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Voluntary Reduction in Health Insurance Coverage: A Theoretical Analysis

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STATEMENT OF THE PROBLEM

Health insurance lowers the price of health care faced by consumers who, as a consequence, demand more health services. This behavior may manifest itself in many ways: consumers may not take as active a role in maintaining their health; they may visit a doctor more often or at lower levels of discomfort; and they may not shop carefully for low-cost providers of care. The reason for this behavior, as discussed by Pauly (1968, 1983), is that the insured consumer is behaving rationally, choosing consumption levels which equate marginal benefits to the personal marginal cost of services, but the presence of insurance results in a personal marginal cost which is less than the price charged by the provider. This disparity leads insured individuals to over-consume, resulting in efficiency losses in the market for health care. Although increased consumption tends to increase insurance premiums, each individual ignores this effect, since the effect of his/her behavior is spread over all policyholders.

Feldstein (1971) and others have also suggested that health insurance drives up the price of health care. Feldstein (1973) goes on to construct a model of spiraling health care expenditures in which more extensive coverage leads to more demand and higher prices which must then be covered by more extensive insurance policies creating new demands, and so on.

The "simple" solution to this problem is to reduce the level of health insurance coverage, possibly by legislative action. However, this solution is not easily implemented. Most private health insurance is provided by employers to employees as a fringe benefit. Due to economies of group purchasing, and the favorable tax treatment of health insurance versus wages, about two-thirds of all non-elderly individuals in the U.S. obtain health insurance through the employment of a family member (SIPP, 1985). For these individuals, health insurance benefits are part of a compensation package that includes other fringe benefits (some of which also receive favorable tax treatment) and wages. Health insurance benefits, therefore, cannot be viewed in isolation from other forms of compensation, and proposals to reduce health insurance benefits must recognize that other forms of compensation will have to increase in order to maintain the viability of the total compensation package. In the next section, we develop a theoretical model of employee compensation and explore some of the steps that employers and employees are already taking to reduce health insurance coverage. We show that if employers were misinformed about the relationship between coinsurance and the employee's consumption of health care services, employers would assume that a health insurance policy with no coinsurance is optimal, regardless of diversity in employee preferences or illness probabilities.

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With improved information regarding the effect of coinsurance, the employer would choose to offer one or more health plans with some employee cost-sharing. We discuss two cases: the firm with homogeneous employee preferences and illness probabilities; and the firm with two groups of employees with different preferences and illness probabilities. We also explore the effects of several specific proposals to use tax policy to encourage choice of compensation packages featuring less health insurance.

A THEORETICAL MODEL OF EMPLOYEE COMPENSATION: THE FIRM WITH NO TAXES

Consider an employee who is covered by health insurance through his or her place of employment. For simplicity, we will limit the discussion to single member coverage (no dependents) with no supplementary plans available to the employee. Let this employee maximize any state-dependent utility function with health care (M) and other goods (X) as arguments. The general utility function is

$$U^s = U^s(X^s, M^s)$$

where s is the state of the world, including the individual's state of health. By the usual conventions, marginal utility is positive but decreasing in each argument, with a special case being no utility weight for health care when the individual is well.

When only one health insurance plan is offered by the firm, health insurance is like a local public good to employees, each of whom receives a health insurance policy with the same premium value (Goldstein and Pauly, 1976). We assume that the premium, B, is actuarially fair:

$$B = (1 - c)\,pE(M),$$

where c denotes the coinsurance rate, i.e., the fraction of each dollar of medical expenses paid by the consumer, and p is the price of medical care. For simplicity we assume that the insurance policy contains no deductible or special provisions such as limits on coverage.[1] We also assume that the individual considers both the coinsurance rate and the expected cost of health care covered by the policy, pE(M), as exogenous. These assumptions are justified, first, because individual employees do not bargain with the employer over the terms of the policy and, second, because the costs of each person's health care consumption are spread over the whole group and are therefore negligible to the individual.

The employee regards total compensation, consisting of health insurance (B) and wage income (I), as fixed:

$$\overline{Y} = B + I,$$

where $\overline{Y}$ is total compensation. Out of this fixed compensation, the employee pays for health care, other goods, and health insurance. Therefore, the consumer's budget for state s is

$$\overline{Y} = B + X^s + cpM^s.$$

We have assumed that the price of X is one dollar. In addition, taxes are ignored. Introduction of taxes changes the analysis significantly and will be considered after the basic model has been presented.

Since the employee chooses X^s and M^s but not c, he/she does not face an expected utility maximization problem. Instead, the employee's objective can be represented as maximization

of the Lagrangean (L) function:

$$L = U^s + \lambda^s(\overline{Y} - X^s - cpM^s - B).$$

First-order conditions for utility maximization are

$$U^s_X = \lambda^s \qquad \text{and} \qquad U^s_M = \lambda^s pc.$$

Subscripts on variables represent partial derivatives, for example,

$$U_X = \partial U/\partial X.$$

The employer's objective can be modeled as minimizing total compensation cost, subject to a constraint on the worker's level of expected utility. Employees will select the job that offers the highest-valued combination of wages and health insurance benefits. At a point in time, the highest value that employees can obtain is determined by supply and demand (i.e., the labor market equilibrium value of compensation) for employees with similar skills. An employer that offers a wage-health benefit combination having lower value cannot hire workers in the competitive marketplace.

The employer controls two variables: wages and the coinsurance rate. Since the coinsurance rate must be selected before the realized value of s is known, the employer faces a problem involving decision-making under uncertainty. The employer's chosen coinsurance rate affects the health insurance premium (B) and, thus, influences the worker's utility. In addition, the chosen wage (which does not involve uncertainty) influences the worker's utility. This model, in which one agent chooses the values of variables that affect another agent's utility function is a standard application of a Ramsey-optimal pricing rule (Ramsey, 1927; Harris, 1979).

