (4). The mean lifetime benefit for single-plan firms can be calculated from the difference-in-differences model by adding the intercept term to the coefficient on the *Single Plan Firm* indicator; doing so yields a mean benefit of $311,576, which is fairly close to the mean benefit of $271,759 shown in Column (1). Similarly, the effect of job attachment in multiple-plan firms is given by the coefficient on *Industry SVP*, which is small and not statistically different from zero at any reasonable level of significance. The effect of job attachment in single-plan firms is given by the sum of the coefficient on *Industry SVP* and the coefficient on the interaction variable, *Single Plan Firm* × *Industry SVP*. Adding these coefficients yields a value of $131,391, which is again quite close to the corresponding estimate of $121,758 from Column (1). Thus, the difference-in-differences model appears to yield similar estimates to those obtained when single- and multiple-plan firms are considered separately.

The difference-in-differences specification provides a natural framework for testing the predictions of our theoretical model. As discussed previously, we would expect the coefficient on *Single Plan Firm* to be negative because our model predicts that, ceteris paribus, single-plan firms should offer less insurance than multiple-plan firms. In addition, the coefficient on the interaction variable, *Single Plan Firm* × *Industry SVP,* should be positive since the effect of job attachment should be more pronounced in firms offering a single insurance policy.

Focusing again on *Industry SVP 1980*, we find that both of these predictions are upheld. All else equal, lifetime benefits are approximately $662,000 lower in single-plan firms. Furthermore, a one-unit increase in *Industry SVP 1980* raises lifetime benefits by approximately $140,000 more in single-plan firms than in multiple-plan firms (where the effect of job attachment is found to be negligible). These differences are statistically significant at the 15 percent level using a two-tailed test and at the 7.5 percent level using a one-tailed test.[26] As shown in Column (8), larger and more statistically significant differences are found when *Industry SVP 1987* is used as our measure of job attachment.

**E.2 Annual Stop-Losses.** The annual stop-losses provide a useful complement to our lifetime benefit results for two reasons. First, one might argue that the lifetime coverage limits are less relevant than other contract provisions because they are often set at sufficiently high levels that they are unlikely to be breached. Although this argument would be hard to justify on theoretical grounds (given that low probability, catastrophic events deliver the largest utility gains per dollar spent), or on empirical grounds (since we find substantial variation in the limits in our sample), it is nonetheless useful to examine a contractual provision that "bites" at a lower point in the loss distribution. The stop-losses are also of interest because they apply on an annual, as opposed to a lifetime, basis. This allows for an additional check on the robustness of our findings.

Results for the annual stop-losses are shown in Table 6. We proceed in exactly the same fashion as in the previous section, with two differences. First, the nature of the stop-loss provisions requires that two additional control variables be added to our regressions: an indicator variable for whether the stop-loss applies to all covered expenses or only the policyholder's out-of-pocket expenses; and an indicator for whether the annual deductible is counted toward the stop-loss.[27] Second, being that a lower stop-loss is associated with more insurance coverage, the predicted signs of the coefficients from Equations (6) and (7) are reversed. Specifically, we would expect that the coefficient on *Industry SVP* should be negative and larger in absolute value for single-plan firms than for multiple-plan firms. In the difference-in-differences models, we would expect the *Single Plan Firm* dummy to carry a positive coefficient (consistent with single-plan firms offering less insurance, ceteris paribus), while the *Single Plan Firm* × *Industry SVP* interaction variable should be negative (indicating that job attachment lowers stop-losses by more in single-plan firms).

Both of these implications are supported by the data. Focusing on *Industry SVP 1980*, a comparison of Columns (1) and (4) reveals a negative effect of job attachment on stop-losses in firms offering a single health insurance policy, but not in firms that offer multiple policies.[28] The coefficient on *Industry SVP* in Column (1) implies that a one standard deviation increase in *Industry SVP* lowers the annual stop-loss by approximately $240. Relative to a mean stop-loss of $2400, this represents a 10 percent reduction in the threshold set for limiting a policyholder's annual loss exposure. The difference-in-differences estimates reported in Column (7) are consistent with single-plan firms having significantly higher stop-losses that are more negatively related to job attachment, as implied by our model. These differences are statistically significant at the 13 percent and 10 percent levels based on a two-tailed test, and at the 6.5 percent and 5 percent levels based on a one-tailed test. As in the case of the lifetime limits, the coefficients in the difference-in-differences model are more precisely estimated when *Industry SVP 1987* is used to proxy for job attachment.

One potential difficulty that arises with the stop-loss sample is that not all policies contain an annual stop-loss. This was not an issue with the lifetime maximums because virtually all of the contracts in our sample specified a maximum benefit. In the case of the stop-losses, there were approximately 350 policyholders whose contracts did not contain an annual stop-loss. In the previous regressions, we dropped these observations from the sample. To examine whether our results are sensitive to this choice, we attempted to estimate our difference-in-differences model with a Heckman selection correction, but were unable to obtain convergence (regardless of the optimization algorithm chosen). Such an approach would have been suspect in any case since identification would have been achieved solely based on the differing functional forms of the two equations. A priori, it is extremely difficult to think of an explanatory variable that would be correlated with whether a stop-loss provision is specified in an insurance policy that would not also influence the magnitude of the stop-loss.

As an alternative, we estimated a Tobit model that treated contracts without a stop-loss as being right censored. The rationale for this approach is that an insurance policy without a stop-loss provision can be viewed as having an "effective" stop-loss of infinity, i.e. there is no expenditure threshold at which the policyholder's loss exposure is truncated. If policyholders (or their employers) might have chosen a policy containing a stop-loss had a larger stop-loss been available (rather than opting for an implicit stop-loss of infinity), then it seems reasonable to treat the missing observations as being right censored. Because this approach leaves open the question of where the censor point lies, we decided to set it at the highest stop-loss observed in our sample, which was $62,500. As a sensitivity check, we estimated a second model that dropped this observation and set the censor point at $25,000, the second highest stop-loss in our sample. In each case, we obtained results that were virtually identical to those reported in Columns (7) and (8) of Table 6. This provides some evidence that omitting these observations from our earlier regressions did not bias our coefficient estimates.

## 4. Conclusions

In many insurance settings it may be argued that private information, and the attendant problem of adverse selection, is the primary cause of market failure. The evidence increasingly suggests, however, that the market for health insurance is more accurately characterized as one in which participants possess symmetric information regarding the evolving health status of insurance purchasers. The key ingredient for a successful health insurance package is to have those who turn out to be healthier than average agree to cross-subsidize the members of the pool who are less fortunate. But, as illustrated by the increasing use of re-underwriting in the individual health insurance market, the inability of low risks to precommit to remain in the insurance pool may eliminate the ability to insure against the classification risk that results when premiums are adjusted to reflect observed health status.

The evidence presented in this paper demonstrates the importance of precommitment in the provision of long-term health insurance. When insurance is bundled with employment, we find that frictions in worker mobility impart a de-facto commitment to employment-based insurance pools that can be exploited to provide more complete insurance of health risks than would be available in a competitive market. In the absence of such a commitment device, insurers anticipate that the healthier individuals would, over time, exit the insurance pool in order to obtain coverage at more favorable terms elsewhere. Thus, the ability of insurers to offer benefit packages which insure individuals against the classification risk associated with changes in their health status is enhanced when workers experience an attachment to their job that impedes their exit from the pool.

Consistent with this view, we find that the amount of coverage provided under employment-based health insurance contracts is increasing in the degree of worker commitment. The measures of coverage that we consider in the analysis are the lifetime coverage cap, and the stop-loss amounts, since these are the contract provisions most likely to be encountered by individuals who have chronic, long-term illnesses, and whose costs of treatment are likely to result in higher premiums for the healthier members of the group. As predicted by the theoretical model, we find that the distortions in coverage are most pronounced in cases where firms offer a single insurance contract to all of their workers. In contrast, the coverages associated with multiple-plan benefit packages, which permit the voluntary experience-rating of premiums through the selection of contracts by insureds, are much less sensitive to job attachment.

Our results indicate that, in addition to the advantages conferred by preferential tax treatment, employer-sponsored health insurance is also attractive because the bundling of insurance with employment results in a more stable, and therefore insurable, risk pool. If employment were to become less stable or the incentive to invest in job-specific skills were to decline, insurers would need to utilize institutions other than employer sponsorship to craft insurable risk pools. From a policy perspective, our results suggest caution when considering proposals that might weaken the link between health insurance and employment.[29]

At a broader level, our findings support the view that limitations on insured commitment are a potentially important impediment to the implementation of the long-term contracts required to fully insure chronic illnesses. Thus, our results also provide a glimpse into the often hidden costs of unreliable contract enforcement.

## Appendix

*Theorem 1 (Optimal Pooling Packages)*:

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

(i) for $K<K_1$, pooling is not possible since low-risk insureds will always prefer the outside insurance option;

(ii) for $K_2>K\geq K_1$, an optimal pooling package can retain low-risk insureds, and in characterized by the following conditions:

(a) $\Pi(C^P)=0$;

(b) $R^p < S$;

(c) The feasibility constraint (4) is satisfied with equality;

(iii) for $K \geq K_2$, the full-commitment contract $C^*$ is attained.

