

SUBSIDIZATION AND CHOICE IN THE GROUP HEALTH INSURANCE MARKET

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ABSTRACT

This study investigates the effect of group health insurance plan choice on insurance unit price. The empirical findings suggest that the unit price of insurance, as measured by the ratio of the premium to expected indemnity benefits, is lower in group plans that offer employees a choice of different insurance options and require a premium contribution than it is in plans lacking at least one of these two features. The analyses suggest that lower unit prices are related to an increase in indemnity benefits and that the reduction in the unit price is greater for lower risks. The findings indicate that although subsidization of high risks by low risks occurs with group health insurance, the degree of subsidization is less when employees are offered a choice of health insurance plans.

INTRODUCTION

Significant scholarly attention has focused on various aspects of employee benefits (see, for instance, Browne and Trieschmann, 1991; Jensen, Cotter, and Morrissey, 1995; Rhine, 1987). Prior to the passage of the HMO Act of 1973 it was much less common than it is today for employers to provide employees a choice of health insurance plans. Accompanying the growth in market share of HMOs there has been growth in the number of employers offering their employees a choice of several different health insurance options. The question the current article addresses is whether or not the availability of health insurance plan choice is related to a reduction in subsidization of high risks. A reduction and possibly an elimination of subsidization would occur if different risks selected different insurance plans.

Theoretical models show that when information is asymmetric in an insurance market, the individuals seeking insurance may self-select into different risk pools according to their risk levels (see, for example, Rothschild and Stiglitz, 1976). When only one plan is offered to an employee group, the premium and coverage are the same for all

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plan participants, regardless of risk level. Feldman (1987) contends that group health insurance policies pool together disparate risks and entail subsidization of high risks by low risks. Feldman writes that this has been observed by Pauly (1970) who states, "because the group premium is uniform for all members, each individual pays a higher (than experience rated) premium when their risk-type is low in exchange for the opportunity to pay a lower premium when their risk type is high." The potential for significant premium cross-subsidization from low to high risks in these cases is likely (Goldstein and Pauly, 1976; Pupp, 1981; Browne, 1992; Browne and Doerpinghaus, 1993, 1994/1995; Goldman et al., 1997). When employees are given a choice of policies, the potential premium cross-subsidization is expected to change as a result of self-selection.¹

Whether subsidization across risk-types is desirable is unclear. Arrow (1963) and Pauly (1970) argue that under community rating low risks derive an inefficiently low level of benefits compared to the premium they pay, whereas the reverse is true for high risks.² On the other hand, several scholars provide arguments against risk segmentation. Their general concerns involve abnormal profits generated by insurers that aim at low risks (Jackson-Beeck and Kleinman, 1983; Jensen, Feldman, and Dowd, 1984) and wasted resources (see, for example, Jones, 1989; Rogal and Gauthier, 1998) when insurers attempt to cream skim.³ Despite differing perspectives on the desirability of risk segmentation, there has been relatively little empirical analysis of whether or not segmentation and changes in the unit price of insurance occur when employers offer their employees a choice of health plans rather than provide a single health insurance plan for all.⁴

Whether employers offering a choice of different health plans to employees results in risk segmentation within the group insurance market is an important public policy

¹ When a company offers only one health plan and employees are heterogeneous with regard to health risks, premium cross-subsidization from low to high risks would result. If the labor market is competitive and workers choose jobs based on factors other than their own demand for health insurance, we can assume a heterogeneous group in each company. Browne (1992) assumes that subsidization of high risks by low risks occurs in the group market. Goldstein and Pauly (1976) suggests that subsidization is possible in the group market. Pupp (1981) and Goldman et al. (1997) show that cross-subsidization takes place when community rating is used to determine group health insurance premiums.

² Even though insurance policies available to employees are subject to the employer's choice of health plans, Peele et al. (2000) show that the employer understands the employees' preferences of health plans and such preferences are incorporated into their design of health insurance benefits. Feldman and Dowd (2000) provide a review of different perspectives of risk segmentation and suggest ways to improve efficiency when multiple health plans are available.

³ Welfare gains by consumers may offset the resource costs associated with risk selection. Segmentation may result in low risk consumers purchasing more insurance at closer to actuarially fair prices.

⁴ In this study, the unit price of insurance is defined as the ratio of the insurance premium to the expected indemnity benefits payable to the insured. The unit price measurement is similar to the inverse of the loss ratio. The main difference is that we replace the actual loss (i.e., insurance benefits derived) with expected insurance benefits received by each individual. Both the process and rationale for using expected benefits are explained in detail in the following section. See Pauly (2003) for a discussion of measures of the price of insurance.

question. Risk segmentation may result in insurance policies that are more restrictive in their coverage. Higher premiums for some risk groups may also result. In the Rothschild and Stiglitz (1976) model of equilibrium in an insurance market with asymmetric information, individuals with different risks select different policies. Others, including Wilson (1977) and Miyazaki (1977) describe market equilibriums in which cross-subsidization occurs. The empirical results of the current study suggest that although health insurance plan choice is associated with a reduction in subsidization relative to that occurring when only a single plan is provided to all employees eligible for health insurance, group insurance continues to entail subsidization of high risks by low risks.

The remainder of this article is organized as follows. The section on "Group Health Insurance Plan Choice and Premium Cross-Subsidization" reviews the literature on premium cross-subsidization and adverse selection in the group health insurance market. The data and methodology used to empirically test the hypotheses of the study are presented in "Data and Methodology." "Results and Discussion" contains the empirical results of the study. Recommendations for future research and a summary of the major findings of this study are contained in "Conclusion."

GROUP HEALTH INSURANCE PLAN CHOICE AND PREMIUM CROSS-SUBSIDIZATION

The group health insurance marketplace in the United States differs from the marketplace for individual health insurance in several important ways. First, an employee who receives group insurance has at most a very limited choice of health insurance plans after selecting a job. Some employers offer a choice of group health insurance plans to their employees. Others offer a single health insurance plan that provides coverage to all employees eligible for the benefit. Group health insurance is also characterized by a lack of risk-based underwriting of individuals. This is particularly true for large employment groups. Although some employers require higher premium contributions from employees who engage in activities that are associated with higher rates of morbidity, such as smoking, this is not widespread. Coverage and premium rates often do not reflect differences in age and gender within groups, although these are important underwriting criteria in the market for individual health insurance. Worth noting is that the traditional lack of risk-based underwriting in the group health insurance market has resulted in it being one of the only places in the U.S. health insurance system where individuals who maintained jobs that provide coverage could count on long-term protection against having their risk redefined in the event of illness or injury.