Formally, the employer's objective is to minimize the Lagrangean (L) function

$$L = I + B + \mu(\overline{V} - V)$$

where $V = E(U) = \int U^s(X^s, M^s)\,dF(s)$, dF(s) is the probability density function of s, and $\overline{V}$ is the exogeneously-determined minimum value of V. The employer's first-order conditions are

(1) $$\frac{\partial L}{\partial I} = 1 + B_I - \mu\{\int (U_X X_I + U_M M_I)\,dF(s)\} = 0 \quad \text{and}$$

(2) $$\frac{\partial L}{\partial c} = B_c - \mu\{\int (U_X X_c + U_M M_c)\,dF(s)\} = 0$$

The derivatives of the employer's expected budget constraint (with respect to I and c) are

$$1 = X_I + cpM_I \qquad \text{and} \qquad 0 = X_c + pE(M) + cpM_c.$$[2]

Substituting these derivatives and the consumer's first-order conditions into (1) and (2), and rearranging terms, we get

$$1 + B_I - \mu E(\lambda) = 0 \qquad \text{and} \qquad B_c + \mu p\,E(\lambda M) = 0.$$

Equating these conditions and making a final substitution, that $E(\lambda M) = \text{cov}(\lambda M) + E(\lambda)E(M)$, we get

(3) $$\frac{B_c}{1 + B_I} = \frac{-p\,\text{cov}(\lambda M)}{E(\lambda)} - p\,E(M).$$

Equation (3) is a general first-order condition for our model. The left-hand side of (3) represents the rate of tradeoff between money wages and insurance benefits (measured by one minus the coinsurance rate), holding the cost of the total compensation package constant. The right-hand side of (3) is the slope of a worker's indifference curve between money wages and health insurance benefits. Graphically, equation (3) can be interpreted as the point of tangency between these two curves, as shown in Figure 1. The indifference curve in Figure 1 represents the preferences of any individual in the firm.

Finally, varying the exogenous level of worker's utility, $\bar{V}$, yields a contract curve in wages-benefits space. Points on the curve toward the upper right, i.e., compensation packages with more wages and benefits, represent higher levels of worker's utility. Points on the contract curve are Pareto-optimal. Any move to the contract curve from a point not on the curve is potentially beneficial to both the worker and the employer.

Under normal labor market conditions, it is expected that an equilibrium on the contract curve will be stable unless exogenous conditions change. For example, a change in the price of health care or the exogenous level of worker's utility will upset the model's equilibrium. In the latter case, excess supply in the labor market might lead to a reduction in $\bar{V}$. We predict that firms will reduce both wages and insurance benefits in response to such conditions.

Changes in equilibrium in response to new labor market conditions should be kept sharply distinct from a move toward the contract curve which, as noted above, can benefit both the

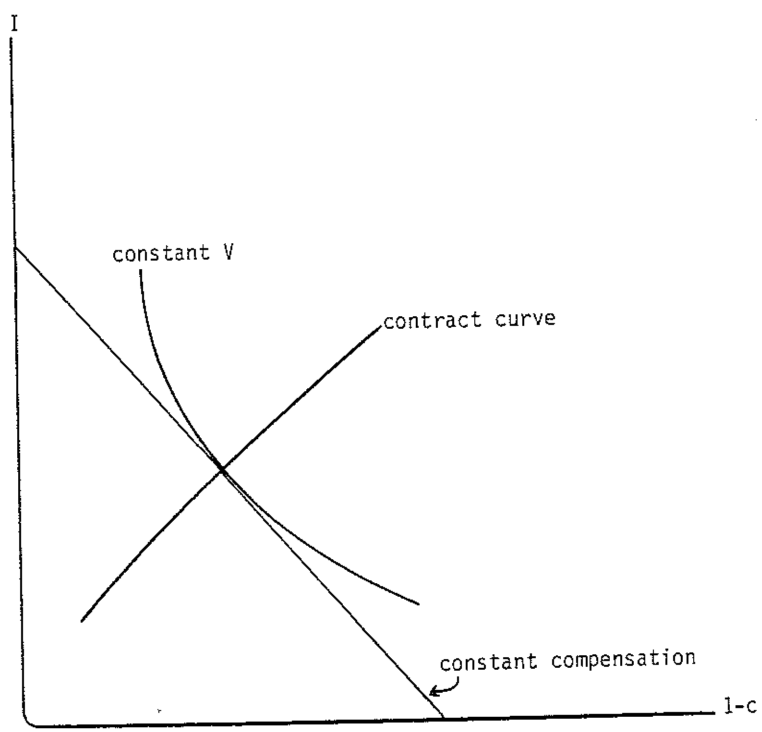

Figure 1

Determination of Equilibrium Wages and Insurance Benefits

worker and the firm. But how could workers and employers be off the contract curve for long periods of time? One answer to this question is that information regarding the trade-off between wages and fringe benefits may be imperfect. For example, employers may believe that the elasticity of demand for health care is close to zero. This, in fact, was a common belief until results from the RAND health insurance experiment showed conclusively that health care demand decreases significantly as coinsurance rises. (Newhouse et al., 1981)

The RAND study also showed that reductions in health care use (in response to higher coinsurance rates) did not harm the health of individuals enrolled in the health insurance experiment (Brook, et al., 1983). This result may not yet be widely-known to workers but if it were, they might reassess their current combination of wages and insurance and decide that a package with more wages and less insurance can produce higher utility for them, without requiring an increase in total compensation.

The role of information in this market can be illustrated clearly by assuming that initially, employers are ignorant of both price and income elasticities of demand for health care. In terms of equation (3), they believe that $B_I = 0$ and $B_c = -pE(M)$. The latter term represents a simple shift in health care costs to workers as coinsurance rises; the underlying *quantity* of health care is constant, however. With these simplifications, equation (3) reduces to cov $(\lambda M) = 0$. This would occur if the marginal utility of income were constant across all states of the world. Assuming that the utility function is separable, this in turn would imply that the optimal coinsurance rate is zero.[3] This situation is shown in Figure 2, where the employee's indifference curve is tangent to the perceived budget constraint at zero coinsurance. Thus, the optimal strategy for the misinformed employer is to offer one full-coverage health plan regardless of employees' tastes or distribution of health states.

