The "New Approach" and the Demand for Hospital Care

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I. Introduction and Model

This paper presents an economic analysis of the demand for a particular kind of health care, short term hospital care. The analysis is both theoretical and empirical. Our model, which forms the basis for our inferences about the parameters of the short-term hospital care demand process, is in the spirit of the more general consumer theory models of Muth [7], Lancaster [6] and Becker [3] often referred to as the "New Approach to Consumer Behavior." These models have in common the notion that the demand for a good or service is derived from the more basic demands for the attributes of the goods or for the more basic things which are "produced" by the good. Health services are an excellent example of such goods. When consumers purchase hospital services, they rarely do so simply because they expect to derive pleasure directly from these services. Rather, they expect that these services will make them healthier and that they will derive satisfaction from that. Thus we view the individual as determining his consumption of hospital care so as to maximize his ordinal utility indicator

$$U=U(C,H) \qquad (1)$$

where

C=Consumption of goods and services in the one period available. (We ignore a bequest motive and savings, in general. This is consistent with our one-period model.)

H=Health Level

and H is in turn produced by

$$H=F(L,S;X) \qquad (2)$$

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Where

F is homogeneous of degree one in L and S[1]

L=length of stay (number of hospitalized days)

S=total special services consumed

X=a vector of personal variables exogenous to this decison, e.g., age, education.

This model relates directly to that investigated by Grossman [4]. Health has both consumption and invesment aspects. Grossman analyzes both. We, on the other hand, abstract from interest rate changes and thus collapse, without loss of generality, his general utility function with its explicit dating of consumption and health levels to (1). We ignore "pure investment" aspects of health demand partly because we do not believe variations in the rate of interest are that important (if only because it probably does not vary substantially within our sample population) and because these have been adequately dealt with by Grossman. More importantly, however, suppressing time in this way allows our exposition to proceed with a minimal analytic superstructure. With a constant interest rate the intertemporal allocation problem can be ignored.

The Grossman analysis simplifies the health production function to

$$H=F(L,S)\alpha(X). \qquad (2)\text{a}$$

The variables in X affect the individual's "relative efficiency" in producing health. By writing $\alpha(X)$ in this fashion one assumes that these factors, e.g., age, education, do not affect the relative productivity of L and S. Clearly this is unrealistic. Age, for example, probably affects L more strongly than it does S. We continue with the symmetry assumption fo simplicity's sake, but drop it at the appropriate place in our comparative statics section. The empirical analysis proceeds entirely independently of the assumption. To our knowledge this has not been done before in the context of the "New Approach".

Our analysis will focus on inferences about

(1) the effect of income and earnings rates on L,S

(2) the price elasticity of demand for health

(3) the elasticity of substitution between L,S in F

(4) the effect of insurance.

1) This assumption is common in the literature; it could be replaced, we believe, by a member of the class of G.P.F.'s. See Arnold Zellner and Nagerh S. Revankar(9).

Irrespective of how one writes (2), the consumer must choose between L and S.[2] He can choose either a "service" or "time" intensive type of care.[3] In addition to choosing S/L he must also allocate his funds between C and H. All these choices must satisfy the budget constraint

$$C=(T-L)w+W-p(RL+BS)-K \qquad (3)$$

where T=total time available within the patient's current planning horizon

L=length of stay in hospital; $L \leqslant T$

w=individual's (average) wage rate

W=nonlabor income

P=percent of bill paid by patient

R=daily charge for hotel-type services(routine room charge including general nursing care)

B=charge per special (ancillary) service

S=total number of special services

K=premium for hospital insurance

(3) may be rewritten as

$$C=Tw+W-(w+pR)L-pBS-K \qquad (3)\text{a}$$

The longer is L, and the greater is S, the smaller must be C. The purchase of more L results in a double cost: a higher hospital bill and lower earnings.[4]

II. Comparative Statics

The utility function may be transformed from the $(C \times H)$ to the $(C \times L)$ or $(C \times S)$ planes, this follows the methodology suggested for this class of pro-

2) Or his physician, acting in the patient's interest, must choose between L and S.

