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A SURVEY OF RECENT RESEARCH IN HEALTH ECONOMICS

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In this survey of recent research in health economics, I concentrate on studies that have appeared since 1971 or are in progress. The survey reflects in part my own research interests and biases and is not meant to be comprehensive. Four topics are covered: (1) demand for adults' health and medical care; (2) effects of health on labor supply and wage rates; (3) demand for children's health and medical care; and (4) selected topics pertaining to the supply side of the medical care market.

I. Demand for Adults' Health and Medical Care

Most recent studies of the demand for adults' health and medical care have adopted the model that I constructed to study this subject [12, 13]. A fundamental proposition of this model is that what consumers demand when they purchase medical services are not these services per se but rather good health. Based on this proposition, one should derive the demand curve for medical care from the interaction between the production function of health and the demand curve for health. Within the context of Becker's household production function framework [3], I treat health as a durable item. Thus, individuals inherit an initial stock of health capital that depreciates with age and can be increased by investment. By definition, net investment in the stock of health equals gross investment minus depreciation. Direct inputs into the production of gross investments in health include the own time of the consumer, medical care, proper diet, exercise, recreation, housing, quality of the environment, and other factors as well.

In the model, consumers demand health for two reasons. As a consumption commodity, it directly enters their utility functions, or put differently,

illness is a source of disutility. As an investment commodity, it determines the total amount of time available for work in the market sector of the economy, where consumers produce money earnings, and for work in the nonmarket or household sector, where they produce commodities that enter their utility functions. The investment motive for demanding health is present because an increase in the stock of health lowers the amount of time lost from market and nonmarket activities due to illness and injury. I develop in detail two extreme versions of this general demand for health model: a pure investment version and a pure consumption version. In the former, health does not enter the utility function directly, while in the latter, the monetary rate of return on an investment in health equals zero.

One of the main advantages of the model is that it makes strong predictions about the effects of shifts in variables other than income and the price of medical care on the quantities of health and medical care demanded. These predictions are based on the proposition that the "shadow price" of health depends on many variables besides the price of medical care. In particular, the shadow price rises with age if the rate of depreciation on the stock of health rises over the life cycle, and it falls with years of formal schooling completed if more schooling makes a person a more efficient producer of health. In general, an increase in the shadow price of health would lower the quantity of health demanded. If, however, the price elasticity of demand for health were less than one, then the quantity of medical care demanded would rise. Thus, in using this framework to study the demand for medical care, an economist does not have to ignore variables, such as attitudes, perceptions, demographic characteristics, and schooling, that noneconomists might consider to be important. Rather, one can make predictions about the effects of these variables in an economic context.

In my initial empirical application of this approach [13], using data for individuals who had finished their formal schooling, I estimated gross investment production functions and demand curves for health and medical care. The data source was a 1963 health interview survey conducted by the National Opinion Research Center and the Center for Health Administration Studies of the University of Chicago. I measured health capital by individuals' self-evaluation of their health status as excellent, good, fair, or poor; and I measured the healthy time output of health capital either by the complement of the number of restricted-activity days due to illness and injury or by the complement of the number of work-loss days. To check the results obtained with these indexes of health, I also examined variations in death rates across states of the United States. In my empirical work, I focused on the effects of age, schooling, the value of time (measured by the wage rate), and property income on the quantities of health and medical care demanded. Although not all its theoretical predictions were fulfilled, enough were to suggest that the model provides a viable framework for understanding variations in health levels and medical care utilization.

During the past few years, several other persons and I have extended the above framework both theoretically and empirically. One class of extensions deal with the properties of the demand function for medical care. Using my basic approach, Phelps [26] has developed a model of the joint determination of the demand for medical care and the demand for health insurance under uncertainty (random illness). He shows that the introduction of uncertainty does not alter the basic properties of the demand curve for medical care that I derive from my model. Newhouse and Phelps [22, 23] employ my pure investment framework as the point of departure for estimating demand curves for various types of medical care. In their model, the "nominal price" of care

and the coinsurance rate associated with a consumer's health insurance policy, as well as the quantity of care, are endogenous variables. Acton [1, 2] stresses that two of the most important time inputs in the health production process are travel time to the usual sources of medical care and waiting time in physicians' offices or in clinics. He finds that the quantity of medical care demanded is negatively related to the amount of travel or waiting time required to obtain a unit of care in several low income samples of New York City residents.

