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Public Insurance, Private Insurance, and the Demand for Hospital Care: Implications for Medicare and Private Contracts

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PUBLIC INSURANCE, PRIVATE INSURANCE, AND THE DEMAND FOR HOSPITAL CARE: IMPLICATIONS FOR MEDICARE AND PRIVATE CONTRACTS

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Chapter 1: Introduction

In 1971, Elliot Richardson, then Secretary of Health, Education, and Welfare, lamented the state of the American health care system:

> Health care in the United States is a current example of a vast social issue encrusted with a layer of invention and illusion. We all know there is something wrong with the current health care system, and it is commonly held that too few doctors, greedy insurance companies, and an apathetic government are at fault. But are these the real problems? (22,p.531).

Twelve years hence Richardson's comments remain pertinent. Hospital care expenditures have continued to rise dramatically, composing 5 percent of Gross National Product in 1982. Moreover, this rise in expenditure has occurred during a period of unprecedented inflation in the economy in general and in the health care sector in particular. Indeed, while the consumer price index rose 36 percent from 1973-1977, the hospital component of the CPI rose 64 percent.

Many economists have suggested that the culprit responsible for the rampant inflation and spiraling expenditures in the health care sector is medical insurance, which lowers the price which consumers pay, thus encouraging them to consume more. Furthermore, by largely divorcing consumption decisions from price considerations, insurance has also been accused of contributing to the inflation of

health care costs. To determine the effect of insurance on the demand for hospital care, a model of the demand for hospital care for the period 1973-1977 is estimated in this paper. By means of this estimation process, the responsiveness of consumers to the actual price they pay for hospital care can be determined. Although economists have previously estimated the effect of insurance on the demand for hospital care, their analysis has never accurately accounted for all types of insurance, i.e., private hospital insurance, Medicare hospital insurance, and Medicaid hospital insurance. Thus, the model estimated in this paper represents an attempt to include all types of insurance in the estimation process, so that the average price paid by the consumer, as calculated in this research, reflects the influence and magnitude of public as well as private insurance. In addition, this research will provide an esimate of the relative effects of public and private hospital insurance on the demand for hospital care.

The findings of this paper can briefly be summarized. Demand, as measured by hospital admissisons rate, is inelastic. Demand, as measured by mean length of stay, is elastic. A given amount of public hospital insurance has a small, but significantly larger effect on demand, by either measure, than an equal amount of private hospital insurance. These estimates can then be applied to several topics. One such topic is the effect of the Reagan Administration's plan

to alter the Medicare benefit payment system. A second application measures the welfare loss (Martin Feldstein's phrase) of "excess" hospital insurance coverage, and the gains which would occur if patients were forced to pay a larger share of total costs. Finally, suggestions are made regarding structural changes in private insurance contracts, and ways in which these proposed changes can alter incentives, and thus alleviate the health care crisis which plagues America.

Chapter 2 is a brief history of private hospital insurance, Medicare, and Medicaid. Chapter 3 is a review of pertinent literature. Chapter 4 describes the methodology used. Chapter 5 enumerates the results. Chapter 6 offers interpretation of the results. Chapter 7 analyzes the implications of the results obtained. Chapter 8 concludes the paper.

Chapter 2: A Brief History of Hospital Insurance

The private hospital insurance market arose from the financial instability of the Depression. The possibilty of catastrophic , expensive hospitalization provided an incentive for individuals to spread the risk of this occurrence through insurance. Simultaneously, the possibility that individuals would be unable to pay for hospital services led hospitals to seek financial protection through insurance as well. From these two forces came Blue Cross. Until very recently, the link between hospitals and Blue Cross has been quite strong, as the activities of Blue Cross were controlled by the American Hospital Association (27). In the 1940's commercial insurers (as distinguished from non-profit Blue Cross) began to compete aggresively with Blue Cross by offering a slightly differentiated product. Before the entrance of commercial insurers, Blue Cross had used community-rating to determine its premiums. That is, no distinction between higher- and lower-risk people was reflected in premiums; all individuals and groups paid essentially the same amount. Commercial insurers, on the other hand, employed experience-rating in the determination of premiums. This meant that the risk connected with a certain group was reflected in the premium

paid by members of that group, based on the group's characteristics (age, sex, race, income). Because of this policy, commercial insurers were able to lure low-risk individuals away from Blue Cross by offering a lower premium for hospital insurance. Blue Cross responded by adopting experience-rating, and vigorous competition ensued. Today, Blue Cross still dominates the private insurance market, possessing market shares of 40 to 80 percent from state to state, with a mean market share of 43 percent.

The development of the private insurance market based upon experience-rating meant that neither Blue Cross nor commercial insurers could economically cover high-risk individuals. Foremost among high-risk individuals were two major groups: the elderly and the indigent. To provide medical coverage for these two segments of society, Medicare and Medicaid, respectively, were instituted in 1966. Both Medicare and Medicaid were products of President Johnson's Great Society program, and were approved under the auspices of the Social Security Amendments as Title XVIII and XIX, respectively. Medicare is composed of two parts: hospital insurance (Part A) and supplementary medical insurance (Part B). No premiums are typically charged for Medicare hospital benefits; instead, benefits are financed by means of the Social Security payroll tax. (Only the elderly who are not eligible for Social Security benefits must pay premiums.) Medicare recipients must, however, make a copayment equal to

the average price of one hospital day for the first sixty days of hospitalization, and pay one-fourth of the copayment for each day from sixty-one through ninety. Finally, if all ninety days of coverage are exhausted, the Medicare beneficiary must pay one-half of the copayment for each day for additional care (each Medicare recipient has a lifetime reserve of sixty such days.) In contrast to Medicare, which is completely administered by the federal government, Medicaid is funded both by the federal government and local governments. Each state determines the size of its direct Medicaid payments, and the federal government supplies matching funds based upon the state's own allocation. All states except Arizona participate in Medicaid, and benefits vary greatly from state to state. Approximately half of the Medicaid program is financed through federal general revenues; the other half comes from state and local funds. Although some states exercise the option to charge premiums to Medicaid beneficiaries who have a certain level of income or higher, the vast majority of Medicaid revenues come directly from income taxes. Finally, Medicaid in its original formulation placed no limit on the number of days of hospital care covered. Although some states have gradually added limitations, relaxation of these restrictions is often allowed because of "medical necessity" (23).

Chapter 3: Review of the Literature

Two theoretical notions have developed to explain the effect which health insurance has upon the demand for medical care. They are moral hazard and welfare loss. Moral hazard is defined by Paul Feldstein in this way: "Since insurance lowers the price of medical care to individuals, they will consume more care than if they had to pay the entire price themselves"(10,p.118). Moral hazard, then is the movement down the demand curve in response to the lower effective price of medical care. This lower effective price occurs because, with insurance coverage,the individual pays a fraction of the total price. The proportion which the individual remits is the coinsurance rate. Thus, if an insurance policy stipulates that 80 percent of an individual's medical expenses will be paid, the corresponding coinsurance rate is 20 percent. Moral hazard is depicted below in Figure 1.

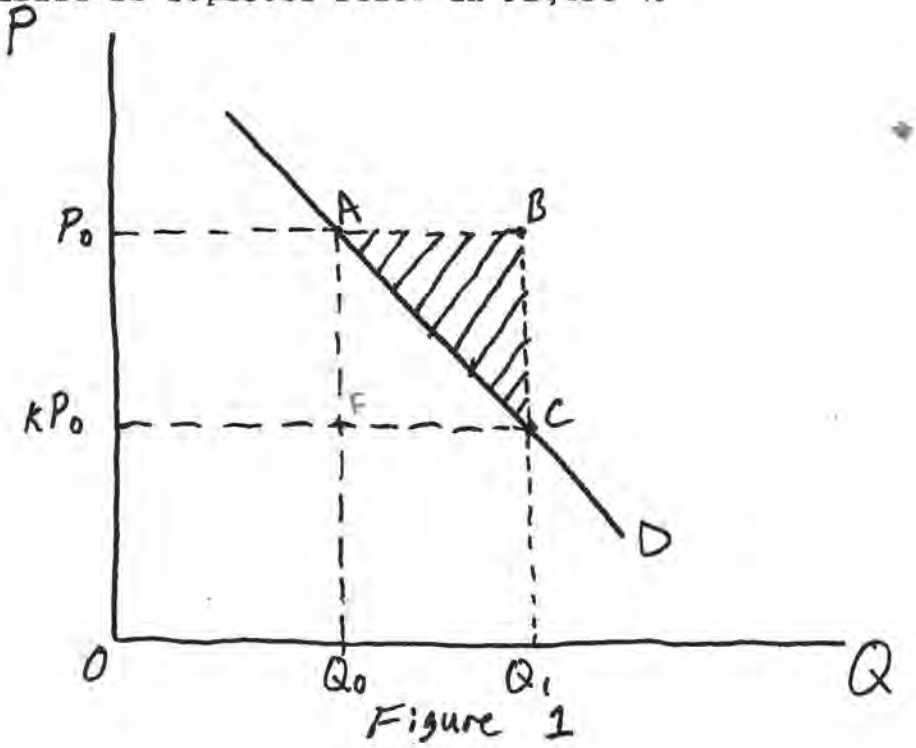


Figure 1

Without insurance the individual initially chooses Q_0 units of medical care at price P_0. With the introduction of (1-k) percent insurance coverage, the individual moves down the demand curve to consume Q_1 units of medical care, where the effective price is the coinsurance rate times the original price, kP_0. The loss to the individual when moral hazard occurs is shown by the shaded triangle ABC. The derivation of ABC as a measure of moral hazard loss can be geometrically described. The market value of the consumer's original choice, (Q_0, P_0), is represented by the rectangle OP_0AQ_0. When the individual increases his consumption to Q_1 the market value of the additional consumption is Q_0ABQ_1. The reason that market value equals Q_0ABQ_1, and not OkP_0CQ_1, as is typically the case in demand theory, is that the true price of each unit is still P_0, although the price to the individual has been reduced. Of the value of the additional care which is consumed, the trapezoid Q_0ABQ_1 is realized as consumer's surplus. Thus, the remaining region, ABC, is dead-weight loss.