Theories on insurance market equilibria, self-selection, and premium subsidizations were developed in the 1970s. Rothschild and Stiglitz (1976) contend that market equilibrium either does not exist or entails the high-risk purchase of full insurance and the low-risk purchase of less than full coverage.⁵ Modifying the assumption of zero transaction costs under the Rothschild–Stiglitz model, Newhouse (1996) proposes two new conclusions that are more consistent with observed market behavior. In Newhouse's model, a pooling equilibrium might exist when contracting costs are large. This is

⁵ Several other influential studies contend that subsidization across risk groups may occur. See, for example, Wilson (1977) and Miyazaki (1977).

consistent with observation of insurance plans with heterogeneous risks, such as large HMOs (see, for example, Neipp and Zeckhauser, 1985). Additionally, high risks, instead of low risks as suggested by the Rothschild–Stiglitz model, are the groups that tend to have trouble in obtaining their desired insurance.

Several scholars have empirically tested the existence of cross-subsidization in different insurance markets and measured the amount of subsidization when high risks and low risks are charged a pooled premium. Pupp (1981) and Goldman et al. (1997) show that cross-subsidization takes place when community rating is used to determine group health insurance premiums. Other empirical evidence consistent with the occurrence of cross-subsidization has been found in life insurance (Beliveau, 1984), automobile insurance (Dahlby, 1983), and health insurance markets (Browne, 1992; Browne and Doeringhaus, 1993, 1994/1995; Monheit and Selden, 1996). Browne (1992) and Browne and Doeringhaus (1993) find there is cross-subsidization from low risks to high risks in the individual medical market. In yet another study, Browne and Doeringhaus (1994/1995) report findings from the Medigap market that also suggest premium cross-subsidization from low risks to high risks. Monheit and Selden (1996) examine the nature of equilibrium in the employment-related health insurance market and show that there is a substantial amount of pooling of heterogeneous risks among households with employment-related coverage, even when employees are able to choose among several plans made available at the workplace.

Elements of self-selection into health plans are identified by Luft, Trauner, and Maerki (1985), Price and Mays (1985), Ellis (1985, 1989), Dowd and Feldman (1985, 1994/1995), Feldman et al. (1989), Short and Taylor (1989), Marquis (1992), Monheit and Selden (1996), and Buchmueller and Feldstein (1997). Studies have shown evidence that self-selection may occur when employers offer multiple plans. However, an unanswered question in health economics is whether the unit price of insurance and subsidization change as a result of self-selection when employees are offered a choice of health plans. Our article extends previous work by looking into the impact of health plan choice on subsidization and insurance unit price in the employer-provided health insurance market. We anticipate that when an employer offers more than one health plan option to employees a self-selection process will result in changes in the unit price of insurance for employees. Both the employer and employee portions of the premium are considered in the analyses.

DATA AND METHODOLOGY

Data and Sample Selection

The data used in this study are from the National Medical Expenditure Survey (NMES) conducted in 1987.⁶ This survey includes a total sample of roughly 35,000 individuals,

⁶ The NMES is well suited for the current analysis as it contains information on both employers and employees. Most other data sets provide only information related to an individual's current insurance plan and the consumption of health services. They lack information on whether the individual was offered other insurance plan options through employment. Although others provide information related to group health insurance obtained through employers, they lack worker specific information. Examples of the former include the Current Population Survey, the Survey of Income and Program Participation, and the Health Interview Survey. An example of the latter is the National Employer Health Insurance Survey.

in 14,000 households. The information obtained in the household component of this survey includes data on household composition, employment, use of health services, insurance coverage, health expenditures, and sources of payment for health services for the civilian population of the United States during the calendar year 1987. The other two components of the survey, the Medical Provider Component and Health Insurance Plans Component, provide supplementary information obtained from employers and insurance companies. The three components of the survey are linked by the respondents' identification numbers.

Because the interest of this study lies only in those people who participated in an employer-provided health insurance plan, the observations included in this study are limited to those with employer-provided health insurance coverage. This limits the maximum possible sample size to 6,549 observations. Individuals are included in the sample for our analysis if they meet all of the following criteria:⁷

- Employer-provided health insurance is the only health insurance coverage the individual had in place during 1987.
- The individual's health insurance policy provided coverage for the entire year.
- Complete information on health status (including self-reported health condition and chronic diseases) and activity limitation for the individual is included in the data set.
- The individual is under age 65.
- Individuals also need to have reported complete information on demographic characteristics and employment status⁸ and need to have stayed with the same employer for the whole year in order to be included in the sample.

We classify all family members covered under the same policy as one observation unit. Due to the wide range in the premium distribution of our data (a minimum premium of \$117.50 and maximum of \$6,683.08), we further limit the sample to the observations between the 5 and 95 percentiles of the premium distribution to avoid error-coding and ensure comparability of insurance coverage. As a result of these restrictions, 1,077 observation units qualify for inclusion in the analysis. Each observation unit includes the policyholder and their nonelderly covered dependants, if any. Because the dependent variable in the empirical model is the ratio of the premium to the expected medical benefits derived from the individuals insurance plan, both premium and benefits are aggregated on a per policy basis for the observation units.

In a second analysis, we limit our observations to single, unmarried individuals with no dependants. This sample consists of 554 observations. Although we control for

⁷ These selection criteria apply to not only the policyholder, but also all of the covered family members. If more than one person is covered by the same policy, and any of the covered members does not have complete information, we exclude the family unit. Health status information is the most restrictive criteria that significantly limit the number of valid observations.

⁸ All of the demographic and employment related variables used in the empirical analysis correspond to the policyholder's characteristics. Health-related variables, such as self-reported health status, indication of chronic disease or activity limitation takes the worst condition of the family members covered under the same policy.

family size and marital status with our larger sample analysis, misspecification of the test equation may occur if demographic characteristics of family members other than the breadwinner are important determinants in the health insurance purchasing decision. Specification of the test equation with the second more narrowly defined sample addresses this concern. The second sample does not permit examination of the relationship between family size and insurance unit price.

As mentioned earlier, only those individuals whose employer-provided health insurance is the only health insurance coverage in place and only those whose policies provided coverage for the entire year are included in the sample. These two selection criteria ensure that the reported insurance benefits received match the reported yearly total premium paid for insurance policies obtained through employment. Table 1 reports indemnity benefits received by people of different gender, race, and health status. The table shows that people in poor health—those reporting a poorer health status, a chronic disease, or an activity limitation—receive greater insurance benefits than those in good health. This pattern persists when we consider two-party and family coverage.

Insurance Unit Price Estimation

The measurement of the insurance unit price involves two steps. First, the expected insurance indemnity benefits received under each policy are estimated.⁹ The unit price of insurance then is calculated by taking the ratio of premium to the expected indemnity benefits. Although employers may pay all or only a portion of the premium, the *total* premiums paid to the insurer (aggregating both employers' and employees' contributions) are used in the empirical equations. This aggregation is justifiable as the inclusion of only the employers or employees contribution will not correctly reflect the premium associated with the insurance coverage. Table 2 displays summary statistics for the premium variable. The results of the *t*-tests suggest that premium levels vary significantly by the availability of health plans choice, gender, health status, activity limitation, and employers' share of premiums.¹⁰

⁹ We follow Browne (1992) in our use of expected benefits rather than actual benefits. Browne contends that expected benefits are a better measure of the distribution of medical care usage of each policyholder than observed medical expenditures from a single year. This is because observed expenditures from a single year represent one random draw from an underlying health expense distribution whereas expected benefits represent the mean of that underlying distribution. The methodology we use to estimate expected benefits is based on that used by Duan et al. (1983). The estimation process can be found in the Appendix.