3) This is analogous to substitution between earnings-intensive commodities and goods-intensive commodities discussed in Becker (3).

4) The consumer's allocation of time between work and "consumption time" is considered by Grossman (4). We neglect it both to simplify our analysis and to focus more narrowly on what seems to be an important attribute of hospital time (L), that because of its all or nothing nature, it excludes the possibility of working in a way that other non-work uses of the consumer's time rarely do. There are other specific differences between the two models: we do not explicity include sick days and income, thereby, lost as result of poor health, or that the consumer may live longer, both of which cause an increase in the consumer's wage (w) to raise the value of good health to him. We would argue that because the above two effects are small and uncertain they do not enter the the consumer's decision process with the same force as does the effect we focus on, and can be reasonably neglected. It is, we think, important to realize that these effects could easily be incorporated into the analysis without dating C and H. These "investment" aspects of health demand can be dealt with and with simpler tools than those used by Grossman.

blems by Lancaster [6]. Using (2)a to substitute for H in (1), we can rewrite it as

$$U=U(C,F(L,\ S)\cdot\alpha(X))=U(C,L\cdot F(1,S/L)\cdot\alpha(X)) \qquad (4)$$

Given our assumptions about the nature of F, we know that for the rational consumer S/L will be related only to their relative costs, i.e.,

$$S/L=h\left(\frac{w+pR}{pB}\right)$$

with

$$h'>0$$

and

$$F(1,S/L)=F(1,h)=h^*\left(\frac{w+pR}{pB}\right) \qquad (5)$$

and similarly

$$L/S=g\left(\frac{pB}{w+pR}\right)$$

with

$$g'>0$$

$$F(L/S,1)=F(g,1)=g^*\left(\frac{pB}{w+pR}\right) \qquad (6)$$

$g^{*\prime};h^{*\prime}>0$ as long as marginal products are positive.

Thus (4) may be rewritten as

$$U=U[C,L\cdot h^*\left(\frac{w+pR}{pB}\right)\alpha(X)] \qquad (6)\text{a}$$

or

$$U=U[C,S\cdot g^*\left(\frac{pB}{w+pR}\right)\cdot\alpha(X)] \qquad (6)\text{b}$$

or subsuming $h(\ )$ in the shape of the utility function, we have

$$U=U^*(C,L\cdot\alpha(X)] \qquad (6)\text{c}$$

or

$$U=U^{**}[C,S\cdot\alpha(X)] \qquad (6)\text{d}$$

Health is measured in units of L in (6c) and units of S. in (6d). Similarly, the constraint (3a) may be rewritten as

$$C=Tw+W-(w+pR+pBh)L-K \qquad (7)$$

or as

$$C=Tw+W-[(w+pR)g+pB]S-K \qquad (7)\text{a}$$

The variables which are in X twist the indifference map in the $(C\times L)$, or $(C\times S)$ plane. Which way they rotate the map, however, depends on the degree to which H and C are substitutes for each other.

A 1% increase in α reduces the "price of health" by 1%; unless this induces at least a 1% increase in the quantity of health demanded, the demand for medical care will fall. Therefore, if the price elasticity of demand for health is <1, the shift would be such as to decrease L (or S). If it is >1, the opposite would be true.

The price elasticity of demand for health care is generally thought to be considerably <1.[5] Assuming that case, we expect variables which raise α, to decrease L or S. If increased age lowers α, younger age groups should, ceteris paribus consume less care. We may turn this inference around. If we may take as fact that the young are more efficient producers of health, then if we discover the effect of increased age to be positive--i.e., increased care, we may infer that the price elasticity of demand for health is <1. In the context of our application to the demand for short term hospital care this would only be precisely correct if

(1) short term hospital care was in a constant ratio to other health service

(2) age had no efffects on the budget constraint.