Why, then, does moral hazard occur? Pauly (17) and Arrow (2) attribute the occurrence of this phenomenon to informational inefficiency and the special nature of the medical market and product(s). For both Pauly and Arrow the root of moral hazard is individual preventive behavior, or lack thereof. Although, as Arrow maintins, "illness is to a considerable extent an unpredictable phenomenon," individual

behavior such as inactivity, smoking, and poor diet can increase the probability of medical expense (2,p.945). One informational inefficiency occurs precisely because insurers cannot monitor the behavior of individuals. Thus, in specifying the conditions of an insurance contract, it is impossible to distinguish between avoidable and unavoidable risks. As a result, incentives to limit activities which promote "avoidable" losses are difficult to incorporate in insurance contracts. The optimal insurance contract, then, is one in which the insured bears a portion of the costs he incurs to the insurer--a contract in which the "optimal trade-off between conflicting goals of furthering risk spreading and providing appropriate incentives" occurs (17,p.46). Another informational inefficiency which prevents accurate determination of expected losses by insurers is noted by Pauly. Because the possession of insurance increases the consumption of medical care, insurers estimate their expected losses to be an increasing function of the amount of insurance held by their clients. Insurers are not aware, however, of the total insurance holdings of their clients, as individuals may hold policies with several firms simultaneously. In fact, other insurers have strong incentives to conceal their sales, and as a result, premiums will be set inappropriately low to cover the true expected loss of insured individuals. At this lower price insurance is overconsumed relative to Pauly's

"second best optimum", where premiums and expected losses are directly related. (Pauly's true optimum is defined as the case in which premiums vary with participation in activities which increase the probability of illness.)

Other informational inefficiences which cause insurance-holding to be excessive, and thus losses from moral hazard to occur, pertain to informational problems with the medical product. Two special characteristics of the medical market which are cited relate to the behavior of physicians and the inadequate incorporation of information regarding the medical product in insurance contracts. Arrow describes the physician as a figure of trust who is bound by the ethical restrictions of his profession. These ethical restrictions can be thought of in the context of the physician's agency relationship with the patient; that is, the physician is purportedly committed to act in his patient's best interests. Accordingly, the physician is charged with the duty of saving and enhancing life while not prescribing excessive treatment merely to increase his own income. If the physician fulfills these ethical stipulations, his agency relationship with the patient is complete. Pauly and Redisch, however, question the completeness of the agency relationship, and suggest that the physician's primary motive is to maximize income (18). With this possibility, and the prevalence of insurance, it seems plausible that the physician exacerbates the moral

hazard problem. Zeckhauser (26) examines another of the inherent problems of the medical market which leads to moral hazard--the lack of distinction in insurance plans among various medical procedures. Because of the multi-product nature of the hospital, and even intra-product differences (severity of illness,complementary procedures), insurance contracts do not distinguish between different classes of conditions. Zeckhauser shows that without distinctions in claims reimbursement, excessive spending occurs for all possible conditions. To provide adequate coverage simultaneously with incentives to limit expenses, Zeckhauser proposes differentiated reimbursement based upon the type of illness. Although he admits that a plan with distinction between every type of procedure is too costly to be realistic, he suggests that distinctions be made among various classes of illness. Zeckhauser's model shows that the marginal coinsurance rate with class distinctions is higher than the coinsurance rate without distinctions, providing incentives for "appropriate" expenditure while still spreading risk.

The loss from moral hazard, however, is only part of the total effect on individual welfare which insurance-holding, and its implications for price and quantity determination, has. Martin Feldstein (8) examines this total effect, referred to as welfare loss, in his 1973 article. Feldstein maintains that moral hazard loss is an exaggerated measure

for several reasons. First, he claims that because insurance raises the gross price (i.e., price with no insurance coverage), demand does not increase as much as it would have, had gross price remained at its original level. Second, Feldstein suggests that the higher price may denote higher quality, which causes demand to shift. Third, if the higher price does indicate higher quality, then total welfare loss is further reduced. Crucial to Feldstein's analysis is his treatment of quality and the change in quality. Feldstein states that, "The increased gross price (i.e.,cost) per patient day provides a service that is of higher quality as perceived by the hospital" (8,pp.267-8). Feldstein continues his analysis by stating that if patients perceive the new, higher price to manifest an increase in quality, demand will increase. He makes no binding assumption in his empirical analysis, however, about whether this demand shift actually occurs, as he calculates welfare loss with demand shift factors of 0, .33, and .67. Nevertheless, he describes these somewhat arbitrary estimates of demand shift magnitude as "moderate and relatively conservative" (8,p.269).

Welfare loss, as described above, can be graphically depicted (Figure 2).

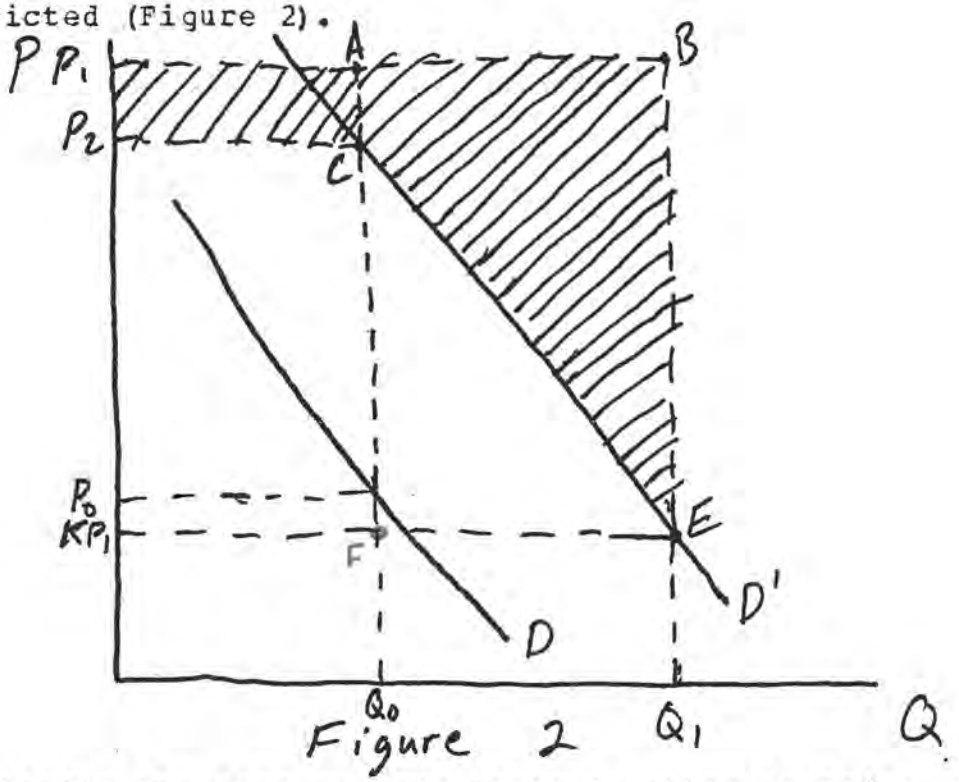


Figure 2

Initially the consumer purchases Q_0 units at price P_0. The introduction of insurance (coinsurance rate=k) increases the gross price of care to P_1, and thus the effective, or net, price to the consumer is kP_1. If the consumer perceives the new, higher gross price P_1 to be a reflection of a quality increase, then the demand curve shifts up from D to D'. To consume the original amount of hospital care, Q_0, a price of P_2 must be paid. The new equilibrium thus becomes (Q_1, kP_1). The amount of welfare loss is represented by the shaded area, P_1BECP_2, and the following formula:

$$(1) \quad WL=(P_1-P_2)Q_0 + [P_1(1-k)-1/2(P_2-kP_1)](Q_1-Q_0).$$

effect of insurance after demand shift

change in cost less Romanos' surplus

The rectangle $P_1 ACP_2$ corresponds to the first term, $(P_1 - P_2)Q_0$, in the welfare loss equation. It represents the loss that occurs due to the effect of insurance after the demand shift. That is, the price per unit of care for the original quantity demanded is P_2 after the demand shift, but after demand shifts and insurance is introduced the price is P_1. Thus the rectangle constructed by the multiplication of Q_0 and $(P_1 - P_2)$ represents one portion of the dead-weight loss. The remaining loss area, trapezoid ABEC, can be derived in a manner similar to that in which moral hazard loss was derived. In moving down the demand curve from Q_0 to Q_1, the total market value of the additional care consumed is the rectangle ABQ_1Q_0. The consumer's surplus, ~~CEQ$_1$Q$_0$ is~~ FCE as the value of the product which the consumer pays, FEQ$_1$Q$_0$, are subtracted from this, leaving trapezoid ABEC as dead-weight loss. This quantity, added to $P_1 ACP_2$, constitutes the total welfare loss resultant from the introduction of insurance.