Currently, Newhouse, Phelps, Acton, and their colleagues at the Rand Corporation are employing the above framework to estimate demand curves in their Health Insurance Study [21]. In this study, which is similar in design to the Income Maintenance Experiments, various forms of national health insurance are being offered to a sample of approximately 5,000 families in six cities. The aims of the study are to measure the impact of national health insurance on utilization of medical care, to obtain precise estimates of demand parameters in addition to the price elasticity, and to measure the effect of increased utilization on health outcomes.

A second class of extensions is concerned with the role of the spouse's characteristics in the production of a person's health. Typically, married men devote most of their time to market production, while their wives devote most of their time to nonmarket production. Based on this division of labor within the family, Joyce [16], Fuchs [7], Grossman and Benham [14], and Grossman [11] suggest that wives' time should be an important input in the production of husbands' health. In the last reference, I argue that, if an increase in wives' schooling raises their nonmarket productivity, then it would raise the quantity of husbands' health demanded. (This argument assumes either that the value of time is held constant or that the percentage increase in nonmarket productivity due to schooling exceeds the

percentage increase in the value of time.) Empirically, I find that wives' schooling has approximately the same effect on husbands' health as husbands' schooling in a high income sample [11]. Currently, Colle [5] is investigating the role of wives' schooling in the demand curves for husbands' and wives' health and medical care.

A third class of extensions is concerned with a detailed investigation of the relationship between years of formal schooling completed and adults' health. In my initial work [12, 13], I modeled and tested the notion that an increase in schooling should cause health to rise. Specifically, the efficiency with which individuals transform medical care and other inputs into better health should rise with schooling. This would tend to create a positive correlation between schooling and the quantity of health demanded. Within the context of the household production function approach to consumer behavior, there are, however, compelling reasons for treating the amount of schooling persons acquire and their health at early stages in their life cycle, as well as their health as adults, as endogenous variables. For instance, it is reasonable to assume that healthier students are more efficient producers of additions to the stock of knowledge or human capital via formal schooling. If so, then they would tend to increase the quantity of investment in knowledge they demand and the number of years they attend school. Given a full life cycle model of decisionmaking, even when an adult's age, income, value of time, and spouse's characteristics are held constant, an observed positive correlation between own schooling and health would not necessarily imply a causal relationship that runs from schooling to health.

In Grossman [11] I develop a methodological framework that can be used to introduce and discuss alternative explanations of the observed positive

correlation between schooling and adults' health. In the theoretical section of this study, I formulate a recursive system whose principal equations are demand curves for children's health, schooling, and adults' health. I then show how this system generates causal relationships from schooling to health and from health to schooling. In addition, this system generates relationships from "third variables," such as genetic endowment, physical and mental ability, and parents' characteristics, to both health and schooling. Existing estimates of the effect of schooling on health are based on data sets that contain information on current health of persons who have completed their formal schooling. These data sets do not, however, have measures of health at early stages in the life cycle and have only limited information on potential third variables. My theoretical analysis stresses that current and past health should be positively correlated and that healthier students should have an incentive to attend school for longer periods of time. Therefore, the coefficient of schooling in a regression with current health as the dependent variable would be biased upward if past health were not included in the regression. Similarly, the schooling coefficient would be biased if relevant third variables were omitted from the health function.

Empirically, I use the NBER-Thorndike sample to obtain an unbiased estimate of the effect of schooling on current subjective health status. My procedure is to include past subjective health status and third variables in a multiple regression analysis of current health. With these variables held constant, schooling has a positive and significant effect on current health. Using a similar methodology Manheim [18] examines the effect of schooling on the probability of survival in a longitudinal sample of males in California. He finds a positive effect of schooling on survival, with past health and background variables held constant.