*Proof of Theorem 1*:

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

$$L = V\left(C^p\right) + \alpha \Pi\left(C^p\right) + \beta\left\{v\left(c; p^L\right) - U\left(Y - K - p^L S\right)\right\} \quad \text{(A-1)}$$

where $\alpha$ and $\beta$ are undetermined multipliers and $C^P \equiv \{c, c\}$ denotes a pooling contract in which $c \equiv \{Z^P, R^P\}$. The first order conditions for an interior maximum are given by

$$\frac{\partial L}{\partial Z^p} = -U'\left(Y - Z^p - S + R^p\right)\left[\overline{p} + \beta p^L\right] - U'\left(Y - Z^p\right)\left[\left(1-\overline{p}\right) + \beta\left(1-p^L\right)\right] + \alpha = 0; \quad \text{(A-2)}$$

$$\frac{\partial L}{\partial R^p} = U'\left(Y - Z^p - S + R^p\right)\left[\overline{p} + \beta p^L\right] - \alpha \overline{p} = 0. \quad \text{(A-3)}$$

Assuming, for the moment, that an interior solution to (A-1) exists, equation (A-3) implies $\alpha > 0$ from which (ii)(a) follows. Also, solving (A-2) for $\alpha$ and substituting the result into (A-3) yields

$$U'(Y - Z^p)[1 - \overline{p} - \beta p^L + \beta] = U'(Y - Z^p - S + R^p)[1 - \overline{p} - \beta p^L + \beta p^L / \overline{p}]. \tag{A-4}$$

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

Finally, it is straightforward to demonstrate that, for sufficiently small values of *K*, there exist no pooling packages preferred by the low-risk agents to their outside option, (part (i)), and that, for sufficiently large amounts of commitment, $\beta = 0$ and the full commitment contract solves (A-1), (part (iii)).

QED

*Theorem 2 (Optimal Multi-Contract Packages)*:

An optimal insurance package $C \equiv \{c^H, c^L\}$ is characterized by the following conditions:

(i) for $K < K_2$, $c^H \neq c^L$ and

(a) The feasibility constraint (4) and the self-selection constraint (5) hold with equality;

(b) $\pi(c^H; p^H) < 0 < \pi(c^L; p^L)$ *and* $\Pi(C) = 0$;

(c) $R^H = S > R^L$.

(ii) for $K \geq K_2$, $c^H = c^L$ and the full-commitment contract $C^*$ is obtained.

*Proof of Theorem 2*:

The Lagrangean expression associated with the maximization problem is written as

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

where $C \equiv \{c^H, c^L\}$ and $c^i \equiv \{Z^i, R^i\}$ for $i \in \{\text{H, L}\}$. The first order conditions for an interior solution are

$$\frac{\partial L}{\partial Z^H} = -(\lambda + \gamma)[p^H U'(Y - Z^H - S + R^H) + (1 - p^H)U'(Y - Z^H)] + \alpha\lambda = 0 \tag{A-5}$$

$$\frac{\partial L}{\partial R^H} = (\lambda + \gamma) p^H U'(Y - Z^H - S + R^H) - \lambda \alpha p^H = 0 \tag{A-6}$$

$$\frac{\partial L}{\partial Z^L} = [-(1-\lambda) p^L - \beta p^L + \gamma p^H] U'(Y - Z^L - S + R^L) + \\ [-(1-\lambda)(1-p^L) - \beta(1-p^L) + \gamma(1-p^H)] U'(Y - Z^L) + \alpha(1-\lambda) = 0 \tag{A-7}$$

$$\frac{\partial L}{\partial R^L} = [(1-\lambda) p^L + \beta p^L - \gamma p^H] U'(Y - Z^L - S + R^L) - \alpha(1-\lambda) p^L = 0. \tag{A-8}$$

Equation (A-6) implies that $\alpha > 0$, so $\Pi(C) = 0$. For $K \geq K_2$, both the feasibility (4) and self-selection (5) constraints are slack, so $\beta = \gamma = 0$ and $C^*$ is attained. When $K < K_2$, a solution requires $\beta > 0$ and $\gamma > 0$ (establishing i(a)).

Solving (A-5) for $\lambda\alpha$ and substituting the result into (A-6) gives the result that $R^H = S$. Similarly, solving (A-7) for $\alpha$ (1 - $\lambda$) and substituting the result into (A-8) yields

$$\frac{U'(Y - Z^L - S + R^L)}{U'(Y - Z^L)} = \frac{(1-\lambda)(1-p^L) + \beta(1-p^L) - \gamma(1-p^H)}{(1-\lambda)(1-p^L) + \beta(1-p^L) - \gamma(p^H / p^L - p^H)}$$

which implies that $R^L < S$ whenever $\gamma > 0$, establishing i (c). The final part of i (b) is an implication of (a), (c) and the fact that $\Pi(C) = 0$.

QED

*Theorem 3:*

Firms which offer a single insurance contract to their workforce should have lower levels of coverage that are more sensitive to worker commitment than firms which offer multi-contract packages. Thus, $R^p < R^i$, and $\frac{dR^p}{dK} > \frac{dR^i}{dK}$, for $i \in \{H, L\}$.

*Proof of Theorem 3:*

Since $R^H = S$, it follows immediately that $\frac{dR^P}{dK} > \frac{dR^H}{dK} = 0$. The rest of the proof will demonstrate that $\frac{dR^P}{dK} > \frac{dR^L}{dK}$.

The contract $C^P$ is characterized by the conditions

$$Z^P - \bar{p}R^P = 0, \text{ and} \tag{A-9}$$

$$p^L U(W_S^P) + (1 - p^L)U(W_N^P) - U(W_0) = 0, \tag{A-10}$$

where $W_S^P \equiv Y - Z^P - S + R^P$, $W_N^P \equiv Y - Z^P$, and $W_0 \equiv Y - K - p^L S$. Total differentiation of (A-9) and (A-10) yields the result

$$\frac{dR^P}{dK} = \frac{U'(W_0)}{\bar{p}(1 - p^L)U'(W_N^P) - p^L(1 - \bar{p})U'(W_S^P)}. \tag{A-11}$$

It is straightforward to demonstrate that (A-11) is positive at $C^P$, since $\bar{V}^L$ is flatter than the pooling zero profit locus, (A-9).

The contract $C^L$ is characterized by the conditions

$$\lambda(Z^H - p^H S) + (1 - \lambda)(Z^L - p^L R^L) = 0, \tag{A-12}$$

$$U(W^H) - p^H U(W_S^L) - (1 - p^H)U(W_N^L) = 0, \text{ and} \tag{A-13}$$

$$p^L U(W_S^L) - (1 - p^L)U(W_N^L) - U(W_0) = 0 \tag{A-14}$$

where $W^H \equiv Y - Z^H$, $W_S^L \equiv Y - Z^L - S + R^L$, and $W_N^L \equiv Y - Z^L$. Solving (A-4) for $Z^H$, substituting the result into (A-13), and totally differentiating yields

$$\frac{dZ^L}{dR^L} = \frac{p^L(1 - \lambda)U'(W^H) + \lambda p^H U'(W_S^L)}{(1 - \lambda)U'(W^H) + \lambda p^H U'(W_S^L) + \lambda(1 - p^H)U'(W_N^L)}, \tag{A-15}$$

which is the slope of the AC* locus depicted in Figure 4. Total differentiation of (A-14) gives the result that

$$\frac{dR^L}{dK} = \frac{U'(W_0)}{\frac{dZ^L}{dR^L}[p^L U'(W_S^L) + (1-p^L)U'(W_N^L)] - p^L U'(W_S^L)}. \tag{A-16}$$

To demonstrate the desired result, we must show that the denominator of (A-16) is greater than the denominator of (A-11). This difference may be written as

$$E_1\left[\frac{dZ^L}{dR^L} - \frac{p^L U'(W_S^L)}{E_1} - \frac{E_2}{E_1}\left[\overline{p} - \frac{p^L U'(W_S^P)}{E_2}\right]\right] \tag{A-17}$$

where $E_1 \equiv p^L U'(W_S^L) + (1-p^L)U'(W_N^L)$ and $E_2 \equiv p^L U'(W_S^P) + (1-p^L)U'(W_N^P)$.

By (A-10) and (A-14), it follows that $E_2/E_1 = 1$, so that (A-17) reduces to

$$E_1\left[\frac{dZ^L}{dR^L} - \overline{p} + \left[\frac{p^L U'(W_S^P)}{E_2} - \frac{p^L U'(W_S^L)}{E_1}\right]\right]. \tag{A-18}$$

Since the L-type's indifference curve is steeper at $C^P$ than at $C^L$, the term in the inner set of brackets is positive. Thus, to complete the proof, it is sufficient to demonstrate that $\frac{dZ^L}{dR^L} > \overline{p}$.

$$\frac{dZ^L}{dR^L} - \overline{p} = \frac{p^L(1-\lambda)U'(W^H) + \lambda p^H U'(W_S^L) - \overline{p}E_3}{E_3} \tag{A-19}$$

where $E_3 \equiv (1-\lambda)U'(W^H) + p^H U'(W_S^L) + \lambda(1-p^H)U'(W_N^L)$. The numerator in (A-19) may be written as

$$U'(W^H)\lambda(1-\lambda)(p^L - p^H) + \lambda p^H U'(W_S^L)(1-\overline{p}) - \lambda(1-p^H)U'(W_N^L)\overline{p},$$

which is greater than

$$U'(W^H)\lambda(1-\lambda)(p^L - p^H) + \lambda p^H U'(W_S^L)(1-\overline{p}) - \lambda(1-p^H)U'(W_S^L)\overline{p} \tag{A-20}$$

since $U'(W_S^L) > U'(W_N^L)$. We may then write (A-20) as

$$\lambda(1-\lambda)(p^H - p^L)[U'(W_S^L) - U'(W^H)] > 0$$

since $p^H > p^L$, and the concavity of *U* and (A-13) imply that $U'(W_S^L) > U'(W^H)$.

Thus, $E_3 > 0$ implies that (A-19) is positive, and the proof of *Theorem 3* is complete.

QED

## Endnotes

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1. This process is empirically documented in a convincing study by Altman, Cutler, and Zeckhauser (1998) which examines the changing enrollments for individuals insured through the Group Insurance Commission of Massachusetts.