Feldstein applies this formulation of welfare loss to demand estimation and thus produces estimates of existing welfare losses. The demand-for-insurance equation is estimated, with both quantity of insurance and proportion of population enrolled as dependent variables. Independent variables are gross price of hospital care, price of health insurance (ratio of premiums to benefits), proportion of employees in manufacturing or government (i.e., those likely to have group coverage), per capita income, an income variable weighted by the distribution of insurance, the

dependent variable lagged, and a composite variable which includes price and income elasticities of demand for hospital care. (These price and income elasticities are the results of a previous study (6), which will be discussed in detail below.) Feldstein's most important result from this estimation is the value of the elasticity of demand for insurance with respect to the price of hospital care. This elasticity is significantly positive both when quantity of insurance is the dependent variable and when proportion enrolled is the dependent variable. Feldstein then proceeds to shows theoretically that an increase in insurance increases the price of hospital care by shifting the demand curve outward. Thus, an increase in the price of hospital care increases the quantity of insurance demanded; an increase in the quantity of insurance demanded increases the price of hospital care. Despite this mutual dependence, Feldstein is able to use difference equations to prove that the markets for hospital insurance and hospital care are stable.

Finally, Feldstein rewrites the welfare loss equation in order to calculate the magnitude of that loss. He substitutes J for P_1/P_0 (gross price change resulting from the introduction of insurance), A for $(P_2-P_0)/(P_1-P_0)$ (increase in quality as perceived by patients), price elasticity E for $(dX/dkP)(kP/Q)$ when that expression is evaluated at P_2, and $-(P_2-kP_1)(\partial Q/\partial kP)$ for (Q_1-Q_0). After

these substitutions welfare loss is expressed as a function of J, A, E, k, P_0, and Q_0:

(2) $WL = \{(1-A)(J-1) + -E/2[J(1-k+(1-A)(J-1)][(1+A(J-1)-kJ)/(1+A(J-1))\}P_0 Q_0$

where J=gross price change from introduction of insurance

A=quality change as perceived by patients

E=net price elasticity of demand for hospital care

P_0=original price

Q_0=original quantity demanded.

Feldstein assigns several values to the parameters J, A, and E in order to estimate welfare loss for 1969. His estimates range from $2.4 billion to $6 billion depending upon his choice of parameter values.

To calculate welfare loss, as specified above, it is necessary first to calculate price elasticity of demand. For this reason, and because one of the purposes of this paper is to compare the effects of private and public hospital insurance on the demand for hospital care, the existing literature regarding the demand for hospital care must be examined. A particular point of contention in demand studies is the price elasticity of demand; indeed, the only conclusion upon which all studies agree is that price elasticity lies between 0 and 1. Also, Phelps and Newhouse raise the question of functional form--that is, is linear or log-log form preferable?

Feldstein estimates the demand equation for 1959-1965 in his 1971 article (6). He estimates two basic functions which are in the logarithms of the variables (except for variables TIME and MCAID, which are simply linear):

(3) $\log(Q) = a + b*\log(RNP) + c*\log(INC) + d*TIME + f*\log(DENS) + g*MCAID + \varepsilon$

(4) $\log(Q) = a + b*\log(RP) + c*\log(INS) + d*\log(INC) + f*TIME + g*\log(DENS) + h*MCAID + \varepsilon$

where RNP=relative net price (gross price times coinsurance rate deflated by the consumer price index)

RP=relative price (gross price deflated by the consumer price index)

INS=estimated coinsurance rate (consumer expenditures on hospital care divided by total (insurance,government,consumer) expenditures on hospital care)

INC=real per capita disposable income

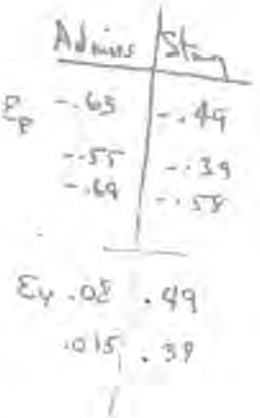
TIME=time trend to represent technical progress and changing popular attitudes about hospital care

DENS=population density

MCAID=dummy variable equal to 1/12 for each month in which a state had a Medicaid program in a given year;0 otherwise.

Feldstein uses two different dependent variables--rate of hospital admissions and mean length of stay in days--both of which are adjusted for demographic composition. Using instrumental variables estimation Feldstein obtains relative net price elasticities of admission of -.63 and a relative

net price elasticity of stay of -.49, both of which are significant at higher than the 99 percent level of confidence. When separate relative price and coinsurance rate elasticities are estimated, the elasticities of admission are -.55 and -.69, respectively, and the elasticities of stay are -.39 and -.58, respectively. All of these coefficients are significant at greater than 99 percent confidence. Income elasticity of admission is .08 and is significant at 99 percent; income elasticity of stay is .46 and is significant at higher than 99 percent. When relative price and the coinsurance rate are separate variables, the income elasticity of admission is .015 and the income elasticity of stay is .378; the former is insignificant, the latter significant at greater than 99 percent. Finally, the Medicaid dummy coefficient is -.08 in the admissions equation and .008 in the mean stay equation; the former is significant at greater than 99 percent, the latter insignificant. When relative price and the coinsurance rate are treated separately, the Medicaid coefficient in the admissions equation is -.09 and it is .006 in the mean stay equation; the former is significant at greater than 99 percent, the latter insignificant.



In summary, Feldstein finds significant net price elasticities ranging from -.39 to -.69, with the higher absolute values occurring in the admissions rate equation. Income elasticities are in the .4-.5 range and highly

significant for the mean stay equation; for the admissions rate equation, one significant value of .08 is obtained. The coefficients of the Medicaid dummy are highly significant and close to -.1 in the admissions rate equations; in the mean stay equations they are insignificant. Concerning the Medicaid coefficients, however, Feldstein rightfully warns that they "should be regarded with great caution", considering his fairly crude method of estimation (6,p.860).

Feldstein presents a slightly revised version of this demand model in 1977 (7). Despite strong similarities in specification to his earlier model, Feldstein's 1977 model yields markedly different estimates. Two different functions are used:

(5) $\log(ADMD)=a+b*\log(RNP)+c*\log(Q)+d*TIME+e*\log(GP)+f*\log(BEDS)+g*\log(DENSITY)+h*MCAID+\varepsilon$

(6) $\log(MSD)=a+b*\log(RNP)+c*\log(Q)+d*\log(INC)+f*\log(GP)+q*\log(BEDS)+h*\log(DENSITY)+j*MCAID+\varepsilon$

where ADMD=admissions rate per capita

MSD=mean length of stay in days in the hospital

Q=quality, defined as average cost per patient day, deflated by an input price index

GP=general practitioners per capita

BEDS=the supply of bed-days (365*the number of available beds).

All other variables are defined as in the 1971 study. No explanation is given for the exclusion of TIME from the ADMD equation and the similar exclusion of INC from the ADMD equation. Perhaps Feldstein believes that income does not affect the rate of admissions; if so, why was INC not included so that its insignificant coefficient could be empirically verified? Another possible explanation is that INC and TIME are highly correlated. Instrumental variables estimation was performed for the periods 1959-1973, 1959-1965, and 1966-1973 for each dependent variable. Net price elasticities of admission for the three periods are -.044, -.042, and -.236, respectively; the first and third values are significant at the 99 percent level, the second is insignificant. Net price elasticities of stay are .028, -.080, and .005, respectively; the negative value is significant at greater than 99 percent. Quality elasticities of admission are .209, .543, and .642, respectively; all are significant at greater than 99 percent. Quality elasticities of mean stay are -.172, .022 and -.200, respectively; the negative values are significant at greater than 90 percent. Income elasticities are found only in the mean stay equation. Their values are .059, .053, and .038, respectively; the first value is significant

Var	Admiss.	Stay
ε_p	-.04	.03
	-.04	.08
	-.24	.01
ε_{qual}	.21	-.17
	.54	.02
	.64	-.20
ε_Y		.06
		.05
		.04

at the 96 percent level. The general practitioners elasticities of stay are .004, .026, and .014, respectively; the second value is significant at the 93 percent level. The GP elasticities of stay are -.017, -.022, and -.023, respectively; the first is significant at 83 percent, the third at 85 percent. Finally, the MCAID dummy coefficients are only estimated for two of the three periods, 1959-1973 and 1966-1973, as Medicaid did not exist before 1966. In the admissions rate equation, the estimated coefficients are -.027 and -.006, respectively; the former is significant at greater than 99 percent. In the mean stay equation the values are .019 and -.006,respectively; the former is significant at greater than 99 percent.

In summary, the net price elasticity of admission is estimated to have markedly increased after the introduction of Medicaid, with a value of -.2 for 1966-1973. The net price elasticity of stay is only signficant for 1959-1965, when it has a value of -.08. Feldstein does not comment upon the major inconsistency between these estimates and his 1971 values, which are substantially larger in absolute value: approximately -.4 for admissions and approximately -.4 for mean stay. Quality is estimated to have a significantly positive effect upon admissions and a significantly negative effect upon length of stay. The latter effect probably occurs because quality, as it is defined in the model and, to some extent, in actuality,

directly reflects cost. Income is estimated to have a small, significant effect over the entire period; its elasticity is approximately .06. The availability of general practitioners increases the admissions rate and decreases mean stay; these results are not always significant, however. Finally, the Medicaid dummy, although a crude measurement, has a negative effect on admissions and a positive one on mean stay for the entire period.

Rosett and Huang also estimate the demand for medical care (20). Using 1960 data from the Survey of Consumer Expenditures they first estimate the expenditure function for medical care in two equations--one for uninsured households, the other for insured households:

(7) $M=a+bY+cY^2+dD+\varepsilon$

(8) $M=a+bY+cY^2+dD+fk+gkY+hk^2+\varepsilon$

where M=total household expenditure on medical care
Y=income
D=direct household expenditures on medical care
k=proportion paid by insurer (1-coinsurance rate).

Due to the nature of their data set, Rosett and Huang were required to estimate M and k. Although this slightly weakens their results, they acknowledge this shortcoming and make an effort to calculate the bias which occurs.

