THE DEMAND FOR SUPPLEMENTARY HEALTH INSURANCE, OR DO DEDUCTIBLES MATTER ?

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PREFACE

It is frequently alleged that if a national health insurance plan includes deductibles and coinsurance (i.e., requirements that the patient pay part of the bill), consumers will purchase supplementary or companion insurance that will eliminate patient payments. Thus, any supposed impact of deductibles on demand will be negated.

This report estimates the probability of demand for supplementary insurance. It finds that if there are no special tax benefits for supplementary insurance, consumers will almost certainly not purchase such coverage for nonhospital services; however, if tax subsidies for supplementary insurance are continued, the demand for such insurance would be positive, but it is still likely to be small. The report was prepared under Rand's Health Insurance Study program of nonexperimental research on the demand for insurance, supported by a grant from the Department of Health, Education, and Welfare.

SUMMARY

This report estimates the likelihood that consumers will purchase private insurance policies to supplement or "fill in" a deductible that might be included as part of a national health insurance plan. If such supplementation does occur, demand for ambulatory health services may stress existing supply, leading to extensive nonprice rationing of services.

We show that if the current tax subsidy of health insurance is ended, the administrative costs, and hence the premiums for policies covering all medical expenses that supplement a moderate (up to $200 per person) deductible, will be so high that almost no one will buy them. Ending the tax subsidy will mean that employer-paid premiums for supplementary policies will be taxable income, just as employer-paid life insurance for face values in excess of $50,000 is taxable income. Also, there will be no individual deduction for health insurance premiums.

By contrast, if the tax subsidy is continued, our assumptions imply that the median individual will be willing to buy full supplementation. However, the decision is close and our assumptions favor supplementation, so we doubt that there will be much demand even with a subsidy. Supplementary insurance that covers hospital expenditures only is more attractive because the administrative costs are much lower.

Our predictions are corroborated by the experience under Medicare; we estimate that only about one in every ten individuals eligible for Medicare has chosen to supplement the $60 per person deductible in Part B (which pays for physician services), although somewhat more than half have purchased policies that supplement Medicare coverage for hospital services only.

If national health insurance is written with a moderate deductible that applies to *unreimbursed* expenses (as the present medical deduction on the personal income tax does), individuals can eliminate that deductible only by foregoing any benefits from NHI. Thus, there will be no demand for supplementary insurance. None of the current health insurance bills propose this treatment.

Our results are based on an economic model of the decision to purchase supplementary insurance. We assume that the consumer is risk averse and is therefore willing to pay a certain loading fee (excess over actuarial value) for a supplementary insurance policy; the amount of the loading fee will depend on the degree of risk aversion. In calculating the loading fee that the consumer would be willing to pay, we make a number of conservative analytical assumptions: (1) We analyze the case of group insurance. Because transaction costs (and hence loading fees) are much lower for group insurance than for individual insurance, and because the adverse selection problem is not so severe, demand for supplementary group insurance is greater than demand for supplementary individual insurance. (2) We analyze the case in which all members of the group must belong to the supplementary insurance plans. If some group members are allowed to opt out of the plan, we show that purchase of supplementary insurance is much less likely. If all members must belong, we assume that the preferences of the median individual are decisive in a vote on the level of supplementation purchased by the group. (3) We assume that supplementary insurance has no effect on demand for medical services. Because supplementary insurance does affect demand, our analysis is likely to overestimate the desirability of supplementary insurance.

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CONTENTS

I. INTRODUCTION

Most proposals for national health insurance (NHI) include arrangements for the consumer to pay a share of his medical expenditures by using deductibles and coinsurance.[1] Because the consumer will be exposed to the risk of variable out-of-pocket expenditures, it is conceivable that he will want to purchase private insurance to supplement his coverage under NHI. The purpose of this report is to consider whether or not, given NHI with a moderate deductible of $200 per person per year or less,[2] there will be a demand for supplementary insurance to cover expenditures below the NHI deductible. Our analysis suggests that demand will be negligible if there is no favorable tax treatment of supplementary insurance.

In Sec. II of this report, we discuss the policy significance of supplementary insurance. Estimates of the premiums required for such insurance and an evaluation of demand are given in Sec. III. Evidence on the extent of supplementation under an NHI plan, based on the Medicare experience and other data, is discussed in Sec. IV.

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[1] A deductible of $X means that the consumer pays the first $X of his expenditure in a given time period; a coinsurance rate c means that the consumer pays a fraction c of his bill.

[2] We are not considering a national health insurance plan with very large deductibles. Given a deductible of $2000 per family or 10 percent of family income, as proposed by the Long-Ribicoff and Feldstein plans, respectively, a demand for private insurance below the deductible may well be substantial. Our calculations, however, show that even in this case the optimal level of supplementation would not leave the deductible at zero.

II. POLICY SIGNIFICANCE

There is considerable disagreement on the desirability of cost sharing for medical services. In this report, we do not wish to take a position in this debate. Rather, we ask: Is cost sharing even relevant? Or will individuals purchase supplementary insurance that eliminates it? For example, it has been argued that if demand for medical care responds to cost sharing, consumers will purchase supplementary insurance that "robs [the cost sharing] of effect" (Evans, 1972, p. 120).

Those who argue for the use of cost-sharing provisions in NHI see it as one means of restraining demand. Estimates have been made that the increase in demand for office visits could be 75 percent or more if no deductible is included in a national plan.[3] Because an increase in demand of this magnitude could not be accommodated with the existing supply of ambulatory medical services, there would very likely be extensive nonprice rationing of services if supplementary insurance were widespread. Of course, if supplementary insurance is purchased, the cost-sharing provisions will not restrain demand, and the cost sharing will only serve as a tax on the sick or a user charge, depending on one's view of the world.

Theory suggests that demand as a function of a deductible approximates a logistic curve (Fig. 1).[4] If the NHI deductible were set at d_1 with the intent of restraining demand,[5] it would be important to

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[3] Newhouse, Phelps, and Schwartz (1974). Newhouse, Rolph, Mori, and Murphy (forthcoming) estimate that the difference in demand between a $50 and a $200 (per person per year) deductible is around 50 percent.

[4] Keeler, Newhouse, and Phelps (1974) outline the theoretical basis for this statement.