2. To mitigate this problem, Cochrane (1995) proposes the use of specially designated accounts 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 these severance payments are enforceable, the result is that all consumers pay the same present value of premiums and, at each point in time (after the lump sum payments have been implemented), face a premium equal to their expected actuarial cost.

3. Hendel and Lizzeri (forthcoming) and Chiappori (2000) provide nice overviews of recent developments in the empirical contracting literature.

4. "In theory, health insurance could be sold for the long term on a level premium basis. In practice, matters will be more complex. Much health insurance is now bundled with the provision of care. If an individual left a geographic region, he might have to change provider, and no new provider/insurer would want to take him at his old level rate. Portability is but one problem. Once individuals purchase lifetime medical insurance, why should an insurer strive for efficiency when people are stuck in his plan? This problem is exacerbated since the insurer must agree to pay for or provide a changing level of services. Health insurance policies optimally change from year to year, as medical technology improves and knowledge about optimal treatments expands. Finally, with future medical costs so unpredictable, insurers cannot take on the risk, which would apply to all policies, that costs will escalate beyond expectation. With life insurance, by contrast, portability, changing service mix, and varying costs are not problems." (Cutler and Zeckhauser 2000, 627)

5. See Epstein (1997) for a discussion of the legal problems associated with enforcing long-term insurance contracts. A concise summary of the problem can be found in Cochrane (1995, 468), who notes that, "... courts often reinterpret insurance contracts ex post, judge the merits of each clause separately rather than how the clauses fit together to form a

reasonable contract, and will not enforce severance payments or bond forfeitures against consumers."

6. When workers are free to choose among plans, inducing self-selection is necessary even with observable types.

7. But, as noted in the anecdote provided in the introduction, some individual health insurance providers have been forced to re-underwrite in order to keep the lower risk customers in the insurance pool. The problem, of course, is that in the individual market there are not significant transactions costs incurred by low risk individuals who wish to exit the pool.

8. Formally, we must have $v(pL, cL) \geq v(pL, cH)$ as well. We ignore this constraint since it is never binding.

9. The zero profit constraint (3) allows for the possibility that either the insurer or the employer may wish to cross subsidize the premiums associated with the two contracts. For insurers, this would be possible in cases where both contracts are issued by the same insurance company. In 1997, over half of all employers who offered multiple policies did so through a single insurer (Marquis and Long 1999; Encinosa 2001). Alternatively, the employer could pay the actuarially fair premium for each contract and vary employee premium contributions to effect the desired level of cross subsidization. Of course, it may be that neither the insurer nor the employer wishes to implement cross subsidized premiums, in which case Equation (3) will still hold since, in the absence of cross subsidization, each contract will earn zero profits individually.

10. Note that these three conditions define a class of contractual pairs which consist of a full-coverage contract for high risks, a partial coverage contract for low risks located on AC* which is equally valued by the high risks, and which together make zero profit on average. One element of this class is the contract which awards the allocation "A" to low risks and $\hat{c}^H$ to high risks. These contracts are located on the same high-risk indifference curve and correspond to the well-known Rothschild-Stiglitz separating allocation, where each contract makes zero profit. These are the contracts we would expect to observe when there is no mechanism for effecting cross subsidization within the pool, as would be the case, for example, if $c^H$ and $c^L$ were issued by different insurers and employee premium contributions were not adjusted by the employer. When cross subsidization is possible, the low risk contract migrates toward $c^*$ along the AC* locus and the high risk contract (on the same $\bar{v}^H$ indifference curve) moves from $\hat{c}^H$ toward $c^*$ as the magnitude of the cross subsidy increases. One such contract is that denoted as $\{cH, cL\}$ in Figure 4, where profit earned on low-risk individuals subsidizes losses incurred on the contract sold to higher risks. The limiting case occurs when both contracts coincide at the pooling allocation $c^*$. As indicated in Theorem 2, the participation constraint for low risks implies that not all of the members of this class of contracts (in particular, those in the vicinity of $c^*$) are feasible.

11. The reason, of course, is that the multi-contract package, which is a second-best contractual response to the feasibility constraint (4), entails distortions in two margins, exposing the insured to both financial risk and classification risk. In contrast, the single

(pooling) contract loads all of the distortion into financial risk while eliminating completely the insured's exposure to the risk of reclassification. As is often the case in second-best settings, the optimal response to the presence of a constraint involves small distortions in all of the choice variables, as opposed to a large distortion in only one. While multi-contract benefit packages are generically superior, many firms may not have sufficient enrollment to support more than a single plan.

12. Note that the cross-subsidization from low risks to high risks inherent in the optimal multi-contract package provides another reason why employer-sponsored health insurance may be desirable. Such a subsidy would be quite difficult to effect were insurance provided to workers in a competitive market environment, since in such a setting insurers would always have the incentive to drop the unprofitable contract being sold to high risks, and competitors could always offer a superior contract (for example, $\hat{c}^L$, depicted in Figure 3) to low risks. By providing insurance to workers, the employers can collect the efficient cross-subsidized premiums from the insureds and then purchase insurance coverage from outside insurers at actuarially fair rates ($\hat{Z}^i$) for each type. Alternatively, the insurers themselves could effect the desired level of cross subsidization in cases where both contracts are issued by the same insurance company.

13. Available evidence suggests that the returns to specialized training are substantial. Topel (1991, 147), for example, finds that, "10 years of job seniority raises the wage of the typical male worker in the United States by over 25 percent relative to what he could obtain elsewhere."

14. To take one example, consider an academic health economist and a retail sales worker, both living in Syracuse, New York. Although neither person has significant firm-specific human capital, the set of employment opportunities available in the Syracuse area is quite limited for the health economist, but not for the retail worker. In order to find a comparable employment opportunity elsewhere, the health economist would almost certainly have to re-locate—a process that is both time-consuming and costly—whereas the retail worker is likely to have many employment opportunities that would not require relocation. The difference between the two stems from the more specialized nature of employment for academic economists which, although not based on firm-specific human capital per se, is related to their having more specialized training overall.

15. The complete definition of SVP 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).

16. The SOC codes are the occupational analogue of the well-known Standard Industrial Classification (SIC) codes.

17. To preserve comparability, we also calculated a measure of average industry income using this group of workers.

18. In our sample, the average annual deductible is approximately $150 (in 1987 dollars). Actuarial values measure the fraction of medical expenditures reimbursed by the plan for the *average* person in the population. Thus, for a representative individual (who will have low medical expenses), a generous plan is one that provides a lot of “first-dollar” coverage, even if it omits coverage for catastrophic illnesses which, due to their low likelihood of occurrence, do not affect expected medical expenses very much. However, from an insurance perspective, it is exactly these low probability, high expenditure conditions that risk averse individuals will most want to insure. This illustrates why the actuarial value is not a particularly good measure of insurance coverage, even though it may accurately reflect plan generosity in a different sense.

19. Sub-chapter S corporations have much higher lifetime limits than other types of firms (an average of $1,543,848 vs. $857,297 for the entire sample), perhaps due to the large number of physicians who incorporate themselves in this way. Including S corporations in our sample distorts our results unless their mean effect is controlled with an indicator variable. Unfortunately, the NMES variable for firm ownership type contains so many missing observations that our samples sizes are cut by roughly a third when we use this variable, reducing the precision of our estimates substantially. However, the coefficient estimates on the variables of interest are little changed when we include S corporations in our sample and control for their influence with a dummy variable.

20. We control for plan- and firm-level variables, rather than person-specific characteristics, because it is unlikely that the characteristics of a particular policyholder would influence the attributes of a group health insurance policy. Recent work suggests that the set of insurance plans offered by employers, as well as the provisions of the offered plans, are determined by the preferences of the workforce as a whole (Moran, Chernew, and Hirth 2001; Bundorf 2002).

21. Because *Industry SVP* is measured at the industry level, while the dependent variable and other explanatory variables are measured at the firm level, it is possible that our regression residuals could be correlated within industries. To allow for this possibility, we implement a variant of the standard error correction proposed by Moulton (1986) using the CLUSTER command in STATA. This command also adjusts the standard errors for heteroscedasticity using White’s procedure (White 1980).

22. IV estimation of Equation (7), analogous to that used for Equation (6), is not possible because of the need to employ multiple instruments once the effect of *Industry SVP* is allowed to vary across single- and multiple-plan firms. However, as we will see, the estimates obtained from Equation (7) will generally be consistent with those from Equation (6).

23. Recall from Theorem 3 that these predictions hold regardless of which contract ($c^H$ or $c^L$) i*s* held by respondents in multiple-plan firms.

24. Because our model makes a monotonic prediction about the effect of job attachment on insurance coverage in single-contract firms, it is appropriate to use a one-tailed significance test. Based on a one-tailed test, we can reject the hypothesis that *Industry SVP 1980* has a non-positive effect on lifetime benefits at the 0.055 level of significance.

25. The partial F-statistics shown at the bottom of Columns (3) and (6) indicate that *Industry SVP 1980* is a very good instrument for *Industry SVP 1987*.

26. As mentioned previously, the monotonic nature of both predictions permits us to use one-tailed tests for hypothesis testing.

27. Our results are virtually identical if we incorporate the deductible into the dependent variable, where appropriate. The principal advantage of using an indicator variable on the right-hand side of the regression is that it avoids problems associated with measurement error and/or non-reporting of deductibles by instead controlling for their mean effect on the dependent variable.

28. These conclusions continue to hold when *Industry SVP 1987* is used in lieu of *Industry SVP 1980*, and when *Industry SVP 1987* is instrumented with *Industry SVP 1980*.