Since neither of these seems likely to be true in fact, our inference cannot be made with enormous strength. Therefore, we should say, "is not inconsistent with" instead of "we infer that."

Suppose we now drop the assumption that

$$H=F(L,\ S;\ X)$$

can be written as

$$H=F(L,\ S)\ \alpha(x)$$

and suppose instead that it can be written as

$$H=F[L,\beta(x)\cdot S]\ \alpha(x)$$

That is, factors such as age or education are allowed to affect an individual's relative efficiency of L to S in producing health as well as his overall efficiency in producing health. What is the effect of increasing β on the ratio S/L?[6]

Rather than cloud the air with derivatives, we may reason directly from well-known results. An increase in β produces the same effect on the share in "expenditures" on S relative to L as an increase in S would have if market prices were inferred from L and S's marginal products. If the elasticity of substitution between L and S in F is <1, increasing S decreases its "relative

5) For example, Klarman (5), p.28. But, as he notes, other factors could have biased the estimates.

6) The queston is exactly analogous to the well-known question of the effect of labor augmenting technological on the wage of labor, and the result is analogous. See, for example, Hicks, *Theory of Wages*.

share." With constant relative market prices for L and$S$ (i.e., a given $\frac{w+pR}{pB}$ ratio), this implies that the equilibrium S/L ratio is decreased. Thus, if the elasticity of substitution between L, S in F is less than one, then factors which increase β will lower the ratio S/L; if it is greater than one, they will raise the ratio.

Given *a priori* information the relative effect of age on (L,S), for example, we may infer whether this elasticity is greater or less than one. It seems reasonable to assume that *decreased* age raises the relative efficiency of L more than S (the young do heal faster). If we then discover that *increased* age lowers the ratio S/L we may infer that the elasticity of substitution between L and S in the production of health is greater than one, while if the ratio is reduced we would infer that it is less than one.[7]

Earnings (w) and the percent of the bill paid by the patient (p) shift both the budget constraint and the indifference map. Their effects on the indifference map have, however, already been implicitly analyzed. When the unility function is written with H measured in units of L we have

$$U=U[C,L\cdot h^*\left(\frac{w+pR}{pB}\right)\alpha(X)] \tag{6}$$

While in units of S we have

$$U=U[C,S\cdot g\left({}_*\frac{pR}{w+pB}\right)\alpha(X)] \tag{6)a}$$

$$h^{*\prime},g^{*\prime}>0$$

Thus an increase in the wage has an effect on the indifference map which is similar to that of an increase in α when we measure H in units of L, while when H is measured in units of S it has an effect similar to a decrease in α.[8] If, as seems likely, the price elasticity of demand for health is <1, then the effect of w through its shifting of the I-map will be to reduce L and increase S.

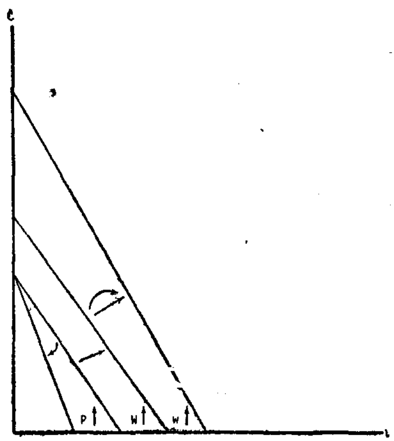
Figure I indicates the ways in which these variables shift the budget constraint. The effect of an increase in w, the individual's earnings rate, on the budget costraint is twofold. First, it is shifted outwards which should cause the individual to consume more L, since he now can purchase more of everything, and presumably health is a normal good. On the other hand, time spent

7) The caveat applied to the elasticity of demand inference does not apply here because we infer on the ratio S/L. See Muth (7).