> While we cannot infer from the results we get that k and M, could we observe them both directly, would be related as the regression says they are, we can infer that they would be related more or less as the regression says they are, provided insurance premiums depend on k and M as hypothesized. In short, we have estimated M so as to be consistent with the assumption that insurance companies calculate their premiums to reflect their actuarial costs (20,p.287).

After performing a simulation of the relationship between M and k, they suggest that their estimating procedure introduces a downward bias in the slope of approximately 10 percent; that is, M is biased downward by about 10 percent.

After estimating the expenditure function, Rosett and Huang transform expenditure equation (8) into a demand equation by artificially creating a quantity variable whose units have a price of $1.00 each.

The transformed equation is:

$$(9)\quad Q=a+bY+cY^2+dr+frY+gr^2+hZ+jZr+kZr^2+\varepsilon$$

where r=1-k=coinsurance rate

Z=a normally distributed random variable with a zero mean and a standard deviation, σ_z.

The estimated coefficients of this demand function are: Y, .04181; Y^2, $-.3026 \times 10^{-6}$; r, 625.1; rY, .03031; r^2, 468.17; Z, 876.48; Zr, -876.48; and Zr^2, 219.12. No standard errors are provided. By substituting a range of values for Z a family

of demand curves is created, each corresponding to a certain distributional level of insurance-holding. From these demand functions price and income elasticities are generated. Estimated demand elastaicities vary from -.35 for r=.2 to -1.5 for r=.3. Income elasticity estimates vary from .25 for Y=$4,000 to .45 for Y=$10,000. Finally, from these elasticities, Rosett and Huang calculate a crude measure of household welfare loss for given levels of income and coinsurance rates. The loss which they compute is the difference between marginal cost and utility value to the consumer as he moves down the demand curve, a move induced by insurance. One example of this type of analysis which they cite is that, by their estimation, a family with income of $7,000 paid 2.5 times the actuarial value of a ~~certain loss to protect itself against a~~ "highly probable" $110 loss. to insure themselves against that loss.

Finally, Phelps and Newhouse also estimate the demand for hospital care (19). Prior to this estimation, however, they discuss several theoretical aspects of the demand for hospital care. They simply state two relationships which are derived elsewhere. These are: (1) the elasticity of demand with respect to the gross price of medical care is equal to the elasticity of demand with respect to the coinsurance rate, and (2) the elasticity of demand with respect to the consumer's wage is equal to the elasticity of demand with respect to time allotted per unit of medical

care consumed. From these relationships Phelps and Newhouse draw seven implicatcns, one of which is of particular relevance in this research. They state:

> Goods with proportionally high time-price components and nearly complete insurance coverage (C[oinsurance rate] near zero) will show relatively small money-price and coinsurance elasticities and relatively high time-price elasticities....Hospital days might ...be an example, although if one is seriously ill enough to be hospitalized, the opportunity cost of time will generally fall and with it the time-price (19,p.335).

This hypothesis has implications for the interpretation of price elasticity and for the treatment of time-price in this research, both of which will be discussed later. Phelps and Newhouse present the demand elasticities for hospital care using both admisssions rate and mean stay as dependent variables. They use Connecticut data for the period 1966-1968, a period in which a change in the coinsurance rate took place. Employing a linear specification they discover an elasticity w/r to of admissions of -.05 and an elasticity of mean stay of -.02. (No information is given on significance.) These figures are arc elasticities computed over the range of zero to 25 percent coinsurance which they designate "policy relevant". As a result of their findings, Phelps and Newhouse reject the null hypothesis that price has no effect on the consumption of hospital care. The scenario which they reject is one in which the physician makes all choices regarding the amount

of care his patient consumes; that is, price is irrelevant to the consumer. Rather, price has a small but significant negative effect on the consumption of hospital care. Finally, they raise the issue of functional form. They assume linear demand curves (as do Rosett and Huang), although constant elasticity form is more typical. Of this distinction they comment,

> We do not know how sensitive the results in the literature are to this assumption [constant elasticity]; because our results generally come from the observation of two points, we are not well equipped to test for differences in functional form. However, we believe our results are accurate for the ranges given (19,p.335).

It is evident in surveying the literature of demand estimation that substantial disagreement exists regarding the price elasticity of demand for hospital care. Although most if not all economists agree that the elasticity of demand lies between zero and negative one, and is significantly different from zero, estimates vary widely as to its value within that range. Feldstein's early estimates of elasticities (6) range from -.39 to -.69 depending upon which specification is used, elasticities of admission falling within the more negative end of that range. These estimates are fairly consistent with those of Rosett and Huang, who find that demand elasticity is -.35 when a 20 percent coinsurance rate is in effect. Phelps and Newhouse,

however, dispute these estimates and maintain that the true elasticity is much lower in absolute value: -.02 or -.05, depending on which quantity measure is chosen. Feldstein contradicts his own 1971 estimates in a later article (7), offering estimates ranging from -.04 to -.2 for different time periods and specifications. Mysteriously, Feldstein's 1977 model is almost identical to his 1971 version, the major difference being the inclusion of quality as an independent variable. Furthermore, Feldstein even samples the same time period (1959-1965) in both studies, but obtains strikingly divergent results: -.63 and -.49 for admissions rate and mean stay, respectively, in the earlier study, compared with -.042 and -.080 in the later study. Perhaps this inconsistency is attributable to the different methods used to construct the coinsurance rate in each study. In the 1971 paper Feldstein defines the coinsurance rate as:

(10) INS=(consumer expenditures on hospital care)/(insurance +government+ consumer expenditures on hospital care)

The 1977 paper contains a another definition:

(11) INS=PENR*PCOINS + (1-PENR)G*GCOINS

where PENR=proportion of population enrolled in private health insurance plus Medicare

PCOINS=average coinsurance rate of private subscribers

GCOINS=proportion of hospital costs of those without insurance that are not paid by government programs but must be paid by the uninsured themselves.

Although Feldstein fails to include Medicaid coverage as well as Medicare coverage, Medicaid benefits are a relatively small fraction of total hospital insurance benefits, and thus are almost certainly not the cause of the major difference in estimates. Because the coinsurance rate he calculates is a national average, Feldstein admits that the "adequacy of this estimate will be limited by the extent to which the effective coinsurance rate for private insurance and the comprehensiveness of government hospital insurance for the poor differ among the states" (7,p.1692). He fails, however, to discuss the full implications of these state-to-state differences on his net price elasticity estimates, and generally ignores the contradictory results of his earlier work.

Greater agreement seems to exist on income elasticities. Feldstein obtains a mean stay elasticity of .08 and admissions rate elasticities in the .4-.5 range in his 1971 study. The 1977 study includes income only in the admissisons rate equation; its coefficient is .6. In addition, Rosett and Huang find income elasticity to vary from .25 to .45 depending upon income.

Little attempt has been made to measure the relatiave effects of public and private hospital insurance on the demand for hospital care. Feldstein's admittedly crude Medicaid dummy variable does have a significantly negative sign, leading Feldstein to conclude that "Medicaid does not increase the admissions rate by as much as an equal amount of private insurance would" (7,p.1696). This deduction seems tenuous, as to merely indicate the presence or absence of Medicaid reveals nothing abcut its relative proportion and effects.

Finally, functional form, although not the subject of much debate, is an area of disagreement in the literature. No attempt has been made, however, to justify the use of either log-log or linear demand form.

Chapter 4:: Methodology

The model of the market for hospital services which is analyzed in this paper hopefully will provide more definite answers to the unresolved questions posed by previous demand studies. Moreover, an attempt will be made to measure the effects of the different public-private insurance mixes which characterize the various states. That is, what is the effect on demand of a smaller (or larger) proportion of public insurance? Is the behavior of public insurance beneficiaries revealed to differ from the behavior of private insurance beneficiaries? Answers to these questions, in addition to estimates of price and income elasticities of demand, will then provide a framework within which to comment upon such issues as the Reagan Administration's recent Medicare proposal and the inherent problems with insurance contracts, especially private ones, as they are formulated today.

The model which represents the market for hospital services consists of two equations, although only the demand equation will be specified in detail. The demand argument is:

(12) $\ln Q = a + b*\log(NPRI) + c*\log(OAGE) + d*\log(INC) + f*\log(OUTP)$
$+ g*\log(GPS) + h*\log(MALE) + j*\log(WHIT) + k*\log(PPRV) + l*\log(CANC) + \varepsilon$

where NPRI=relative average total price of one day of hospital care

OAGE=proportion of people 65 and over

INC=real per capita income

OUTP=number of outpatient facilities per capita

GPS=number of non-federal general practitioners per capita

MALE=proportion of males

WHIT=proportion of whites

PPRV=proportion of total hospital insurance benefits comprised by private hospital insurance benefits

CANC=rate of death from cancer (per 100,000 population).

The supply argument is:

(13) $Q = Q(NPRI, SAL, PINP, INT, HSP)$

where SAL=real average salary of full-time hospital personnel

PINP=a vector of prices for all non-labor inputs

INT=rate of interest on purchased capital

HSP=number of hospitals per capita.

As in other studies, two quantity measures are used: admissions per capita and mean length of stay in days.

Observations were collected for the five-year period 1973-1977 for the fifty states and the District of Columbia. These 255 observations were extracted from a number of

different statistical sources; in addition, many variables were constructed from several individual figures. Therefore, a detailed description and definition of the variables in the model is warranted.

Admissions rate per capita (ADMI) is the constructed quotient of total annual hospital admissions and population. The number of admissions was taken from Hospital Statistics, the annual publication of the American Hospital Association. Population data was taken from the Statistical Abstract of the United States.