¹⁰ Before restricting our sample to a limited premium range, premium for a single coverage contract ranges from \$1,177.5 to \$5,471 per year for companies that offer a choice of health plans, and varies from \$343 to \$3,643.20 for companies offering only one health plan. For policies that cover more than one individual, premium ranges from \$327 to \$6,683.08 when plan choice is present and from \$594 to \$5,480.80 when plan choice is not available. Bundorf (2000) and Moran, Chernen, and Hirth (2000) study the relationship between employee heterogeneity and the breadth of employer health insurance offerings. They find that firms offer multiple choices and more diversified health plans in response to worker heterogeneity, which explains why the premium range is wider for firms that offer a choice of health plans.

TABLE 1
Descriptive Statistics: Insurance Benefits Received, by Gender, Race, Health Status, and Activity Limitation

Variable	Type of Coverage	Number With Zero Benefits (N = 280)	If Receiving Positive Benefits (N = 797)	
			Mean	Standard Deviation
Gender				
Female	Single coverage	119	881.91	1,659.20
	Two-party or family coverage	8	1,722.40	6,580.42
Male	Single coverage	139	672.90	1,605.58
	Two-party or family coverage	14	2,862.59	5,725.20
Race				
White	Single coverage	185	726.19	1,436.51
	Two-party or family coverage	17	2,583.77	6,378.67
Other	Single coverage	73	1,068.73	2,205.98
	Two-party or family coverage	5	1,665.87	3,156.31
Self-reported health status				
Poor or fair	Single coverage	27	1,622.38	2,813.69
	Two-party or family coverage	4	4,693.61	9,665.71
Good	Single coverage	135	781.30	1,481.83
	Two-party or family coverage	10	1,707.80	3,541.63
Excellent	Single coverage	96	572.08	1,253.24
	Two-party or family coverage	8	515.85	456.88
Ever had chronic disease				
Yes	Single coverage	68	1,202.53	2,196.84
	Two-party or family coverage	11	2,827.11	6,812.28
No	Single coverage	190	602.63	1,234.53
	Two-party or family coverage	11	1,640.96	3,716.45
Activity limitation				
Yes	Single coverage	36	1,287.93	2,148.06
	Two-party or family coverage	13	3,558.81	7,762.58
No	Single coverage	222	667.69	1,445.42
	Two-party or family coverage	9	1,342.04	3,174.21

TABLE 2

Descriptive Statistics: Premiums by Choice of Health Plans, Gender, Education, Health Status, Activity Limitation, HMO, and Employers' Share of Premiums

Variable		Number of Observations	Mean	<i>t</i> -Test
Choice				
Full sample	Yes	654	1,524.3	3.51***
	No	423	1,358.2	
Single only	Yes	336	1,079.2	1.64*
	No	218	1,023.7	
Gender ^a				
Full sample	Female	542	1,294.9	−7.18
	Male	535	1,625.4	
Single only	Female	308	1,086.5	1.56*
	Male	246	1,034.1	
Education ^a				
Full sample	≤12 years	573	1,485.2	1.19
	>12 years	504	1,429.4	
Single only	≤12 years	277	1,043.3	−0.85
	>12 years	277	1,071.4	
Self-reported health status ^a				
Full sample	Poor or fair	171	1,746.6	4.79***
	Good or excellent	906	1,404.8	
Single only	Poor or fair	52	989.67	−1.47
	Good or excellent	502	1,064.4	
Chronic disease ^a				
Full sample	Yes	447	1,691.6	8.25***
	No	630	1,294.1	
Single only	Yes	144	1,024.4	−1.27
	No	410	1,068.9	
Activity limitation ^a				
Full sample	Yes	305	1,769.1	7.84***
	No	772	1,336.6	
Single only	Yes	92	1,049.4	−0.24
	No	462	1,058.9	
HMO				
Full sample	Yes	182	1,409.2	−1.02
	No	895	1,469.2	
Single only	Yes	115	1,113.3	1.75**
	No	439	1,042.7	
Employers pay 100% premium				
Full sample	Yes	575	1,421.9	−1.70**
	No	502	1,501.6	
Single only	Yes	309	1,079.9	1.55*
	No	245	1,028.9	

*Statistically significant at 0.1 level.

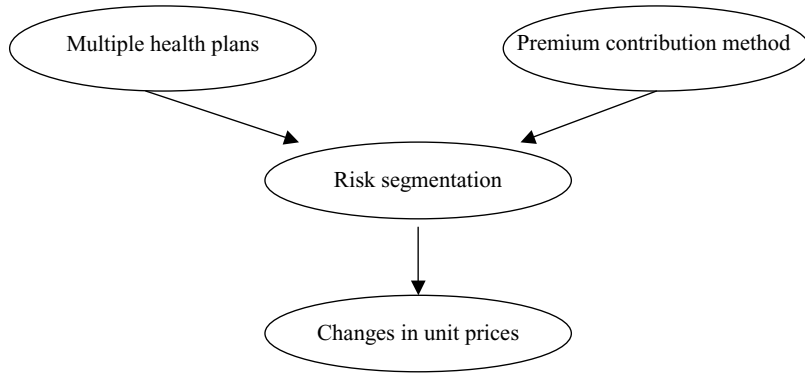
**Statistically significant at 0.05 level.

***Statistically significant at 0.01 level.

^aVariables that differentiate low risks from high risks are based on one-sided tests. The null hypothesis is that high risks do not have higher premiums than low risks.

Premium Cross-Subsidization Equation

Both the availability of choice and the premium contribution method can contribute to the segmentation of risks. We illustrate these relationships in the following diagram:



When choice is available, employees may self-sort into different health plans according to their risk-types. When different amounts of premium sharing for employees are required for different health plans, risk segmentation may also result.¹¹ We anticipate different insurance unit prices for low and high risks when (1) a choice of health insurance coverages is offered to employees and (2) employee premium contributions for health insurance depend on the insurance coverage chosen.

We classify employees as working for employers that offer one of the following four types of plans:

- (a) PLAN 1: Plans that offer several different insurance options and require the employees to share in the premium cost.
- (b) PLAN 2: Plans that offer multiple insurance options and are paid fully by the employer. That is, the employee does not share in the premium cost.
- (c) PLAN 3: Plans that offer only one insurance policy and require that the employees share in the premium cost.
- (d) PLAN 4: Plans that offer only one insurance policy and do not require an employee contribution toward the cost of the plan.¹²

To examine the effect of plan choice on the unit price of insurance, we estimate an equation of the form:

$$\ln \left(\frac{\text{PREM}_i}{E[\text{BEN}]_i} \right) = \alpha + \beta X_i + \omega \gamma_i + \phi(\gamma_i \otimes \mu_i) + \varepsilon_i,$$

¹¹ Self-selection is also possible when firms offer only one insurance policy but require employees to share in the premium cost. In this case, employees would have the choice of being covered and paying their share of the premium or declining coverage.