8) At first glance this may appear paradoxical. Remember, however, that when w increases we substitute S for L in production and thus the marginal product of S goes down.

in the hospital is now more expensive; this is represented by the budget constraint's rotating clockwise. Ths latter will lead the individuial to consume less L or S. Which of these two effects will predominate is uncertain. The substitution of S for L in the production of health which would be induced by an increase in w. Thus, the theory predicts that the difference between the income elasticities of demand for S and L will be positive, or that the sign of the b coefficient of the earnings rate in a regression of S/L on income and other variables will be positive.

Figure 1



As Grossman has shown, in a pure investment model, the wage does not have an uncertain effect. There, its effect is always positive. Thus, empirical information on this sign may be able to provide some information on the relative strengths of the consumption and investment effects. If the effect of wages is negative, then that consumption effects predominate.

The effect of an increase in wealth on the budget constraint is shifted outwards and as a result consumption increases provided "health" is a "normal good." On the other hand, the effect of an increase in the percentage of the bill paid by the patient, which rotates the constraint clockwise can definitely be expected to decrease L (and S), assuming health is a normal good and neglecting the effect of the twist in the indifference map which may work in a contrary direction for either L or S.

III. Definition of Statistical Variables

Theoretical analysis suggests that given a person's illness his consumption of both types of hospital care will be influenced by his: wage rate, wealth, percent of the typical bill uncovered by insurance (p), age (A) and education (N). In addition, various "taste variables" may be presumed to have an effect. These are: sex (M) and race (V) (white-non-white).[9] Both these variables have any number of interpretations.[10] Their general socio-economic interest is in any case clear.

The population studied consists of approximately 8,812 patients admitted to 22 short-term general hospitals in the Pittsburgh area. The data were extracted and compiled from medical records by Blue Cross of Western Pennsylvania, and represent about a one in nine random sample of all hospitalized patients. This information was combined with additional information from the individual's census tract.

Care was taken to avoid various biases. The data were "disease-adjusted."[11] The variable p is measured by the actual percent of hospital bill paid directly by the patient. However, since the extent of hospital insurance coverage is sometimes predetermined by one's expected hospital use[12], eight socio-econo-

9) One might additionally expect the prices R & B to have an effect. We did not take account of this, although in principle we could if only by using twenty-one dummies, to distinguish the 22 hospitals. As p is generally small, and all our observations relate to one city at one city at one point in tme, this omission is probably not too serious. Future work should, however, look into this.

10) For example, there is evidence that whites seek medical hospital care more readily and, thereby, their cases, even within a given disease, tend to be less severe. Thus, even though our input measures will be disease-adjusted, whites are likely to appear to be more efficient than non-whites. Whites are also likely to have better access to out-of-hospital substitutes for L and S and use them more than non-whites which would also tend to make them appear more efficient. Other effects may work in the opposite direction.

11) The effect on hospital use of differences in the medical condition for which patients were hospitalized was explicitly taken into account by grouping all cases into 30 disease categories following the International Code of Disease Classification. Each category was then further subdivided into four groups: (1) surgical single diagnosis, (2) nonsurgical single diagnosis, (3) surgical multiple diagnoses and (4) nonsurgical multiple diagnoses. Adjusted indices were than constructed using the deviations from the standard (the mean value of) hospitals use for each of the resulting 120 different "disease" groups. A summary of the data are given in Auster, R (2). The deviations are computed by ratios, e.g., L_{ij}/L_j where L_{ij} is the length of stay of the ith patient with the final diagnosis of j (say, appendicitis, single diagnosis and surgical) and Lj the mean length of stay all patients in the jth category. A further adjustment for heteroskedasticity with respect to disease categories was not undertaken because of its expensiveness.

12) The amount of hospital services one expects to purchase is assumed to be highly correlated with the amount one actually purchases. This assumption appears to be justified as the amount of individual's consumption of hospital services is positively related to the number of their prior hospitalizations. The variables are given in Auster, Ro (2).

mic variables from the census tract in which the patient resided were used as instrumental variables to estimate the percent of hospital bill paid by the patient.[13] Then, this "estimated price" variable was inserted in the regressions.

