Health Plan Competition and the Costs of Employer Provided Health Insurance

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ABSTRACT

Some employers offer their employees a choice of competing health plans. This might foster competition and keep their health insurance premiums down. Alternatively it could lead to duplication of administration costs and to biased selection, resulting in increased costs. The effect of employee choice on health insurance premiums is estimated using data from the Health Insurance Association of America and the Bureau of Health Professions. The estimation accounts for selection bias with Heckman two-step methods. The results suggest that employee choice reduces premiums of conventional plans, at least for large employers, but not premiums of Health Maintenance Organizations.

1 The Proposal to Offer Health Plan Choice

Rising Health Care Costs in America have lead to a variety of suggestions for reform. One kind of suggestion, which has wide currency among economists, is increased consumer choice and competition. If consumers have a choice of competing health plans, and incentives to choose the most cost effective ones, then downward pressure on costs might be expected. There are at least two possible mechanisms for this process. The first is for cost effective plans to expand at the expense of more costly plans. The second is for health plans to respond, to the threat offered by competitors, by reducing prices. While the strength of such effects can not be established *a priori*, it appears to the adherents of competition that intelligently implemented competition "would obviously be a large step in [the right] direction" (Enthoven 1993, p35).

However there are some reasons to think that introducing health plan choice may actually increase costs. One such reason is the presence of administration costs. If administrative costs are duplicated when multiple plans are offered, then competitive savings may be overwhelmed. This seems most likely for smaller firms. Administration costs make up a large proportion of costs when there are few enrollees.

> "[I]n a small group plan with one to four employees, insurers' overhead accounts for 40 percent of claims. By contrast, the administrative expenses for a large group plan with 10,000 or more employees are 5.5 percent of claims" (GAO 1992, p45).

A second reason why health plan choice may lead to higher costs is that it allows biased selection among employees into different health plans. Rice, Brown and Wyn (1993) argue that employees with higher expected utilization will tend to stay enrolled

in expensive health plans, and so low option health plans will not need to reduce premiums to the level of costs to undercut the more comprehensive plans. Feldman, Dowd and Gifford (1993) express similar concerns. They also tell of cases where making an HMO available, in addition to a conventional plan, seems to have increased costs through biased selection.

It is possible that some optimism about the cost reducing effect of health plan choice is based on the idea of perfect competition. Two alternative frameworks are *Competition for the Field* and *Monopolistic Competition*. Competition for the field (Demsetz 1968) is distinguished from competition *in* the field. The idea is that if there are benefits to having a single provider, then it may be possible to appropriate them without giving up competitive prices. Insurers would compete (with price and benefits) for the privilege of being the sole provider to the employees. There can be two different stages in selling the health insurance - to the employer (to make the plan available to employees) and to the employees. It may be that it is the first stage of selling that is most important in keeping down premiums. If this is so then there may not be significant cost savings, for employers who are careful purchasers, from offering health plan choice to employees.

Another perspective is given by the theory of monopolistic competition. Under this theory, unrestrained competition may lead to excessive prices and numbers of competitors (e.g. Tirole 1990, pp284-5). Mathewson and Winter (1993) suggest that this could provide a motivation for employers to restrict the number of health plans offered to employees.

The above arguments suggest that the effect of choice on costs is not clear *a priori*. Consequently I will treat it as an empirical issue. The effect could plausibly be in either direction, and may vary between different kinds of employers and different kinds of health plans.

2 Previous empirical evidence

During the 1980s, many employers adopted employee choice of health plan and other cost containment strategies. This was recognized by some authors who had earlier been critical of the apparent lack of employer determination in containing their health care costs (e.g. Frech and Ginsburg 1988). However the impact does not appear to have been dramatic. Critics, such as Jones (1990) have claimed that employee choice of health plans has not reduced insurance premiums. One reason for this pessimism is that health care costs continued to rise rapidly in the "competitive" eighties. Another is provided by econometric research summarized in Table 1.

Jensen, Feldman and Dowd (1984) regressed health insurance premiums on health plan provisions and on the characteristics of employees and employers. The regressors included a dummy for whether health plan choice was offered. They found that conventional plan premiums were higher for employers who offered health plan choice to their employees. They could not examine the effect on HMO premiums, as their sample did not contain any firms which offered only an HMO.

Other studies have looked at the effects of offering an HMO. Jensen and Morrisey (1990) regressed conventional plan premiums on health plan provisions, regional and industry dummies and dummies for whether HMOs were offered. The

HMO dummies had positive coefficients, suggesting that offering HMOs increases the premiums of competing conventional plans.

One problem with these two papers is the presence of endogenous regressors. In particular, the decision whether to offer choice to employees will be made with premium cost in mind. If it is mainly high cost (or low cost) employers who offer choice to employees, then the measured effect of choice on costs could be biased upwards (or downwards).

Jensen, Feldman and Dowd (p286) argue that this endogeneity may not be serious, because employers do not change these plan characteristics very often. I do not find this persuasive. The problem is not the likelihood that each individual employer will change, but whether the pattern of employers offering choice is correlated with unobserved determinants of costs.