Our model is radically changed after the employer discovers that coinsurance matters. Then it becomes important to know something about the employees' tastes and distribution of health states. Furthermore, it becomes important to know whether the firm's workforce is composed of "homogeneous" workers with similar tastes and health, or whether the workforce consists of "heterogeneous" employees with different tastes and health.

The simplest case—homogeneous employees—presents the firm with a choice: should it keep its present full-coverage health insurance plan or should it replace this plan with one that has coinsurance? The answer depends on the type of employees in this firm. If they are relatively healthy or if their tastes are not oriented toward health care consumption, then it will be optimal to introduce coinsurance. This situation is shown in Figure 2, where the equilibrium with incorrect information is at point A (full coverage) because the employer has incorrectly estimated the iso-total compensation frontier to be line AB. After learning that the correct frontier is AC, the employer realizes that a move to the contract curve at point D would leave workers with preferences represented by V_1 no worse off and would cost the employer less than the current contract (total cost would be E dollars which is less than the current cost of C dollars). In fact any move from A to the contract curve between D and F would benefit one party without harming the other. Therefore, the distance between D and F on the contract curve represents a feasible region in which the employer and the employees can bargain over the distribution of the gain from higher coinsurance.

It is important to note that the feasible region for employees with V_1 preferences involves less insurance and higher wages. This occurs because workers are giving up insurance benefits that have some marginal value. In order for utility to remain constant, the compensating factor is higher wages.

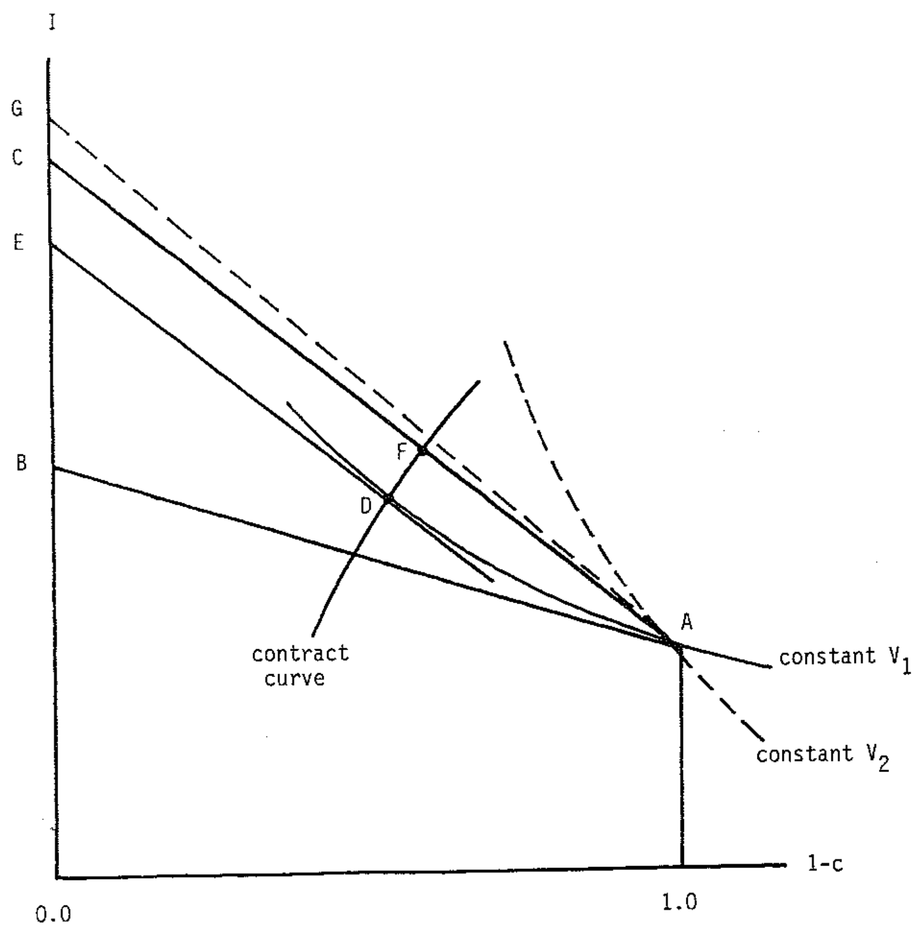

Figure 2

Equilibrium in the Homogeneous Preferences Firm

Not all firms with homogeneous employees will want to replace their existing full-coverage plan, however. In firms where the workers have a large, positive income elasticity of demand for medical care and small (in absolute value) price elasticity of demand (represented by indifference curve V_2 and iso-total compensation frontier AG), it will not be feasible to attract workers to a plan with coinsurance. The reason is that a $1 increase in wages will cause a large increase in medical care use so that coinsurance has to be increased radically in order to hold compensation constant.[4]

The case of workers with heterogeneous preferences is more complicated. Pareto-superior points on the contract curve will be determined, in part, by the distribution of employees' utility functions. In particular, it may be optimal for the firm to introduce multiple insurance plans with different levels of cost-sharing. Before these implications are explored, however, it is necessary to introduce taxes into the model.

TAXES IN THE FIRM WITH HOMOGENEOUS EMPLOYEES

Effects on Employers and Employees

The analysis of equilibrium in the single-option firm becomes significantly different when taxes are introduced. Three different tax plans are considered. Under the first plan, money wages are taxed but employer-provided health insurance is not taxed. This was the "income" tax system in the United States until the recent past. Second, we consider a tax exclusion for both health insurance benefits and out-of-pocket health care expenses. This type of plan has been referred to as a "flexible spending account" (FSA). The central idea behind this plan is that workers will be encouraged to choose insurance plans with increased cost-sharing if out-of-pocket expenses are tax-exempt. Under Section 125 of the Internal Revenue Code and subsequent regulations regarding Section 401 (k), employees can set aside a portion of their salary to pay for tax-preferred fringe benefits including out-of-pocket health care expenses. Until February, 1984, any portion of the salary set-aside which was not used to pay for out-of-pocket health care expenses could be refunded to the employee at the end of the year as taxable wages. In February, 1984, in response to perceived abuse of the 401 (k) regulations, the IRS ruled that any unused portion of the salary set-aside must be forfeited by the employee at the end of the year.