¹² While testing the wage response to employer health insurance plan offerings is beyond the scope of the current research, *ceteris paribus*, plans requiring greater employee premium cost sharing are likely be associated with a reduced wage offset.

where PREM_i is premiums paid to the insurer, aggregating both employers' and employees' contributions, for policyholder i , $E[\text{BEN}]_i$ is expected insurance indemnity benefits for policyholder i , X_i is vector of variables that affect discrepancy between premium paid and expected benefit received by policyholder i , γ_i is vector of dummy variables indicating the type of plan to which policyholder i belongs, $\gamma_i \otimes \mu_i$ is vector of interaction terms of the type of plans and other risk-related variables, and ε_i is error term.

We control for four categories of variables that are expected to affect the discrepancy between premiums paid and expected benefits. These include demographic characteristics, health-related characteristics, insurance provisions, and job characteristics. Demographic characteristics include gender, age, family size, education, marital status, race, income, and occupation. Studies show that on average women incur greater medical expenditures than do men (Worrall, 1987; Sindelar, 1982; Jensen, Feldman, and Dowd, 1984; Monheit, Nichols, and Selden, 1995/1996); older people derive more indemnity benefits from insurance than do younger people (Luft, Trauner, and Maerki, 1985); and larger families make greater use of medical care services than smaller size families. More highly educated individuals also have higher expected medical expenditures. Married people are expected to receive more medical insurance benefits than nonmarried people when charged the same premium. It is assumed that people who have a spouse and children will value the importance of good health more and, therefore, derive higher indemnity benefits. The use of race for rate classification purposes is prohibited by state regulations. However, empirical statistics show that race is associated with expected medical benefits (Browne and Doerpinghaus, 1993). Income is hypothesized to affect the unit price of insurance positively when everyone pays the same premium. This arises from the assumption that poor people are in worse health than richer people and, therefore, derive more indemnity benefits from insurance (see Monheit, Nichols, and Selden, 1995/1996). Occupation is included as a proxy for the unobserved utility function (Browne, 1992).

Health-related characteristics have been found in previous studies to be associated with cross-subsidization. Browne (1992) and Browne and Doerpinghaus (1993, 1994/1995) report evidence that cross-subsidization from low risks to high risks occurs when risk-type is identified by self-reported health status.¹³ There is considerable evidence showing self-reported measures to be generally valid indicators of actual health (Maddox and Douglas, 1973; Ferraro, 1980; Waldron, Harold, and Dunn, 1982; Butler et al., 1987). We also include variables controlling for the presence of chronic diseases and activity limitations. Monheit and Selden (1996) provide evidence that individuals suffering from heart/lung illness are subsidized in their data panel. The presence of an activity limitation due to health problems has been found to be related to subsidization (see, Browne and Doerpinghaus, 1994/1995; Farley and Monheit, 1985).

Insurance provisions affect not only the policy premium, but also a policyholder's incentive to use medical care services (see, for instance, Pauly, 1970). A health insurance

¹³ The NMES questionnaire asked individuals to classify their health status as poor, fair, good, or excellent. For the purposes of our analysis, we group together individuals who report their health status as poor or fair. Less than 1 percent of those surveyed reported their health status as poor.

plan that provides extensive coverage of health services, with low deductibles and coinsurance, or higher maximum benefits, costs more than other plans that are less generous. On the other hand, if cost sharing is less, moral hazard is more likely to lead to an increase in health care utilization (Manning et al., 1987). The availability of physician's office visit coverage and the corresponding deductible level are used in this study to control for these effects. Manning et al. (1987) report that moral hazard is more pronounced with physician office visit coverage than with insurance coverage of in-patient hospital expenses. We also include a dummy variable indicating whether the insurance is an HMO plan.¹⁴

Other control variables include job-related factors, such as industry of employment, geographic location, size of the firm, and classification variables indicating whether employers offer choice of health plans and/or whether employees share premium costs. Two sets of categorical variables control for location effects: the first one divides the country into four regions—south, midwest, west, and northeast. The other set of variables divides cities into three groups—the large standard metropolitan statistical areas, other standard metropolitan statistical areas, and otherwise. The demand for health service is anticipated to be higher in urban areas due to lower travel times and the availability of a broader range of medical services. Firm size may affect the premium rate as economies of scale in group purchase make it cheaper for a larger group of insureds to purchase insurance. Additionally, large purchasers have more leverage than small employers in negotiating with insurance carriers for more favorable premiums (Institute of Medicine, 1993). Jensen, Cotter, and Morrissey (1995) find that employers that self-insure escape the costs of complying with state-mandated benefit requirements and state premium taxes. Therefore, self-insured plans are hypothesized to have a lower unit price, other things equal.

The categorical variables indicating whether the health insurance plan made available to an employee allows for choice among different insurance policies or requires the employee to pay a portion of the premium are interacted with health status variables that differentiate high risks from low risks. These variables include gender, education level, self-reported health status, and the presence of chronic disease or activity limitation. The statistical significance of these interaction variables will depend on whether people sort themselves by risk-type into health insurance plans. Statistically significant interaction term coefficients would suggest changes in insurance unit price do occur when an employer offers a choice of health insurance plans or requires employees to share premiums. The coefficient estimates on the interaction terms show the extent to which insurance unit price differs when choice is available or when employees are required to contribute to premium costs compared to when one insurance policy is offered and employees are not required to contribute toward the plan. Table 3 provides definitions and summary statistics for the variables used in the empirical analysis.

RESULTS AND DISCUSSION

Table 4 reports the estimated parameters of the models. The adjusted coefficient of determination for the full sample model is 67 percent and for the single coverage

¹⁴ Other forms of insurance coverage, such as a PPO, are not identified in the data set.