[5] Opponents of an NHI deductible argue that it would perversely limit demand for preventive or early care and so increase total demand in the long run, thus leading to worse health outcomes. There is little, if any, evidence either to support or refute this claim. However, if

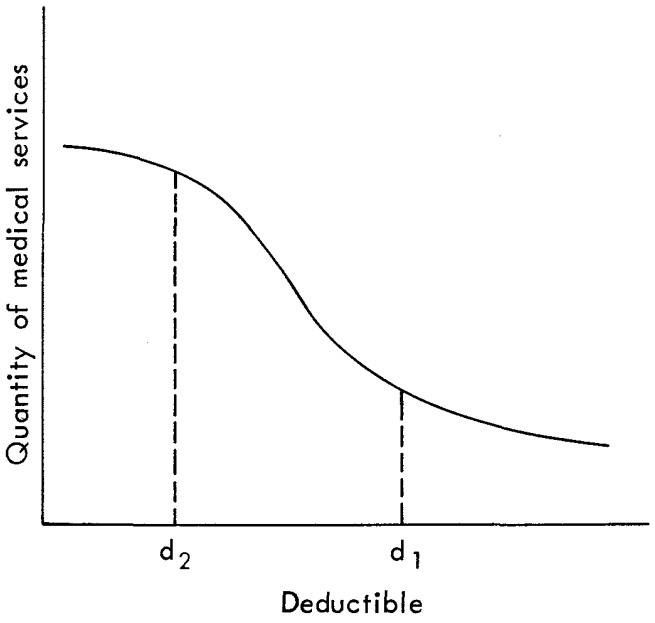

Fig. 1

know whether or not many persons would supplement down to d_2 or beyond. There is little evidence on which to determine where d_1 might lie; however, we conjecture that it may be around $200 per person per year.

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true, it is possible to waive cost sharing for certain preventive services such as vaccinations.

In considering an appropriate level of a deductible, it is also important to realize that the level of the deductible determines the proportion of total expenditures for medical services that flows through the public budget for NHI. Because of the opportunity cost or political cost of public expenditures, it may be desirable to shift medical expenditures from the public to private budgets. For example, increasing the annual per-person NHI deductible from $100 to $200 would transfer an estimated $5.7 billion to private budgets. This estimate is based on the observed distribution of individual expenditures in 1970 (inflated to 1975 dollars). The estimated transfer is

$$T = 210{,}000{,}000 \left[\int_{100}^{200} (x - 100) \cdot f(x)\, dx + \int_{200}^{\infty} 100 \cdot f(x)\, dx \right],$$

where $f(x)$ is the density function of expenditure.

This calculation makes the crude assumption that the expenditure distribution in this range under NHI is the same as the observed distribution.

An increase in the deductible from $50 to $200 would transfer about $10 billion, and from $50 to $150, $5.6 billion.

Only 28 percent of the population had expenditures exceeding this figure in a national probability sample survey (Table 1), which is consistent with d_1 lying near $200.

Table 1

PROBABILITY OF ACTUAL AND ESTIMATED EXPENDITURES

	Dollar Range (Low, High)							
Expenditure	0-25	25-50	50-100	100-200	200-500	500-1000	1000-2000	2000-∞
Actual	.34	.10	.15	.13	.12	.07	.06	.03
Estimated[a]	.36	.11	.12	.11	.12	.07	.05	.06

[a]The proportion of expenditures between the bounds if expenditures are distributed so that $\log (x_{1975} + 1/.718) \sim N(4.08, 5.45)$.

For this reason, we will focus on demand for supplementary insurance that covers a moderate deductible. We will not analyze policies that reduce any coinsurance that may apply above the deductible, because we believe that the level of coinsurance above a deductible is less important than the size of the deductible in determining whether there will be a large increase in demand for outpatient services if an NHI program is enacted.[6] Little increase in demand for hospital services is to be expected from such a program because of extensive existing coverage, but the presence or absence of a deductible is likely to be critical in determining the amount of increase in the demand for ambulatory medical services.

Of course, supplementary insurance of any kind could be virtually eliminated by having NHI apply to *unreimbursed* rather than total expenditures, i.e., to expenditures that are not covered by private

[6]Nor do we consider demand for insurance that might cover fees charged in excess of what a public insurance plan will pay for. In effect, we assume that such insurance is in force (if the public plan does not pay for everything) through our assumption that the coinsurance rate above the deductible is zero.

insurance. The treatment would be similar to the medical deduction on the personal income tax, which does not permit a deduction for expenditures reimbursed by insurance. Private insurance would then vanish, since the only way to get more complete coverage would be to pay for all of that coverage and forego any benefits from the NHI plan.[7] Since none of the major NHI bills before the Congress limits public insurance to unreimbursed expenditure, nor does the Medicare program, we assume the cost-sharing provisions apply to total expenditures.

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[7] Suppose that the NHI plan has a deductible of $X that applies to unreimbursed expenditures. In that case, an individual who purchases a supplementary policy covering the first $X shows that he is willing to buy the policy (pay the excess over actuarial value) rather than incur an exposure of $X. But, of course, after purchasing this policy, he still has an exposure of $X, so by assumption, he would buy a policy to cover the next $X. (There is an income effect that tends to restrain the consumer from continuing in this fashion, but the income effect should be empirically negligible.) Thus, the consumer, if he supplements at all, will continue to supplement until he is completely covered by a private policy. However, at complete coverage the actuarial value of the private policy will amount to several hundred dollars, so that the premium will exceed the values of $X that we consider. The consumer will therefore prefer a probability of spending $X to the certainty of spending a larger amount on a premium, and there will be no market for supplementary insurance. Australia has adopted such a provision in its NHI plan.

III. A MODEL OF SUPPLEMENTATION

The *loading fee* of an insurance policy is the proportion by which the premium charged to the consumer exceeds the expected insurance payments. The fee covers the costs of selling and administering the policy, risk bearing by the insurer, and normal profits. The lower the loading fee, the more attractive insurance becomes to the consumer. In this section we show that even with assumptions favoring supplementation, the maximum loading fee that a consumer would be willing to pay for any comprehensive supplementation below a moderate deductible would generally be smaller than any company could offer without a tax subsidy.

We first derive a simple formula for the largest loading fee that would permit supplementation and then use expenditure data from the 1970 survey of the Center for Health Administration Studies and the National Opinion Research Center (CHAS-NORC) to estimate the parameters in the formula.[8] To simplify our argument, we assume that (1) supplementary insurance has no effect on demand for medical services; (2) the coinsurance rate above the deductible rate is zero; and (3) the supplementary policy could reduce the deductible to any level, including zero. However, these assumptions are not critical to our results.