This problem with the endogeneity of health plan choice is acknowledged in two further papers which look at the effect of offering HMOs. Gifford, Feldman, Dowd and Finch (1991) use Two Stage Least Squares and report a large negative effect on conventional plan premiums. Feldman, Dowd and Gifford (1993) use a Heckman two-step procedure and estimate a positive effect.

These two papers are distinguished not only by their econometric approach and their results, but also by the zealousness with which plausibly endogenous regressors are avoided. The latter paper (1993) includes regressors for the generosity of the benefit provisions. Although this is clearly a factor that is relevant for determining costs, it is also likely to be endogenous. Employers may be influenced by anticipated

costs (including factors not visible to the researcher) in deciding on how generous the benefits should be. If adequate instruments for plan generosity are not available, then it may be difficult to justify its inclusion as a regressor.

However there is a cost to leaving plan generosity out of the regression. It means that we are no longer able to distinguish differences in premiums that reflect differences in efficiency and "good deals" and those premium differences that reflect health plan generosity.

The bulk of the above research (three out of four papers) suggests that offering choice (at least if the choice is an HMO) increase conventional plan premiums. There are a number of possible ways to respond. Adherents of competition such as Enthoven (1990, 1993) and Kronick (1991) have suggested that competition has not truly been tried. They argue that employers too infrequently offer choice, and when they do it is usually with implicit subsidies on costly plans and without much attempt to discourage risk-selection. The idea is that while "half-baked" attempts at competition may have brought little in the way of tangible savings, fully-fledged and intelligently implemented competition will reduce costs. Alternatively, it can be claimed that competition has been tried and has failed.

A third response is to challenge the econometric methods in the papers which find a positive effect on costs. These three papers all included endogenous regressors.

Another interpretation is that although competition leads to higher conventional plan premiums, it need not lead to higher total costs. It may be that competition has the consequence that HMOs "creamskim" the low cost employees from conventional

plans. For example, employees who have high expected utilization may have established a close relationship with their previous physician and be unwilling to join an HMO. According to this interpretation, competition may be associated with higher conventional plan premiums, lower HMO premiums and either higher or lower total costs. This "cream skimming" interpretation is offered by Jensen, Feldman and Dowd, and is consistent with some other research (e.g. Jackson-Beeck and Kleinman (1983) and Schuttinga, Falik and Steinwald (1985)). This possibility was explicitly addressed by Feldman, Dowd and Gifford. They have information on the proportions of employees in different kinds of plans and conclude that total costs are increased when the choice of an HMO is added.

This paper re-examines the claim that competition has not reduced health plan costs. I attempt to assess the effect of competition on both conventional plan and HMO premiums. Because I present results for both conventional plan and HMO premiums, it should be possible to evaluate the "cream-skimming" interpretation.

3 Data

I use two sources of data. The first is the 1991 Health Insurance Association of America (HIAA) survey of employers. This is a national telephone survey. Respondents include both private and public (state, county and municipal, but not federal) employers. The second is the 1991 Area Resource File (ARF) of the Bureau of Health Professions. This provides information on the health care market in each county, and is compiled from various sources.

There are two measures of health plan costs that are used below. The first is

the individual premium for a conventional plan. This is the premium cost, including the contributions of both employer and employee, for a month of individual health insurance cover for an employee enrolled in the conventional plan that has the largest number of employees enrolled. It is reported in the HIAA survey. The second measure is the analogous measure for HMOs.

Unfortunately it is not possible to infer overall costs from these variables. The HIAA survey does not provide sufficient information on the proportions of employees enrolled in different plans and types of plans[1].

Health Plan costs can be expected to depend on employer and employee characteristics and also on the local markets of health services. One such characteristic is firm size (number of employees). Larger firms have more bargaining strength and can exploit economies of scale (GAO 1992, p44). Small firms (under 100 employees) and medium sized firms (with between 100 and 500 employees) face different prospects (HIAA 1990 p78). Dummies for small and medium sized firms are used as regressors, as is the (scaled) number of employees.

Another important factor is the age of employees (GAO p32). The proportion of employees aged over 50 years is reported in the HIAA survey. Unfortunately it has quite a few missing values. I have dealt with this in the following way. I have set it to zero for these observations, and included a dummy which is unity when the variable on age is missing. A dummy for location in an urban area is also used.

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[1]There was a question in the HIAA survey on total costs, but the responses were not considered reliable, and it was dropped from the 1992 survey. My attempts to use robust estimation with this variable were not successful.

The HIAA survey also reports the zip code of the firm, and so it is possible to determine the county. Consequently data from the ARF can be attributed to the firm, with respect the county in which the firm is located[2]. The ARF variables used include an index of physician charges, average health insurance reimbursement rates, per capita numbers of (short term general) hospital beds, hospital admission rates, and the proportion of (short term general) hospitals with low utilization. Firms located in counties with no short term general hospitals are given a zero value of the latter variable and a dummy (for no hospital) set to unity. In addition there are dummies indicating the availability of traditional HMOs (staff or group model), IPAs (Individual Practioner Associations) and other HMOs. Finally, regional and industry dummies are also included.