L is measured by the actual number of hospital days. S is measured as a weighted number of special services, as opposed to dollar expenditures, so as to avoid the errors which might result from "fee scaling."[14]

We do not have information on the individual's income (earnings) level. Instead of the current income of an individual patient, the median income of his census tract is used as a proxy for the patient's "permanent income."[15] In order to better understand the pure effect of earnings, however, we also include a dummy variable reflecting the individual's emplyment status (E). The sign of its coefficient should tell us something more of the effect of the "price of time."

The individual's educational level is also measured by that of his census tract. We use a "negative" index--the percent of population over 25 years

13) The U.S. Bureau of the Census divided the Pittsburgh area into 189 census tracts each containing from 37 to 3, 804 families.

14) The weighing method adopted for adding the different types of special services is that suggested by 1964 Relative Value Studies, prepared by Committee on Fees of the Commsision on Medical Services, California Medical Association (San Francisco, 1964), Failure to hold prices constant can have serious consequences with respect to the estimated effect of income, or earnings. In general, there is a tendency for higher income individuals to be charged more for the same service. The industry practices price discrimination by income level. If the prices elasticity of demand is <1, this will produce a positive bias in the estimated effect of income on the consumption of care. While holding prices constant in our fashion produces a bias in the other direction, the magnitude of this bias depends on the size of the price elasticity of demand and will be small if that elasticity is small as it probably is. In addition to discriminating by income, hospitals may charge different prices for the same service depending on the individuals insurance status. Holding prices constant through the use of fixed weights then, seems preferable to using actual dollar expenditures. Of course, the use of fixed weights implies certain other biases if the factors aggregated are not perfect substitutes (or complements) unless relative prices are constant. This was thought to be a less severe problem than "fee scaling." Fee scaling is discussed by Silver (8).

15) This avovids the bias that would result from the two-way causation between income and hospital use, but blurs our perception of the effects of the earnings rate by including some part of the effect of wealth. Thus, our estimates of the effect of the earnings rate (obtained by looking at the coefficient of our permanent income measure) contain a bias in the positive direction, since the effect of increasing wealth is always positive. This offsets to some extent the bias introduced by holding prices constant in the presence of systematic price discrimination by income.

old with less than eight years of schooling.[16]

Age is given by the individual's actual age group. Three age dummies are used to represent the four age categories (0-19, 20-44, 45-64, 65 and over). Sex and race are also available from the basic records and are represented by dummies.

All variables in our regressions are in logs except the dummy variables.

IV. Results

Table I presents the results of regressing L and S (as well as S/L, for convenience) on our various independent various independent variables. The coefficient of income is negative for both L and S and more than twice its standard error for S. This suggests that comsumption effects predominate. [17] This finding is supported by other results. When the patient population is disaggregated by the method of payment, thus eliminating the intercorrelation between income and p, while holding p constant reasonably effectively, the effect of income is again negative for both types of care (with the exception of the free service category where it is positive for L but not S) (Table A-2). For the Blue Cross, commercial insurance and patient categories, moreover, the difference between the elasticities for L and S is in the direction predicted by economic rationality.

Returning to Table I we find that p has a negative effect on the length of stay and a posititive effect on S. The latter is greater than its standard error while the former is not. The effect should be negative in both cases and that it is not may reflect various things. One hypothesis is that insurance companies screen out unnecessary(unessential) services to the extent that they pay the bill, while patients are not in a position to do this as effectively. Another is that people who anticipate illness get good insurance.

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16) We would have liked to examine the effect of a change in non-work sources of income on L and S independently, but such data are unavailable.