The effects of supplementation on demand for medical services are the reason for this analysis, so it may seem odd to assume that supplementary insurance has no effect. Nevertheless, it makes analysis much simpler; and if supplementary insurance is not bought if it has no effect on demand, it should not be bought if it increases demand.[9]

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[8] This survey is described in Andersen, et al. (1973).

[9] Demand for supplementary insurance will be reduced if the distortions that supplementation brings to below-the-deductible demand are associated with a welfare loss (Pauly 1968; Feldstein 1973). One could argue that prices do not reflect social cost in this market, so that there is no necessary welfare loss from the additional demand. While the assumptions sufficient to prove a welfare loss are strong, we feel that some welfare loss is likely. Any externalities in consumption (a common rationale for subsidized medical care) are not relevant to the individual's decision.

Note that, because supplementation increases demand, individuals are more likely to exceed a deductible and so obtain publically financed

Our second assumption is that the coinsurance rate above the deductible is zero. Reduction of the coinsurance rate should be more attractive to consumers than reduction of the deductible because its marginal administrative costs should be very small (the company administering the policy covering above-deductible expenses has only to increase the amount of the check) and because demand is more sensitive (and hence losses due to insurance distortions are greater) to price in the $50 to $200 range than it is in the case of larger expenditures.[10] For these reasons, if we show that supplementary insurance is purchased against a deductible, we may assume that insurance against any coinsurance above the deductible will also be purchased. If we show the reverse, we cannot say whether any coinsurance above the deductible will be eliminated; but the critical policy point is whether supplementation will considerably change demand for outpatient services and also eliminate whatever price competition exists in the ambulatory marketplace. If a deductible of sufficient size exists (say about d_1 in Fig. 1), supplementary insurance that serves to eliminate a 20 to

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benefits for expenditures in excess of the NHI deductible. Thus, it might be thought that such benefits should be accounted for in our analysis of supplementary insurance. To the contrary, the benefits above the deductible are available to the individual whether he purchases supplementary insurance or not, and so should not affect his decision to purchase it. Consider a risk-neutral individual under three different circumstances: (1) He purchases an actuarily fair supplementary policy. (2) He does not purchase an actuarily fair supplementary policy, but acts as though he did. (3) He does not purchase an actuarily fair supplementary policy and his actions are unconstrained. The individual must either prefer the third circumstance to the second or be indifferent between them, since the underlying conditions he faces are similar, but his actions in responding to them are constrained under the second circumstance but not under the third. He should be indifferent between the first and second circumstance, since his expected losses are the same in each and he is risk neutral. Therefore, he either prefers the third state to the first or is indifferent between them; i.e., he will either not supplement or will be indifferent. Note that this prediction was derived without reference to benefits in excess of the deductible.

[10] Full ("basic") hospital insurance is quite common (Reed and Carr, 1970).

to 25 percent coinsurance rate above the deductible will not greatly increase demand for outpatient services. Moreover, if we show that supplementation of a deductible will not occur, we have shown that some market incentives will be preserved.

Suppose that individual i can decide the deductible level d for a group to which he belongs.[11] Let the pre-existing national level be D. If $B_i(d)$ is the benefit to i if his group has insurance with a deductible d, supplementation of the deductible is attractive if for some $d < D$, $B_i(d) > B_i(D)$. By definition,

$$B_i(d) = -R_i(d) + I_i(d) - P_g(d), \tag{1}$$

where $R_i(d)$ is the risk premium, $I_i(d)$ is the expected payment by the insurer, and $P_g(d)$ is the premium for the group policy. We shall explain each of these in turn.

The risk premium is the amount an individual would pay in excess of actuarial value to avoid the losses he remains exposed to at deductible level d. (Thus $R(0) = 0$.) Assuming that the individual's preferences can be represented by a utility function that is separable in health and money, the risk premium can be computed from the individual's distribution of expenses, $f_i(x)$, and his aversion to risk. Let $h_i = \min(x_i, d)$ be the random variable of out-of-pocket expenses with a deductible d, and let u be the individual's utility function for money. Pratt (1964) measured risk aversion by $r = -u''/u'$, and showed for small gambles Z that the risk premium is approximately $(r/2) \cdot \mathrm{var}(Z)$. In the range of deductibles under investigation ($0 to $200), and for reasonable measures of risk aversion ($r \leq .002$), this approximation is quite good.[12] Thus, we assume

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[11] Administrative costs (and hence loading fees) are much lower for group insurance than for individual insurance, and the problem of adverse selection (that only the sickliest want insurance) is not so severe. Hence, demand for group insurance will be larger than demand for individual insurance.

[12] Two common families of utility functions used in theoretical examples are $-e^{-rx}$ and $-x^c$, $c < 0$. The exponential is easier to work with,

$$R_i(d) = r/2(\text{var } h_i) = r/2 \cdot E(h_i - E(h_i))^2. \qquad (2)$$

We shall need the derivative $R_i'(d)$, below:

$$R_i'(d) = r/2(E(2h_i \cdot h_i') - 2E(h_i) \cdot E(h_i')). \qquad (3)$$

Define $F_i(x) = \int_0^x f_i(t)\,dt$ to be the probability of individual expenditures less than x, and $F_g(x) = \int_0^x f_g(t)\,dt$ to be the proportion of group expenditures less than x.
Then

$$R_i'(d) = r(d(1 - F_i(d)) - E(h_i) \cdot (1 - F_i(d)), \qquad (4)$$

since $h_i'(d) = 1$ for $x < d$, $h_i'(d) = 0$ for $x > d$.