The factors which affect costs should also affect the decision whether to offer choice. Cost will be a consideration in this decision, and so the regressors in the cost equation should also be included in any equation for choice. In addition, an HMO can insist (legally) that it be offered to employees, if no HMOs are currently offered and there are more than 25 employees. Consequently I include an interaction between HMO availability and a dummy for having more than 25 employees.

As stated above, the dependent variables are measures of health plan cost, which do not allow discrimination between the component of cost due to inefficiency, utilization and price and the component due to plan generosity. This means that care should be taken in interpreting results with a view to framing policy proposals. It also

[2]Unfortunately this will lead to errors for multi-location firms.

means that the effect of some factors on cost may not be straightforward. Firm size is one example. Firms with a large number of employees can obtain better deals on health insurance (GAO 1992, p44), which may lead to a negative relation between firm size and premium cost. However large firms may also provide more generous benefits, which could lead to the opposite pattern. Some other employee characteristics should lead to both higher costs and more generous benefits. One example might be the age of employees, as older enrollees tend to have higher expected utilization and also to demand more generous benefits.

It can be expected that high values of the physician price index and average insurance reimbursement are associated with higher costs. The availability of HMOs may be correlated with lower HMO costs and perhaps also with lower conventional plan premiums.

4 Methods

The determination of health insurance costs can be modelled as

$$p_i = \alpha + \beta \cdot x_i + \gamma \cdot d_i + u_i$$

where p_i is per employee premium cost for employer i, x_i is a vector of characteristics of the firm and the local health care markets and d_i is a dummy variable that equals one when health plan choice is offered to the employees, and zero when it is not.

Unfortunately d_i is endogenous and this may compromise the consistency of OLS estimates. As choice of plans will be offered, at least partly with premium cost in mind, it is to be expected that d_i and u_i will be correlated. There are a number of possible approaches to take in accounting for the endogeneity of a regressor (e.g. Heckman and Robb 1985, p167). One of the most convenient is to use "Heckman

correction terms". The problem with OLS is that the expectation of the value of the disturbance, conditional on d_i, is not zero - i.e. that $E[u_i|x_i,d_i] \neq 0$. The suggested solution is to estimate this term using discrete choice estimation. Heckman terms are more usually used when there are separate equations for each "regime" (e.g. Lee, 1978), but the rationale is the similar when there is a single equation and a dummy variable[3] to capture the effect of a change of regime such as employee choice.

The standard way to construct Heckman terms would be to use Probit to model the decision whether to offer choice. Unfortunately this may neglect a source of selection bias. We only see the dependent variable (say conventional plan premiums) when the employer decides to offer a conventional plan. If the unobservable determinants of this employer decision are correlated with u_i, then there is another source of selection bias. Consequently it can be argued that there are really two selection issues - whether choice is offered and whether a conventional plan is offered. Clearly they are not independent. However it is possible to model this double decision with bivariate probit and to use the results of the bivariate probit to construct (more complicated) Heckman terms[4]. I will present results from a simple Probit selection model (Type-5 Tobit) and also from a Bivariate Probit Selection model.

It should be noted that the dummy variable specification is quite restrictive. The effect of offering choice is assumed to be a shift of the intercept, but not of the slope of the premium equation. This is to say that the effect is assumed not to vary across

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[3]See the appendix for an explanation of this approach.

[4]These are also discussed in the appendix.

firms with different observable characteristics. Furthermore, the effect is not assumed to vary across firms which differ by unobserved characteristics.

It may be difficult to justify these restrictions. One observed characteristic that seems likely to be relevant to the impact of employee choice is firm size. It seems credible that there could be both administrative costs and competitive benefits to employee choice, but that the firm must be big enough for the costs to be dominated by the benefits. If the effects of employee choice differ by firm size then I may inadvertently estimate a rather uninformative average effect. I propose to deal with this by checking how sensitive the results are to restrictions on the sample by firm size.

Unobserved characteristics may also lead to variation in the effect of employee choice. Firms that do offer choice and firms that do not may differ in their unobserved characteristics, not only with respect to the determinants of costs (which is dealt with by the Heckman terms), but also by the impact that choice will have on costs (which is not). For example, employee choice of health plans may be offered by the firms for which it would have the greatest cost savings. This means that the estimate of γ will reflect the average effect of choice on those firms who do offer choice, rather than the average effect of all firms being compelled to offer choice[5]. Consequently the results will be pertinent to the evaluation of existing efforts to provide health plan choice.

2.5 Results

It is of interest to examine the data without trying to account for selection bias.

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[5]See Heckman and Robb (1985, 1986) for a discussion of this issue.

One reason is to see if the pattern reported by Jensen, Feldman and Dowd is present in this dataset. Another reason could be to check for an immediate pattern of variation over firm size, in cost differences between firms that do and do not offer choice. One way to summarize the data is with a nonparametric regression. Figure 1 reports the results of such a regression. Conventional plan premiums for individual cover were regressed on employment separately for the subsamples of firms offering and not offering choice. The method was that of MacQueen (see Delgado and Stengos (1990)).

The result is consistent with the results of Jensen, Feldman and Dowd. The cost equation for firms that do offer choice is higher than that for those who do not. If we do not account for selection bias (or other regressors), it would seem that employee choice increases costs.