A final class of extensions applies the quality-quantity model developed by Becker and Lewis [4] to the market for physicians' services. Goldman and Grossman [10] argue that differences in quality are a distinguishing characteristic of this market. The study has two purposes. The first is to develop a methodology for the estimation of "hedonic" fee functions and demand functions for the quantity and quality of physicians' services. The second is to apply the methodology to analyze the demand for pediatric care (care rendered to children by all physicians) in a sample of New York City residents. In this sample detailed information on physicians' characteristics, such as experience, specialty, board certification status, and membership in professional societies, is combined with data on fees, family characteristics of patients, and number of visits. By examining the relationship between fees and physicians' characteristics, one can estimate the quality of care received by each child in the sample and the quality-adjusted price paid by his or her parents.

In our theoretical model, we stress the effects of income, the value of time, and the quality-adjusted price of pediatric services on the quantity (visits) and quality of services demanded. Since consumers have the option to trade quality for visits, these effects are somewhat different than those discussed in other studies of the demand for medical care with microdata sets. It is shown that the price of quality relative to the price of visits (the relative price of quality) is directly related to the quality-adjusted price of a visit and inversely related to the "fixed" costs of a visit. Fixed costs are costs that are independent of quality and are defined as the sum of (1) transportation cost per visit and (2) travel time to the physician's office and waiting time in the office evaluated at the opportunity cost of the mother's time.

Since the relative price of quality is a positive function of quality-adjusted price, consumers should substitute away from quality and toward visits as quality-adjusted price rises. Although visits need not rise absolutely, the ratio of visits to quality should be positively related to quality-adjusted price. Since the relative price of quality is a negative function of fixed costs of a visit, an increase in these costs would cause consumers to substitute quality for visits. In summary, fixed costs and quality-adjusted price should have opposite signs in the demand curve for quality. In addition, visits should be more sensitive to variations in fixed costs than to variations in quality-adjusted price.

The empirical work in the paper is based on a special sample of New York City residents conducted by the New York City Department of Health in 1965-66 (the Mindlin-Densen survey). Estimates of quality and quality-adjusted price of pediatric care are obtained from an ordinary least squares regression analysis of the usual fee of pediatric services rendered by primary care physicians in private practice in their offices. These fees were reported by mothers of children in the sample, who also were asked to identify by name all primary care physicians in private practice who examined their children during the survey period. Characteristics of these physicians were obtained from the American Medical Association or New York State Medical Directories.

Differences in characteristics among physicians are assumed to reflect differences in quality or productivity. Therefore, by regressing usual fee on these characteristics, we obtain an estimate of quality from the predicted value of usual fee for a given observation and an estimate of quality-adjusted price from the regression residual. These estimates serve as inputs into the computation of demand functions for visits and quality.

The demand functions are fitted by two-stage least squares with quality-adjusted price treated as an endogenous variable. This procedure is followed for two reasons. First, we argue that variation in quality-adjusted price in a cross section can be traced in part to imperfect information due to costs of search. Since equilibrium search time should increase and equilibrium quality-adjusted price should decrease as the quantity of pediatric services demanded increases, it would be inappropriate to estimate demand functions by ordinary least squares. Second, our preliminary estimate of quality-adjusted price is likely to contain errors of measurement. By introducing a set of instrumental variables (equivalent to estimation by two-stage least squares), we reduce these errors. In addition to the exogenous variables in the demand functions, the instrumental variables include proxies for search and information.

The major empirical results are as follows:

(1) Variations in usual fee associated with physicians' characteristics are consistent with the hypothesis that these characteristics reflect differences in quality. In particular, non-board certified pediatricians charge higher fees than general practitioners, and board certified pediatricians charge higher fees than non-board certified pediatricians. Fees are also sensitive to the number of years in which physicians have been in private practice, to the number of memberships in recognized special societies, and to the place of medical education.

(2) Quality-adjusted price has a negative and statistically significant regression coefficient in the demand curve for quality. The same variable has an insignificant negative regression coefficient in the demand curve for visits. At the point of means, the absolute value of the elasticity of quality with respect to quality-adjusted price (.08) exceeds the absolute

value of the elasticity of visits with respect to quality-adjusted price (.06). This is consistent with our hypothesis that consumers should substitute visits for quality as quality-adjusted price rises.

(3) An increase in the fixed costs of a visit simultaneously reduces number of visits and increase quality per visit. In the demand curve for visits, the absolute value of the slope coefficient of fixed costs exceeds that of quality-adjusted price. This same result emerges when elasticities at the mean are compared. Both results support our prediction that fixed costs should be a more important determinant of visits than quality-adjusted price.