29. The American Medical Association (and others) have argued for de-coupling health insurance from employment by eliminating the preferential tax treatment afforded employer-sponsored policies (Dickey 1998). More recently, some benefits specialists have advocated a "defined contribution" approach to health insurance whereby workers would be provided with a voucher to purchase insurance in the individual market (Trude and Ginsburg 2000).

**Table 1. Specific Vocational Preparation (SVP)**

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

Source: The 1977 *Dictionary of Occupational Titles*.

**Table 2. Representative Occupations by SVP Quartile**

| | |
|---|---|
| **SVP Quartile 1 (1.00-3.43)** | |
| Cashiers | Teachers |
| Duplicating Machine Operators | Library Clerks |
| Mail Carriers, Postal Service | Legislators |
| Waiters and Waitresses | Textile Sewing Machine Operators |
| Farm Workers | Timber Cutting and Logging Occupations |
| Construction Laborers | Machinery Maintenance Occupations |
| Truck Drivers, Light | Sheetmetal Duct Installers |
| Garbage Collectors | Railroad Brake, Signal, and Switch Operators |
| Messengers | Machine Feeders and Offbearers |
| Janitors and Cleaners | Production Inspectors, Checkers, and Examiners |
| **SVP Quartile 2 (3.43-5.29)** | |
| Receptionists | Licensed Practical Nurses |
| Stenographers | Peripheral Equipment Operators |
| Traffic, Shipping, and Receiving Clerks | Production Coordinators |
| Billing Clerks | Bill and Account Collectors |
| Dispatchers | Longshore Equipment Operators |
| Correctional Institution Officers | Mining Machine Operators |
| Bus Drivers | Optical Goods Workers |
| Stock and Inventory Clerks | Lathe and Turning Machine Operators |
| Guides | Hand Engraving and Printing Occupations |
| Welfare Service Aides | Inspectors, Agricultural Products |
| **SVP Quartile 3 (5.29-6.94)** | |
| Buyers, Wholesale and Retail Trade | Personnel, Training, and Labor Relations Specialists |
| Real Estate Sales Occupations | Drafting Occupations |
| Broadcast Equipment Operators | Science Technicians |
| Supervisors, Forestry and Logging Workers | Power Plant Operators |
| Insurance Adjusters, Examiners, and Investigators | Supervisors, General Office |
| Horticultural Specialty Farmers | Advertising and Related Sales Occupations |
| Social Workers | Adjusters and Calibrators |
| Precision Assemblers, Metal | Ship Captains and Mates, except Fishing Boats |
| Precision Grinders, Fitters, and Tool Sharpeners | Electrical and Electronic Equipment Assemblers |
| Heat Treating Equipment Operators | Supervisors and Proprietors, Sales Occupations |
| **SVP Quartile 4 (6.94-8.29)** | |
| Administrators and Officials, Public Administration | Chief Executives and General Administrators |
| Purchasing Managers | Personnel and Labor Relations Managers |
| Managers, Properties and Real Estate | Architects |
| Underwriters | Aerospace Engineers |
| Archivists and Curators | Nuclear Engineers |
| Urban Planners | Technical Writers |
| Clergy | Supervisors, Production Occupations |
| Designers | Supervisors, Police and Detectives |
| Managers, Marketing, Advertising, and Public Relations | Supervisors, Extractive Occupations |
| Tool and Die Makers | Air Traffic Controllers |

Source: Authors' calculations based on the Commerce Department's Standard Occupational Classification (SOC) codes and data from the Household Survey and the 1980 Census.

**Table 3. Summary Statistics for Maximum Benefit Sample**

| | Mean | Minimum | Maximum |
|---|---|---|---|
| Maximum Benefit (Lifetime) | 857,297 | 10,000 | 25,000,000 |
| | [833,969] | | |
| Industry SVP 1980 | 5.058 | 3.019 | 6.774 |
| | [0.725] | | |
| Industry SVP 1987 | 5.206 | 3.111 | 7.037 |
| | [0.734] | | |
| Single Plan Firm | 0.603 | 0.000 | 1.000 |
| | [0.489] | | |
| Single Plan Firm x Industry SVP 1980 | 3.006 | 0.000 | 6.765 |
| | [2.508] | | |
| Single Plan Firm x Industry SVP 1987 | 3.081 | 0.000 | 7.037 |
| | [2.571] | | |
| Two Party Policy | 0.062 | 0.000 | 1.000 |
| | [0.242] | | |
| Family Policy | 0.532 | 0.000 | 1.000 |
| | [0.499] | | |
| Other Policy | 0.017 | 0.000 | 1.000 |
| | [0.128] | | |
| Self Insured Policy | 0.434 | 0.000 | 1.000 |
| | [0.496] | | |
| Partially Self Insured Policy | 0.039 | 0.000 | 1.000 |
| | [0.193] | | |
| Policy is an HMO | 0.010 | 0.000 | 1.000 |
| | [0.101] | | |
| Nonprofit Organization | 0.122 | 0.000 | 1.000 |
| | [0.327] | | |
| Government Organization | 0.168 | 0.000 | 1.000 |
| | [0.374] | | |
| Other Organization | 0.021 | 0.000 | 1.000 |
| | [0.142] | | |
| Midwest | 0.252 | 0.000 | 1.000 |
| | [0.434] | | |
| South | 0.423 | 0.000 | 1.000 |
| | [0.494] | | |
| West | 0.159 | 0.000 | 1.000 |
| | [0.366] | | |
| Urban Location | 0.683 | 0.000 | 1.000 |
| | [0.466] | | |

**Table 3 (cont.). Summary Statistics for Maximum Benefit Sample**

| | Mean | Minimum | Maximum |
|---|---|---|---|
| Small Firm (10–25 employees) | 0.076 | 0.000 | 1.000 |
| | [0.265] | | |
| Medium Firm (26–100 employees) | 0.136 | 0.000 | 1.000 |
| | [0.343] | | |
| Big Firm (101–500 employees) | 0.212 | 0.000 | 1.000 |
| | [0.409] | | |
| Huge Firm (more than 500 employees) | 0.532 | 0.000 | 1.000 |
| | [0.499] | | |
| Partially Unionized Firm | 0.319 | 0.000 | 1.000 |
| | [0.466] | | |
| Fully Unionized Firm | 0.010 | 0.000 | 1.000 |
| | [0.101] | | |
| Industry Income (1000s of dollars) | 22.420 | 7.400 | 40.321 |
| | [5.716] | | |

Notes: The sample consists of 2038 persons who purchased health insurance policies through their employer. Standard deviations are in brackets.

Source: Authors' calculations using data on employer and health plan characteristics from the 1987 National Medical Expenditure Survey (NMES) and data on specific vocational preparation (SVP) from the 1977 *Dictionary of Occupational Titles*.

**Table 4. Summary Statistics for Stop-Loss Sample**

| | Mean | Minimum | Maximum |
|---|---|---|---|
| Annual Stop-Loss | 2397<br>[2944] | 150 | 62,500 |
| Industry SVP 1980 | 5.080<br>[0.731] | 3.019 | 6.774 |
| Industry SVP 1987 | 5.231<br>[0.733] | 3.111 | 7.037 |
| Single Plan Firm | 0.597<br>[0.491] | 0.000 | 1.000 |
| Single Plan Firm x Industry SVP 1980 | 3.008<br>[2.532] | 0.000 | 6.765 |
| Single Plan Firm x Industry SVP 1987 | 3.079<br>[2.594] | 0.000 | 7.037 |
| Stop-Loss Based on Covered Expenses | 0.502<br>[0.500] | 0.000 | 1.000 |
| Stop-Loss Includes Deductible | 0.249<br>[0.433] | 0.000 | 1.000 |
| Two Party Policy | 0.048<br>[0.215] | 0.000 | 1.000 |
| Family Policy | 0.537<br>[0.499] | 0.000 | 1.000 |
| Other Policy | 0.014<br>[0.118] | 0.000 | 1.000 |
| Self Insured Policy | 0.412<br>[0.492] | 0.000 | 1.000 |
| Partially Self Insured Policy | 0.033<br>[0.179] | 0.000 | 1.000 |
| Policy is an HMO | 0.007<br>[0.082] | 0.000 | 1.000 |
| Nonprofit Organization | 0.123<br>[0.329] | 0.000 | 1.000 |
| Government Organization | 0.167<br>[0.373] | 0.000 | 1.000 |
| Other Organization | 0.021<br>[0.144] | 0.000 | 1.000 |
| Midwest | 0.232<br>[0.422] | 0.000 | 1.000 |
| South | 0.409<br>[0.492] | 0.000 | 1.000 |
| West | 0.154<br>[0.361] | 0.000 | 1.000 |
| Urban Location | 0.703<br>[0.457] | 0.000 | 1.000 |

**Table 4 (cont.). Summary Statistics for Stop-Loss Sample**

| | Mean | Minimum | Maximum |
|---|---|---|---|
| Small Firm (10–25 employees) | 0.083 | 0.000 | 1.000 |
| | [0.276] | | |
| Medium Firm (26–100 employees) | 0.146 | 0.000 | 1.000 |
| | [0.353] | | |
| Big Firm (101–500 employees) | 0.217 | 0.000 | 1.000 |
| | [0.412] | | |
| Huge Firm (more than 500 employees) | 0.515 | 0.000 | 1.000 |
| | [0.500] | | |
| Partially Unionized Firm | 0.318 | 0.000 | 1.000 |
| | [0.466] | | |
| Fully Unionized Firm | 0.009 | 0.000 | 1.000 |
| | [0.094] | | |
| Industry Income (1000s of dollars) | 22.749 | 7.400 | 40.321 |
| | [5.754] | | |

Notes: The sample consists of 1898 persons who purchased health insurance policies through their employer. Standard deviations are in brackets.