Another possible preliminary examination is to compare average costs for firms offering choice of health plan with firms which do not. Mean values of individual premiums for conventional plans and HMOs are reported in Table 2. It appears that firms which offer choice have higher values of both of these premium variables, although the difference is very small for HMO premiums.

However the possibility remains that it tends to be the firms which have higher unobservable determinants of costs which offer choice, and so the pattern need not reflect a cost increasing effect of employee choice. A (probit based) sample selection model is estimated to deal with this possibility.

The results of such a regression is reported in Table 3. Asymptotic t-statistics,

accounting for the estimated nature of the Heckman term, are reported in brackets[6]. The first column contains estimates from the first stage probit regression of whether choice is offered. The second column is the results of second stage (conventional plan) cost regression. A large negative coefficient is estimated for CHOICE. This is the opposite result to that suggested by a simple comparisons of means in Table 2.

There are at least two reasons to be cautious about this result. The first is that it does not account for the possibility of selectivity in the decision of whether to offer a conventional plan. This possibility is addressed by estimating a bivariate probit selection model. The results of such an estimation are reported in Table 4.

The first two columns of Table 4 contain estimates from the (first stage) bivariate probit model. The first column pertains to the equation determining whether employee choice is offered. The second column refers to the decision whether to offer a conventional plan. The final column reports the results of the (conventional plan) premium equation using the estimated bivariate probit model. There is again a large negative estimated coefficient for the effect of offering employee choice, although the (asymptotic) t-statistic is smaller. The coefficient on the lambda pertaining to the offering of a conventional plan has a very small t-statistic, and so does not provide strong evidence that the simpler model of Table 3 is inadequate.

A second potential concern is that the ARF variables (characteristics of the county health care market) may actually be endogenous for firms who have employment large enough to be a significant proportion of the population. This

[6]In Tables 3 to 6.

possibility is allowed for in the first two columns of Table 5. The model is re-estimated with the ten percent of observations who have the highest ratio of employment to county-population dropped from the sample. A large negative coefficient on choice is estimated again.

Given the apparent importance of administration costs discussed above, it would be surprising if choice reduced costs even for very small firms. This can be addressed by re-estimating the model for smaller firms. I am unable to get such a regression with a "statistically significant" positive coefficient on choice, although it is certainly possible to get a positive coefficient. One example, where the sample is restricted to firms with 25 or fewer employees, is presented in the rightmost two columns of Table 5.

The effect of choice on HMO premiums is not so convincingly established. As reported in the third column of Table 3, choice attracts a positive coefficient in the HMO premium regression. However the t-statistic is fairly modest. Nevertheless the results are suggestive that choice is more effective in restraining conventional plan premiums than HMO premiums.

Throughout Tables 3 to 6, the signs of estimated coefficients for other regressors are usually as expected. Higher values of the physician price index and insurance reimbursement are associated with higher costs, as are higher proportions of older workers.

It is possible that the effect of choice depends on what the choice is. One way to address this possibility is to separately estimate the effect of the offering of an HMO

on conventional plan premiums, and vice versa. This is the motivation for Table 6. The first two columns address the effect of the presence of a conventional plan on HMO premiums and the next two columns concern the effect of HMOs being offered for conventional plan premiums. The results are in the same direction as, but stronger than, the results for undifferentiated choice. The presence of HMOs appears to reduce conventional plan premiums but the presence of conventional plans *increases* HMO premiums.

2.6 Discussion and Conclusions

The reported results indicate that the average effect of health plan choice (for those firms that offer it) on conventional plan premiums is large and negative. The estimated effect does vary with the specification, but seems to be in the order of a $50 to $60 saving.

This contrasts with most of the previous findings which estimate a positive impact on costs. The exception is the paper which, like the model of this chapter, avoided endogenous regressors.

The result for HMO premiums is not so strong. It does not point to a clear direction for the effect of CHOICE. The sign of the estimated coefficient is positive but the low t-statistic does not lend much confidence to this conclusion. However it does appear that choice is less cost reducing impact on HMO premiums than conventional plan premiums. This effect seems much stronger and more certain when the other choice is a conventional plan.

That there is a stronger competitive effect for conventional plans than for HMOs

may be surprising. It is certainly at odds with the position of Jensen, Feldman and Dowd who suggest that choice may allow "cream-skimming" resulting in increases in conventional plan premiums and possible decreases of HMO premiums. However, there are at least two possible explanations.

The first possible explanation is "shadow pricing". According to this explanation, HMOs have lower costs than conventional plans but not all of the cost difference is manifested in premium differences. It may be that HMOs make sure that their premiums are lower than those of competing conventional plans, but they see little gain in reducing premiums even further. This would be more credible in cases where the employer implicitly subsidizes more expensive plans. This explanation receives some support from the apparently stronger effect, in raising HMO premiums, of a conventional plan rather than another HMO, being offered.

A second explanation is that HMOs have less active "experience rating". It may be that conventional plans vary their premiums more, according to the characteristics of the firms. If this is true, then conventional plans may vary their premiums more to account for different degrees of competition too. A quick check of this suggestion is provided by comparing the variation of conventional plan and HMO premiums. As expected, the standard deviation of the former (53.6) is higher than that of the latter (32.2).