The expected insurance company payment to the decisive individual, $I_i(d)$, is given by

$$I_i(d) = \int_d^D (x - d)f_i(x)\,dx + (D - d)(1 - F_i(D)). \qquad (5)$$

The premium for the policy is based on the expected payments by the insurance company to members of the group and the loading fee, θ. Thus, $P_g(d) = (1 + \theta)I_g(d)$ or

$$P_g(d) = (1 + \theta)\left[\int_d^D (x - d)f_g(x)\,dx + (D - d)(1 - F_g(D))\right]. \qquad (6)$$

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but lacks the realistic property of decreasing risk aversion. As wealth increases, people with exponential utility functions have the same attitude toward gambles and do not become more willing to take risks. For both functions, the gamble Z for which they differ most from the approximation is a .5 chance of losing \$200 and a .5 chance of no loss. If r = .002, the approximation is .002/2 · var(Z) = \$10; for the exponential $Eu(Z) = .5\,e^{-r(-200)} - .5\,e^{-r(0)} = -1.2459 = -e^{-r(109.93)}$, the difference is 7 cents. If $u = -x^c$, $r = (1 - c)/x$. Thus, r = .002 is consistent with c = -9, x = 5000. In this case Eu(Z) = u(109.94), a difference of 6 cents from the approximation.

The value of insurance to the consumer varies inversely with the effective loading fee. When the loading fee is so large that the premium is bigger than any possible payment, no one will want insurance; when the effective loading fee is minus one (as it would be if insurance payments could be used as a tax credit), insurance is free and every one should want it. For any individual, any deductible, and any proposed supplementary reduction to $x \leq D$, we can find a break-even effective loading fee, θ_x, such that the individual is indifferent between purchasing or not purchasing that reduction. For loading fees larger than θ_x, supplementation will not be desirable; and for loading fees smaller than θ_x, it will be desirable.

The θ_0 associated with full supplementation for the decisive individual can be found by solving $B_i(D) = B_i(0)$ for θ, to get

$$\theta_0 = \frac{R_i(D) + I_i(0) - I_i(D)}{I_g(0) - I_g(D)} - 1 \tag{7}$$

(recall that $R_i(0) = 0$). The θ_D associated with a slight reduction in the deductible can be found from the marginal value of supplementation at D, $B_i'(D)$. From (2), (3), (4), and (5), we obtain

$$\begin{aligned} B_i'(D) = &-r(1 - F_i(D))(D - E(h_i)) - (1 - F_i(D)) \\ &+ (1 + \theta)(1 - F_g(D)). \end{aligned} \tag{8}$$

And so θ_D is found by solving $B_i'(D) = 0$ for θ to obtain

$$\theta_D = \frac{(1 - F_i(D))[r(D - E(h_i)) + 1]}{1 - F_g(D)} - 1. \tag{9}$$

Formula (9) shows that supplementation will occur at larger loading fees (i.e., that demand for supplementation will be greater) when purchasers are more risk averse (r is large), when the deductible is large and the average loss is small ($D - E(h_i)$ is large), and when the

decisive individual's probability of exceeding the deductible is high relative to that of the group ($(1 - F_i(D))/(1 - F_g(D))$ is large).[13]

Let

$$\theta_{max} = \max_{x \leq D} \theta_x.$$

Then if the real effective loading fee is larger than θ_{max}, supplementation to any level below D will not occur. In all cases considered, our results show that θ_{max} was associated with either a slight reduction in the deductible or complete elimination of the deductible (i.e., $\theta_{max} = \max(\theta_0, \theta_D)$).

In the computation of θ_{max} below, r will be assigned several values and $d - E(h_i)$, f_i, and f_g will be estimated for different groups by means of the CHAS-NORC survey results.

THE BASIS OF THE CALCULATIONS

(1) A group on which the insurance company would base an experience rating is defined. We assume that this group belongs to a firm whose members are representative of the nonpoor and nonaged in the general population.[14] The nonpoor are defined as persons in families with income above a family-size specific poverty line.[15] The nonaged are defined as persons under 65. Because the distribution of expenditures for children is significantly different from that for adults, and

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[13] Formula (9) also shows that if the loading fee were truly θ_D, then D would be the preferred deductible level for the decisive individual. For any other θ, the preferred level of d is the one that maximizes $B_i(d)$. In particular, for individual policies or for groups of identical individuals, $f_i(x) = f_g(x)$ for all x, and the maximum occurs at the deductible d where $d - E(h_i) = \theta/r$.

[14] All major proposed NHI plans that include cost sharing for the general population reduce or eliminate it for the poor and continue the Medicare program for the aged.

[15] Poverty level is defined here as the income level at which families would receive free care under the 1974 Kennedy-Mills National Health Insurance Bill. These levels for 1974 income are deflated to 1970 equivalents in order to correspond to the CHAS-NORC data. The

because a separate premium might be set for children, we have treated children as a separate group.

(2) The assumed NHI deductible D is varied from $50 to $200 per individual in increments of $50 and from $150 to $450 per family in increments of $150 (1975 dollars). The accounting period is taken to be 1 year. This represents the range of deductibles commonly proposed for NHI (except for those plans that provide catastrophic coverage only).

(3) Because the CHAS-NORC data are for 1970, we deflate the 1975 deductible levels and seek to determine what the demand for supplementary insurance below these levels would have been in 1970. The deflator used is the ratio of the Consumer Price Index (CPI) for Medical Care Services in March 1970 to the same CPI in March 1975. This ratio is .718. Thus, the 1970 equivalents for the 1975 deductible levels mentioned in the previous paragraph are $36, $72, $108, and $144 per individual and $108, $215, and $359 per family. The results reported below have been inflated back to 1975 dollars.

(4) In the figures presented, only those expenditures are counted that are likely to be covered by NHI: hospital, physician services (inpatient and outpatient), prescription drugs, dental services for children under 18, and vision and hearing services. One may question whether drugs, dental services, and vision and hearing will be included in a national plan in addition to hospital and physician services. Although the premiums for insurance would be lower if only hospital and physician services were included, our calculations show that supplementary insurance would be even less attractive if the insurance plan

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deflator is Overall CPI_{1970}/Overall CPI_{1974} = .787. The income levels are as follows:

Family Size	1974 Poverty Level	1970 Poverty Level
1	$2400	$1890
2	3600	2833
3	4200	3305
4	4800	3778
4+n	4800 + 400n	3778 + 314n

were limited to hospital and physician services; these calculations are not presented.[16]

(5) The effective loading fee $\theta = (1 + \lambda)(1 - t) - 1$, where λ is the loading fee charged by the company and t is the tax subsidy. Although large groups are now charged as little as 8 percent loading,[17] supplementary insurance would involve numerous small-dollar claims, and so the loading fee for such insurance would be markedly higher. Parish (1974) asserts that the cost of processing a claim is about $3, regardless of the size of the claim. In this case, the administrative cost alone would be 25 percent of an assumed routine office visit fee of $12 and approximately 80 percent of an average prescription charge of $3.75.[18] These office visits and prescriptions would constitute the bulk of claims against the supplementary policy.[19] We have assumed, conservatively, that λ = 35 percent.[20]

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[16]The reason that supplementary insurance is less attractive when the national policy covers only hospital and physician services is that the variance between individuals for these services is higher than when drugs, dental, and vision and hearing are included. This makes the median individual less likely to purchase the supplementary insurance. While the within-individual component of variance is also higher for those services alone, it does not rise very much precisely because of the deductible feature that limits individual exposure.