Source: Authors' calculations using data on employer and health plan characteristics from the 1987 National Medical Expenditure Survey (NMES) and data on specific vocational preparation (SVP) from the 1977 *Dictionary of Occupational Titles*.

**Table 5. Effect of Job Attachment on Lifetime Maximum Benefits**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| Intercept | 271,759 | 351,763 | 259,130 | 984,337 | 977,189 | 937,326 | 973,103 | 1,079,422 |
| | (344,617) | (252,301) | (348,377) | (264,119) | (249,138) | (287,967) | (237,605) | (254,537) |
| | [0.431] | [0.165] | [0.458] | [0.000] | [0.000] | [0.001] | [0.000] | [0.000] |
| Industry SVP | 121,758 | 89,641 | 112,413 | 20,158 | 32,920 | 28,258 | -8706 | -38,199 |
| | (75,521) | (49,634) | (80,794) | (30,004) | (30,800) | (43,222) | (39,225) | (45,883) |
| | [0.109] | [0.072] | [0.166] | [0.503] | [0.287] | [0.514] | [0.825] | [0.406] |
| Single-Plan Firm | --- | --- | --- | --- | --- | --- | -661,527 | -799,166 |
| | | | | | | | (457,599) | (445,559) |
| | | | | | | | [0.150] | [0.074] |
| Single-Plan Firm x Industry SVP | --- | --- | --- | --- | --- | --- | 140,097 | 162,230 |
| | | | | | | | (96,838) | (91,017) |
| | | | | | | | [0.150] | [0.076] |
| R-squared | 0.030 | 0.033 | 0.032 | 0.042 | 0.038 | 0.039 | 0.028 | 0.028 |
| Number of Observations | 1208 | 1228 | 1208 | 797 | 810 | 797 | 2005 | 2038 |
| Partial F-statistic for instrument | --- | --- | 328.55 | --- | --- | 91.83 | --- | --- |

Notes: Dependent variable is the maximum lifetime dollar benefit each policyholder is entitled to receive. Standard errors are shown in parentheses; p-values are shown in brackets. Standard errors are adjusted for both heteroscedasticity and within-industry error correlation. The instrumental variable models use Industry SVP 1980 as an instrument for Industry SVP 1987. All regressions include controls for type of coverage (single, two-party, family, or other), self-insurance status of employer (fully self-insured, partially self-insured, or commercial insurance), type of insurance (HMO or indemnity), type of employer (for profit, nonprofit, government, or other), region (northeast, midwest, south, or west), urban location (SMSA or non-SMSA), firm size (indicator variables for: < 10 employees, 10-25 employees, 26-100 employees, 101-500 employees, > 500 employees), employer unionization (fully unionized, partially unionized, or non-union), and industry income. Results for these variables are shown in Table 5A.
Source: Authors' calculations derived from Equation (6).

**Table 5A. Effect of Covariates on Lifetime Maximum Benefits**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| Two Party Policy | -95,603 | -93,786 | -96,804 | 215,331 | 202,287 | 212,053 | 51,843 | 47,591 |
| | (59,886) | (60,359) | (62,645) | (167,047) | (163,326) | (165,770) | (85,898) | (84,562) |
| | [0.112] | [0.122] | [0.124] | [0.199] | [0.217] | [0.203] | [0.547] | [0.574] |
| Family Policy | -771 | -7556 | -7477 | 22,669 | 18,502 | 18,855 | 8855 | 3669 |
| | (48,909) | (47,285) | (48,239) | (40,880) | (41,702) | (42,335) | (32,746) | (31,963) |
| | [0.987] | [0.873] | [0.877] | [0.580] | [0.658] | [0.657] | [0.787] | [0.909] |
| Other Policy | -251,141 | -237,443 | -251,444 | -6536 | -17,273 | -14,193 | -120,850 | -119,520 |
| | (79,093) | (77,968) | (80,280) | (75,773) | (77,771) | (78,592) | (64,011) | (62,946) |
| | [0.002] | [0.003] | [0.002] | [0.931] | [0.825] | [0.857] | [0.060] | [0.059] |
| Self Insured | -114,374 | -120,228 | -115,880 | -24,637 | -29,787 | -32,916 | -79,881 | -82,209 |
| Policy | (83,086) | (84,003) | (83,143) | (56,311) | (54,220) | (55,231) | (53,154) | (52,460) |
| | [0.170] | [0.154] | [0.165] | [0.662] | [0.584] | [0.552] | [0.134] | [0.119] |
| Partially Self | -13,416 | -11,481 | -8678 | -64,259 | -62,913 | -61,839 | -59,455 | -55,308 |
| Insured Policy | (113,765) | (116,155) | (113,416) | (71,282) | (71,105) | (70,821) | (64,927) | (63,234) |
| | [0.906] | [0.921] | [0.939] | [0.369] | [0.378] | [0.384] | [0.361] | [0.383] |
| Policy is an HMO | 121,479 | 66,446 | 76,099 | 36,535 | 49,617 | 47,854 | 62,376 | 55,397 |
| | (100,136) | (64,796) | (84,495) | (95,806) | (94,937) | (95,175) | (68,183) | (61,721) |
| | [0.227] | [0.306] | [0.369] | [0.703] | [0.602] | [0.616] | [0.361] | [0.370] |
| Nonprofit | -115,960 | -89,338 | -104,023 | -107,117 | -99,771 | -100,641 | -102,896 | -85,698 |
| Organization | (77,553) | (59,854) | (74,990) | (87,185) | (82,948) | (82,559) | (60,033) | (51,351) |
| | [0.136] | [0.137] | [0.167] | [0.221] | [0.231] | [0.225] | [0.088] | [0.097] |
| Government | -54,718 | -26,426 | -37,559 | -24,032 | -36,654 | -27,327 | -28,770 | -14,952 |
| Organization | (92,999) | (74,593) | (84,199) | (49,118) | (49,289) | (49,706) | (52,926) | (42,977) |
| | [0.557] | [0.724] | [0.656] | [0.625] | [0.458] | [0.583] | [0.587] | [0.728] |
| Other | -137,214 | -118,664 | -121,927 | -59,977 | -58,147 | -67,791 | -95,391 | -67,322 |
| Organization | (106,560) | (102,341) | (104,321) | (70,416) | (69,497) | (74,604) | (64,730) | (58,724) |
| | [0.199] | [0.248] | [0.244] | [0.396] | [0.404] | [0.365] | [0.142] | [0.253] |
| Midwest | -15,227 | -22,338 | -25,161 | 26,901 | 14,505 | 15,622 | 5833 | -3923 |
| | (154,583) | (159,690) | (158,480) | (68,255) | (71,443) | (72,370) | (79,550) | (82,263) |
| | [0.922] | [0.889] | [0.874] | [0.694] | [0.839] | [0.829] | [0.942] | [0.962] |

**Table 5A (cont.). Effect of Covariates on Lifetime Maximum Benefits**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| South | -125,489 | -120,177 | -121,775 | -27,700 | -38,203 | -36,266 | -76,564 | -81,231 |
| | (180,121) | (177,802) | (177,963) | (72,724) | (74,324) | (76,463) | (92,932) | (92,114) |
| | [0.487] | [0.500] | [0.495] | [0.704] | [0.608] | [0.636] | [0.411] | [0.379] |
| West | -19,367 | -19,117 | -25,083 | 44,503 | 38,759 | 45,349 | 20,711 | 19,099 |
| | (189,036) | (186,658) | (189,933) | (86,654) | (87,217) | (88,083) | (98,030) | (95,603) |
| | [0.919] | [0.919] | [0.895] | [0.608] | [0.657] | [0.607] | [0.833] | [0.842] |
| Urban Location | 9818 | 7593 | 3561 | 81,953 | 82,056 | 84,384 | 30,054 | 28,755 |
| | (42,006) | (41,866) | (41,845) | (71,495) | (67,798) | (69,613) | (36,762) | (35,750) |
| | [0.815] | [0.856] | [0.932] | [0.254] | [0.228] | [0.227] | [0.415] | [0.422] |
| Small Firm (10 – 25 employees) | 214,424 | 179,837 | 201,084 | 108,374 | -18,174 | 36,112 | 206,041 | 170,274 |
| | (96,991) | (94,426) | (94,918) | (177,254) | (175,745) | (191,172) | (85,984) | (84,580) |
| | [0.028] | [0.058] | [0.035] | [0.542] | [0.918] | [0.850] | [0.017] | [0.045] |
| Medium Firm (26 – 100 employees) | 109,958 | 80,167 | 100,624 | 137,018 | 22,676 | 74,873 | 115,999 | 88,031 |
| | (73,411) | (69,239) | (71,813) | (161,265) | (155,993) | (175,399) | (61,342) | (58,621) |
| | [0.136] | [0.248] | [0.163] | [0.397] | [0.885] | [0.670] | [0.060] | [0.135] |
| Big Firm (101 – 500 employees) | 85,308 | 46,335 | 66,378 | 159,988 | 49,633 | 98,689 | 105,383 | 70,611 |
| | (91,102) | (78,427) | (84,026) | (155,403) | (149,432) | (169,543) | (75,422) | (66,662) |
| | [0.350] | [0.555] | [0.431] | [0.305] | [0.740] | [0.561] | [0.164] | [0.291] |
| Huge Firm (more than 500 employees) | 163,291 | 131,716 | 156,051 | 62,276 | -43,831 | 6648 | 108,266 | 81,487 |
| | (190,474) | (179,827) | (187,243) | (158,957) | (151,805) | (172,151) | (126,604) | (119,629) |
| | [0.392] | [0.465] | [0.406] | [0.696] | [0.773] | [0.969] | [0.393] | [0.497] |
| Partially Unionized Firm | -208,766 | -205,014 | -205,731 | -80,262 | -107,086 | -109,616 | -154,479 | -167,302 |
| | (95,116) | (92,250) | (92,360) | (58,397) | (49,971) | (52,051) | (48,573) | (47,880) |
| | [0.029] | [0.027] | [0.027] | [0.171] | [0.034] | [0.037] | [0.002] | [0.001] |
| Fully Unionized Firm | -406,258 | -472,593 | -425,072 | -9695 | -53,374 | -55,538 | -223,658 | -279,984 |
| | (185,237) | (178,523) | (195,477) | (126,529) | (113,914) | (115,778) | (113,656) | (119,449) |
| | [0.029] | [0.009] | [0.031] | [0.939] | [0.640] | [0.632] | [0.050] | [0.020] |
| Industry Income (1000s of dollars) | 5808 | 7751 | 6062 | -30,402 | -13,450 | -13,080 | -7864 | -323 |
| | (7838) | (6369) | (5617) | (13,718) | (6884) | (7243) | (6753) | (4146) |
| | [0.460] | [0.225] | [0.282] | [0.028] | [0.053] | [0.073] | [0.246] | [0.938] |

Notes: Dependent variable is the maximum lifetime dollar benefit each policyholder is entitled to receive. Standard errors are shown in parentheses; p-values are shown in brackets. Standard errors are adjusted for both heteroscedasticity and within-industry error correlation.
Source: Authors' calculations.