Another benefit plan that is similar to the FSA is the health bonus plan (HBP), also referred to as a health incentive payment or individual health account (Stano, 1981; Williams, 1981). Under the HBP, as in the FSA, an amount of money is made available to cover out-of-pocket health care expenses. Employees do not pay taxes on payments to health care providers from the HBP. As in an FSA, any unused portion of the HBP must be forfeited by the employee at the end of the year. Unlike an FSA, the funds set aside by an employer in an HBP to cover increased health care costs under the new plan are an "addition" to wages. For example a firm formerly offering a full coverage health plan might install a twenty percent copayment provision and concurrently give each employee a $500 HBP.

Although FSAs and HBPs appear to differ in that employees "fund" the FSA with salary reductions while employers "fund" the HBP with additional wages, the differences between the plans are more apparent than real. Total compensation in an industry is determined by supply and demand in the industry's labor market. Employers, over the long run, will not increase wages $500 per employee to fund an HBP unless the average cost of health insurance per employee falls by that amount or more. Similarly, in equilibrium, employees will not agree to an FSA that reduces both wages and insurance (though they may be forced to accept both if the equilibrium compensation level in an industry falls due, for example, to a decrease in demand for labor). If employees, in equilibrium, reduce their salary to make contributions to an FSA, compensation in other forms will have to be increased to maintain equilibrium in the industry's labor market. Viewed from this perspective, the FSA and HBP are simply two ways to offer compensation packages consisting of more wages and less health insurance to employees.

Our third tax alternative is taxation of all income—both money wages and in-kind health insurance benefits. This plan is the limiting case of the health insurance tax "caps" proposed by the Reagan Administration in 1983 and by the Treasury Department's tax reform proposal in 1984. Health insurance tax caps would tax benefits exceeding a certain amount. We simply let the cap be reduced to zero.

Each of these three plans can be analyzed by making appropriate changes in the budget constraint. Let the general budget constraint be

$$I + B = X^s + t_1 I + B(1 + t_3) + cpM^s - cpM^s t_2 \tag{4}$$

Tax payments appear on the right-hand side of the budget constraint as expenditures. The parameters t_1, t_2, and t_3 represent tax rates on money income, the tax subsidy for out-of-pocket expenses, and the tax rate on health insurance benefits, respectively. Appropriate restrictions on these parameters will produce each of the plans discussed above. The income tax system sets t_2 and $t_3 = 0$; the FSA sets $t_3 = 0$; and the tax cap set $t_2 = 0$.[5] For simplicity we assume that marginal tax rates are constant and that all nonzero tax parameters are equal. For example, if health insurance is taxed, it is assumed that it is taxed at the same marginal rate as wage income. In this model, the last two terms ($cpM^s - cpM^s t_2$) represent a refundable FSA which is presently prohibited. We choose to analyze this case because refundable FSAs are preferred by both employers and employees to non-refundable FSAs and are still of public policy interest. In the present case of non-refundable FSAs, it is expected that employees are very cautious in allocating salary to the FSA, putting aside only amounts which their out-of-pocket payments for health care services are almost certain to exceed. In that case, the only change to the model to accomodate non-refundable FSAs is replacement of the last term on the right-hand side ($cpM^s t_2$) with $(FSA)t_2$ where FSA is the amount of salary the employee allocates to the FSA.

Using the same method as in the case of no taxes, first-order equilibrium conditions corresponding to each of the three tax systems are derived. For the income tax, we have

$$\frac{B_c}{1 + B_I} = \frac{-p \text{ cov } (\lambda M)}{E(\lambda)(1 - t_1)} - \frac{pE(M)}{1 - t_1}. \tag{5}$$

An income tax system increases the employee's incentive to choose tax-free health insurance, compared to the model with no taxes. This can be seen from equation (5), in which denominator of the right-hand side is multiplied by $(1 - t_1)$. Since the right-hand side of (5) is negative, increasing the value of t_1 makes the employee's indifference curve more negatively sloped (steeper). The employee will choose a compensation package with less money income and more health insurance than under the no-tax model represented by equation (3).

The tax cap system has the following equilibrium condition:

$$\frac{B_c}{1 + B_I} = \frac{-p \text{ cov } (\lambda M) - pE(\lambda)E(M) - E(\lambda)t_3 B_c}{E(\lambda)(1 - t_1) - E(\lambda)t_3 B_I}. \tag{6}$$

But, since it is assumed that the tax rates on income and health insurance benefits are equal, equation (6) reduces to equation (3), which is the equilibrium condition for the no-tax model. Therefore, we conclude that a tax cap does not distort the choice of health insurance benefits and money wages. This result occurs because both forms of compensation are subject to the same tax rate.

The equilibrium condition for the FSA system (with tax exempt out-of-pocket health care expenses) is:

$$\frac{B_c}{1 + B_I} = \frac{-p \text{ cov } (\lambda M)(1 - t_2)}{E(\lambda)(1 - t_1)} - \frac{pE(M)(1 - t_2)}{1 - t_1}. \tag{7}$$

If marginal tax rates are equal ($t_1 = t_2$) then the FSA equilibrium is identical to the model with no taxes, as it affects the division of compensation between wages and fringe benefits. Therefore, our model supports the arguments made by proponents of refundable FSAs that a refundable FSA will encourage workers to choose less health insurance than under the present income tax system.