[17]See Phelps (1973), pp. 61-64.

[18]The average prescription price in 1967, as reported by the Lilly Digest, was $3.66. The 1974 prescription cost index was 102.9 (1967 = 100). (See Firestone, 1970, p. 23.)

[19]For supplementary insurance that also covers coinsurance payments, the loading fee for coverage of the deductible portion represents the marginal administrative cost for that portion of coverage. To the extent that the loading fee must cover selling and other transaction costs, the marginal cost for adding coverage of the deductible only would be higher. Note, however, that the loading fees for supplementary insurance would be lower for those private insurance companies that served as carriers for NHI.

[20]Claims experience in the experimental portion of the Health Insurance Study (Newhouse 1974) suggests that an insurance plan that covers hospital, physician, and dental services, prescription drugs, and vision and hearing services will have roughly two-thirds of its claims for physician, dental, vision, and hearing services (of which 80 percent will be for physician services) and one-third of its claims for drugs. Only 1 percent of the claims will be for hospitalizations.

Applying weights of .66 and .33 for physician and drug expenses

Under current law, employer contributions to health insurance premiums are not considered taxable income. Assuming that employer-paid payroll taxes are shifted to the employee, Mitchell and Phelps (1975) estimated the marginal tax rate in the $5000 to $20,000 income range to be 31 percent (federal personal income tax plus payroll tax).[21] If such subsidies are not eliminated under NHI, the loading fee will be $(1 + .35)(1 - .31) - 1 = -.07$. If they are eliminated, the loading fee will be .35.

(6) In the computations, we let r = .0005 and .002 (in 1975 dollars). These levels of risk aversion are considered by the economics literature to be high and should therefore encourage supplementation.[22] To interpret them, note that a person whose utility for money showed constant absolute risk aversion would be just willing to make a bet to win $1000 or lose $663 at even odds if his r = .0005. If his r = .002, he would only be willing to lose $311 to win $1000 at even odds.[23]

(7) The observed CHAS-NORC expenditures, E, have been estimated

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estimated in the test to have loading fees of 25 and 80 percent, respectively, one calculates an average approximate administrative expense of just over 40 percent. The reduction to 35 percent accounts for some upward bias from treating all physician claims as though they were for office visits, whereas some of them will be for more expensive services (especially inpatient services) and therefore will have administrative costs of less than 25 percent of the bill. In addition, if coinsurance supplementation were already sold, such claims would have to be processed in any event. One might argue that drug claims could be submitted together, thereby reducing the loading; our conclusion that with no tax subsidy, the deductible would not be eliminated, however, will not change.

[21]This income range contains 90 percent of the nonpoor population.

[22]Friedman (1974) calculates r = .0026 from 1968 health insurance data, and remarks that the value is high. Feldstein (1973) considers r = .0007 to be very risk averse. Since r must be deflated by the CPI, Friedman's and Feldstein's values represent .0017 and .0005, respectively, in 1975.

[23]It may be argued that small losses are more relevant and that someone whose r = .002 would be willing to lose $90 to win $100 at even odds, which appears less risk averse. However, even if his r = .02, our result that with no tax subsidy there would be no supplementation would not be affected; someone whose r = .02 would just be willing to lose $31 to win $100 at even odds. Our results would begin to change if r were as high as .05, which means individuals would be willing to lose only $14 to win $100 at even odds.

to be roughly lognormal.[24] By direct calculation, the mean of log (E + 1) = 3.54 and the variance of log (E + 1) = 5.45. The mean must be increased by log (1/.718) to convert to 1975 dollars. In addition, for our purposes, the mean gives undue weight to large expenditures. Since we could compute the premiums for various deductibles directly by using formula (5), we increased the computed mean to 4.08 so that the premiums estimated from the assumed lognormal approximated the premiums estimated directly from the data. The fit of the assumed lognormal to the CHAS-NORC data is shown in Table 1.

(8) We assume that all the members of the firm decide, as a group, whether or not to purchase supplementary insurance by majority vote (Goldstein and Pauly, 1976). Since a uniform premium will be charged, formula (8) shows that the attractiveness of a policy to an individual increases with his anticipated expenditures (assuming risk aversion to be independent of health status). Thus, the decision of the individual with median anticipated expenditures is decisive for the group.

(9) We assume that individual expenditures, E, are composed of two factors: the individual's propensity for illness, H (given by his median anticipated expenditures, which he is presumed to know), and a random error term, u. Let k = 1/.718. Because of evidence that (E + k) is lognormally distributed, we adopt the following convenient form:

$$(E + K) = u \cdot (H + k), \tag{10}$$

or

$$Y = Z + e, \tag{11}$$

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[24] Except for a spike at $0 and a dip in the range of small expenditures, Keeler, Relles, and Rolph (1975) found that the lognormal distribution fit the CHAS-NORC data fairly well. They also found log (E + 1) to be most nearly normal among the family of distributions log (E + c), c > 0.

where

$$Y = \log (E + k),$$
$$Z = \log (H + k), \tag{12}$$
$$e = \log u$$

are normally distributed variables with means E(Y), E(Z), and 0, respectively. Suppose, further, that e and Z are independently distributed. Then the distribution of expenditures of an individual with propensity for illness h is X_h, where

$$X_h = (h + k) \cdot u - k \tag{13}$$

and u is lognormally distributed. Thus, the anticipated expenditures of the median individual are given by (13), with h equal to the median value of H. Since Z = log (H + k) is normally distributed, the median of H corresponds to the mean of Z. From (11), it follows that E(Z) = E(Y) = 4.08. To complete the specification of $f_h(x)$, the distribution of X_h, it is necessary to specify the variance of e = log u. Since Z and e are assumed independent,

$$\text{var}(Z) + \text{var}(e) = \text{var}(Y) = 5.45. \tag{14}$$

Since medical expenditures are so unpredictable, one would expect the between-individual variance, var(Z), to be less than the within-individual variance, var(e). Let b = var(Z)/var(Y) be a measure of the division. Using a similar model, Morris (1974) has estimated that b = $\frac{1}{3}$ for the distribution of the log of the number of physician visits.[25] We will assume, somewhat more conservatively, that b = .3

[25] One would thus expect that the population R^2 for explanations of variation in cross-sectional data on the log of physician visits would be at most .33.

and hence that var(e) = .7 × 5.45 = 3.82.[26] In sum, we assume that the decisive individual has anticipated expenditures X_i where log $(X_i + K)$ $\sim N(4.08, 3.82)$.