17) Income has a negative effect on the ratio S/L which is more than twice its standard error and this is inconsistent with economic rationality to the extent that variations income reflect changes in the wage. But in our population income does not only reflect the wage,but also non-labor income and for individuals not in the labor force this difference is particularly large. When income employment status is used as a wage proxy, and education is deleted because of its high intercorrelation with income, its coefficient is positive and more than twice its standard error for the S/L ratio. The effect of this new variable on L and S, separately, is negative in both cases (and three times its standard error for L). All the other coefficients are substantially unaffected by the change.

The effect of being employed is to reduce both L and S, and raise the ratio S/L. Its coefficient for L and S/L are more than twice their standard errors, while its coefficient for S is less than its standard error. Employed people, as a group, have a higher opportunity cost of hospitalized time than those who are not. Thus, E acts much like a price variable. Its sign is consistent with theoretical analysis.

Increased age increases both types of care and reduces the ratio S/L. Assuming age reduces one's efficiency in producing health this is not inconsistent with the elasticity of demand for health(η_H) being <1. If we assume that the

Table 1

Dependent Variable / Independent Variable	Log Length of Stay b Coeff.	Log Length of Stay Std. Err.	Log Total Services b. Coeff.	Log Total Services Std. Err.	Log Total Service/Length of Stay b. Coeff	Log Total Service/Length of Stay Std. Err.
Log Income	−0.0109	0.0477	−0.1052*	0.0448	−0.0943*	0.0429
Log p	−0.0250	0.0474	0.0622	0.0445	0.0872*	0.0426
Employed	−0.0272*	0.0091	−0.0076	0.0086	0.0196*	0.0082
Not employed	——	——	——	——	——	——
Age: 0−19	−0.1827*	0.0113	−0.1251*	0.0106	0.0576*	0.0101
20−44	−0.0846*	0.0105	−0.0482*	0.0099	0.0363*	0.0095
45−64	−0.0401*	0.0111	−0.0135	0.0104	0.0265*	0.0100
65& over	——	——	——	——	——	——
Log Lack of Education	0.0770*	0.0271	0.0129	0.0254	−0.0642*	0.0244
Sex: Male	−0.0435*	0.0078	−0.0031	0.0074	0.0404*	0.0070
Female	——	——	——	——	——	——
Race: White	−0.0002	0.0103	−0.0465*	0.0097	−0.0462*	0.0093
Non-White	——	——	——	——	——	——
Constant	0.0763		0.4695		0.3935	
R Square	0.0425		0.0241		0.0144	

N=8812

Nog Income	Mean=3.7502	Std.Dev.=0.1204
Log Lack of Education	Mean=0.7505	Std.Dev.=0.2256
Log p	Mean=−1.0253	Std. Dev.=0.1285

* Significant at 0.05 level.

reduction in efficiency resulting from increased age is greater for L than S, then $\frac{\partial\beta}{\partial \mathrm{Age}}>0$, and we may infer that the elasticity of substitution between S and L in F (σ_{SL}) is less than one.

The effect of the lack of education is to increase the consumption of both types of care and to decrease the ratio S/L. Assuming the correctness of our assumptions about the effects of age, and our inferences about η_H and σ_{SL} we may conclude that the *lack* of education

(1) reduces efficiency in the production of health,
(α is reduced)

(2) decreases the efficiency of L more than of S
(β is increased).

Males consume less of both types of care and consume relatively more services. Whites also consume less of both types of care, but have lower S/L ratios. Whether these reflect different "efficiencies" in the production of health, different opportunity costs of hospitalized time, patterns of discrimination or some other factors is not clear. The coefficients for race are many times their standard errors, as is that for sex with respect to L but S.[18]