Relative net price of hospital services (NPRI) is the constructed product of gross (total) price of one day of hospitalization and the coinsurance rate--the proportion of the price paid by the consumer-- divided by the consumer price index. (This price is, of course, strictly a money-price; the issue of time-price is considered elsewhere.) The coinsurance rate itself is also a constructed variable. Its formula is:

(14) COIN=1-(PRIV+MCAR+MCAI)/PAY

where PRIV=real total private insurance hospital benefits paid
MCAR=real total Medicare hospital benefits paid
MCAI=real total Medicaid hospital benefits paid
PAY=real total payments for hospital care, both direct by individuals, and indirect through all forms of hospital insurance.

Thus the second term on the right side of the equation is the fraction of total hospital expenditures covered by all forms of insurance; when it is subtracted from one the coinsurance rate remains. All coinsurance rates calculated are individual state rates, rather than one national rate, which Feldstein uses. This provides a much more accurate measure of state-to-state differences in insurance coverage. PRIV was constructed by taking total health insurance benefits paid in each state from the Source Book of Health Insurance Data (Health Insurance Institute) and multiplying it by the proportion which hospital benefits are of total health benefits for the nation, which was taken from Health Care Financing Review. As a result, this estimate is biased for states whose residents receive proportionally more or less hospital coverage. Medicare values were taken from the Statistical Abstract . Medicaid values were taken from Medical Assistance Financed Under Title XIX of the Social Security Act. Total payments were taken from Hospital Statistics.

Because PAY values applied to community hospitals, while PRIV, MCAR, and MCAI values applied to all hospitals, PAY was multiplied by the national ratio of total hospital expenditures to community hospital expenditures for each year. Thus, this estimate does not account for differences in community hospital market share across states.

The proportion of people 65 and over (OAGE) was taken from the Statistical Abstract. Actual percentages were available for 1975-1977;OAGE was constructed for 1973-1974 by dividing the number of people 65 and over by the estimated population. Per capita income was taken from the Statistical Abstract. and was deflated by the consumer price index to obtain real per capita income (INC). Per capita income values were based on nominal income estimates developed for Federal revenue-sharing allocations. Outpatient facilities per capita (OUTP) was constructed by dividing the number of "organized outpatient departments" per state by population. The number of outpatient facilities was found in Hospital Statistics. General practitioners per capita (GPS) was calculated in a manner analogous to OUTP. The number of non-federal general practitioners (no information was available on federal general practitioners) came from Physician Distribution and Medical Licensure in the United States , an annual American Medical Association publication.

The proportion of males (MALE) and the proportion of whites (WHIT) in each state were found in Demographic, Social, and Economic Profile of the States. Unfortunately, this data only applied to 1976, and other years were not available. Because it is reasonable to assume, however, that these proportions changed little in most states within five years, the 1976 value for each state was used each year.

The proportion which private hospital insurance benefits comprise of total hospital insurance benefits (PPRV) was computed by taking the quotient of total private insurance hospital benefits (PRIV), and the sum of PRIV, total Medicaid hospital benefits (MCAI), and total Medicare hospital benefits (MCAR).

The rate of death from cancer (CANC) was taken from the Statistical Abstract and it measures the number of annual deaths from malignant neoplasms per 100,000 population.

Data was also collected for the two instruments used to conduct two-stage least squares regressions. The first instrument is average salary of full-time hospital personnel (SAL). This data was taken from Hospital Statistics and Selected Community Hospital Indicators, another American Hospital Association publication. SAL is the quotient of payroll and total full-time hospital personnel. SAL was directly available for 1975-1976, and was computed for 1973, 1974, and 1977.

Finally, the number of hospitals per capita (HSP) was constructed by dividing total hospitals by total population. The number of hospitals was found in Hospital Statistics.

Defined as such, what do these variables purport to measure, and why were they chosen rather than other conceivable alternatives? The quantity of hospital care can be measured in several different ways --admissions rate, mean length of stay, or patient days demanded, which is the

product of the first two. Both admisssions rate and mean stay are preferable to patient days demanded precisely because the act of entering a hospital and the length of time which one stays are two different things. Thus, in constructing patient days demanded, a state with low admissions and long stays will appear the same as a state with high admissions and short stays, when in reality, two very different sets of societal preferences are revealed. Because patient days demanded obscures this difference, admisssions rate and mean stay are better measures. Is one of these two measures superior to the other as an index of the demand for hospital care? To attempt to answer this question, one must examine the nature of product which hospital care is. Unlike that for most products, the revealed behavior of consumption of hospital care is not completely the result of the consumer's own decision. Instead, the asymmetry of information between physician and patient regarding the latter's medical condition necessitates that the patient allow the physician to act as his agent. As noted above, however, the agency relationship is incomplete; one consequence of this incompleteness is the prescription of unnecessary care, which if the patient were fully informed (or had to pay more of the cost), would not be consumed. On the other hand, because individuals are able to obtain "second opinions" and possess some knowledge of the seriousness of ailments and neccesity of treatment,

they retain some decision-making power. Because the specification of a demand function attempts to explain the factors which affect demand, it is most desirable to choose a definition of quantity demanded whose value is the most affected by individual choice. Indeed, if the individual has limited choice regarding the quantity he consumes as measured in a particular way, the determinants of demand, i.e., price, income, etc., while actually having little effect upon demand, may appear to significantly affect demand in statistical testing. Thus, the best definition for quantity demanded is one which is influenced by individual choice; that is, a definition of quantity demanded such that it systematically varies with variations in its determinants. Although both the admissisons rate and mean stay are chosen for the patient, to some extent, by physicians, both contain some elements of choice, and compelling arguments can be presented that each is more of a choice variable than the other. A physician's recommendation is not sufficient to ensure that his patient will choose hospital admission; the patient may decide otherwise based upon a "second opinion", his own positive assessment of his condition, or fear. In many cases, the choice to admit is the individual's. Mean length of stay, alternatively, is pre-determined to a large extent, as many procedures have a standard operating and recovery time. Moreover, the individual is more likely to accept his

physician's judgment regarding his prescribed length of stay; he is hospitalized, so part of the decision has been made already, and, more importantly, he is more likely to accept his physician's recommendation to stay longer, as evidenced by his prior acceptance of his physician's judgment regarding admittance. On the other hand, perhaps length of stay is more of a choice variable than admission. The two options of admission and non-admission are much more extreme than, say, the two options of a seven-day stay and an eight-day stay. As a result, individuals probably "choose" to be admitted when they do not need to be as a precautionary measure; the alternative of non-admisssion is perceived to be much riskier. Furthermore, besides the risk perceived by the patient, the risk perceived by his physician may lead him to insist that his patient be admitted. Thus, because the patient is consuming basically the same product whether he stays one day less or one day more, while he does not consume the product at all if he is not admitted, perhaps length of stay is a matter about which the patient has more choice.

Reasons for the inclusion of the other variables are more straightforward. Demand theory stipulates that price be included. To control for the effects of general inflation, gross price is deflated by the consumer price index. This relative price is then multiplied by the coinsurance rate so that it measures the effective price to

the consumer. Because hospital care is certainly not a Giffen good, the coefficient of net price is expected, a priori, to be significantly negative. The proportion of population 65 and over is included to control for the effect which age has upon rate of hospitalization. Because of the deterioration which accompanies age, the coeficient of OAGE is expected to be significantly positive. Income is positively related to demand in traditional theory; in the market for hospital care, however, its role is more complex. If hospital care is not an inferior good (a very reasonable assumption), then demand theory suggests that demand will increase with income. While this effect is certainly present with regard to hospital care, there are two other effects as well. First, people with higher income generally have more education, and may engage in more preventive activity as a result. Second, if we assume that all people work the same number of hours per week, then per capita income measures the average time-price of hospital care. Accordingly, those people with a higher opportunity cost of time will consume less care. All income effects may be muted, however, due to the fact that the population sampled is state averages rather than individual values, thus eliminating the wide dispersion which is present in a random sample of individuals. Because of all this, it is difficult to predict the sign or significance of the income coefficient, although it is suspected to be positive and

significant, as others have found. The availability of outpatient facilities and general practitioners both appear to have ambiguous effects on demand, as each has qualities of both substitutes and complements. Availability, as measured by outpatient facilities and general practitioners per capita, is used instead of price, because, as Feldstein notes, price does not ration these services; persistent excess demand suggests that availability plays the most important role in rationing these services (7). An outpatient facility can either complement inpatient care, following one's release from the hospital, or serve as a substitute for it, as similar procedures can be performed without necessitating hospitalization. A visit to a general practitioner can result in the prescription of hospitalization, and is thus complementary, or may actually take the place of hospital care, thus functioning as a substitute. Because the substitution effects seem stronger than the complementary ones, the signs of both coefficients are expected to be negative, and because outpatient care is a closer substitute for inpatient hospital care than general practitioner care, its coefficient will be more highly significant. Hospitalization statistics indicate that women are more frequently hospitalized than men, even after obstetric care is removed from the total. Therefore, the coefficient of MALE is expected to be significantly negative. A higher proportion of whites is expected to

produce a higher demand for hospitalization, due primarily to higher employment, and thus, more likely participation in groups health insurance, and higher education. This coefficient is expected to be significantly positive. The coefficient of PPRV, the proportion of total hospital insurance benefits comprised by private insurance hospital benefits, is expected to be negatively significant. This is primarily because the large majority of public insurance benefits (Medicare benefits) are paid to people with relatively low cost of time. That is, the elderly are much less likely to be employed than are people who are covered by private hospital insurance, who are generally younger. Because opportunity cost of time is probably not captured too well in the per capita income variable, its effects are likely to be manifested in the PPRV coefficient. Another possible reason, although certainly less significant, is that the emphasis of Medicaid and Medicare coverage is on the early stages of treatment, whie private insurance often offers a deductible which only takes effect after a certain level of expenditure has been reached. Thus, a higher proportion of public hospital insurance benefits is expected to increase the rate of admissions. (The full ramifications of this hypothesis are discussed in Chapter 7.) The rate of death from cancer (CANC) is a proxy for the rate of ocurrence of all cancer (terminal and otherwise), and its coefficient is expected to be significantly positive. If

the proportion which cancer deaths are of all cancer cases is relatively constant across states, then rate of death is an acceptable proxy. More generally, this variable is intended to measure differences in occurrence of disease across states. Because cancer is so prevalent and because it reflects environmental, occupational, and behavioral differences among states, it is a good proxy for the whole vector of diseases which distinguish states. Finally, the two instruments must be justified. Average real salary of full-time hospital personnel is a determinant of the supply of hospital care, and is considered exogenous in its use as an instrument for two-stage least squares, although it is to some extent derived from the demand for hospital care. Average salary is a proxy for average hourly wage; thus, it is assumed that the average number of annual hours worked by hospital employees is the same across states. Hospitals per capita is also considered exogenous, as the number of hospitals is not very responsive to current demand-and-supply conditions because of barriers to entry, both economic and regulatory. High capital costs is an example of the former; certificate-of-need-regulations an example of the latter.