RESULTS

Table 2 gives the premiums for full supplementation, and the expected insurance payments and benefit from the risk avoided by insurance to the median individual for various groups and deductible sizes. The column marked "unsubsidized premium" assumes that NHI eliminates the tax subsidy, while the next column gives the effective premium if the subsidy remains. The unsubsidized premiums are so large relative to the deductible that full supplementation in this case is clearly not attractive. Why should the median individual pay $44.70 "for sure" to avoid some chance of paying $50? The actuarial value of the policy is only $34.30 and the benefit from the risk avoided by insurance is only 10 cents, for an r of .0005. The risk is linear with r, so that even if r were bigger by a factor of 10, full supplementation would not be attractive; r would have to be over 100 times as large for full supplementation to be desirable. For larger deductibles, the premium is considerably smaller than the deductible, but is larger than expected insurance payments plus risk avoided, so full supplementation remains undesirable.

On the other hand, since the insurance payments to the median individual are larger than the effective premium if the tax subsidy is continued, there may be supplementation in this case. Still, our assumptions seem conservative, and the overall gain from supplementation is slight. This gain might well be outweighed by negative effects of demand shifts or a fixed transaction cost for buying the policy.

Table 3 gives the maximum effective loading fees consistent with purchase of supplementary insurance. The first two columns show the loading, θ_D, at which the individual would be indifferent between

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[26] Sensitivity tests were made with b = .2 and b = .4. Insurance is more attractive if b is lower, since the group is more homogeneous, but the effect on maximal loading fees in this range is minor.

Table 2

PREMIUMS, PAYMENTS, AND RISK AVOIDED WITH FULL SUPPLEMENTARY INSURANCE

(In dollars)

Group	Deductible	Premiums		Payments to Median Individual	Value of Risk Avoided by Complete Supplementation (r = .0005)
		Unsubsidized	Tax Subsidized		
Nonpoor adults between the ages of 18 and 65 (individual deductibles)	50	44.70	30.80	34.30	.10
	100	75.70	52.10	57.00	.40
	150	101.00	69.60	74.50	.90
	200	122.60	84.50	88.90	1.60
Children (less than 18) in nonpoor families (individual deductibles)	50	40.20	27.70	30.40	.10
	100	63.00	43.40	45.90	.40
	150	79.30	54.60	55.90	.70
	200	91.90	63.30	63.10	1.10
Nonpoor families with head under 65 and more than one member (family deductible)	150	171.60	118.20	132.50	.30
	300	302.80	208.60	233.70	2.30
	450	411.20	283.30	315.00	6.30

Table 3

MAXIMUM LOADING FEES, θ, COMPATIBLE WITH MANDATORY SUPPLEMENTARY DEDUCTIBLE INSURANCE

Group	Deductible ($)	Slight Supplementation (θ_D)		Supplementation to 0 (θ_0)	
		r = .0005	r = .002	r = .0005	r = .002
Nonpoor adults between the ages of 18 and 65 (individual deductibles)	50	.02	.05	.04	.05
	100	-.02	.06	.02	.05
	150	-.04	.08	.01	.05
	200	-.06	.11	.00	.05
Children less than 18 in nonpoor families (individual deductibles)	50	-.03	.01	.03	.03
	100	-.11	-.02	-.01	.01
	150	-.16	-.03	-.04	.00
	200	-.20	-.02	-.06	-.01
Nonpoor families with head under 65 and more than one member (family deductible)	150	.07	.11	.04	.05
	300	.08	.22	.05	.08
	450	.09	.36	.05	.12

purchasing a marginal change in his deductible and not purchasing supplementary insurance. The only entry in the table larger than the 0.35 loading that we believe will prevail is the $450 family deductible and a risk-aversion parameter of 0.002. Even in this case, θ_D falls to 0.35 at a deductible of $430 (not shown), so little supplementation will take place. Thus, in general, supplementary insurance that causes a small change in the deductible will not be purchased unless there is a tax subsidy so that the effective loading is -0.07. Even in this case, insurance may not be purchased, since our assumptions about the maximum loading fee that consumers will pay are conservative.

The third and fourth columns of Table 3 show the θ_0 for supplementing a deductible to zero. These figures are also well below 0.35, and so full supplementary insurance is also unlikely to be purchased in the absence of a tax subsidy.

Table 3 reveals an interesting fact about group insurance. It is generally assumed that the marginal value of insurance to a risk-averse consumer decreases as the deductible decreases.[27] Table 3 illustrates in two ways that this result does not necessarily apply to group insurance in which the decisive individual's distribution of expenses is different from that of the group. First, for individual adults and for children under group insurance, the maximum loading fee *falls* as the deductible rises, the exact opposite of what would be observed in the case of individual insurance.[28] It follows that there are loading fees such that supplementation to zero would occur while marginal supplementation would not ($\theta_0 > \theta_D$).[29] This again would not happen in the case of individual insurance.

These results occur because the median individual's expenses are considerably less than the average for the groups considered (most of

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[27]Arrow (1963) showed this to be true for individual buyers, if, as we have assumed here, price elasticity is zero.

[28]From formula (9), at the median value of expenditures (around $50), $\theta_D = r(D - E(h_I))$, which is approximately 0.01. This holds even if θ_D is considerably less than 0 for larger deductibles.

[29]We also examined supplementation to intermediate values; but for all cases examined, the maximum value of θ occurs at slight or full supplementation.

the expenses are caused by a few sickly people). Thus, a negative loading fee is frequently necessary to make group insurance attractive to the median individual (another result that differs from the individual insurance case). Because of the skewed distribution of expenditures, this effect is more noticeable for larger deductibles.