TABLE 3
Definition of Variables

Variable	Definition	Mean	Standard Deviation
FEMALE	1 if female	0.50	0.50
AGE	Years of age	40.00	12.56
FAMSIZE	Number of persons covered by policyholder's policy	1.34	0.59
HIGHEDU	1 if highest grades of education >12	0.47	0.50
MARRIED	1 if married	0.45	0.50
WHITE	1 if white	0.79	0.41
INCOME	Family income	41,559.50	26,548.83
WCOLLAR	1 if occupation is profession, management, or clerical	0.56	0.50
NOGOOD	1 if at least one person in the family has self-reported his or her health status as fair or poor	0.16	0.37
GOOD	1 if at least one person in the family has self-reported his or her health status as good and no one in the family has self-reported a health status as fair or poor	0.56	0.50
CHRONIC	1 if has been diagnosed with chronic disease	0.42	0.49
LIMACT	1 if has activity limitation due to health problems	0.28	0.45
IND1	1 if employment is in agriculture, forestry, fishing, or unknown	0.02	0.15
IND2	1 if employment is in mining, construction, or transportation	0.10	0.30
IND3	1 if employment is in sales, finance, public administration, repair, personal services, entertainment, or professional services	0.61	0.49
SOUTH	1 if live in the south area	0.34	0.47
MIDWEST	1 if live in the midwest area	0.26	0.44
WEST	1 if live in the west area	0.18	0.38
LSMSA	1 if live in the one the 19 largest SMSA area	0.27	0.44
OSMSA	1 if live in the one other SMSA area	0.49	0.50

FSIZE1	1 if firm size is less than 10	0.11	0.31
FSIZE2	1 if $10 \leq$ firm size < 25	0.15	0.35
FSIZE3	1 if $25 \leq$ firm size < 100	0.27	0.44
FSIZE4	1 if $100 \leq$ firm size < 500	0.24	0.43
SELFINS	1 the plan is a self-insurance plan	0.35	0.48
HMO	1 if held plan is HMO	0.17	0.37
OPCOV	1 if policy offers physician's office visit benefits	0.95	0.21
OPDED ^a	Level of deductible of physician's office visit benefits	107.02	140.05
TCOV	1 if two-party coverage	0.26	0.44
FCOV	1 if family coverage	0.04	0.19
PLAN1	1 if plan offers several different insurance options and requires the employees to share in the premium cost	0.30	0.46
PLAN2	1 if plan offers several different insurance options and do not require employee contribution toward the cost of the plan	0.30	0.46
PLAN3	1 if plan offers only one insurance policy and requires the employees to share in the premium cost	0.16	0.37

^aObservations used in variable OPDED here include only those whose policies provide physician office visit coverage.

TABLE 4
Regression Results for Insurance Unit Price

Variable	Full Sample ($N = 1077$)		Single Only ($N = 554$)	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
INTERCEP	5.068***	0.380	5.750***	0.489
FEMALE	-0.329***	0.066	-0.393***	0.089
LN(AGE)	-0.743***	0.059	-0.796***	0.077
LN(FAMSIZE)	-0.908*	0.489	—	—
HIGHEDU	-0.533***	0.067	-0.472***	0.094
MARRIED	-0.132***	0.039	—	—
WHITE	-0.215***	0.039	-0.163***	0.050
LN(INCOME)	-0.021	0.034	-0.073	0.047
WCOLLAR	-0.165***	0.037	-0.147***	0.050
NOGOOD	-1.232***	0.123	-0.834***	0.202
GOOD	-0.460***	0.074	-0.410***	0.095
CHRONIC	-0.216***	0.076	-0.254**	0.110
LIMACT	-0.284***	0.086	-0.315**	0.136
IND1	0.421***	0.104	0.723***	0.137
IND2	-0.128**	0.057	-0.007	0.079
IND3	-0.098**	0.039	-0.013	0.053
SOUTH	0.258***	0.045	0.241***	0.058
MIDWEST	0.218***	0.046	0.168***	0.058
WEST	-0.011	0.050	-0.014	0.063
LSMSA	-0.303***	0.047	-0.417***	0.066
OSMSA	-0.321***	0.041	-0.462***	0.061
FSIZE1	0.257***	0.060	0.431***	0.079
FSIZE2	0.071	0.053	0.053	0.068
FSIZE3	0.170***	0.045	0.195***	0.059
FSIZE4	-0.092**	0.044	-0.112**	0.059
SELFINS	-0.137***	0.036	-0.207***	0.048
HMO	0.014	0.057	0.030	0.072
OPCOV	-0.051	0.080	-0.113	0.105
LN(OPDED)	0.018**	0.009	0.024**	0.012
TCOV	0.817***	0.332	—	—
FCOV	1.509***	0.561	—	—
PLAN1	-0.389***	0.107	-0.326**	0.139
PLAN2	-0.343***	0.106	-0.261**	0.129
PLAN3	0.163	0.123	0.309**	0.143
PLAN1 $\times$ FEMALE	0.178**	0.086	0.257**	0.120
PLAN1 $\times$ HIGHEDU	0.185**	0.087	0.097	0.122
PLAN1 $\times$ NOGOOD	0.421***	0.156	-0.037	0.245
PLAN1 $\times$ GOOD	0.200**	0.102	0.179	0.129
PLAN1 $\times$ CHRONIC	-0.095	0.098	-0.083	0.144
PLAN1 $\times$ LIMACT	-0.030	0.110	0.099	0.173
PLAN1 $\times$ LN(FAMSIZE)	-0.221	0.137	—	—
PLAN2 $\times$ FEMALE	0.196**	0.086	0.238**	0.112
PLAN2 $\times$ HIGHEDU	0.184**	0.087	0.104	0.116

(continued)

TABLE 4
(Continued)

Variable	Full Sample ($N = 1077$)		Single Only ($N = 554$)	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
PLAN2 $\times$ NOGOOD	0.401***	0.160	0.007	0.250
PLAN2 $\times$ GOOD	0.100	0.099	0.075	0.120
PLAN2 $\times$ CHRONIC	-0.115	0.099	-0.098	0.138
PLAN2 $\times$ LIMACT	-0.039	0.113	0.137	0.168
PLAN2 $\times$ LN(FAMSIZE)	-0.017	0.145	-	-
PLAN3 $\times$ FEMALE	-0.006	0.101	-0.133	0.130
PLAN3 $\times$ HIGHEDU	0.056	0.102	-0.062	0.133
PLAN3 $\times$ NOGOOD	0.241	0.181	0.081	0.264
PLAN3 $\times$ GOOD	0.019	0.116	-0.010	0.139
PLAN3 $\times$ CHRONIC	-0.148	0.115	-0.087	0.158
PLAN3 $\times$ LIMACT	0.096	0.134	0.231	0.199
PLAN3 $\times$ LN(FAMSIZE)	-0.570***	0.164	-	-
<i>F</i> -value	42.31***		26.92***	
Adjusted R^2	0.67		0.69	
<i>p</i> -Value of White test	0.29		0.70	

*Statistically significant at 0.10 level.

**Statistically significant at 0.05 level.

***Statistically significant at 0.01 level.

only sample is 69 percent. The White test does not reject the null hypothesis of homoskedasticity for either model.

Many of the explanatory variables in the model demonstrate a statistically significant relationship with the measure of insurance unit price, the premium paid per dollar of expected indemnity benefits. The empirical results in both models suggest that insurance unit price is lower, other things equal, for females, older individuals, and those who are more highly educated. The unit price is also lower, other things equal, for those who are married, those classified as white, and those who report their health status as less than excellent. The indicator variables for two person and family coverage are both positive and significant in the full sample model.

Other things equal, the insurance unit price is lower for group plans that offer employees a choice of different insurance options than it is for group plans that do not. Of the plans that do not offer a choice of different insurance options, the results from the single only equation suggest that unit price is higher for those that require an employee contribution than for those that do not.