After the two versions of the demand equation are estimated, several types of tests will be performed. First, the value and significance of all coefficients will be examined, and compared with hypotheses made regarding the

coefficients. Three coefficients are of particular interest--those corresponding to relative net price, income, and the proportion which private insurance benefits are of total benefits. Just how price-elastic is the demand for hospital care? Does income have a sigificant effect? If so, what is the direction of that effect? What effect does an increase in the proportion of public insurance benefits have? Of additional interest are the comparative magnitudes and significance of the coefficients in each equation. Does one of the two specifications generally have smaller and/or less significant coefficients? If the coefficients of one of the two equations are generally less significant, some evidence is provided regarding the relative status of the dependent variable used in that specification as a choice variable. If the consumer has absolutely no choice regarding the quantity which he consumes of of a good, one expects all of the elasticities with respect to that good to not be significantly different from zero. Thus, if the consumer has relatively less choice about the amount of his consumption of a good, as measured in a particular way, one expects the coefficients of that equation to be less significant than the coefficients of another equation, which is defined in terms of a dependent variable about which the consumer has greater choice. Hopefully, the regression results will provide some resolution concerning the degree of choice connected with admissions and length of stay.

From this conclusion, policy implications will be able to be drawn regarding the potential change in consumption by either measure which would occur if patient incentives were altered. Policy implications will also be suggested by the price elasticities and the proportion of private insurance elasticities, such as, what would be the efect of an increase in the proportion of private insurance benefits paid? Also, the income elasticities may imply something about the net effect of the many hypothesized income effects. Finally, using estimates of net price elasticity of demand and the average coinsurance rate, the welfare gain of increasing the coinsurance rate will be calculated. The validity of this estimate will then be considered in light of Feldstein's definition of welfare loss, and an improved definition of welfare loss will be offered.

Chapter 5: Results

Two-stage least squares regressions were conducted using admissions rate and mean stay as dependent variables. Complete regression results are listed in Table 1. In the admissions rate specification five coefficients are significant at higher than the 90 percent level, and one other coefficient is significant at higher than the 80 percent level. The five coefficients significant at higher than 90 percent correspond to the variables relative net price (NPRI), real per capita income (INC), proportion of males (MALE), proportion of whites (WHIT), and proportion of private insurance hospital benefits of total hospital insurance benefits (PPRV). The net price elasticity of admissions is estimated to be -.604, and its corresponding t-statistic is -2.598, indicating that the coefficient is significantly different from zero at approximately the 99 percent level. The income elasticity of admissions is -.393, and its t-statistic is -2.580, indicating significance at the 99 percent level. The proportion of males coefficient is -2.321, and its t-statistic is -2.206, indicating significance at the 97 percent level. The proportion of whites coefficient is .763, and its t-statistic is 2.302, indicating significance at close to the 98 percent level. Finally, the proportion of private

insurance coefficient is -.053, and its t-statistic is -1.834, indicating significance at the 93 percent level. The other fairly significant coefficient is that corresponding to the outpatient facilities per capita variable. Its value is -.110, and its t-statistic is -1.441, indicating significance at the 84 percent level.

The coefficients of the variables measuring proportion of the population 65 and over, general practitioners per capita, and the rate of death from cancer, as well as the constant term are insignificant. The constant term is .819 and its t-statistic is .489. The proportion of the population 65 and over coefficient is .035 and its t-statistic is .460. The general practitioners per capita coefficient is -.121 and its t-statistic is -.790. Finally, the rate of death from cancer coefficient is -.217 and its t-statistic is -.872.

In the mean length of stay specification, all but one of the coefficients are signficant at the 80 percent level, and all but two are significant at the 90 percent level. The constant term is -20.230 and its t-statistic is -1.686, indicating significance at slightly above the 90 percent level. The net price elasticity of stay is -4.844, and its t-statistic is -2.905,indicating significance at well above the 99 percent level. The income elasticity of stay is 1.690 and its t-statistic is 1.547, indicating significance at the 87 percent level. The outpatient facilities per

capita coefficient is -1.190 and its t-statistic is -2.171, indicating significance at the 97 percent level. The general practitioners per capita coefficient is -2.561, and its t-statistic is -2.334, indicating significance at the 98 percent level. The proportion of males coefficient is -17.411 and its t-statistic is -2.307, indicating significance at almost the 98 percent level. The proportion of whites coefficient is 7.010, and its t-statistic is 2.948, indicating significance at well above the 99 percent level. The proportion of private insurance coefficient is -.483, and its t-statistic is -2.331, indicating significance at the 98 percent level. The rate of death from cancer coefficient is -4.416, and its t-statistic is -2.479, indicating significance at the 98.5 percent level. The only insignificant coefficient is that corresponding to the proportion of people 65 and over variable. Its value is .126, and its t-statistic is .229.

TABLE 1

REGRESSION 1: MSTY DEPENDENT VARIABLE*

VARIABLE	ESTIMATED COEFFICIENT	t-STATISTIC
C	-20.230	-1.686
NPRI	-4.844	-2.905
OAGE	.126	.229
INC	1.690	1.547
OUTP	-1.190	-2.171
GPS	-2.561	-2.334
MALE	-17.411	-2.307
WHIT	7.010	2.948
PPFV	-.483	-2.331
CANC	-4.416	-2.479

SUM OF SQUARED RESIDUALS=1908
STANDARD ERROR OF REGRESSION=2.791

REGRESSION 2: ADMI DEPENDENT VARIABLE

C	.819	.489
NPRI	-.604	-2.598
OAGE	.035	.460
INC	-.393	-2.580
OUTP	-.110	-1.441
GPS	-.121	-.790
MALE	-2.321	-2.206

* All variables are in logarithms.

WHIT	.763	2.302
PPEV	-.053	-1.834
CANC	-.217	-.872

SUM OF SQUARED RESIDUALS=37.09
STANDARD ERROR OF REGRESSION=.3891

Chapter 6: Interpretation of Results

Close examination and interpretation of the regression results produces some striking and provocative conclusions. In general, the elasticities of mean stay are much greater than the elasticities of admission, many by a factor of eight or more. As already mentioned, the mean stay equation also has more significant and more highly significant coefficients than the admissions rate equation. This general pattern is probably due to the greater degree of choice associated with length of stay, as opposed to admission. Because people have more choice with respect to length of stay, they are thus more responsive to the many factors which determine their length of stay. Indeed, a marginal effect is present with respect to mean stay that is not present with respect to admissions. Certainly, the difference between seven and eight days in the hospital is much less than that between admission and non-admisssion. Many people who would not consider non-admission a viable alternative would, however, attempt to shorten their length of stay in response to the net price or opportunity cost of an additional day. The net price elasticity of admissions of -.604 is quite consistent with Feldstein's 1971 estimate of -.63, although it is much larger in absolute value than Feldstein's 1977 estimates, which range from -.042 to -.236,

depending upon which period of time is sampled (-.236 applying to 1966-1973). The net price elasticity of admission found in this research means that the demand for admission to the hospital does not respond much to the effective price faced. The net price elasticity of stay is much larger in absolute value, however. Its value of -4.844 indicates relatively high responsiveness to changes in the effective price of one day of hospital care. By contrast, Feldstein obtains net price elasticities of stay of -.5 in his 1971 study and -.08 in his 1977 study. These estimates imply that not only is net price elasticity of stay inelastic, but it is generally less elastic than net price elasticity of admission. This study, alternatively, suggests that the consumer is more responsive to the price he pays in choosing (if he can) his length of stay than in choosing (if he can) whether to be admitted.

Also provocative are the income elasticities. The only coefficient to change sign in the two regressions (besides the constant term), the income elasticity of admission is -.393 and income elasticity of stay is 1.690. Both values are significant, although the elasticity of admission is more highly significant. Feldstein's income elasticity of admission is .08 and is significant. The negative elasticity of admission found here can perhaps be ascribed to the two negative income effects described earlier. If so, then the effects of hypothesized preventive behavior and

higher opportunity cost of time outweigh the traditional normal good effect. The income elasticity of stay is somewhat consistent with previous estimates , which are in the .4-.6 range, and are usually significant. The estimated value of 1.690 in this study, however, implies that demand for marginal days of stay is income elastic. This finding is in conflict with the existing literature, wherein the demand for marginal days is estimated to be income inelastic.