Unfortunately there are no direct findings on a more important variable - overall costs. Without information on the proportions of employees in different kinds of plans, conclusions for total costs must be tentative. Nevertheless some possibilities are

suggested, which may merit further study. It seems that the decision to offer choice, where previously only one conventional plan is offered, may be beneficial for costs. But this will be contingent on the firm being large enough. In contrast, if only an HMO is offered, the addition of a choice of a conventional plan may lead to an increase in the premiums of the HMO. But HMO premiums tend to be lower than conventional plan premiums for individual cover. Consequently, such a change seems unlikely to reduce overall costs of individual insurance coverage.

The evidence suggests that employee choice may reduce costs for large firms who previously offered only a conventional plan, but not necessarily for other employers.

Appendix 2A

(i) The bivariate case

Health insurance premiums (p_i) are determined by exogenous factors (x_i), by whether health plan choice is offered (d_i) and by unobserved determinants (u_i). This relation is $p_i = \alpha + \beta \cdot x_i + \gamma \cdot d_i + u_i$. The dummy variable for health plan choice is determined by observable factors (z_i) and unobservable factors (ϵ_i) with the relation $d_i = 1[z_i \cdot \delta + \epsilon_i > 0]$. The disturbances u_i and ϵ_i are distributed joint normally with zero means and covariance matrix

$$\begin{bmatrix} \sigma_u^2 & \sigma_{u\epsilon} \\ \sigma_{u\epsilon} & 1 \end{bmatrix}.$$

In the general case the covariance between the disturbances $\sigma_{u\epsilon}$ is nonzero and so d_i is an endogenous regressor.

This is basically Amemiya's (1985) category of "Type-5 Tobit" with the restriction that the effect of "program participation" (i.e. whether d_i is zero or one) is only to move the intercept of the relation between x_i and p_i (p402). The estimation strategy is approach (v) of Heckman and Robb (1985, p167). Heckman terms are used to augment a single regression for both participants and nonparticipants. The cost equation can be rewritten as

$p_i = \alpha + \beta \cdot x_i + \gamma \cdot d_i + d_i \cdot E[u_i | z_i, d_i = 1] + (1 - d_i) \cdot E[u_i | z_i, d_i = 0] + \eta_i$, where

$E[\eta_i | z_i, d_i = 1] = E[\eta_i | z_i, d_i = 0] = 0$. Consequently it may be possible to "subtract out" the selectivity bias by estimating $E[u_i | z_i, d_i]$ (up to a scale parameter). In the assumed case of bivariate normality,

$E[u_i | z_i, d_i = 1] = \sigma_{u\epsilon} \cdot E[\epsilon_i | \epsilon_i > -z_i \cdot \delta]$ and $E[u_i | z_i, d_i = 0] = \sigma_{u\epsilon} \cdot E[\epsilon_i | \epsilon_i \leq -z_i \cdot \delta]$.

Therefore the Heckman term $\lambda_i(z_i,d_i) = \begin{cases} -\dfrac{\phi_i(z_i\cdot\delta)}{1-\Phi_i(z_i\cdot\delta)} & \text{if } d_i=0 \\ \dfrac{\phi_i(z_i\cdot\delta)}{\Phi_i(z_i\cdot\delta)} & \text{if } d_i=1 \end{cases}$

(where ϕ and Φ are the standard normal PDF and CDF) can be included as an estimated regressor, which should (asymptotically) take the coefficient $\sigma_{u\epsilon}$ and subtract out the selection bias.

(ii) The trivariate case

The above approach can be extended to cover the more complicated case where p_i is not always observable. For example, conventional plan premiums are only observed when a conventional plan is offered. But the unobserved determinants of the decision whether to offer a conventional plan are also plausibly correlated with the unobserved determinants of the premium itself. To allow for this correlation, the model can be elaborated to have an additional source of selection bias. As in the bivariate case, the value of the endogenous dummy variable has observable and unobservable determinants (z_{2i} and ϵ_{2i}), but now there is also censoring of the premium variable. This censoring is determined by z_{1i} and ϵ_{1i}, where the plan is offered if $z_{1i}\cdot\delta_1 + \epsilon_{1i} > 0$. The model becomes[7] $p_i^* = \alpha + \beta\cdot x_i + \gamma\cdot d_i + u_i$, where

$$p_i = \begin{cases} p_i^* \text{ if } \epsilon_{1i} > -z_{1i}\cdot\delta_1 \\ 0 \text{ otherwise} \end{cases} \qquad d_i = \begin{cases} 1 \text{ if } \epsilon_{2i} > -z_{2i}\cdot\delta_2 \\ 0 \text{ otherwise} \end{cases}$$

and the disturbances $(u_i,\epsilon_{1i},\epsilon_{2i})$ are jointly distributed trivariate normal

[7]See Fishe, Trost and Lurie (1981) for a similar model.

variables with zero means and covariance

$$\begin{bmatrix} \sigma_u^2 & \sigma_{u1} & \sigma_{u2} \\ \sigma_{u1} & 1 & \rho \\ \sigma_{u2} & \rho & 1 \end{bmatrix}.$$