Relative to those firms that offer no choice in insurance coverage, the reduction in insurance unit price in plans offering a choice of insurance coverages (Plan Types 1 and 2) is greater for males than females in both samples. In the full sample, the

reduction is also greater for the less educated relative to the more highly educated and is greater for those who report their health status as excellent than for those who report their health status as less than or equal to good.

Taken together, the findings suggest that lower risks—males and those in better health—benefit to a greater degree from a reduced unit price of insurance when a choice of insurance coverage is provided and employees are required to share in the premium cost.¹⁵ The empirical results suggest a largely similar effect for employer group plans that provide a choice of insurance options but do not require the employees to share in the premium cost. Finally, there is little evidence that the relative insurance unit price for high and low risks differs between plans that offer a single insurance option and require an employee contribution and those that offer a single insurance option and do not require an employee contribution. The one exception to this is that family size is associated with lower insurance unit price in plans that require that employees share in the premium cost.

Table 5 reports for various risk-types the difference in insurance unit price between traditional group health insurance plans, those that offer no choice in insurance coverage and require no employee contribution, and other types of group plans. For instance, the table reports that relative to a traditional plan the insurance unit price is 19 percent less for females when an employer's plan offers a choice of insurance coverages and requires that the employee contribute toward the cost of the plan. In contrast, the cost for males is 32.2 percent less.

To analyze further the changes in insurance unit price faced by different risk groups when choice in health insurance is available through employment, we unbundled the components of the insurance unit price variable. In Table 6, we report regression results on premiums and expected benefits, separately. In general, the results suggest that plan type does not have a statistically significant relationship with the premium level. Indemnity benefits, however, are generally greater when an employer offers a choice of health plans. In contrast, when employers do not offer a choice of plans, indemnity benefits are lower when employers require that employees share in the premium cost.

The results from both the full sample and single only models suggest that the increase in insurance benefits in multiple option plans is greater for males than for females. In the full sample model, the increase is also greater for those who report their health status as excellent than those who report it as less, and greater for the less educated. The analyses indicate that the smaller differences in insurance unit price faced by different risk groups is not due to changes in premium paid by these groups, but rather due to changes in the indemnity benefits they receive—the increase in indemnity benefits for high-risk groups is relatively less than that of low-risk groups when an employer offers

¹⁵ There is no sign of change in the insurance unit price for those with chronic diseases or activity limitations when choice of plans becomes available. One possible explanation for the lack of segmentation based on these characteristic is that health plans may limit coverage through preexisting clauses. These conditions, particularly in the small group market, may also result in many insurance products being unavailable to these groups.

TABLE 5
Percentage Change Effects of Coefficients

Variable		Multiple Health Plans and Employees Share Premium Costs	Multiple Health Plans and Employers Pay 100% Premiums	Single Health Plan and Employees Share Premium Costs
Gender				
Full sample	Female	−19.0%**	−13.7%**	17.0%
	Male	−32.2%***	−29.0%***	17.7%
Single only	Female	−6.7%**	−2.3%**	19.2%
	Male	−27.8%**	−23.0%**	36.2%**
Education				
Full sample	High	−18.5%**	−14.7%**	24.5%
	Low	−32.2%***	−29.0%***	17.7%
Single only	High	−20.5%	−14.5%	28.0%
	Low	−27.8%**	−23.0%**	36.2%**
Self-reported health status				
Full sample	Poor or fair	3.3%***	6.0%***	49.8%
	Good	−17.2%**	−21.6%	20.0%
	Excellent	−32.2%***	−29.0%***	17.7%
Single only	Poor or fair	−30.4%	−22.4%	47.7%
	Good	−13.7%	−17.0%	34.9%
	Excellent	−27.8%**	−23.0%**	36.2%**
Chronic disease				
Full sample	Yes	−38.4%	−36.7%	−1.5%
	No	−32.2%***	−29.0%***	17.7%
Single only	Yes	−33.6%	−30.2%	24.9%
	No	−27.8%**	−23.0%**	36.2%**
Activity limitation				
Full sample	Yes	−34.2%	−31.8%	29.6%
	No	−32.2%***	−29.0%***	17.7%
Single only	Yes	−20.3%	−11.7%	71.6%
	No	−27.8%**	−23.0%**	36.2%**

Note: For categories that represent high risks, e.g., females, higher educated, inferior self-reported health status, and those who had been diagnosed with chronic disease or have activity limitation, the notations of statistical significance of percentage change are present when the percentage changes for the high risks are significantly different from that of the low-risk groups.

*Statistically significant at 0.10 level.

**Statistically significant at 0.05 level.

***Statistically significant at 0.01 level.

a choice of health plans.¹⁶ As employers typically pay the same premium amount for all employees enrolled in a plan, regardless of risk heterogeneity, the finding that

¹⁶ This conclusion is based on the assumption that the variables used to categorize the type of health plans and the generosity of coverage have sufficiently captured the differences in premiums.

TABLE 6

Parameter Estimates From Regressions for (a) Premiums and (b) Expected Benefits

Variable	Full Sample ($N = 1077$)		Single Only ($N = 554$)	
	(a) Premium	(b) Expected Benefits	(a) Premium	(b) Expected Benefits
INTERCEP	6.434***	1.366***	6.634	0.884**
FEMALE	-0.026	0.303***	-0.033	0.360***
LN(AGE)	0.040	0.784***	-0.036	0.760***
LN(FAMSIZE)	0.126	1.034***	—	—
HIGHEDU	-0.033	0.500***	0.001	0.474***
MARRIED	0.033	0.165***	—	—
WHITE	-0.074***	0.141***	-0.041	0.122***
LN(INCOME)	0.052***	0.073***	0.060*	0.133***
WCOLLAR	-0.006	0.159***	0.011	0.158***
NOGOOD	-0.108	1.124***	-0.143	0.691***
GOOD	-0.038	0.422***	0.011	0.421***
CHRONIC	-0.003*	0.213***	0.002	0.257***
LIMACT	0.045	0.329***	0.007	0.322***
IND1	0.074	-0.347***	0.231***	-0.492***
IND2	-0.079**	0.049	-0.057	-0.050
IND3	-0.064***	0.033	-0.032	-0.019
SOUTH	-0.075***	-0.332***	-0.088**	-0.328***
MIDWEST	-0.028	-0.246***	-0.071*	-0.238***
WEST	0.017	0.028	0.039	0.052
LSMSA	0.034	0.337***	0.038	0.455***
OSMSA	-0.005	0.316***	-0.037	0.425***
FSIZE1	0.009	-0.247***	0.009	-0.423***
FSIZE2	-0.023	-0.094**	-0.070	-0.123**
FSIZE3	-0.033	-0.203***	-0.062*	-0.257***
FSIZE4	-0.033	0.059	-0.053	0.059
SELFINS	-0.133***	0.004	-0.231***	-0.023
HMO	-0.038	-0.052	-0.002	-0.031
OPCOV	0.050	0.101	-0.026	0.088
LN(OPDED)	-0.004	-0.022***	0.006	-0.018*
TCOV	0.791***	-0.026	—	—
FCOV	0.899***	-0.610	—	—
PLAN1	0.042	0.431***	0.034	0.360***
PLAN2	0.022	0.365***	0.076	0.337***
PLAN3	-0.052	-0.215**	-0.052	-0.361***
PLAN1 × FEMALE	-0.036	-0.213***	0.063	-0.194**
PLAN1 × HIGHEDU	0.003	-0.182***	-0.048	-0.145
PLAN1 × NOGOOD	0.119	-0.303**	0.132	0.169
PLAN1 × GOOD	0.041	-0.158*	0.016	-0.163
PLAN1 × CHRONIC	-0.076	0.019	-0.102	-0.018
PLAN1 × LIMACT	-0.030	0.000	0.020	-0.079
PLAN1 × LN(FAMSIZE)	-0.227***	-0.006	—	—
PLAN2 × FEMALE	-0.031	-0.227***	-0.021	-0.260***