**Table 6. Effect of Job Attachment on Annual Stop-Losses**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| Intercept | 1453.70 | 758.36 | 1874.17 | 726.10 | -96.24 | 644.93 | 166.81 | -434.25 |
| | (725.28) | (678.55) | (838.62) | (1142.68) | (952.63) | (1313.21) | (807.42) | (695.71) |
| | [0.046] | [0.265] | [0.027] | [0.526] | [0.920] | [0.624] | [0.837] | [0.533] |
| Industry SVP | -327.22 | -209.71 | -547.32 | 93.13 | 319.81 | 169.45 | 11.79 | 138.55 |
| | (167.17) | (165.72) | (258.00) | (165.01) | (145.33) | (295.43) | (153.32) | (145.99) |
| | [0.052] | [0.207] | [0.035] | [0.573] | [0.029] | [0.567] | [0.939] | [0.344] |
| Single-Plan Firm | --- | --- | --- | --- | --- | --- | 1462.57 | 1445.52 |
| | | | | | | | (959.60) | (860.79) |
| | | | | | | | [0.129] | [0.095] |
| Single-Plan Firm x Industry SVP | --- | --- | --- | --- | --- | --- | -288.23 | -270.39 |
| | | | | | | | (173.73) | (157.35) |
| | | | | | | | [0.099] | [0.087] |
| R-squared | 0.180 | 0.176 | 0.174 | 0.215 | 0.217 | 0.217 | 0.178 | 0.176 |
| Number of Observations | 1116 | 1134 | 1116 | 750 | 764 | 750 | 1866 | 1898 |
| Partial F-statistic for instrument | --- | --- | 346.61 | --- | --- | 116.36 | --- | --- |

Notes: Dependent variable is the policyholder's annual stop-loss, defined as the expenditure threshold above which the policyholder is no longer required to make co-payments. Standard errors are shown in parentheses; p-values are shown in brackets. Standard errors are adjusted for both heteroscedasticity and within-industry error correlation. The instrumental variable models use Industry SVP 1980 as an instrument for Industry SVP 1987. All regressions include controls for type of coverage (single, two-party, family, or other), self-insurance status of employer (fully self-insured, partially self-insured, or commercial insurance), type of insurance (HMO or indemnity), type of employer (for profit, nonprofit, government, or other), region (northeast, midwest, south, or west), urban location (SMSA or non-SMSA), firm size (indicator variables for: < 10 employees, 10-25 employees, 26-100 employees, 101-500 employees, > 500 employees), employer unionization (fully unionized, partially unionized, or non-union), and industry income. The nature of the stop-loss provisions necessitated the inclusion of two additional controls: an indicator for whether the stop-loss applies to covered or out-of-pocket expenses and an indicator for whether the annual deductible is counted toward the stop-loss. Results for these variables are shown in Table 6A.
Source: Authors' calculations derived from Equations (6) and (7).

**Table 6A. Effect of Covariates on Annual Stop-Losses**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| Stop-Loss Based | 2515.67 | 2504.52 | 2515.41 | 2104.89 | 2082.72 | 2098.49 | 2368.33 | 2350.66 |
| on Covered | (220.43) | (210.68) | (216.44) | (216.72) | (215.91) | (222.11) | (156.89) | (153.37) |
| Expenses | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Stop-Loss | -34.90 | -56.98 | -46.37 | -196.57 | -211.29 | -200.21 | -87.67 | -109.71 |
| Includes | (231.62) | (232.18) | (235.46) | (181.03) | (177.16) | (180.99) | (177.28) | (175.66) |
| Deductible | [0.880] | [0.806] | [0.844] | [0.279] | [0.235] | [0.270] | [0.621] | [0.533] |
| Two Party Policy | 253.64 | 155.57 | 197.11 | -507.78 | -495.75 | -513.32 | -151.55 | -177.87 |
| | (386.24) | (392.85) | (390.40) | (260.81) | (254.39) | (260.03) | (235.46) | (234.75) |
| | [0.512] | [0.693] | [0.614] | [0.053] | [0.053] | [0.050] | [0.521] | [0.450] |
| Family Policy | 228.52 | 194.36 | 205.38 | -161.92 | -144.50 | -153.22 | 69.81 | 58.82 |
| | (207.36) | (200.78) | (204.28) | (188.62) | (184.30) | (190.04) | (149.03) | (143.10) |
| | [0.272] | [0.334] | [0.316] | [0.392] | [0.434] | [0.421] | [0.640] | [0.681] |
| Other Policy | 628.97 | 379.55 | 562.60 | -578.03 | -538.64 | -560.72 | 261.83 | 139.30 |
| | (809.08) | (805.02) | (821.11) | (412.74) | (398.57) | (400.82) | (549.77) | (546.39) |
| | [0.438] | [0.638] | [0.494] | [0.164] | [0.179] | [0.164] | [0.634] | [0.799] |
| Self Insured | -380.16 | -384.30 | -394.10 | 230.38 | 227.70 | 245.10 | -101.77 | -104.90 |
| Policy | (301.23) | (303.10) | (305.63) | (205.23) | (201.15) | (206.85) | (202.39) | (198.85) |
| | [0.208] | [0.206] | [0.199] | [0.264] | [0.260] | [0.238] | [0.616] | [0.598] |
| Partially Self | 169.10 | 153.94 | 93.62 | 65.75 | 70.04 | 69.11 | 170.97 | 166.87 |
| Insured Policy | (1021.29) | (1030.21) | (1047.14) | (312.93) | (309.59) | (311.72) | (409.05) | (408.21) |
| | [0.869] | [0.881] | [0.929] | [0.834] | [0.821] | [0.825] | [0.676] | [0.683] |
| Policy is an HMO | 742.17 | 921.18 | 929.44 | 1800.59 | 1770.59 | 1769.95 | 1560.40 | 1582.84 |
| | (719.99) | (752.46) | (899.29) | (569.48) | (575.31) | (576.09) | (485.88) | (488.22) |
| | [0.304] | [0.222] | [0.303] | [0.002] | [0.002] | [0.003] | [0.002] | [0.001] |
| Nonprofit | 3.56 | -75.43 | 165.49 | -50.20 | -168.03 | -98.58 | -15.67 | -99.91 |
| Organization | (252.65) | (266.77) | (288.06) | (304.86) | (268.99) | (314.63) | (162.30) | (158.60) |
| | [0.989] | [0.778] | [0.566] | [0.869] | [0.533] | [0.754] | [0.923] | [0.529] |
| Government | 402.21 | 343.14 | 472.51 | -162.23 | -281.61 | -192.43 | 103.39 | 39.00 |
| Organization | (295.37) | (284.10) | (314.22) | (220.73) | (191.26) | (255.85) | (187.46) | (176.05) |
| | [0.175] | [0.229] | [0.134] | [0.464] | [0.143] | [0.453] | [0.582] | [0.825] |
| Other | -363.03 | -464.16 | -449.30 | -413.36 | -410.83 | -427.98 | -346.99 | -368.99 |
| Organization | (321.71) | (324.27) | (302.42) | (352.21) | (342.54) | (385.89) | (248.79) | (253.75) |
| | [0.261] | [0.154] | [0.139] | [0.242] | [0.232] | [0.269] | [0.165] | [0.147] |