Effects on Public Policy

Although refundable FSAs might increase the extent of lower coverage/higher wage compensation packages and make employers and employees better off in the process, public policy objectives might suffer under such a tax subsidized system. The reason, of course, is that the ultimate variable of public policy interest is not health insurance coverage, but health care spending, and the effect of FSAs on health care spending is a two-edged sword. Although FSAs encourage employees to choose less health insurance, they also increase the demand for health care by reducing the out-of-pocket price. Thus, the net effect on health care *spending* is ambiguous. This can be demonstrated formally by noting that the consumer's price of health care under an FSA is $cp(1 - t_2)$.[6] An increase in FSA coverage can be represented by a larger value of t_2, thus the effect of FSAs on health care spending can be derived by differentiating health care spending with respect to t_2:

$$\frac{\partial pE(M)}{\partial t_2} = \frac{p\partial E(M)}{\partial cp(1 - t_2)} \left\{ -cp + p(1 - t_2) \frac{\partial c}{\partial t_2} \right\}. \tag{8}$$

The term outside of the brackets is negative. Within the brackets, the first term represents the effect of an FSA on the price of health care; the second term (which we have shown to be positive) represents the consumer's choice of increased coinsurance under an FSA. The net effect of these terms is unclear.

The Office of the Assistant Secretary for Planning and Evaluation (OASPE) in the Department of Health and Human Services (DHHS) simulated the effects of FSAs on health care expenditures using data from the RAND Health Insurance Experiment and four corporations and two surveys of companies using FSAS (DHHs, 1985). Simulations were performed for each of three prototypical FSA health plan specifications. Under each plan the coinsurance rate was fifteen percent. The deductibles for single and family coverage, respectively, in the first plan were $0/$0 and $150/$300 in the latter two plans. The cost sharing limits for single and family coverage, respectively, in the three plans were $150/$300, $500/$1000 and no limit. Health expenditures were found to increase under all three prototypical FSA plans for both refundable and non-refundable plans. The results from the OASPE study represent total changes in expenditures that would result from changes in tax policies. These total effects include the conversion of traditional health plans to FSA plans as well as the effects of increased coinsurance and untaxed out-of-pocket expenditures. Thus, the results from this simulation indicate that the reduction in the out-of-pocket price of health care resulting from tax exempt out-of-pocket payments under the FSA induces increased health expenditures which more than offset any reductions associated with higher cost sharing.

The OASPE simulation results suggest that tax-exempt deductibles and coinsurance are not advisable. This does not mean that the search for Pareto superior compensation packages should be abandoned, however. It still may be possible to increase taxable wages enough to provide an incentive for voluntary choice of a lower coverage health plan by employees in which out-of-pocket payments are made with after-tax dollars (as shown in the income tax model). Tax-exempt FSAs, in this case, may represent too much encouragement of a good idea, and could result in the worst case from a public policy perspective: further tax subsidy of even higher health care spending.

The discussion, thus far, has dealt with a firm offering a single health plan to a homogeneous workforce. The following section extends the model to a firm with heterogeneous employee preferences.

THE FIRM WITH HETEROGENEOUS EMPLOYEES

In the previous section, all employees were assumed to have a similar utility function $U^s = U^s(X^s, M^s)$ over health care services (M) and other goods (X). When this assumption is relaxed, it is apparent that the Pareto-superior points on the contract curve will be determined, in part, by the distribution of employees' utility functions. Different utility functions for different subgroups of employees affect the slopes of both the utility function at any point and the equal compensation frontier (line CA, Figure 2), and these different slopes will produce different equilibria. The objective is to find contracts that are Pareto superior to the original position (point A, Figure 2).

To simplify the analysis, it is assumed that there are only two types of individuals in the firm. On average, across all states (s), the marginal utility of health care consumption $E(U_M)$ is assumed to be higher for the first type of employee, denoted S, than the second type, denoted W. This could be true for two reasons. First, U^s_M could be higher in the first group in each of a set of frequently occurring states. Second, the distribution of states F(s) in the first group could be weighted towards those (presumably sick) states in which M makes a greater marginal contribution to utility.[7]

To evaluate the effect of higher marginal utility of health care consumption on the slopes of consumers' indifference curves and the equal compensation frontier it is necessary to assume a particular functional form for the consumer's utility function. Suppose the consumer's utility function has the simple Cobb-Douglas form:

$$U^s = M^{\alpha}X^{1-\alpha}$$

with $\alpha = g(s)$. As before, the consumer is assumed to maximize U^s subject to the budget constraint:

$$\overline{Y} - B - X^s - cpM^s = 0.$$

For the Cobb-Douglas utility function the resulting demand equation for M is:

$$M = \frac{\alpha I}{pc}$$

and thus:

$$\partial M/\partial I = \alpha/pc \qquad \text{and} \qquad \partial M/\partial c = -\alpha I/pc^2$$

Using these results (Appendix A) it can be shown that as α increases, the slope of the equal compensation frontier and the consumer's indifference curves both become more negative (steeper). The indifference curves for type-S (higher value of α) and type W individuals are shown in Figure 3. Figure 3 also shows the iso-total compensation frontiers for W and S individuals, lines AW and AS, respectively. AC in Figure 3 is the equal compensation frontier for all employees taken as a group, identical to line AC in Figure 2.

It is assumed, initially, that an area of Pareto-superior compensation packages exists for both types of employees and that the firm can identify each employee as being either a type-W or type-S employee. It can then solve equation (3) for each type of worker and offer each an