V. Summary, Conclusions, et al.

A model of the demand for short-term hospital care constructed along the lines of the "New Approach to Consumer Behavior" apparently has meaningful insights to offer. Income has a negative effect on the consumption of both types of short-term hospital care. While this is readily understood in terms of the "New Approach" it would be harder to rationalize in terms of the conventional approach. That income has a negative effect is very suggestive for public policy. If we may assume that increased labor productivity will raise incomes in the future, then we would expect, *ceteris paribus*, the equilibrium ratio of hospital beds per capita to decline. Public planning of future hospital availability should take this into account. The conclusion holds, however, only if other things remain constant--e.g., the basic health level of the population. This may not be happening. ALS [1], in a cross sectional analysis, found

18) On the whole, while many coefficients are number of times their standard errors, theses equations leave much of the variation in L, S unexplained; clearly there is room for improvement. The f-statistics are significant, however, and the results on R^2 within the usual range for disaggregate micro-data. Alternatively, the data could be averaged, one way or another, thus eliminating some of the variation and increasing R^2. Apart from producing the illusion of "better results," however, it is not clear what the latter procedure would really help, unless one is worried about measurement error.

that income reduced health when medical care, education, etc., were held constant. If further increases in income have similar effects, then the equilibrium level of beds per capita may not decrease.[19] It should be stressed, however, that we deal only with people who do go to hospitals; very low income people may not. Increasing their incomes may have the opposite effect.

The ALS finding of a negative relation between income and health has at least one simple explanation. Competitive pressures in labormarkets can be expected to cause jobs with high health hazards to have, *ceteris paribus*, higher wage rates. To the extent that this effect exsts, however, even "permanent income" is an endogenous variable, while we treated it as exogenous. There are thus, other[20] theoretical explanations for our income findings, besides those of section II. Future research might well try to isolate these various effects.

The price elasticity of demand for health may be <1. This is consistent with previous research findings and might be taken to suggest that National Health Insurance as large an increase in the demand for health facilities as one would otherwise expect. On the other hand, consumers are apparently able to manipulate health care institutions in their own interests. If this is in fact the case, devising the appropriate controls for an NHI will be more difficult than is generally believed.

Increased education has a negative effect on the consumption of care. ALS found that education improved health (so much so, in fact, that an additional dollar spent on education would produce a greater improvement in health than an additional dollar spent on an across the board increase in medical care). Together these results suggest the viability of an indirect strategy for improving the nation's health at the same time as we reduce our expenditures on medical care.

APPENDEX

Further Results on the Effect of the Wage Rate

TABLE A-1

Dependent Variable	Log Length of Stay	Log Tol Services	Log Total Services/ Length of Stay

19) The possibility that income would reduce efficiency in health, which is what the ALS result suggests, was not taken account of in our (or Grossman's) theoretical analysis, but could in principle be incorporated quite easily. See also Grossman's paper on joint production in the household.

20) E.G., higher incomes are probably associated with a greater availability of pleasant home care, the possibility of a private day (or 24 hour) nurse, etc. Our model could be easily extended along these lines.

Independent Variable	b coeff.	Std. Err.	b coeff.Std	Err.	b coeff.	Std. Err.
Log Income X Employment Status	−0.0076*	0.0024	−0.0023	0.0023	0.0052*	0.0022
Log Marginal Cost	−0.1387*	0.0300	−0.0282	0.0282	0.1105*	0.0270
Sex: Male	−0.0426*	0.0078	−0.0026	0.0074	0.0400*	0.0070
Female	——	——	——	——	——	——
Race: White	0.0004	0.0103	−0.0573*	0.0097	−0.0477*	0.0093
Non-White	——	——	——	——	——	——
Age: 0−19	−0.838*	0.0113	−0.1270*	0.0106	0.0577	0.0100
20−44	−0.0854*	0.0105	−0.0488*	0.0099	0.0365*	0.0095
45−64	−0.0399*	0.0111	−0.0138	0.0104	0.0260*	0.0100
65 & over	——	——	——	——	——	——
Constant	−0.1390		−0.0258		0.1133	
R Square	0.0413		0.0231		0.0135	

N=8,812

Log Income X employment status	Mean=0.9872	Std. Dev.=1.6583
Log Marginal Cost	Mean=−1.0253	Std. Dev.=0.1285

*Significant at 0.05 level

As opposed to holding p constant directly we could disaggregate our population by the method of payment category (Blue Cross,commercial insurance, patient, free services and government). Table C-2 presents these results. Age, sex and race were also held constant, while education and emploment status were not.