II. Effects of Health on Labor Supply and Wage Rates

Several persons have tested the hypotheses that exogenous improvements in health should raise market productivity, measured by the wage rate, and should also increase the amount of time allocated to work in the market. Grossman and Benham [14], for example, estimate the effects of health on labor supply and wage rates in the context of fully specified structural equations for these two components of earnings. We also examine how the estimated effects of health on labor market behavior are altered when health is made an endogenous variable. The empirical results confirm the two hypotheses and suggest that the effect of health on productivity is strengthened when health is treated as an endogenous variable.

It is worth considering the role of health in the supply side of labor in some detail. My treatment of health capital [12, 13] assumes that an increase in the stock of health increases the total amount of available time for work in the market and for household production during any specified time interval, say a year. With the market wage rate and nonmarket productivity held constant, it would not be optimal for a consumer to allocate all of this

additional time to household production. If such a plan were followed, then the ratio of consumption time to market goods would rise, which would cause the wage rate to exceed the value of the marginal product of consumption time. Based on this argument, health should have a positive effect on the amount of time supplied to the market.

If health is viewed as an exogenous variable, then its effect on labor supply reflects a pure income effect. With the market wage rate and nonmarket productivity held constant, an increase in health would raise "full income," defined as earnings plus property (nonearnings) income plus the monetary value of time spent in consumption. Since healthier persons would have more full income, their demand for commodities and their derived demand for market goods would expand. In order to purchase additional goods, they would spend more time at work in the market. Although both property income and health influence hours of work by means of a pure income effect, these effects go in opposite directions. This difference arises because an increase in property income has no effect on the amount of consumption time associated with a <u>given</u> amount of working time. On the other hand, an increase in health has no effect on the amount of consumption of market goods associated with a <u>given</u> amount of working time.

I stress the above analysis because of the well-known difficulties associated with the use of property (nonearnings) income to estimate pure income effects on labor supply in the cross section. The availability of health measures in data sets such as the Parnes sample, the Survey of Economic Opportunity, and the Income Dynamics Panel might allow one to refine existing estimates of these effects. To be specific let ℓ be annual leisure time, t be working time, s be sick time, ω be total time, and w be the hourly wage rate. As an identity

$$w = t + \ell + s \ . \tag{1}$$

Suppose that the demand curve for leisure time is given by

$$\ell = a_0 + a_1 w + a_2 s \ , \tag{2}$$

where the coefficient of s is negative and less than one in absolute value. Equations (1) and (2) imply a labor supply curve of the form

$$t = w - a_0 - a_1 w - (a_2 + 1) s \ . \tag{3}$$

The hypothesis that I am suggesting is that $b \equiv a_2 + 1$ is significantly less than one in a statistical sense.

The above framework is also relevant in isolating the pure effect of nonmarket productivity variations on labor supply. This follows because indexes of nonmarket productivity, such as years of formal schooling completed, should be closely related to health. In a simple model suppose than an individual with no property income maximizes a utility function of the form

$$u(x, z) = u(x, a\ell), \tag{4}$$

where x is consumption of market goods, ℓ is leisure (nonmarket) time, and a is a measure of nonmarket productivity. Equation (4) is an elementary version of the household production function model in which the home-produced commodity (z) depends on time alone.

Associated with equation (4) is a demand curve for leisure time of the form (say)

$$\ln \ell = b_0 + b_1 \ln w + b_2 \ln a \ . \tag{5}$$

In terms of basic parameters, one can show

$$b_1 = (1 - k)\ (\eta - \sigma) \tag{6}$$

$$b_2 = k\ \eta + (1 - k)\ \sigma - 1\ , \tag{7}$$

where k is the share of leisure in full income, σ is the elasticity of substitution in consumption between x and ℓ, and η is the full income elasticity of demand for ℓ. Note that $k\ \eta + (1 - k)\ \sigma$ is the uncompensated price elasticity of demand for z:

$$-\frac{\partial \ln z}{\partial \ln a}\Big|_{w \text{ fixed}} = \varepsilon = k\ \eta + (1 - k)\ \sigma\ . \tag{8}$$

Therefore, $b_2 \gtrless 0$ as $\varepsilon \gtrless 1$. That is, with the wage rate held constant, an increase in nonmarket productivity would increase the demand for leisure time (would reduce the supply of hours of work) if the uncompensated price elasticity of z exceeded one.