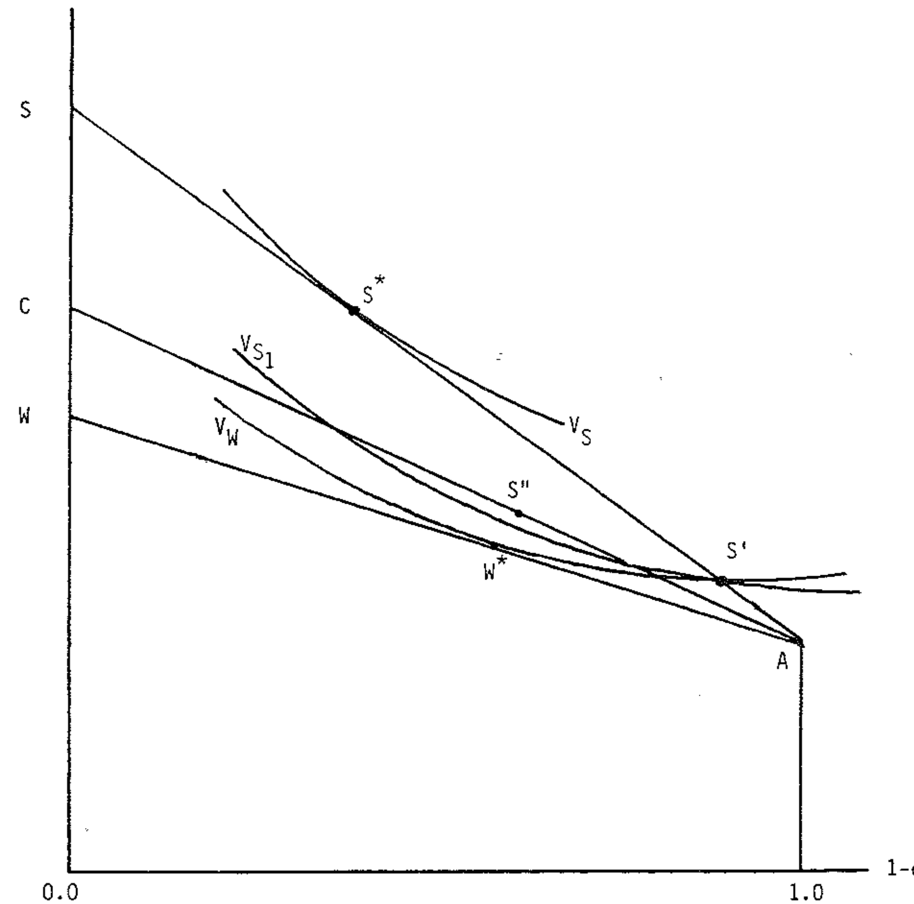

Figure 3

Equilibrium in the Heterogeneous Preferences Firm

appropriate compensation package. All of the results pertaining to both the no-tax model plus the different tax systems considered above apply directly to this firm.

As in the previous sections, the Pareto-superior packages will contain some that lie on a contract curve for each type of employee. The firm and the workers can bargain over the distribution of the gains to be had from moving to the contract curve. In Figure 3, indifference curves V_W and V_S are drawn under the assumption that employees get all the gains from choosing compensation packages with higher money wages and less health insurance. These packages are shown by points W* and S* on the equal-compensation frontier for each type of employee.

The firm can decide whether to replace its present health plan by W* and S* by examining past patterns of health care expenses among its employees. If these patterns are highly bimodal—with distinct groups of high and low expenditure employees—then the substitution of two new options may be recommended. One of the new plans (W*) should involve a relatively low wage incentive per unit reduction in health insurance coverage; the other plan (S*) should be offered along with a greater rate of wage incentives. The main requirement for following this strategy is that the firm must be able to identify type-W and type-S workers so that the appropriate option can be offered to each group.

The employer's calculations are more difficult when it cannot identify each employee's risk group. The problem is that relatively healthy employees may prefer the contract intended for less-healthy employees. In Figure 3 they would prefer S* rather than W*. The employer's total compensation costs would rise if all employees chose S*.

This problem has been studied in detail by Rothschild and Stiglitz (1976) in the context of a competitive indemnity market (indemnity insurance pays the policyholder a specified amount of money in the event that a specified event such as an accident occurs). The RS analysis showed that equilibrium insurance contracts in a competitive market with imperfect information will involve full insurance for high risks and less-than-full insurance for low risks. High-risk policyholders, in effect, impose an externality on low risks by preventing the market from offering full coverage at favorable premiums for low risks. If such policies were offered, high risks would flock to them and they would lose money.

A similar type of analysis applies to our problem, which therefore represents an extension of the RS model. Our approach is novel, however, since we apply the model to health insurance policies offered through the place of employment. This is how most people in the United States obtain their health insurance coverage.

In our model the employer offers contract W* to type-W employees. In order to prevent the contract offered to type-S employees from being preferred by *all* employees, the firm will offer a second contract with a limited wage incentive. This contract—denoted by S′ in Figure 3—is found at the point where indifference curve V_W cuts the equal compensation frontier for type-S workers. The pair contracts (W*, S′) breaks even in the sense that the firm's total compensation costs are unchanged relative to point A. Furthermore, type-W workers will prefer contract W* to A and type-S workers will prefer S′ to A. However, S′ is not Pareto-optimal because type-S workers would prefer S* to contract S′. The unique feature of our analysis is the source of the externality: low-risk workers impose an externality on high risks by preventing the firm from offering the high risks a generous wage incentive to drop their present full-coverage policy.

Given the potential importance of information in insurance markets, it is surprising that very little empirical work has been done on this type of imperfect-information equilibrium.[8] As Pauly (1984) says, we do not even know whether the necessary conditions—consumers who know their level of risk but insurers (or employers) who do not—are satisfied to any important degree. Observed market segmentation of high and low risks into different insurance plans does not necessarily indicate the presence of adverse selection, since high and low risks will also be found in different plans if the employer has perfect information and each worker type is offered a plan along its equal compensation frontier.

Our model contains one case in which the employer may want to replace its present compensation package with one, rather than two, new packages. This happens when type-S workers are relatively numerous (so that the firm-wide equal compensation frontier is close to line AS), and type-S workers are willing to accept fairly low wage incentives to give up insurance coverage. Provided that these conditions are met, the type-S indifference curve that passes through point S′ (V_{S_1} in Figure 3) will dip below the firm-wide equal compensation frontier. This enables the firm to offer a common contract that breaks even (because it lies on the equal compensation frontier) and is preferred by both types of workers relative to the

contract pair (W*, S′). An example of such a compensation package is S″ in Figure 3. Notice that if V_{S_1} correctly describes the preferences of type-S workers, S′ will no longer be an equilibrium.