The proportion of private insurance benefits coefficient is negative in both specifications tested, assuming values of -.053 in the admissions rate equation and -.483 in the mean stay equation, and both are significant. This means that the greater the proportion of private insurance benefits paid in a state, the lower will be the admissions rate and the mean length of stay, ceteris paribus. Considered another way, these results mean that a given amount of public hospital insurance benefits has larger effect on both measures of demand than does the same amount of private hospital benefits. Feldstein crudely approximates the effects of Medicaid on demand by including a dummy variable which indicates the presence or absence of Medicaid in a given state in a given year. He obtains a significant positive coefficient when mean stay is the dependent variable and a significant negative coefficient when admissions rate is the dependent variable. From this,

he concludes that "Medicaid does not increase the admissions rate by as much as an equal amount of private insurance would" (7,p.1696). This deduction seems spurious, however, since Feldstein does not measure the actual amounts of private and public hospital insurance benefits paid, as is done in this study.

Surprisingly, the coeficent corresponding to the proportion of the population over 65 variable is insignificant, although it is positive. Because of the tendency of the elderly to have longer hospital stays, one would particularly have antipicated a significant age effect on mean stay. Instead, the age coefficient is insignificant in both cases. If this finding is consistent with reality, perhaps it represents availability problems, i.e., inability to get to the hospital, the unwillingess of the elderly to seek treatment, or their inability to recognize that they are ill.

The general practitioners per capita coefficient is -.121 and insignificant for the admissions rate specification and -2.561 and significant for the mean stay specification. This difference indicates that general practitioners serve as a much better substitute for the marginal day in the hospital than for admission to the hospital. That is, while general practitioners cannot perform most procedures which patients undergo in a hospital, agreement to visit one's general practitioner may

allow one to be released earlier. Feldstein (7) shows general practitioners to be a substitute for marginal hospital days, although his elasticities are around -.02, much smaller in absolute value. He also estimtes that general praactitioners are a complement to hospital admissions, as his GP coefficient is .03. This complementary relationship exists when one enters a hospital based upon his general practitioner's advice.

Outpatient facilities are also estimated to act as a substitute for hospitalization, measured both in terms of admissions and length of stay. The outpatient elasticity of admissions is -.110, and is fairly significant (84 percent level) while the elasticity of mean stay is -1.190, and is significant (97 percent level). Similar to general practitioners, outpatient facilities are a better substitute for marginal days in the hospital than for admissions. In addition, outpatient facilities appear to be a better substitute for admission than general practitioners, as, in the admissions equation, the coefficient of OUTP is significant, while the GPS coefficient is not.

The significant negative value of the proportion of males coefficient in both cases is consistent with statistical evidence which indicates that women demand more hospital care than men, even after obstetric care has been removed. Both elasticities are relatively large (-2.321 for ADMI and -17.411 for MSTY), indicating that a one percent

increase in the proportion of women leads to a 2.321 percent increase in admissions and a staggering 17.411 percent increase in average length of stay. Whether this sexual difference in hospital use is caused by differences in rates of illness or in preferences is unknown; this provides an interesting question for future research, if an accurate method of preference measurement can be determined.

The proportion of whites has a sigificantly positive effect on both admissions and mean stay, particularly the latter. Indeed, a one percent increase in the proportion of whites leads to a 7.010 percent increase in average length of stay. This finding is probably most attributable to the generally higher level of education attained by whites, and the positive relationship between education and consumption of health care. That is, education emphasizes the value of good health and portrays medical science as beneficial and safe. Those with less education, on the other hand, probably tend to reject science and to fear medical procedures as mysterious and dangerous.

Finally, the coefficient of the cancer variable is surprisingly negative in both specifications. In fact, in the mean stay specification the coefficient is -4.416 and is significant at almost the 99 percent level. Perhaps cancer patients who eventually die have shorter stays because they die quickly or because they are released when their condition is realized to be hopeless. Still, one suspects

that the relationship between cancer patients and cancer deaths is fairly constant across states, thus making the death rate a good proxy for the actual rate of cancer. Perhaps the rate of death from cancer is highly correlated with one of the other independent variables, causing its coefficient to be biased.

Chapter 7: Implications

The results generated by the model of the market for hospital care presented in this paper have important implications for the structure and magnitude of public as well as private hospital insurance programs. One application of the results of this research can be made to the Reagan Administration's recent proposal to alter the benefit emphasis of the Medicare program. At present Medicare beneficiaries pay the full price of the first day of hospitilization ($304 in 1982) and are then completely covered for days two through sixty. After sixty days, Medicare recipients are partially covered for additional days, subject to a constraint of sixty such days per lifetime. The Reagan proposal contains a significant shift from full short-term coverage to full long-term, "catastrophic" coverage. The plan stipulates that, as before, the first day is fully paid by the patient. During the subsequent two weeks, however, the patient must pay 8 percent of the daily charges. Days 16 through 60 have a 5 percent coinsurance rate; thereafter, full coverage is provided. Intuitively, this proposal seems likely to have a profound cost-reducing effect, as the average stay of Medicare patients is 11.5 days, well below the 60 day level at which coverage dramatically changes; also, the bulk of

hospital stays (97.6 percent) are less than 30 days (14,p.9). Using the elasticities estimated in this paper, the effects of this policy shift can be evaluated. The present price to the consumer of a fifteen day stay is $304. With the Reagan proposal that price rises to $644. This 113 percent increase in price, coupled with an elasticity of mean stay of -4.844 implies an impossible result-- a reduction in quantity demanded of 547 percent. There are, however, several explanations for this insensible result. Certainly, the price increase proposed by the Reagan Administration is based upon Feldstein's estimated elasticity, which is smaller than one in absolute value. Also, it may be inappropriate to apply the estimated elasticity of this paper to the Medicare proposal for two reasons. First, this elasticity may only hold for a certain price range; the demand function may not have constant elasticity. Second, the elasticity is calculated for the population in general, and the elderly may have an elasticity much smaller in absolute value. Indeed, if we perceive the elderly to need care more because of their deteriorating health, and if they translate that need into a rigidity with respect to price changes, then their demand is certainly less elastic than that of the general population. If we assume, however, that the elasticity presented here is applicable and accurate, then the Reagan Administration's suggested price increase is too drastic. If, say, a 30

percent decrease in quantity demanded is desired, a price increase of 6 percent, a relatively small change, is recommended.

In connection with the Reagan-Feldstein proposal, it is useful to examine the coefficient of PPRV, the proportion of private benefits variable, found in this paper. The regression results presented in Chapter 4 show that the proportion of private hospital insurance variable is negatively related to both the admissions rate and mean length of stay. That is, a state with a higher proportion of private hospital insurance benefits paid has lower admissions and shorter mean stay than a state with a lower proportion of private hospital insurance benefits paid, ceteris paribus. This effect is relatively small--the elasticity of admission is -.053 and the elasticity of stay is -.483--but it is significant in both cases. This implies that systematic differences exist between the privately insured and the publicly insured regarding the level of hospital care consumed. Because age is already explicitly taken into account, these differences can probably be primarily attributed to differences in opportunity cost of time between the large majority of public insurance beneficiaries--Medicare recipients--and private insurance beneficiaries. Because most Medicare recipients do not work, the price of their time is much less than that of private insurance beneficiaries, most of whom are employed.

As a result, Medicare recipients have a smaller disincentive to stay in the hospital than private insurance-holders, and, as a result, tend to be admitted more frequently and stay longer. Also, it is possible that differences in the structure of insurance contracts of public and private beneficiaries create differences in incentives regarding consumption. Although great variety exists among private insurance packages, most tend to offer low deductibles (20,p.283). As a result, many of the privately insured must pay much of the cost of hospital care up to a specified level, after which the insurance company provides full, or at least partial, coverage. By contrast, as previously mentioned, Medicare, which composes a large proportion of public insurance payments, is oriented towards comprehensive coverage in the early stages of hospitalization, and its coverage can expire after a certain number of days. Because the vast majority of hospital stays last thirty days or less, Medicare recipients and private insurance-holders may have differing incentives regarding their admission and length of stay. Because the private insurance-holder is more likely to be paying for more of his stay than the Medicare recipient, it is not surprising that statistical testing reveals the Medicare recipient both to be admitted more frequently and to stay longer. To counteract these differences in incentives, particularly the former, a change in the Medicare benefit structure is advocated. The Reagan

Administration proposal takes one approach to this problem; another might involve a base coinsurance rate which rises with each additional day of stay through the first thirty days, plus an admissions monitoring system which raises the level of the base coinsurance rate and/or charges the patient for two full days instead of one if he has been admitted "too often" within a certain past period of time. The first proposal provides strong incentive to shorten one's stay if possible; the second deters frequent admissions.

More complex analysis of the effect of coinsurance rate changes can be done using Feldstein's notion of welfare loss (equation 1). For the period studied in this paper, 1973-1977, the welfare gain from the reduced price and quantity distortion of excess insurance can be estimated. These welfare gains measure the dollar benefits from lower hospital care use and lower hospital care prices when hospital insurance is reduced. To be specific, the magnitude of welfare loss for 1973-1977, at the average coinsurance rate for that period, .356, is calculated. Then, estimates of welfare loss for the same period, had higher coinsurance rates been in effect, are made. The difference between the latter value and the former value is the welfare gain which would have resulted from an increase in the coinsurance rate. In this analysis, the assumption is made that the patient perceives no increase in quality of

treatment, and therefore the demand curve does not shift as shown in Figure 2. This assumption is made because, first of all, in a period of five years, it is unlikely that most patients would have noticed a perceptible improvement in quality. Second, the increase in price which Feldstein asserts to be a signal of higher quality to patients, was likely ascribed to inflation by patients, as the period studied was one of high inflation. Referring again to Equation (1), Feldstein notes that the parameter J, the ratio of gross price with insurance to gross price without insurance, can be written k^{-b}, where k is the coinsurance rate. Two different values are used for b: 1 and .5. The latter value, .5, is a more conservative estimate, as it implies a smaller increase in price when insurance is instituted than the value b=1. Estimates of the welfare loss at various combinations of k and b as well the potential welfare gains from a higher coinsurance rate during that pericd are listed in Table 2. As can readily be observed, increases in the coinsurance rate, ceteris paribus, are associated with lower levels of welfare loss. If one assigns the largest realistic value, 1, to the price change parameter, a gross welfare loss of $153 billion is calculated. Also, a potential gross gain of approximately $80 billion was possible during 1973-1977, had a higher coinsurance rate been in effect.