Note that $E[u_i|p_i=p_i^*,\ d_i=0]$ is $E[u_i|\epsilon_{1i}>-z_{1i}\cdot\delta_1, \epsilon_{2i}\leq -z_{2i}\cdot\delta_2]$, an expectation of a conditional normal, and so can be rewritten as

$$\frac{\sigma_{u1}-\rho\cdot\sigma_{u2}}{1-\rho^2}\cdot E[\epsilon_{1i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1,\ \epsilon_{2i}\leq -z_{2i}\cdot\delta_2] + \frac{\sigma_{u2}-\rho\cdot\sigma_{u1}}{1-\rho^2}\cdot E[\epsilon_{2i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1, \epsilon_{2i}\leq -z_{2i}\cdot\delta_2].$$

Similarly $E[u_i|p_i=p_i^*,\ d_i=1]$. becomes

$$\frac{\sigma_{u1}-\rho\cdot\sigma_{u2}}{1-\rho^2}\cdot E[\epsilon_{1i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1,\ \epsilon_{2i}>-z_{2i}\cdot\delta_2] + \frac{\sigma_{u2}-\rho\cdot\sigma_{u1}}{1-\rho^2}\cdot E[\epsilon_{2i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1, \epsilon_{2i}>-z_{2i}\cdot\delta_2].$$

Consequently it is possible to estimate an augmented regression

$p_i = \alpha + \beta\cdot x_i + \gamma\cdot d_i + \theta_a\cdot\lambda_a + \theta_b\cdot\lambda_b + v_i$ where

$\theta_a = \frac{\sigma_{u1}-\rho\cdot\sigma_{u2}}{1-\rho^2}$, $\theta_b = \frac{\sigma_{u2}-\rho\cdot\sigma_{u1}}{1-\rho^2}$. To make this operational, we require expressions for appropriate means of the truncated bivariate normal distributions in

$\lambda_a = (1-d_i)\cdot E[\epsilon_{1i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1,\ \epsilon_{2i}\leq -z_{2i}\cdot\delta_2] + d_i\cdot E[\epsilon_{1i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1, \epsilon_{2i}>-z_{2i}\cdot\delta_2]$, and

$\lambda_b = (1-d_i)\cdot E[\epsilon_{2i}|\epsilon_{1i}>-z_{1i}\cdot\delta_1,\ \epsilon_{2i}\leq -z_{2i}\cdot\delta_2] + d_i\cdot E[\epsilon_{2i}|\epsilon_{2i}>-z_{1i}\cdot\delta_1, \epsilon_{2i}>-z_{2i}\cdot\delta_2]$.

Expressions for these expected values can be found in Maddala (1983, p368).

The asymptotic variance of the resulting estimate of β is given in Greene (1992, p646).

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Figure 1

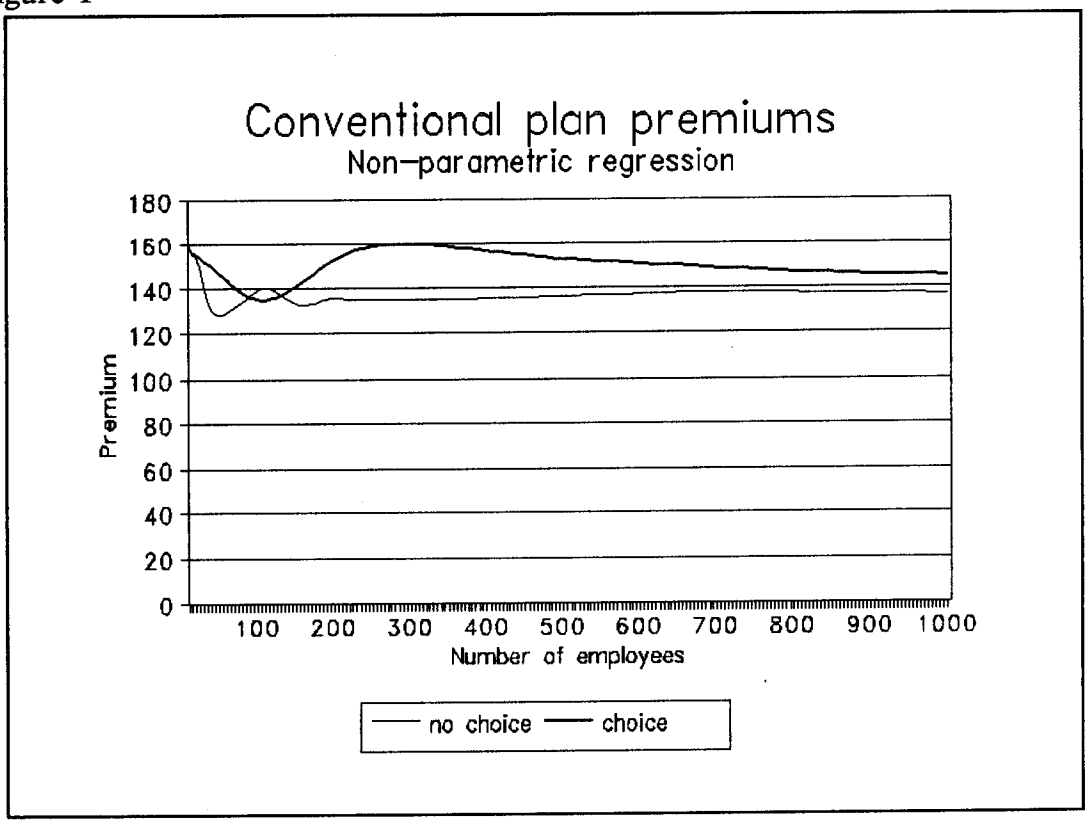
Conventional plan premiums
Non-parametric regression
Premium
180
160
140
120
100
80
60
40
20
0
100
200
300
400
500
600
700
800
900
1000
Number of employees
no choice
choice