Expenditures for children are substantially lower than those for adults.[30] For this reason a separate premium is often offered for children. (If parents had to pay as much for each child as they did for each adult, few would accept.) For premiums set on a per-child basis, Tables 2 and 3 show that supplementary insurance is considerably less desirable for children than for adults. If the premium were independent of family size, it would be unattractive for small families, who would opt out, and the market would disappear as larger and larger families dropped out of the insured pool.

Expenditures for families are larger and more predictable than for individual adults.[31] For this reason, and because many families can pool their risks, deductibles are often set higher for families than for individuals. According to Table 3, some supplementation of the higher family deductibles seems possible.

We also considered the case in which the supplementary insurance is offered just to those members of a group who sign up for it rather than to all or none. Such policies are generally written only if more than a certain percentage of the potential members join. Assume that 75 percent of the members of the firm must join to obtain the group rate. Then the decisive individual is not the one with median anticipated expenditures, but the individual whose expenditures are exactly at the 25th percentile. The group on which the premium is based is not the whole group, but the three quarters with highest anticipated expenditures. Since the decisive individual is healthier than in the all or nothing mandatory insurance case, and the group on which the premium

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[30] For children, $\log (E + k) \sim N(3.54, 3.346)$.

[31] For families, $\log (E + k) \sim N(6.08, 3.14)$.

is based is sicker, insurance is less attractive than in the mandatory case.[32]

Comparing Table 4 with the last three rows of Table 3, we see that the effective loading fee necessary to induce the decisive individual to join is indeed much lower. Also shown are the maximum loading fees if only 50 or 25 percent of potential members must join to get the group rate.[33] In these cases the decisive individual is more sickly than in the 75 percent case, and even though the premium rises as healthy people opt out of the plan, the decisive individual catches up to the group in sickliness, and is therefore more likely to purchase insurance. As in Table 3, adverse selection by large families makes the numbers in Table 4 too high.

Table 4

MAXIMUM LOADING FEES FOR INCREMENTAL VOLUNTARY SUPPLEMENTARY PLANS[a]

Group	Deductible ($)	Minimum Percentage[b]		
		75	50	25
Nonpoor families with head under 65 and more than one member	150	-.18	-.08	-.05
	300	-.20	-.07	-.01
	450	-.17	-.01	.05

[a]We assume that r = .002, b = .3.

[b]We assume that a group policy will not be written unless this percentage of potential members join.

Finally, we consider the case of supplementary insurance that covers only hospital care. Such insurance would have much lower loading fees than the insurance we analyzed above. For example, virtually all overnight stays in a hospital result in total expenditures in excess

[32]For further discussion of voluntary insurance market problems when the insured group is heterogeneous, see Rothschild and Stiglitz (forthcoming).

[33]Only the results for families are shown--all the loading fees for adults and children were less than -0.07.

of $200; if it costs $3 to process such a claim for the hospitalization, the administrative marginal cost is less than 1.5 percent (and negligibly small if the above deductible expenditures would cause a claim to be filed anyway). Thus, such insurance could be more attractive than the broader insurance we considered above. We have not presented estimates of maximum loading fees for such insurance for two reasons: (1) Elimination of a moderate deductible for hospital services only should have little effect on demand for such services[34] and so would be less significant than elimination of a deductible for all services. (2) We have no good estimate of the variance across individuals in expected expenditure (the b parameter for hospital services only).

The markedly lower administrative costs of insurance that covers only hospital services suggests an explanation of why existing insurance for hospital services is nearly complete (over 90 percent of hospital expenditures are paid by a third party), whereas coverage for other services is much less complete (Newhouse, Phelps, and Schwartz, 1974). The probable importance of loading fees in explaining the pattern of insurance by type of service is consistent with Phelps' (1973) finding that variation in loading fees faced by various consumers were the single most powerful predictor of amount of insurance held.

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[34] Provided the consumer exceeds his deductible, the deductible should have no effect upon length of stay or price per day. It will have an effect upon a decision to go to the hospital at all (i.e., be admitted), but the moderate deductibles we are discussing will have only a small effect (Newhouse, Phelps, and Schwartz, 1974).

IV. EXISTING EVIDENCE ON SUPPLEMENTATION

That Medicare enrollees buy supplementary insurance is sometimes cited as evidence that supplementation will occur under an NHI plan that includes cost sharing. What is overlooked is that few Medicare enrollees have private insurance that covers the first dollar of physician expenditures (i.e., the $60 Part B deductible is not eliminated), so that the Medicare experience is actually strong support for our conclusion that supplementation that eliminates cost sharing for all covered services is unlikely to occur.

We estimate that only 11 percent of those who might have purchased supplementary insurance to eliminate the deductible for physician expenditures did so.[35] The basis for this calculation is data from the

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[35]The data used to make the estimate of 11 percent are taken from Peel and Scharff (1969), who present data on approximately 80 percent of Medicare enrollees who have coverage for physician bills and who were *not* hospitalized in 1969. No data are given on the remaining 20 percent of the population. The population that was not hospitalized consists of 14,960,000 people. On the basis of the data presented by Peel and Scharff in their Tables 1 and 8, we estimate that 900,000 of these individuals were covered by the Medicaid program and another 190,000 were enrolled in prepaid group practices or received care through the Veteran's Administration. We have excluded these individuals from the population of interest, leaving a population of 12,870,000 that might have purchased supplementary insurance. Data in Table 8 indicate that 2,400,000 or 18.6 percent of these persons did so. There are no data on how many of these persons had insurance that covered the deductible. However, in footnote 8, Peel and Scharff state that a review of 70 Blue Shield supplementary plans (by far the most common supplementary insurance) shows that "roughly one-third paid all of the deductible and coinsurance, one-third paid no deductible, and about 10 percent paid four-fifths of the 20 percent coinsurance amount. For the remainder, the policies imposed various combinations of restrictions on place or type of service." Thus, up to two-thirds of the policies may not have covered the deductible; however, we have been conservative and assumed that all of the "remainder" referred to in the last sentence did cover the deductible, while the 10 percent that paid four-fifths of the coinsurance did not. Given this assumption, 57 percent of the policies covered the deductible. There are no data on what proportion of persons with insurance these policies covered, but the most reasonable assumption is that 57 percent of the individuals were covered by such policies. Multiplying 18.6 percent by 57 percent leads to the 11 percent figure cited in the text.