(continued)

TABLE 6
(Continued)

Variable	Full Sample ($N = 1077$)		Single Only ($N = 554$)	
	(a) Premium	(b) Expected Benefits	(a) Premium	(b) Expected Benefits
PLAN2 $\times$ HIGHEDU	0.061	-0.123*	0.012	-0.091
PLAN2 $\times$ NOGOOD	0.154	-0.247*	0.141	0.134
PLAN2 $\times$ GOOD	0.041	-0.060	-0.014	-0.089
PLAN2 $\times$ CHRONIC	-0.029	0.086	-0.038	0.059
PLAN2 $\times$ LIMACT	-0.048	-0.009	0.046	-0.091
PLAN2 $\times$ LN(FAMSIZE)	-0.109	-0.092	—	—
PLAN3 $\times$ FEMALE	0.008	0.013	0.054	0.187*
PLAN3 $\times$ HIGHEDU	0.020	-0.035	-0.033	0.029
PLAN3 $\times$ NOGOOD	0.009*	-0.233	0.033	-0.048
PLAN3 $\times$ GOOD	0.033	0.014	0.018	0.028
PLAN3 $\times$ CHRONIC	0.060	0.208**	0.063	0.151
PLAN3 $\times$ LIMACT	0.067	-0.028	0.208*	-0.023
PLAN3 $\times$ LN(FAMSIZE)	-0.297***	0.273**	—	—
<i>F</i> -value	35.95***	104.28***	3.43***	40.77***
Adjusted R^2	0.637	0.838	0.171	0.772

*Statistically significant at 0.10 level.

**Statistically significant at 0.05 level.

***Statistically significant at 0.01 level.

differences in the unit price of insurance are due to differences in benefits, rather than premium, is expected.

The HMO variable and insurance policy control variables are not statistically significant. Our results indicate that people with higher deductible levels derive less insurance benefits; however, they do not pay less premiums. One possible explanation for this is that some insurance policies with higher deductibles may provide broader coverage through other attributes of the contract. Another explanation is that selection is occurring with healthier people choosing plans with higher deductibles.¹⁷

Many of the control variables are statistically significant and display the expected sign. In both models, workers classified as white are found to receive greater benefits than others. In both models, income is positively associated with both premiums and benefits. Also, in both models premiums are lower for self-insured plans. This result is consistent with Jensen, Cotter, and Morrissey's (1995) finding that employers with

¹⁷ The methodology does not account for possible endogeneity in plan selection by employees or employers. Multiple health insurance choices and premium contribution requirements may be designed to ensure risk segmentation or may only be part of plans when employers do not expect segmentation to occur.

self-insured programs face lower costs. Self-insured plans are not required to comply with many state regulations, which may increase costs. They also are not subject to state premium taxes.

CONCLUSION

Traditionally companies that have offered health insurance as an employee benefit have provided a single policy for all covered employees. Accompanying the growth of HMOs, there has been an increase in the number of employers that offer employees a choice of different health insurance plans. The question the current article addresses is whether or not the availability of health insurance plan choice is related to a reduction in subsidization of high risks. Theoretical research on adverse selection suggests that individuals may sort by risk-type when offered a choice of different insurance plans. The empirical findings reported here suggest that the insurance unit price is lower for group plans that offer employees a choice of different insurance options and require a premium contribution than it is in plans lacking at least one of these two features. The analyses further indicate that an increase in expected indemnity benefit contributes to the reduction of insurance unit price. The results suggest that the cost reduction is greater for low risks than high risks, a result consistent with self-sorting as predicted by adverse selection theory.

Although not tested in this study, the changes in insurance unit price faced by different risks are expected to be related to group health insurance take-up rates, including a decreased take-up rate by high risks and an increased take-up rate by low risks when choice in health plans is available. This is an important area for further research.¹⁸

APPENDIX

Similar to the distribution of medical expenditures, the health insurance indemnity benefits distribution has two characteristics. First, many in the population receive no indemnity benefits. Second, the distribution of positive benefits is highly skewed. Because of these two characteristics, we have adopted the two-part model developed by Duan et al. (1983).¹⁹ The applications of the two-part model in this article closely

¹⁸ Prior studies have attributed the decline in the percentage of workers with employment-based health insurance to the increasing cost of group health insurance to employees (Kronick, 1991; Shactman and Altman, 1995; Fronstin and Snider, 1996/1997; Cooper and Schone, 1997; Cutler, 2002). Other factors include decrease in the generosity of insurance offered by employers, declining real incomes, rising employee contributions to health insurance premiums, and expansions in Medicaid. Another possible explanation is that some employees are deriving less value from group health insurance than they did in the past and are therefore opting out of the group plan. Changing demographic characteristics of workers is another possible source of changes in take-up rate in the group market.

¹⁹ As Maddala (1985) pointed out, the tobit model is appropriate only if the censored observations arise because of *non-observability*, instead of *individual choice*. In this current study, people with zero benefits are not cases with missing benefits, but rather, with actual zero benefits. For more on the comparison between two-part model and the tobit model, the self-selection

follow Duan et al. (1983). One difference is that this study uses a logit model, as in Manning et al. (1987), instead of the probit model, for the first part of the two-part model.