TABLE 2

WELFARE LOSS ($ BILLIONS), 1973-1977

b	Coinsurance Rate .356	.5	.67
.5	$114	$68	$34
1	$153	$119	$79

POTENTIAL WELFARE GAIN FROM INCREASING COINSURANCE RATE ($ BILLIONS), 1973-1977

b	Coinsurance Rate .356 to .5	.356 to .67
.5	$57	$80
1	$35	$84

Although the estimated loss of $153 billion corresponding to k=.356, b=1 compared with total hospital expenditures over the five year period of $237 billion is probably exaggerated, reasons exist for this apparent overestimation. First, Feldstein's model provides only an approximation, as its use requires the somewhat arbitrary assignment of values to several paramaters. Second, and more fundamentally, the definition of welfare loss used here is an exclusive concept which does not take into account several significant effects. Two particularly important ommissions from the welfare loss model are measurement of risk-spreading and measurement of externalities. Although Feldstein presents a function to measure the gains or losses from different levels of risk-spreading, he does not provide explicit means for calculating all of the parameters of the function. As a result, the gains from risk-spreading which accompany the losses from price and quantity distortion were unable to be measured. Had measurement of risk-spreading benefits been possible, more realistic estimates could have been presented. A second significant effect of insurance, which Feldstein overlooks, is the externalities which are generated by higher consumption of hospital care, which is a result of higher levels of insurance. Three different externality effects may accompany higher consumption of hospital care, two of which are positive, one of which is negative. One of the positive externalities is perceived to

occur if health is considered as a public good. While one's own health is a private good, the health of others is indeed a public good. Because someone else's hepatitis can become our own, we have incentives to ensure that others do not contract the disease. Thus, the good "absence of hepatitis" is a public good, as it fulfills the necessary qualities of equality of consumption for each member of society, zero marginal cost, and non-excludability, i.e., one person's consumption does not limit another's. Because society benefits from the absence of hepatitis, a disease which can be medically treated, medical insurance which prompts the consumption of hepatitis treatment produces benefits which offset, to some extent, the welfare loss which accompanies higher levels of insurance-holding. A second positive externality of higher consumption of medical care benefits employers. Because of the favorable tax treatment which employer-provided health insurance receives, many of the privately insured people in the United States are covered by employment group plans. Probably the employer's strongest motivation in offering health insurance as part of employee compensation, besides desire to compete with firms which offer similar plans, is the anticipated higher productivity of a healthier workforce. If employees are frequently ill they disrupt the production process, and the firm's productivity is reduced. If the employer feels that provision of health insurance will enable ill employees to

return to work sooner and to generally exhibit better health, then it is in his best interest to provide it. In this same situation, however, the potential exists for negative externalities. If increased provision of insurance encourages employees to seek treatment more frequently than they need it, they will tend to miss work more frequently than before. Thus, the employer's good intentions may be foiled if employees respond differently than he anticipates. Because the net effect of these three externalities and risk-spreading is probably positive, estimates made using Feldstein's model of welfare loss should be considered as maximum values. Finally, further research done in this area should attempt to quantitatively incorporate all welfare effects in calculations of the loss which accompanies the possession of excess health insurance.

The implications discussed above estimate the impact of changes in the coinsurance rate and of a change in Medicare provisions. Another possible solution to the problem of excessive, rising health expenditures is a fundamental change in the nature of private insurance contracts. Much bewilderment and, paradoxically, many suggestions for change have accompanied the tremendous rise of prices and expenditures in the American hospital system. Certainly the problem is complex; the intertwining of buyer, seller, and insurer has created a nearly unimaginable distortion of incentives. Many consumers of hospital care pay so little

of the bill that their incentives to reduce consumption are small; hospitals and physicians attempt to maximize income, so they have no incentive to lower costs; and insurers simply adjust premiums upward to cover their ever-burgeoning expenses. Thus, the individual consumer (or his employer, in a sense) and taxpayer bear the escalating costs of public and private hospital insurance. ~~As a result, only~~ Unfortunately the individual ~~truly has an~~ has relatively little incentive to reduce hospital expenditures. The major problem with the present system is that individual costs and benefits are divorced from one another. To influence individual incentives regarding the consumption of hospital care, costs and benefits must be placed in direct relation. One method for doing this is what Viscusi (24) refers to as "merit rating". Merit rating signifies that an individual's premium be adjusted up or down based upon the extent of his claims in the preceding period. In Viscusi's model, if no claims are made, the premium decreases; if claims are made, the premium increases relative to the amount of claims made by the individual. Viscusi develops a comparative statics model which uses the above payment procedure. His results strongly confirm the efficacy of merit rating as a cost reduction device. Using a two-person, two-state model (claim,no claim) he shows that a lower premium following no claim and a higher premium following a claim each induce less insurance-holding and more self-protection by both the claimant and the

non-claimant. Viscusi's results can analogously be applied to the present experience-rating model which dominates the private health insurance market. To reiterate, experience-rating means that the premium which an individual pays is based on the risk associated with the demographic (age,sex,race,income) group to which the individual belongs,, and increases in premiums are solely based on the expenses of that group, and not on increases in individual claims. To test Viscusi's model, assume that one firm in the private health insurance market, Moral Hazard Insurance, Inc. has two clients, Mr. Risk and Mr. Distortion. The premium for each is P_1 dollars. During period one, Mr. Risk is hospitalized at a cost to Moral Hazard, Inc. of W dollars, while Mr. Distortion is not hospitalized. If we assume that Moral Hazard, Inc. has no administrative costs, then premiums must rise by W dollars to cover Mr. Risk's expense. Under the conventional practices of private insurers, Mr. Risk's expense is shared with the other member of his group, Mr. Distortion. As a result, the new premium for each is $P_2 = P_1 + .5W$, as Mr. Risk's expenditure is spread equally among the members of his group. According to Viscusi's model, ~~both Mr. Risk and~~ Mr. Distortion will purchase more insurance and engage in less self-protection in period two, with the former behavior causing more frequent and more costly hospitalizations and the latter behavior creating a higher probability of illness and thus

Mr Risk will purchase less ins. & more self-protection

of hospitalization. As a result, the distortive effects of insurance are perpetuated and increased, giving a low-consumption person like Mr. Distortion an incentive to seek an insurance plan in which premiums paid are directly related to individual benefits received.

Not only do incentives exist for low-consumption private insurance holders to seek a merit-rating plan, but they also exist for insurance companies. Companies could conceivably lower their present premiums for low-consumption clients to a price still above expected cost, while simultaneously raising the premium for high-consumption clients to a price still below expected cost so that they could still break even. Assuming that all insurance-holders were free to break their contracts immediately without penalty, and that all insurance companies could obtain evidence of the amount of each person's expenditures in the previous period, all low-consumption people would purchase policies with the firms using merit-rating and all high-consumption people would flee to firms without merit-rating, which would offer a lower price. After this massive adjustment, competition would adjust the premiums of all companies such that they were proportional to expected cost, i.e., a merit-rating system. To allow for some risk-spreading, each person would have to pay a certain amount (regardless of expected consumption) which would be the same for all those covered by one plan. Although this risk-spreading portion of the

premium would be the same for each person in a given plan in a given year, the merit-rating portion of the premium would monitor consumption, as individuals would have to pay k percent of their previous year's expenditures. Thus the new premium formula is:

$$(15)\quad P_i = R + kX_i(t-1)$$

where P_i = the ith person's premium in time t

R = the equal risk-spreading portion of everyone's premium

k = constant fraction of benefits paid in time (t-1)

$X_i(t-1)$ = benefits paid on behalf of person i in time (t-1)

Thus, R still allows risk-spreading to occur, but $kX_i(t-1)$ ensures that people will consider the necessity and magnitude of their expenditures. It is difficult to know why merit-rating plans have not been offered by private health insurers; perhaps this is a fitting topic for future research.

Chapter 8: Conclusion

The price which the consumer pays influences his demand for hospital use, with price changes exerting a greater influence on length of stay than on admissions rate by a factor of eight. The elasticity of stay calculated in this paper is much higher than previous estimates and is elastic, casting some doubt on the estimate presented, although reasons can be advanced for expecting the elasticity of mean stay to exceed the elasticity of admissions. In attempting to apply this elasticity to a recent government proposal it is clear that a markedly different elasticity is used to make the government's calculation of demand effects. The estimated welfare gains from higher coinsurance rates are also calculated. As a result it is shown that an increase in the coinsurance rate from .356, the actual value, to .67 would have produced a gross welfare gain of approximately $80 billion during the period 1973-1977. These figures must be viewed with qualification, however, as the definition of welfare loss used does not take risk-spreading and externality benefits into account.

Finally, suggestions are made concerning the nature of both public and private insurance contracts. A given amount of Medicare has a larger effect on demand than an equal amount of private insurance. As a result a new type of

Medicare contract is proposed--one in which incentives to reduce admissions and shorten length of stay are provided. With respect to private insurance, the institution of a system which associates individual insurance benefits and premiums--merit-rating-- is proposed as the best way to control hospital costs: an appeal to individual incentives.

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