**Table 6A (cont.). Effect of Covariates on Annual Stop-Losses**

| | Single-Plan Firms | | | Multiple-Plan Firms | | | Difference-in-Differences | |
|---|---|---|---|---|---|---|---|---|
| | Industry SVP 1980 (1) | Industry SVP 1987 (2) | IV Model (3) | Industry SVP 1980 (4) | Industry SVP 1987 (5) | IV Model (6) | Industry SVP 1980 (7) | Industry SVP 1987 (8) |
| Midwest | 181.14 | 187.62 | 184.06 | 183.12 | 161.21 | 177.41 | 116.37 | 120.54 |
| | (175.17) | (176.42) | (179.63) | (215.04) | (215.80) | (218.15) | (157.19) | (153.34) |
| | [0.302] | [0.289] | [0.307] | [0.396] | [0.456] | [0.417] | [0.460] | [0.433] |
| South | 494.93 | 478.50 | 496.46 | 98.83 | 139.66 | 107.53 | 311.34 | 322.08 |
| | (193.62) | (197.08) | (198.08) | (253.17) | (236.08) | (250.48) | (173.61) | (165.96) |
| | [0.011] | [0.016] | [0.013] | [0.697] | [0.555] | [0.668] | [0.074] | [0.054] |
| West | 1253.12 | 1161.89 | 1242.45 | 246.32 | 220.63 | 244.57 | 711.17 | 719.40 |
| | (517.29) | (511.14) | (514.84) | (287.63) | (283.17) | (288.25) | (327.68) | (323.20) |
| | [0.016] | [0.024] | [0.017] | [0.393] | [0.437] | [0.398] | [0.020] | [0.027] |
| Urban Location | 176.53 | 141.55 | 193.98 | -205.41 | -214.22 | -208.37 | 23.06 | -9.51 |
| | (247.29) | (236.50) | (245.84) | (236.13) | (250.23) | (236.51) | (175.73) | (172.83) |
| | [0.476] | [0.550] | [0.431] | [0.386] | [0.393] | [0.380] | [0.896] | [0.956] |
| Small Firm (10 – | 289.12 | 353.48 | 318.71 | 196.69 | 350.78 | 173.58 | 289.40 | 351.18 |
| 25 employees) | (306.00) | (294.92) | (305.90) | (811.24) | (783.47) | (832.90) | (286.79) | (276.14) |
| | [0.346] | [0.232] | [0.299] | [0.809] | [0.655] | [0.835] | [0.314] | [0.205] |
| Medium Firm (26 | 200.03 | 293.37 | 201.68 | -95.61 | 98.48 | -111.88 | 183.05 | 278.39 |
| – 100 employees) | (216.25) | (223.64) | (220.12) | (746.41) | (680.90) | (732.92) | (210.77) | (213.26) |
| | [0.356] | [0.191] | [0.361] | [0.898] | [0.885] | [0.879] | [0.386] | [0.193] |
| Big Firm (101 – | 307.18 | 433.19 | 308.31 | -267.57 | -49.97 | -268.29 | 187.86 | 314.79 |
| 500 employees) | (244.99) | (260.42) | (257.40) | (698.31) | (679.83) | (717.08) | (229.11) | (238.38) |
| | [0.211] | [0.098] | [0.233] | [0.702] | [0.942] | [0.709] | [0.413] | [0.188] |
| Huge Firm (more | 936.24 | 1046.69 | 933.41 | 97.70 | 293.44 | 83.25 | 685.91 | 781.82 |
| than 500 | (396.96) | (418.58) | (404.80) | (660.24) | (635.86) | (675.24) | (274.59) | (286.25) |
| employees) | [0.019] | [0.013] | [0.022] | [0.883] | [0.645] | [0.902] | [0.013] | [0.007] |
| Partially | -294.61 | -247.14 | -298.29 | -24.68 | 63.16 | 23.79 | -155.83 | -96.13 |
| Unionized Firm | (304.49) | (284.14) | (283.89) | (239.75) | (231.32) | (263.54) | (188.86) | (180.47) |
| | [0.335] | [0.386] | [0.295] | [0.918] | [0.785] | [0.928] | [0.410] | [0.595] |
| Fully Unionized | -508.25 | -530.88 | -614.06 | -545.67 | -474.82 | -499.12 | -493.14 | -451.26 |
| Firm | (580.39) | (555.89) | (575.79) | (396.46) | (385.46) | (392.54) | (307.92) | (294.36) |
| | [0.382] | [0.341] | [0.288] | [0.171] | [0.220] | [0.206] | [0.111] | [0.127] |
| Industry Income | 19.48 | 15.97 | 44.42 | 27.80 | -10.92 | 0.19 | 24.83 | 7.38 |
| (1000s of dollars) | (56.54) | (22.29) | (30.47) | (39.33) | (19.74) | (28.44) | (36.01) | (15.06) |
| | [0.731] | [0.475] | [0.147] | [0.481] | [0.581] | [0.995] | [0.491] | [0.625] |

Notes: Dependent variable is the policyholder's annual stop-loss, defined as the expenditure threshold above which the policyholder is no longer required to make co-payments. Standard errors are shown in parentheses; p-values are shown in brackets. Standard errors are adjusted for both heteroscedasticity and within-industry error correlation.
Source: Authors' calculations.