Rothschild and Stiglitz also discovered this case in the indemnity insurance model. They suggested, however, that the common contract could not be maintained because another insurer could "pick off" the good risks by offering a contract tailored to their preferences. Therefore, RS denied the existence of equilibrium in this case. The analogous situation in our model would be another firm attracting type-S workers by offering them a contract with better insurance coverage.

There are two reasons why the RS conclusion may not apply to employment-based health insurance. First, employment groups are formed for reasons largely unrelated to the purchase of health insurance. There are significant transactions costs to job-hopping, as well as firm-specific human capital that binds workers to their present employer. Therefore, we doubt that small improvements in health insurance coverage will induce workers to switch jobs. Second, the type-S workers are relatively costly to hire, compared to type-W workers with similar skills. Other firms wouldn't be interested in hiring them unless there are strong complementarities in production that require both types of workers to be hired.[9] Therefore, we expect type-S workers to be especially unlikely to switch jobs.

When the employer proposes a new compensation package it is important to have reasonably accurate estimates of the equal compensation frontier(s) and the employee indifference curve(s). The most important information is the location of the firm-wide equal compensation frontier. When employees have heterogeneous preferences, the firm-wide equal compensation frontier will represent a weighted average of the frontiers for each sub-group of employees with homogeneous preferences. The weights are the proportions of employees in each group. The best available estimates of the firm-wide equal compensation frontier come from the RAND health insurance experiment. In studies of six different levels of deductibles ($50, $75, $100, $200, $500, and $1,000) demand at the $1,000 level was found to be roughly two-thirds of demand at the $50 level (Newhouse, 1978). The RAND experiment results for coinsurance rates (Newhouse, et al., 1981) are shown in Table 1.

Estimating the location of employee indifference curves obviously is more difficult, but less crucial, since the greatest losses to the employer would occur if a compensation package lying above the population-wide equal compensation frontier (line AC, Figure 3) was offered. By proposing a relatively small reduction in coverage, e.g., c = .2, accompanied by small increase in wages, the employer can explore the location of contracts on the equal compensation frontier that make both employee groups better off.

Our advice to such firms is that the new compensation package should not be a voluntary

TABLE 1
The Effect of Coinsurance on Health Care Services Expenditures

	Percent of c = 0 (Free Care) Expenditure Level
c = 0 (Free care)	100
c = 0.25	81
c = 0.50	67
c = 0.95	69

Source: Newhouse, et al. (1981)

option in addition to the old package at point A. Firms following this strategy run the risk that only type-W employees will choose the new package that is intended for all employees. This will substantially increase the firm's total compensation costs. On the other hand, by making the new package mandatory for all workers, the worst harm (from the workers' viewpoint) is that type-S employees will be made slightly worse off than they were at point A. The firm should carefully monitor the employees' satisfaction with the new contract to prevent this outcome from occurring.

Our final analysis concerns the effect of tax policy on firms with heterogeneous employees. As previously noted, the case of perfect information can be analyzed by applying the model of the firm with homogeneous employees to type-S and type-W employees separately.

The flexible spending account (FSA) proposal may have two interesting effects on firms with heterogeneous preferences if information is not perfect. First, because the FSA makes employee indifference curves flatter (relative to the present income tax system), it decreases the externality imposed on type-S workers by type-W workers. This occurs because the type-W indifference curves cut the equal compensation frontier AS further to the left as they become flatter. Consequently, the imperfect information compensation package for type-S workers features a larger reduction in health insurance coverage.

Second, however, the possibility of a common contract to replace the old full-coverage health insurance policy *increases* as a result of the FSA. This occurs because the type-S indifference curves are flatter and, hence, more likely to dip below the firm-wide equal compensation frontier.

SUMMARY

The widespread presence of insurance in the market for health care leads to inefficiencies in consumption. Since insured individuals do not face the true marginal cost of consumption they tend to consume too much health care. Reduced levels of insurance coverage may help reduce the extent of these inefficiencies.

We have presented a theoretical model of compensation in which employers and employees reach agreement on an equilibrium package of wages and insurance. New and more accurate information on the location of the equal compensation frontier, may result in compensation packages which are Pareto optimal for employers and employees that involve less insurance and higher wages than present packages. We assume that the employer is the first to possess this new information and thus it is the employer who makes alternative compensation offers to employees. If the employees in a firm are relatively homogenous they may, at the suggestion of the employer, be willing to accept a lower coverage/higher wage compensation package which will replace the existing package.

If employees are heterogeneous, however, the employer may decide to replace the existing full-coverage health insurance policy with two new policies that both feature some cost-sharing. This choice can be made under conditions of perfect or imperfect information. In the latter case, relatively healthy employees impose a constraint on the compensation package offered to less-healthy employees. Finally, the employer may decide to replace the full-coverage policy with a single policy offered to all workers. Rothschild and Stiglitz (1976) would identify this as a non-equilibrium offer, but our analysis of employment-based health insurance suggests that such contracts may not cause workers to switch jobs. Our advice to firms following the single-offer strategy is to make the new plan mandatory, lest it be chosen only by relatively healthy employees.

The model in this paper, combined with the results from other studies, has important public policy implications. The principal public policy choice variable regarding lower coverage/higher wage compensation packages is the tax treatment of wages, health plan premiums and out-of-packet health care expenses. Our results indicate that the new compensation equilibria under a refundable FSA would have higher wages and less insurance than the present income tax equilibrium. However, an OASPE (DHHS, 1985) simulation indicated that total health expenditures would rise under several prototypical refundable FSA plans because the expenditure-reducing effects of higher coinsurance would be overcome by the expenditure-increasing effects of reduced out-of-pocket health care prices produced by payment with pre-tax dollars. Thus it appears that the choice of lower coverage/higher wage compensation packages should take place in a market free of FSA or HBP tax subsidies. Government can play an important role in the market, however, by providing employers with information on the correct location of the equal compensation frontier and reporting the experience of firms which replace their existing full coverage plans with lower coverage plans or offer lower coverage options to employees. Rigorous analyses of these firms' experience could provide important data to employers and employees considering lower coverage options.