The two-part model decomposes the observed random variable, BEN_i , into two parts. Part one models the probability of receiving positive insurance indemnity benefits. In part two, the dollar value of such benefits is estimated, conditional on indemnity benefits being greater than 0. More specifically, the first part of the model is a logistic regression. The dichotomous dependent variable takes the value 1 if the policyholder or covered family members received positive benefits, and the value 0 otherwise. The logistic regression is written as

$$\text{logit}[P_i] = \log\left(\frac{P_i}{1 - P_i}\right) = x_i\delta_1 + \eta_{1i}, \quad (\text{A1})$$

where

$$P_i = P(BEN_i > 0 | x_i) = \frac{\exp(x_i\delta_1)}{1 + \exp(x_i\delta_1)}. \quad (\text{A2})$$

The second part of the two-part model employs the log transform of indemnity benefits received, conditional on this being some positive amount, as the dependent variable. This equation is written as

$$\log(BEN_i | BEN_i > 0) = x_i\delta_2 + \eta_{2i}, \quad (\text{A3})$$

where $\eta_{2i} \sim N(0, \sigma_\eta^2)$. The logarithm eliminates the undesirable skewness of the extremely high values among observations and renders nearly normal error distributions. The expected indemnity benefits conditioned on positive benefits, after retransforming the error terms of the equation, will then be

$$\begin{aligned} E(BEN_i | BEN_i > 0) &= E[\exp(x_i\delta_2 + \eta_{2i})] \\ &= E[\exp(x_i\delta_2)] E[\exp(\eta_{2i})] \\ &= \exp(x_i\delta_2) \exp(\sigma_\eta^2/2) \\ &= \exp(x_i\delta_2) \phi, \end{aligned} \quad (\text{A4})$$

where

$$\phi = E[\exp(\eta_{2i}) | x_i] = \exp(\sigma_\eta^2/2). \quad (\text{A5})$$

model or Heckman model, see Duan et al. (1983–1985), Hay and Olsen (1984), and Maddala (1985).

The identity in (A5) is valid only if the error η_2 is homoskedastic and normally distributed.²⁰ Combining (A2) and (A4) allows us to estimate the expected insurance benefits for an insured with characteristics x_i to be²¹

$$\begin{aligned} E(\text{BEN}_i | x_i) &= P(\text{BEN}_i > 0 | x_i) E(\text{BEN}_i | \text{BEN}_i > 0, x_i) \\ &= P_i \exp(x_i \delta_2) \phi. \end{aligned} \quad (\text{A6})$$

Using recent theoretical and empirical studies regarding demand for health insurance (Luft, Trauner, and Maerki, 1985; Ellis, 1985, 1989; Dowd and Feldman, 1985, 1994/1995; Feldman et al., 1989; Short and Taylor, 1989; Browne, 1992; Browne and Doeringhaus, 1993, 1994/1995) independent variables included in the expected insurance indemnity benefit equation were identified and incorporated in this study.²² As discussed earlier, two-stage least squares estimation is not appropriate for estimating insurance benefits received because there is not an exogenous variable to identify the insurance coverage equation. A reduced form equation of the received insurance benefits is used here by including additional factors affecting the type of policies an employee holds in order to control for moral hazard. Firm size²³ and the type of plan offered by the employer²⁴ are the two variables used to control for moral hazard. Table A1 shows the mean values of actual indemnity benefits and expected indemnity benefits received by policyholders. Correlations between actual indemnity benefits and expected indemnity benefits by availability of choice, risk factors, insurance plan, and employers' share of premium are also reported. Statistically significant correlations between actual and expected insurance benefits are found across all variables.

²⁰ We test the residuals from the lognormal regression for homoskedasticity assumption in the empirical study. The results do not reject the hypothesis of homoskedasticity (chi-square statistics = 796.89 with degrees of freedom = 805).

²¹ Assuming there are totally n observations in which the first N_1 observations receive positive benefits and the remaining $n - N_1$ receive zero benefits. The likelihood function for this model is

$$\begin{aligned} L(\delta_1, \delta_2, \sigma_{\eta_2}^2) &= \left\{ \prod_{i=1}^{N_1} P(\text{MED}_i > 0 | x_i) \text{density}(\text{MED}_i | \text{MED}_i > 0, x_i) \right\} \times \left\{ \prod_{i=N_1+1}^N P(\text{MED}_i = 0 | x_i) \right\} \\ &= \left\{ \prod_{i=1}^{N_1} \frac{\exp(x_i \delta_1)}{1 + \exp(x_i \delta_1)} \frac{1}{\sigma_{\eta_2}} \phi\left(\frac{y_i - x_i \delta_2}{\sigma_{\eta_2}}\right) \right\} \times \left\{ \prod_{i=N_1+1}^N \frac{1}{1 + \exp(x_i \delta_1)} \right\}, \end{aligned}$$

where ϕ is standard normal p.d.f. and y_i is $\log(\text{BEN}_i)$. Duan et al. (1983, 1984) mention specifically that the likelihood function depends exclusively on parameters in (A1) and (A3). They emphasize that the error terms η_{1i} and η_{2i} in (A1) and (A3) may well be correlated, however, the correlation does not enter into the likelihood function. Therefore, the correlation coefficient ρ is irrelevant for the purpose of estimating the two-part model.

²² Those variables can be grouped as demographic characteristics, job characteristics, and insurance provisions. The empirical results of two-part model are available from the author.

²³ Because of the economics of scale, it is assumed that large firms offer more generous plans compared to small size ones, and therefore firm size variable is used for controlling the generosity of the insurance policy here.

²⁴ Previous studies have found that the higher the employer's share of premium, the more extensive insurance coverage the employee would purchase (Farley and Monheit, 1985; Browne, 1992). Here, we classify employees as working for employers that offer one of the four types of plans as described in page 421.

TABLE A1

Actual and Expected Insurance Benefits Received by Policyholders by Choice of Health Plans, Gender, Education, Health Status, Activity Limitation, HMO, and Employers' Share of Premiums

Variables	Actual Benefits	Expected Benefits	Correlation (<i>p</i> -Value)
Choice			
Yes	629.81	532.87	0.32*** (<0.0001)
No	645.99	374.07	0.26*** (<0.0001)
Gender			
Female	617.82	422.54	0.16*** (<0.0001)
Male	654.75	519.08	0.32*** (<0.0001)
Education			
≤ 12 years	642.48	450.55	0.29*** (<0.0001)
> 12 years	628.98	493.17	0.23*** (<0.0001)
Self-reported health status			
Poor or fair	1,236.00	1,142.00	0.36*** (<0.0001)
Good or excellent	522.94	343.69	0.14*** (<0.0001)
Ever had chronic disease			
Yes	955.20	739.27	0.24*** (<0.0001)
No	409.80	279.80	0.24*** (<0.0001)
Activity limitation			
Yes	1,045.00	904.15	0.28*** (<0.0001)
No	474.70	299.17	0.23*** (<0.0001)
HMO			
Yes	548.25	441.07	0.18** (0.017)
No	654.04	476.48	0.27*** (<0.0001)
Employers pay 100% premium			
Yes	635.65	439.43	0.41*** (<0.0001)
No	636.75	506.08	0.13*** (0.003)

Note: The mean values of actual indemnity benefits and expected indemnity benefits received by policyholders. Correlations between actual indemnity benefits and expected indemnity benefits by availability of choice, risk factors, insurance plan, and employers' share of premium are also reported. Statistically significant correlations between actual and expected insurance benefits are found across all variables.

*Statistically significant at 0.10 level.

**Statistically significant at 0.05 level.

***Statistically significant at 0.01 level.

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