## Figure 1. Sequence of Events

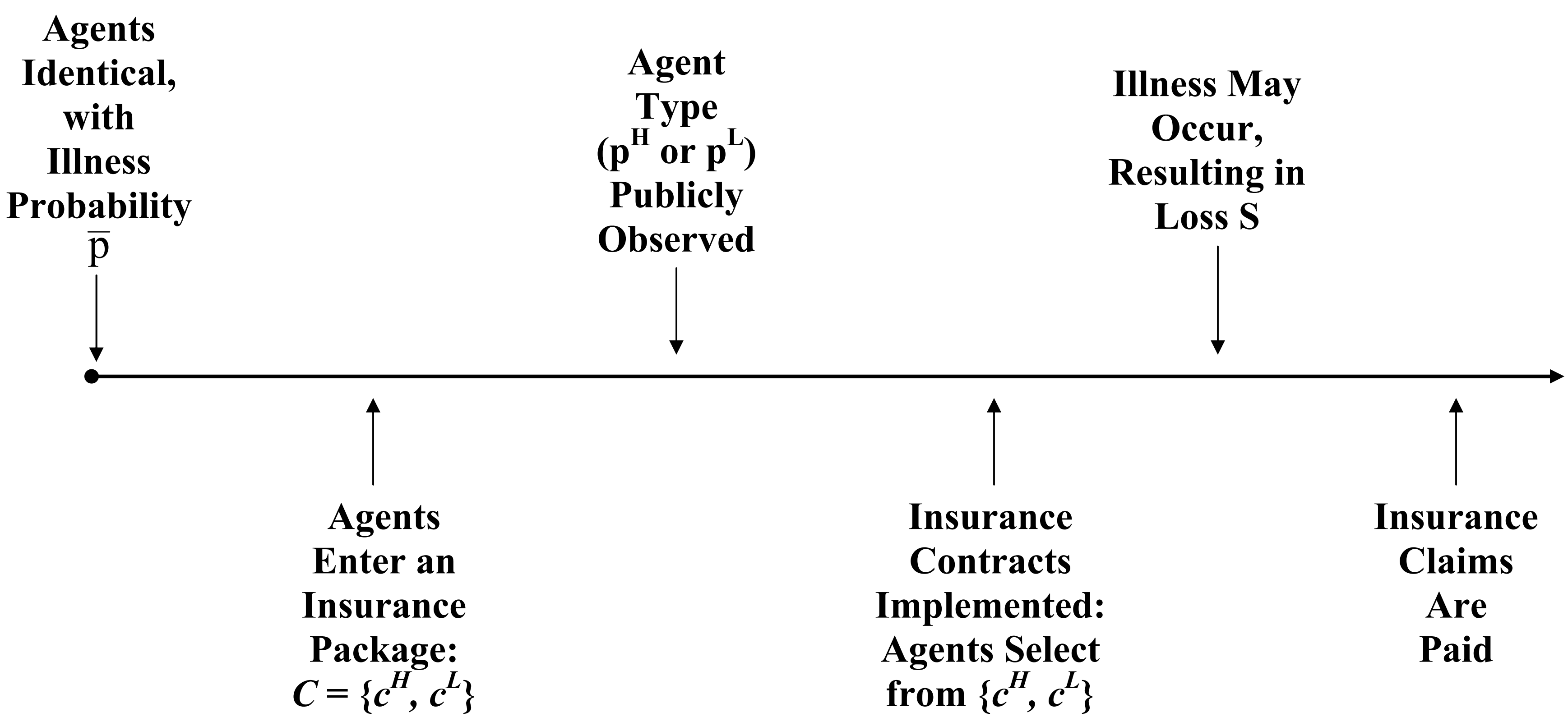


**Figure 2. Spot Market and Full Commitment Contracts**

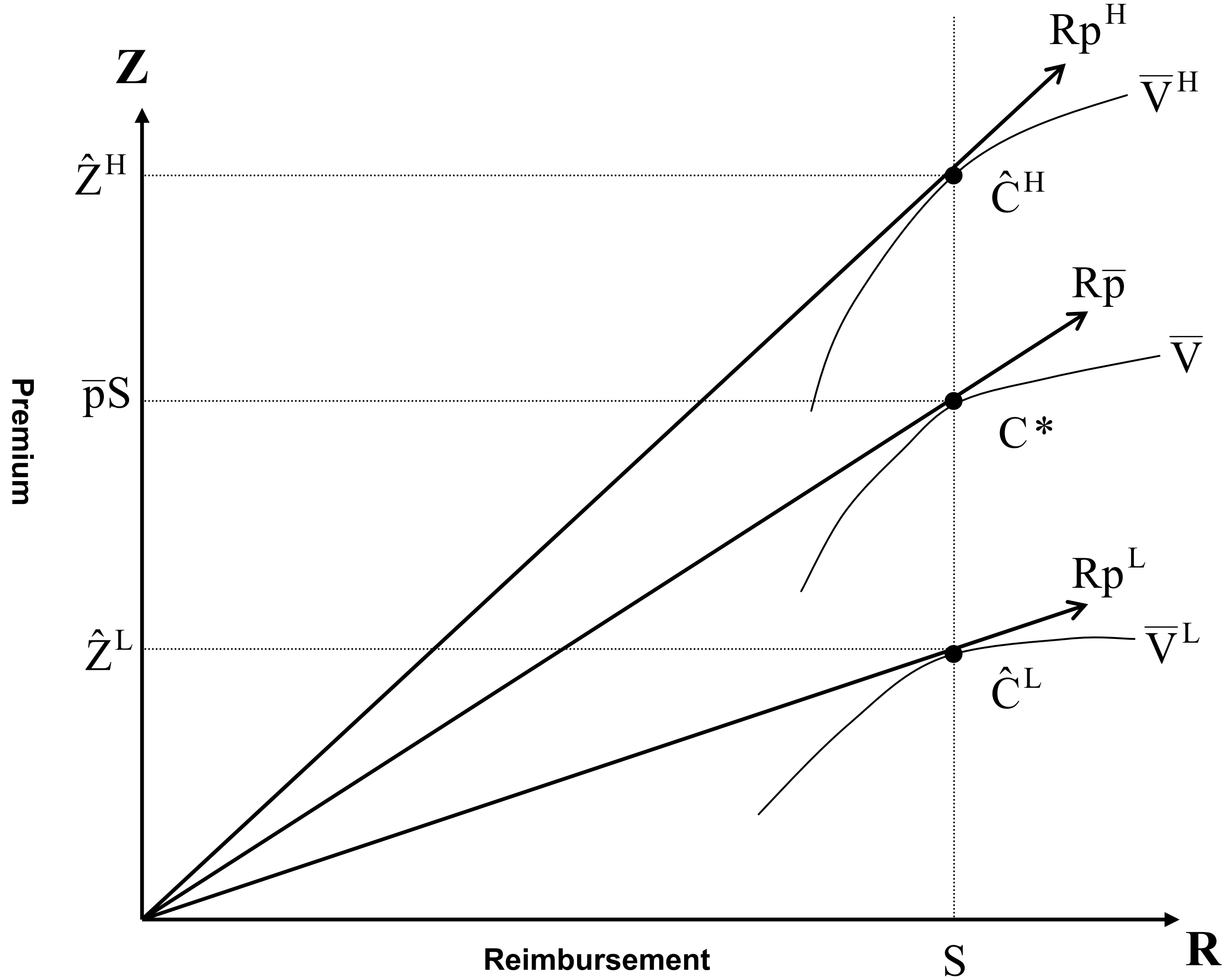


**Figure 3. Single-Contract Benefit Packages**

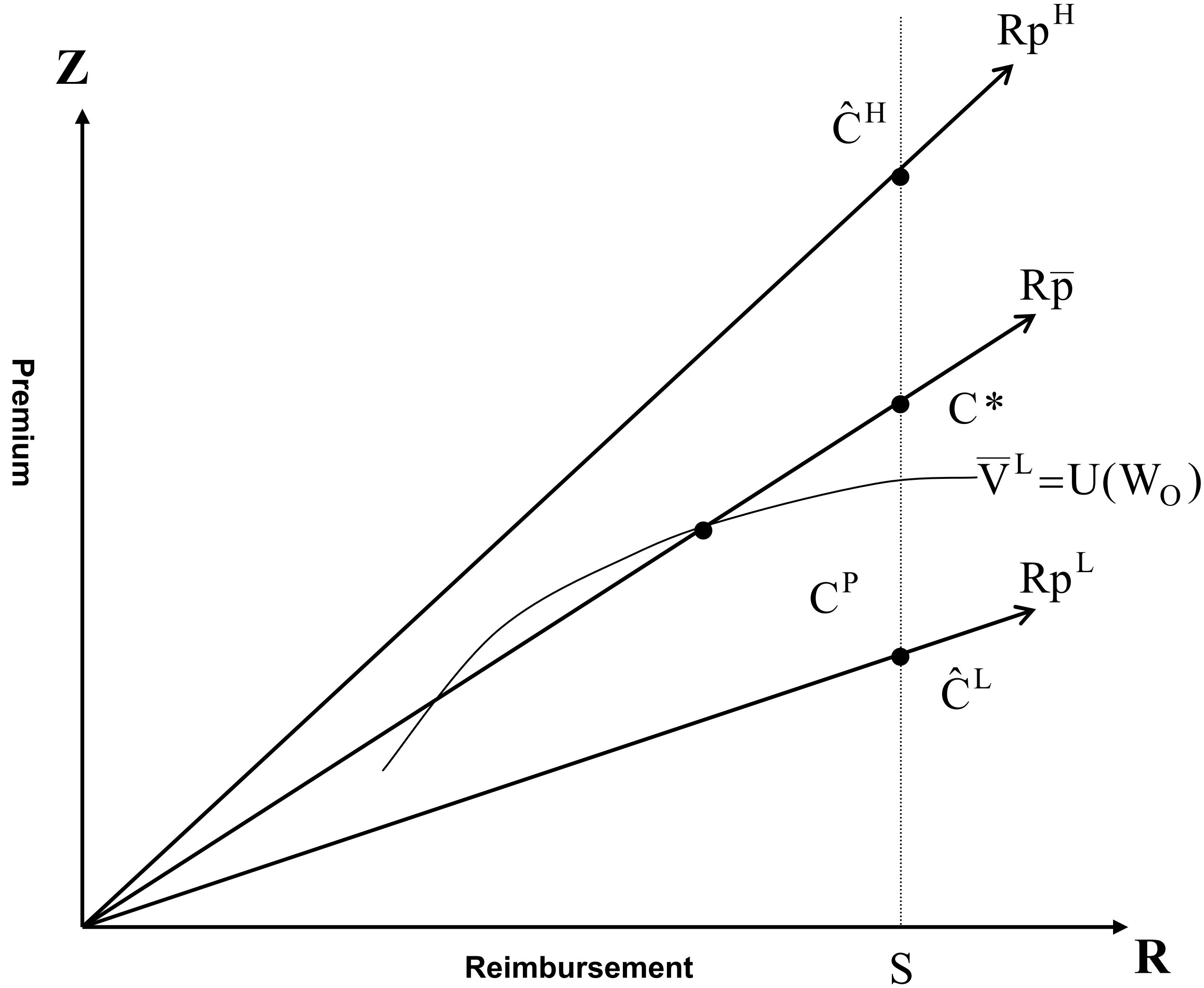
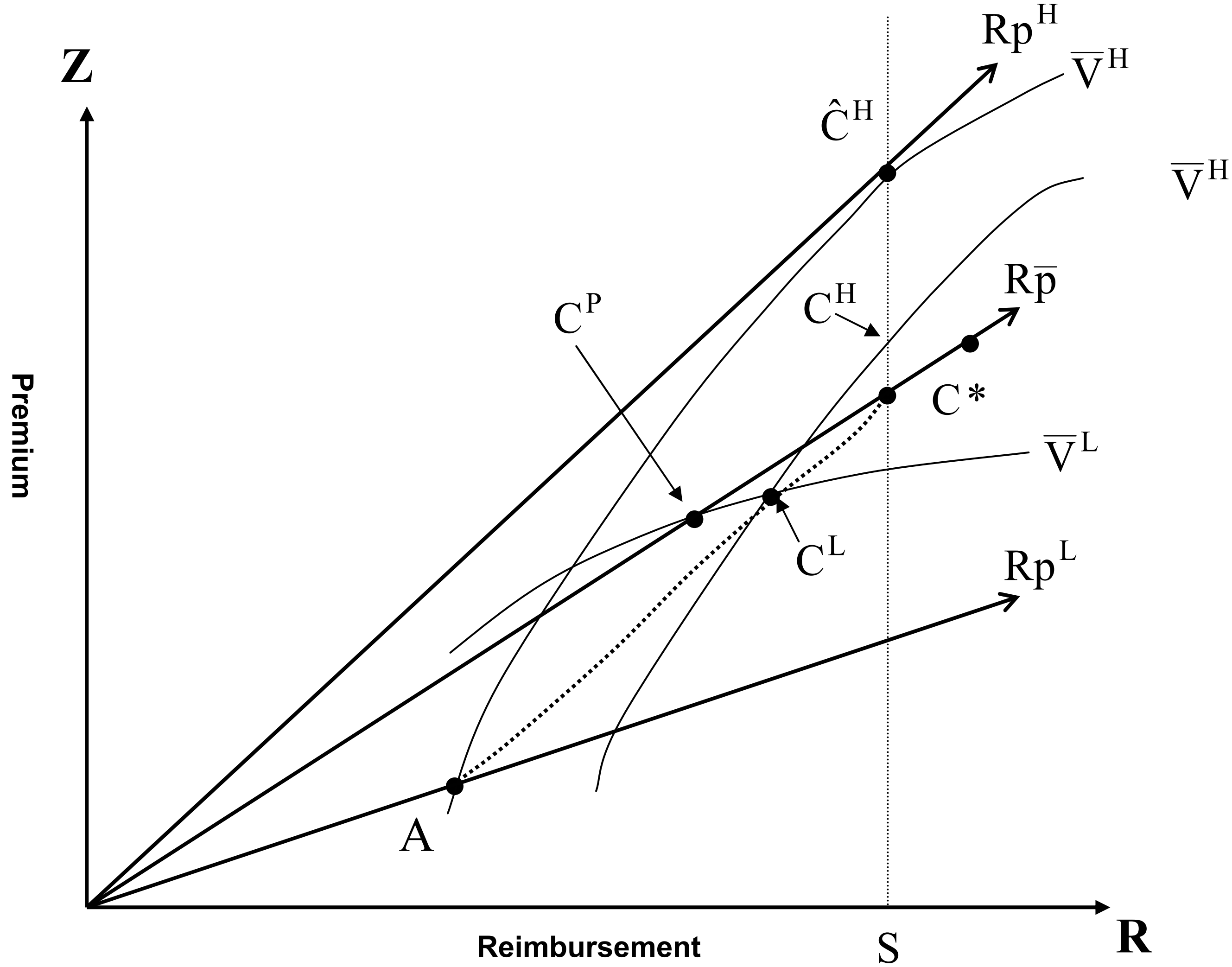


**Figure 4. Multi-Contract Benefit Packages**



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