At the empirical level, nonmarket productivity can be measured by schooling. This framework can be expanded to estimate pure income effects with sick time. With sick time held constant, other health variables could be added to the supply function as proxies for nonmarket productivity.

III. Demand for Children's Health and Medical Care

In the literature on the economics of fertility and optimum family size, a distinction is made between the quantity and the quality of children. Studies by Friedman and Leibowitz [6], Goldman and Grossman [10], and Inman [15] stress that children's health is one aspect of their quality. In a broad sense, the aims of all three studies are to derive and estimate demand curves for

pediatric care from the interaction between the demand and production functions of children's health. The study by Goldman and Grossman was described in Section I. Friedman and Leibowitz [6] assume that mothers' schooling is a positive correlate of efficiency in the production of healthy children. In their model, parents transfer human (health) and non-human capital to their children. They postulate diminishing returns in the case of investment in human capital but not in the case of investment in physical capital. It follows that an increase in efficiency in health production would increase the quantity of pediatric care demanded. Empirically, they find that mothers' schooling has a positive and very significant effect on pediatric visits.

Inman [15] assumes that the child health production function has three direct inputs: parents' time, preventive pediatric visits, and curative pediatric visits. He postulates that the relative productivities of these inputs should depend on mother's schooling. He finds some evidence in favor of this proposition in a sample of black children in Washington, D.C. The members of the sample were given a thorough ear, nose, and throat examination; and Inman uses the results of the examination as measures of health. His estimates of demand curves for the three health care inputs reveal that an increase in its relative productivity increases the quantity of the input that is demanded.

In general I think that much more work can be done on determinants of children's health and medical care utilization. Research in this area is related to theoretical and empirical studies of interactions between fertility and infant mortality by O'Hara [24], Lewit [17], and Williams [27].

IV. The Supply Side

Many persons have pointed out that physicians play a rather unique role in the market for medical care services. This has lead to theoretical

discussions and empirical estimates of the "availability effect." By this is meant the notion that the physician can directly influence the demand for his or her services. In their interstate model of the market for physicians' services, Fuchs and Kramer [9] report that the elasticity of physicians' visits per capita with respect to physicians per capita is approximately equal to .4. This estimate is obtained from a demand curve for visits in which income and the money price of a visit are held constant. This finding is not direct evidence in favor of the availability effect. For example, the travel, waiting, and inconvenience costs of obtaining physicians' services should fall as the number of physicians per capita rises. Yet many persons would argue that the elasticity is too large to be explained entirely by this factor. Moreover, in a study that controls for travel and waiting time, May [19] finds a statistically significant availability effect. His estimate, however, is only half as large as that of Fuchs and Kramer.

Pauly [25] hypothesizes that better educated consumers should be less susceptible to demand manipulation by physicians. He tests this proposition by estimating separate demand curves for physicians' visits for each of three education groups. The individual is the unit of observation, but each demand curve includes physicians per capita in the county of residence as an independent variable. Pauly reports that the size of the availability effect falls as education rises.

The relatively high cost of the physician input has stimulated analyses of the market for paramedical personnel (health workers excluding physicians). Using states of the United States as the units of observation, Monheit [20] examines the effects of licensure on wage rates of registered nurses relative to wage rates of practical nurses and on number of RN's employed relative to number of PN's. Although all states had some form of licensure by 1960,

Monheit draws a distinction between states in which licensure is mandatory and states in which it is permissive. His estimates are in the context of a simultaneous equations supply-demand model for the two types of personnel. On the demand side, his main result is that mandatory RN licensure raises the relative wage of RN's. On the supply side, his main result is that mandatory PN licensure lowers the relative number of PN's. He also finds that the elasticity of substitution between RN's and PN's is greater than one.

Fuchs [8] analyzes quality-adjusted wage rates of health workers in 1959 and in 1969 and trends between these two years. He reports a rapid increase in wage rates in the 1960's, particularly for RN's and PN's. Currently, he is examining the determinants of wage rates in hospitals as opposed to other health settings and the responsiveness of the hospital industry to wage differentials.

Footnotes

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