APPENDIX A

Let the consumer's utility function be:

$$U^s = M^\alpha X^{1-\alpha}$$

where

U^s is utility in state "s"
M is health care services
X is other commodities

The consumer is assumed to maximize U^s subject to the budget constraint:

$$\overline{Y} = X^s + cpM^s + B$$

where

$\overline{Y}$ is fixed total compensation
c is the coinsurance rate
p is the price of medical care
B is the health insurance premium

and the price of X is assumed to be 1. The resulting demand functions for M and X are

$$M = \frac{\alpha I}{pc} \quad \text{and} \quad X = I(1-\alpha)$$

We now write the indirect utility function expressing utility as a function of prices and income:

$$V^s = \{I(1-\alpha)\}^{1-\alpha}\{\alpha I/pc\}^\alpha$$

Differentiating with respect to I and c, with utility held constant, yields:

$$0 = (1-\alpha)^{1-\alpha}\alpha^\alpha(pc)^{-\alpha}dI - \alpha p(pc)^{-\alpha-1}I(1-\alpha)^{1-\alpha}\alpha^\alpha dc$$

thus:

$$\frac{dI}{dc} = \frac{\alpha I}{c}$$

and:

$$\frac{\partial^2 I}{\partial(1-c)\partial(\alpha)} \frac{-I}{c}$$

which is unambiguously negative. So as α increases, the slope of the consumer's indifference curves in Figure 2 becomes more negative. The slope of the equal compensation frontier is:

$$\frac{B_c}{1 + B_I}$$

To see how this slope changes with α we note that:

$$\text{(A1)} \qquad \partial\{B_c/(1 + B_I)\}/\partial\alpha \leq 0 \quad \text{if} \quad \frac{B_{c\alpha}(1 + B_I) - B_{I\alpha}B_c}{(1 + B_I)^2} \leq 0$$

where B_{ij} is the cross partial derivative:

$$\frac{\partial^2 B}{\partial i \partial j}.$$

Inequality A1 holds if:

$$\text{(A2)} \qquad \frac{B_{c\alpha}}{B_{I\alpha}} \leq \frac{B_c}{(1 + B_I)}$$

Since $B = (1 - c)p\,E(M)$, inequality A2 may be re-written as:

$$\text{(A3)} \qquad \frac{p(1 - c)M_{c\alpha} - pM_\alpha}{(1 - c)pM_{I\alpha}} \leq \frac{p(1 - c)M_c - pM}{1 + (1 - c)pM_I}$$

From the demand equation for M:

$$\frac{\partial M}{\partial \alpha} = I(pc)^{-1} \qquad \frac{\partial M}{\partial I} = \alpha(pc)^{-1}$$

$$\frac{\partial^2 M}{\partial I \partial \alpha} = (pc)^{-1} \qquad \frac{\partial M}{\partial c} = -\alpha I(pc)^{-2}$$

$$\frac{\partial^2 M}{\partial c \partial \alpha} = I(pc)^{-2}$$

When these substitutions are made, inequality A3 is seen to hold whenever $c > 0$. Thus, as α increases, the slope of the equal compensation frontier becomes more negatively sloped.

FOOTNOTES

1. Raviv (1979) has shown that any insurance policy with an upper limit is dominated by a policy without an upper limit. Furthermore, a zero deductible is optimal if the insurance policy is actuarially fair, as we assume in this model.

2. In taking these derivatives, we do not hold total compensation constant, as we did in the employee's maximization problem. This is because we are now considering the employer's objective, which is to minimize the cost of the compensation package required to attract workers to the firm.
3. For example, let $U^s(X^s, M^s) = F(X^s) + G(M^s)$. Substituting the budget constraint, we get $U^s = F(\bar{Y} - B - cpM^s) + G(M^s)$. As health care use varies across different states of the world, the only way that the marginal utility of income can remain constant is for coinsurance to be zero. Another way of stating this conclusion is that "full insurance" is optimal if there is no moral hazard. This result has been noted by Arrow (1963) and Pauly (1968).
4. Formally, the condition for a corner solution is that equation (3) holds as an inequality at $c = 0$. We have already shown, in footnote #3, that $\text{cov}(\lambda M) = 0$ at this point; thus, the inequality becomes $B_c/(1 + B_I) > -pE(M)$. Differentiating the premium equation to obtain B_c and B_I and substituting these derivatives into the inequality, we get $M_I > -M_c/pE(M)$ as the condition for a corner solution. This condition is more likely to hold if M_I is large and M_c is close to zero.
5. We assume that employer paid health insurance benefits are tax-exempt under the FSA plan and that the tax cap plan does not include an FSA. Note that the "no tax" system used to introduce the model restricts all tax parameters to zero.
6. The consumer maximizes utility in state s by setting $U^s_M = \lambda^s pc(1 - t_2)$. An increase in FSA coverage lowers the price of health care and encourages the consumer to spend more of his/her money income on health care and less on other goods. This is in contrast to all of the other systems (no tax, income tax, and tax cap), which have the consumer equilibrium condition that $U^s_M = \lambda^s pc$.
7. We do not provide a separate analysis of the choice of family coverage versus single coverage in this paper. But clearly one condition that could skew the distribution of states towards sick states would be the presence of multiple family members. As shown in the previous section, higher tax rates also result in more negatively sloped indifference curves.
8. An exception is Jensen (1986), who suggests that employee premium contributions in multi-plan firms may represent a barrier to adverse selection. In equilibrium the plan with higher gross premium requires an employee contribution, which is set so that employees in the lower-cost plan are indifferent between the two plans.
9. Similar complementaries in production must be assumed for both types of workers to be found in the firm analyzed in this section of our model. See Dye and Antle (1984) or Jensen (1986) for models which use similar assumptions to guarantee that heterogeneity or workers' preferences exists within a firm.

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