Table A-2

Method of Payment Category	Length of Stay b Coeff. of Income	Std. Err.	Number of Services b Coeff. of Income	Std. Err.
Blue Cross	−.154*	.037	−.027	.034
Commercial Insurance	−.108	.057	−.026	.053
Patient	−.070	.052	−.099	.045
Free Services	.005	.030	−.025	.029
Government	−.003	.097	−.119	.076

*Significant at .05 percent level

REFERENCES

(1) Auster, R.D., Leveson I.F., and Sarachek, D., "The Producton of Health

and Exploratory Study." *Journal of Human Resources*, No.4(Fall 1969), pp. 411-36.

(2) Auster, R.D., Ro, K.K., *Income and Hospital Use.* University of Arizona Discussion Paper, 1974.

(3) Becker, G.S., "A Theory of the Allocation of Time." *Economic Journal* 75 (September 1965), pp. 593-617.

(4) Grossman, M., "On the Concept of Health Capital and the Demand for Health." *Journal of Political Economy* 80, No. 2(March-April 1972), pp. 223-56

(5) Klarman, H.E., *The Economics of Health.* New York and London, Columbia University Press, 1967.

(6) Lancaster, K.J., "A New Approach to Consumer Theory." *Journal of Political Economy* 74 (April 1966), pp. 132-57.

(7) Muth, R., "Household Production and Consumer Demand Functions." *Econometrica* 34(July 1966), pp. 699-708.

(8) Silver, M., "An Economic Analysis of Variations in Medical Expenses and Work-Loss Rates." In H. E. Klarman (ed.), *Empirical Studies.* Baltimore and London, The John Hopkins Press (1970), pp. 121-41.

(9) Zellner, A., and Revankar, N.S., "Generalized Production Functions." *Review of Economic Studies* 36 (2), No. 106 (April 1969), 240-50

ABSTRACT

This paper presents an economic analysis of the demand for short term hospital care. The analysis is both theoretical and empirical. Our model, which forms the basis for our inferences about the parameters of the short-term hospital care demand process, is in the spirit of the more general consumer theory models of Muth, Lancaster and Becker often referred to as the "New Approach to Consumer Behavior." These models have in common the notion that the demand for a good or service is derived from the more basic demands for the attributes of the goods or for the more basic things which are "produced" by the good. Health services are an excellent example of such goods. Thus, hospital care is treated as an input for the production of health in our model. This way of looking at the consumption of hospital care is novel and useful.

Our sample consists of 8, 812 individuals admitted to 22 short-term general hospitals in the Pittsburgh area. Since these individuals are already in hopitals, we investigated how these patients choose what kinds of inputs (inpatients care) and in what quantities to "produce health" according to their indvidual

characteristics.

Our empirical results show that there are trade-offs between service-intensive care and time-intensive care. As expected, patients with higher costs of time, as represented by those employed and with higher income, choose service intensive care in that they stay a shorter period of time hospitalized and receive a greater number of ancillary services per day than patients with lower costs of time for the treatment of the same category of disease. Individuals with more education are more efficient in the production of health than people with less education in that they use a smaller amount of inputs (inpatient days and ancillary services) for the production of a given amount of health than people with less education. People who pay higher input (patient days and ancillary services) prices economize input resources more by using a smaller amount of inputs than those who pay lower input prices for production of the same amount of health. This shown in that those who pay more out-of-pocket stay a shorter period of time in hospital and receive a smaller amount of ancillary services for the treatment of the same kind of disease than those who pay less out-of-pocket.