Table 2: Mean premiums for individual cover

	HMO premiums	Conventional plan premiums
No choice	129.6	141.7
Choice	132.9	148.7

TABLE 3: Conventional Plan and HMO Premiums

	CHOICE	Conv Prem	HMO Prem
Constant	0.69	83.10	92.23
	(2.22)	(3.01)	(4.22)
Firm Size			
Employment	0.04	1.14	-0.16
	(3.20)	(1.48)	(-0.57)
Employment < 100	-1.07	-4.24	5.43
	(-13.66)	(-0.36)	(0.48)
100 < = emplt < 500	-0.71	-9.88	0.06
	(-9.85)	(-1.14)	(0.01)
Employee Characteristics			
% over 50 yrs	0.26	86.30	17.23
	(1.13)	(7.16)	(1.51)
missing 50 yrs	0.15	28.85	6.83
	(1.69)	(5.11)	(1.68)
County Health Market			
Dr price index	0.09	53.86	5.74
	(0.22)	(2.13)	(0.33)
av ins reimbnt	-0.41	60.76	44.19
	(-1.36)	(3.40)	(3.15)
urban	0.03	5.81	-0.86
	(0.42)	(1.36)	(-0.29)
HMOs			
traditional	0.15	4.45	2.18
	(1.87)	(0.83)	(0.66)
IPAs	-0.02	-6.92	-0.58
	(-0.08)	(0.51)	(-0.06)
other HMOs	0.09	6.29	-6.23
	(1.10)	(1.16)	(-1.72)
(empl > 25)*HMO	0.40		
	(4.45)		
Hospitals			
no STG hosptl	0.26	-12.42	7.96
	(1.14)	(-0.99)	(0.61)
% low utilistn	-0.09	-1.85	-0.41
	(-0.95)	(-0.33)	(-0.08)
admission rate	0.18	-6.30	-0.13
	(1.20)	(-0.85)	(-0.01)
bed availablty	-0.53	-6.10	-16.32
	(-2.42)	(-0.59)	(-1.00)
CHOICE		**-49.19**	**15.15**
		(-1.79)	**(0.63)**
lambda		31.78	-8.22
		(1.95)	(-0.58)
R^2		0.19	0.10
n		1021	651

(t-statistics in brackets, regional and industry dummies not reported)

TABLE 4 :Bivariate Probit Selection

	CHOICE	Offer Conv	Conv Prem
Constant	0.68	0.61	61.41
	(2.09)	(1.84)	(0.60)
Firm Size			
Employment	0.04	0.01	1.39
	(5.81)	(0.65)	(1.46)
Employment < 100	-1.06	-0.15	-9.78
	(-13.37)	(-2.02)	(-0.58)
100 < = emplt < 500	-0.71	-0.11	-13.53
	(-9.83)	(-1.39)	(-0.98)
Employee Characteristics			
% over 50 yrs	0.26	0.26	92.93
	(1.09)	(1.17)	(3.73)
missing 50 yrs	0.15	0.12	31.52
	(1.66)	(1.28)	(2.74)
County Health Market			
Dr price index	0.10	-0.06	53.37
	(0.23)	(-0.13)	(1.11)
av ins reimbnt	-0.40	-1.52	27.98
	(-1.28)	(-4.82)	(0.32)
urban	0.03	0.02	6.73
	(0.39)	(0.26)	(0.84)
HMOs			
traditional	0.14	0.08	6.72
	(1.78)	(1.01)	(0.66)
IPAs	-0.03	-0.58	-5.08
	(-0.12)	(-2.54)	(-0.12)
other HMOs	0.09	-0.32	-1.04
	(1.03)	(-4.06)	(-0.05)
(empl > 25)*HMO	0.41		
	(4.45)		
Hospitals			
no STG hosptl	0.26	0.07	-11.15
	(1.10)	(0.30)	(-0.50)
% low utilistn	-0.09	0.01	-1.88
	(-0.85)	(0.09)	(-0.18)
admission rate	0.17	-0.27	-9.19
	(1.13)	(-1.40)	(-0.47)
bed availablty	-0.52	0.89	6.97
	(-2.35)	(3.10)	(0.14)
		CHOICE	**-55.00**
			(-1.11)
rho	0.16	λ_{CHOICE}	38.95
	(4.23)		(1.37)
		λ_{CONV}	51.56
			(0.30)
(t-statistics in brackets, regional		R^2	0.19
and industry dummies not reported)		n	1021