Current Medicare Survey regarding insurance policies held by the 80 percent of the Medicare population that was not hospitalized in a year; data are not available on the 20 percent of the Medicare population that was hospitalized, but this omission is unlikely to affect the 11 percent estimate by more than a few percentage points.

Other data from the Current Medicare Survey support the conclusion that the proportion of Medicare beneficiaries supplementing the deductible for physician expenditures is small. Table 5 shows data from 4 years of the Medicare program. Those with expenditures less than $50 (the deductible amount for physician services for these years) were covered by private insurance only 12 to 17 percent of the time, although those with expenditures greater than the $50 deductible were much more frequently covered.[36]

On the basis of the data presented in Sec. III, one may ask why there is *any* elimination of the deductible for physician services in Medicare, even if only 11 percent of the population purchases such insurance. The 11 percent reflects some coverage of retirees by existing group insurance plans, coverage that is sufficiently subsidized by the employer or the employed members of the group so as to make it attractive to purchase.[37] Also, those who itemize deductions on their personal income tax receive a subsidy for health insurance amounting to one-half the marginal tax rate.[38] For sufficiently high marginal

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[36]These figures cannot be used as a direct estimate of the proportion with private insurance. On the one hand, those with no insurance are less likely to have any expenditure (and hence will not be counted in Table 5); on the other, those with expenditures of $50 or more are more likely to have insurance that covers the deductible. Additionally, some private supplementary policies may pay for a hospital emergency room visit, but normally not pay for ambulatory health services. This may account for some of the individuals in the first row of Table 5 and help to explain why those figures exceed 11 percent.

[37]For example, federal employees who have been members of the Federal Employees Health Benefits Plan can continue to participate in that plan (which covers physician expenditures) after they become eligible for Medicare at a premium that is subsidized by the federal government.

[38]For those whose out-of-pocket expenditure exceeds 3 percent of income and who itemize, the subsidy is the entire marginal tax rate. The $150 maximum deduction is not likely to be binding for supplementary insurance.

Table 5

PERCENTAGE OF PERSONS USING PRIVATE INSURANCE TO PAY ALL OR PART OF THE DEDUCTIBLE OR COINSURANCE AMOUNTS

Total Expenditure	1967	1968	1969	1970
Under $50	17	12	14	14
$50 or more	33	31	37	38

SOURCE: Current Medicare Survey, Medical Insurance sample. Data reported in *Current Medicare Survey Report: Use of Medical Care Under Supplementary Medical Insurance, 1967-1970*, Office of Research and Statistics, Social Security Administration, February 22, 1972, Table 5 (DHEW Publication No. SSA 72-11702).

tax rates (in the neighborhood of 50 percent, including any state and local income taxes), the effective loading fee is zero.[39]

Slightly over half the Medicare population has purchased supplemental insurance that covers only inpatient expenditures.[40] It is not known what percentage of these policies eliminate the $84 hospital deductible, but all the supplementary policies known to us provide coverage above the upper limits on expenditures covered by Medicare. We have not estimated the demand for such catastrophic insurance because we lack reliable information on very large expenditures, but the large

[39] $(1 + .35)(1 - .5(.5185)) = 1$. If the subsidy equals the entire marginal tax rate (i.e., if medical expenditures exceed 3 percent of income), then the effective loading is 0 at a marginal tax rate of 26 percent.

[40] From unpublished data derived from the Current Medicare Survey conducted by the Social Security Administration, who have kindly made the data available to us. Medicare requires that the individual pay a deductible roughly equal to the first day of a hospital stay (now $84); after that there is no expense until the 61st day of the stay, when a $21 per day copayment is imposed until the 90th day, after which there are no further insurance benefits unless the individual remains out of the hospital for 60 days. The individual also has a so-called lifetime reserve of 60 hospital days with a $42 per day copayment that may be used for stays longer than 90 days.

potential loss might well cause substantial demand for insurance. Thus, the small fraction of the aged population that has eliminated the Medicare deductible and the relatively large fraction that has purchased coverage against large losses are consistent with our model.

In addition to the Medicare experience, there is some evidence from Sweden that the market for supplementary insurance to cover small expenditures is not likely to be large. The Swedish patient pays one-quarter of the cost for general practitioner services; if he uses a specialist in private practice, he pays one-half the cost. The remainder is paid by a public insurance plan that was instituted in 1955. Prior to the implementation of this plan, voluntary health insurance financed approximately 6 percent of total health care expenditure. After the public plan was passed, voluntary health insurance disappeared and "does not exist in Sweden today, not because it is forbidden, but apparently because there is no market" (Anderson, 1972, p. 118).

V. CONCLUSION

The calculations presented in this report strongly suggest that if there is no special tax benefit for supplementary health insurance premiums, demand for insurance that provides first-dollar coverage for out-of-hospital service is likely to be negligible. The premium for such insurance would simply be too high to make its purchase attractive.

If the present tax treatment of health insurance premiums is continued (employer-paid premiums are not taxable income and individually paid premiums are one-half deductible for those who itemize), supplementary insurance becomes considerably more attractive. Whether it will prove attractive enough to be demanded in these circumstances is uncertain.[41] We would speculate that purchases would be small even with the tax subsidy.

But if an NHI plan includes cost sharing, continuation of the tax treatment is difficult to defend. One rationale for cost sharing is to shift monies for financing medical care out of the government budget; however, the tax subsidy is a form of "tax expenditure" that simply adds to the government budget, thereby defeating the aim of shifting monies from the budget. Another rationale for moderate cost sharing is to restrain demand and at the same time protect families against heavy financial loss. If this is the rationale, one clearly does not wish to increase demand (by a potentially large factor) by encouraging the purchase of supplementary insurance.[42] There are other possible objectives of NHI--such as redistribution of care toward the poor--that argue for no cost sharing. But the debate over cost sharing should not be considered moot because of the possibility of supplementary insurance.

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[41] Feldstein and Friedman (1974) used a different model to point out that demand for insurance and hence medical care are increased by the tax subsidy.

[42] Purchase of supplementary insurance will increase demand for benefits in excess of the deductible--i.e., in the public plan. Pauly (1974) has suggested a positive tax on supplementary insurance equal to the expected additional demand in the public program. Such a tax, if enacted, would obviously further reduce the likelihood of any demand for supplementary insurance.

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