TABLE 5: Sample restricted by employment level

	CHOICE	Conv Prem	CHOICE	Conv Prem
Constant	0.75	91.52	-0.47	62.90
	(2.28)	(2.95)	(-0.49)	(0.90)
Firm Size				
Employment	0.43	9.81	2.42	-30.10
	(3.78)	(1.36)	(0.04)	(-0.90)
Employment < 100	-0.90	-5.38		
	(-9.44)	(-0.44)		
100 < = emplt < 500	-0.57	-10.29		
	(-6.49)	(-1.12)		
Employee Characteristics				
% over 50 yrs	0.23	87.77	0.33	119.41
	(0.97)	(6.77)	(0.74)	(5.09)
missing 50 yrs	0.12	30.54	0.47	27.70
	(1.26)	(4.81)	(1.98)	(1.34)
County Health Market				
Dr price index	-0.14	51.05	0.39	42.37
	(-0.32)	(1.83)	(0.30)	(0.61)
av ins reimbnt	-0.55	53.37	-0.96	71.84
	(-1.67)	(2.66)	(-0.99)	(1.42)
urban	0.03	6.04	0.17	14.19
	(0.40)	(1.30)	(0.87)	(1.15)
HMOs				
traditional	0.08	4.30	-0.10	7.36
	(0.98)	(0.78)	(-0.41)	(0.53)
IPAs	-0.09	5.70	-0.38	-41.70
	(-0.32)	(0.40)	(-0.44)	(-0.88)
other HMOs	0.11	7.17	0.15	-6.49
	(1.25)	(1.21)	(0.67)	(-0.47)
(empl > 25)*HMO	0.40			
	(4.26)			
Hospitals				
no STG hosptl	0.18	-11.31	-3.44	-43.70
	(0.64)	(-0.72)	(-0.06)	(-1.55)
% low utilistn	-0.08	-1.15	0.34	-21.78
	(-0.73)	(-0.18)	(1.17)	(-1.28)
admission rate	0.12	-3.29	0.27	2.84
	(0.72)	(-0.39)	(0.70)	(0.14)
bed availablty	-0.37	-9.12	-0.01	-20.53
	(-1.50)	(-0.79)	(-0.03)	(-0.82)
CHOICE		**-60.10**		**19.24**
		(-2.00)		**(0.16)**
lambda		38.52		-14.62
		(2.16)		(-0.22)
R^2		0.18		0.33
n		939		204

(t-statistics in brackets, regional and industry dummies not reported)

TABLE 6: Specific kinds of choice

	Offer Conv	HMO prem	Offer HMO	Conv prem
Constant	0.62	64.67	-0.03	80.11
	(2.02)	(2.13)	(-0.09)	(3.35)
Firm Size				
Employment	0.01	-0.23	0.04	1.22
	(0.96)	(-0.74)	(2.85)	(1.65)
Employment < 100	-0.17	1.53	-0.78	-3.56
	(-2.23)	(0.32)	(-9.67)	(-0.39)
100 < = emplt < 500	-0.11	-1.62	-0.60	-11.01
	(-1.45)	(-0.38)	(-8.05)	(-1.44)
Employee Characteristics				
% over 50 yrs	0.25	14.27	0.18	86.08
	(1.14)	(1.00)	(0.78)	(6.82)
missing 50 yrs	0.11	5.66	0.18	30.50
	(1.20)	(1.14)	(1.99)	(5.05)
County Health Market				
Dr price index	-0.03	8.82	0.18	58.47
	(-0.06)	(0.41)	(0.43)	(2.20)
av ins reimbnt	-1.52	68.83	0.22	73.05
	(-5.06)	(2.80)	(0.70)	(3.91)
urban	0.03	-0.76	0.11	7.12
	(0.42)	(-0.21)	(1.50)	(1.56)
HMOs				
traditional	0.09	1.28	0.23	7.56
	(1.20)	(0.35)	(2.98)	(1.29)
IPAs	-0.47	12.14	0.43	16.06
	(-1.86)	(0.91)	(1.69)	(1.05)
other HMOs	-0.29	0.76	0.23	9.92
	(-3.59)	(0.13)	(2.73)	(1.64)
(empl > 25)*HMO	-0.09		0.29	
	(-0.99)		(3.26)	
Hospitals				
no STG hosptl	0.08	8.45	0.11	-14.68
	(0.33)	(0.52)	(0.44)	(-1.14)
% low utilistn	0.01	-0.76	-0.07	-2.14
	(0.09)	(-0.12)	(-0.69)	(-0.37)
admission rate	-0.25	5.94	0.28	-6.44
	(-1.59)	(0.47)	(1.61)	(-0.84)
bed availablty	0.90	-35.83	-0.65	-6.17
	(3.73)	(-1.59)	(-2.47)	(-0.59)
CONV-PLAN/HMO		**56.51**		**-70.23**
		(1.50)		**(-2.39)**
lambda		-31.88		42.71
		(-1.43)		(2.44)
R^2		0.10		0.18
n		651		1021

(t-statistics in brackets, regional and industry dummies not reported)