EDITORIAL

'A THEORY OF THE ALLOCATION OF TIME' TURNS FIFTY: ITS IMPACT ON THE FIELD OF HEALTH ECONOMICS

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ABSTRACT

The year 2015 is the 50th anniversary of the publication of 'A Theory of the Allocation of Time,' by Gary S. Becker in the 1965 volume of *The Economic Journal*. To mark that occasion, this editorial focuses on the importance of that paper in the history and evolution of the field of health economics. Copyright © 2015 John Wiley & Sons, Ltd.

The year 2015 is the 50th anniversary of the publication of 'A Theory of the Allocation of Time,' by Gary S. Becker in the 1965 volume of *The Economic Journal* (Becker, 1965; hereafter *EJ* paper). To mark that occasion, the Editors of *Health Economics* have been kind enough to invite me to write an editorial that focuses on the importance of that paper in the history and evolution of the field of health economics. I am very grateful to them for the invitation because it gives me the opportunity to pay tribute to Gary's memory. He was by far the best economist who I had the privilege to know. He had a profound impact on my professional career in economics, and I owed a debt to him that I could never repay.

I begin with some little known information about the early impact of Gary's paper. In the fall of 1966, he was a member of a National Bureau of Economic Research staff reading committee that reviewed a paper entitled 'The Production of Health: An Exploratory Study,' by Richard Auster, Irving Leveson, and Deborah Sarachek. Gary's main comment on the paper was that it ignored that what people demand when they purchase medical care services are not these services per se but rather good health. The latter item enters the utility functions of consumers, and medical care is only one of many inputs into its production. He proceeded to specify a demand function for health whose arguments included the prices of health inputs, the efficiency of the production process as reflected by the number of years of formal schooling completed by the consumer, and income or more precisely, the exogenous components of income.

When Gary wrote his review, I had just entered my third year in the Ph.D. Program in Economics at Columbia University. I had completed all the courses and examinations and was searching for a dissertation topic. I also was working as a research assistant to Victor R. Fuchs at the NBER. Victor had encouraged me to select a topic in health economics for my dissertation, and I had consulted Gary about a topic. But he had not worked in health economics and did not have any suggestions. His review changed all that. After Gary finished it, he gave it to me and said that it contained an idea for a dissertation. Originally, it was supposed to be a study of the effects of education on health, but along the way he encouraged (some might say demanded) me to broaden it into a theoretical and empirical analysis of the demand for health.

It is not surprising that Gary emphasized the difference between health as an output that enters the utility function and medical care as one of a number of inputs into its production in his review. After all, he had published his paper on the allocation of time in the previous year. In that paper, he developed the household

production function model of consumer behavior by drawing a distinction between fundamental objects of choice—called commodities—that enter the utility function and market goods and services. Consumers produce commodities with inputs of market goods and services and their own time. Because goods and services are inputs into the production of commodities, the demand for these goods and services is a derived demand for a factor of production. Although most of the applications in his paper pertain to extensions of labor supply theory, Gary could easily have titled it 'The Household Production Approach to Consumer Behavior' or 'On the New Theory of Consumer Behavior' because the applications extended far beyond labor supply. Indeed, he published a paper with the latter title in the *Swedish Journal of Economics* in 1973 (Michael and Becker, 1973).

In my dissertation and the publications that resulted from it (Grossman, 1972a, 1972b), I use the household production function approach as one of two building blocks to construct a model of the demand for health. I assume that consumers demand health, defined broadly to include illness-free days in a given year and life expectancy, and produce it with inputs of medical care services, diet, other market goods and services, and their own time. Hence, the demand for medical care and other health inputs is derived from the basic demand for health.

My second building block, also because of Gary, is the theory of investment in human capital (for example, Becker, 1964). Health, like knowledge, is a durable capital stock, and both may be viewed as components of the stock of human capital. Consumers have incentives to invest in this stock in the present because it increases their earnings in the future. Indeed, in his EJ paper, Gary points out that investment in human capital is a prominent use of a portion of the time allocated to nonmarket or household production. I proceeded to pursue a distinction between the returns to an investment in knowledge and the returns to an investment in health that he suggested to me. To be specific, investments in knowledge raise wage rates, while investments in health raise the total amount of time available for market and household production in a given year and prolong length of life.

I have continued to pursue the approach just outlined during my 45-year professional career in economics. I am pleased to report that many, many health economists have joined me in that endeavor. My 1972 paper in the *Journal of Political Economy* (Grossman, 1972a) has received many more citations in the health economics literature than Gary's *EJ* paper (approximately 2480 compared to approximately 270 based on *Google Scholar* and *EconLit*). It should be obvious, however, that my paper owes its existence to Gary and that he is the 'grandfather' of the massive health economics literature that focuses on the determinants of the health of the population. Moreover, the number of citations of my paper in all disciplines (a little less than 4500) pales in comparison to the number of citations his paper has received (a little less than 10 400).

I have reviewed the literature that resulted from the two papers just mentioned a number of times (Grossman, 2000, 2003, 2006, 2008) and cannot deal with all of them here. Instead, I want to highlight a few examples of the profound impact of Gary's ideas. Theoretically, Ehrlich and Chuma (1990) extended my treatment of the morbidity and mortality returns to health capital, originally suggested by Gary, to a diminishing returns to scale technology. They also develop a more formal treatment of the determinants of length of life than the one contained in my *JPE* paper.

Nobel Laureate James J. Heckman and colleagues (for example, Cunha *et al.*, 2010) use the household production function framework to conceptualize the technology of cognitive and noncognitive skill formation in childhood and adolescence as key determinants of completed schooling and health as an adult. In their framework, self-productivity (skills produced early in life increase skills at later stages) and dynamic complementarity (early investments raise the marginal product of later investments) interact to generate multiplier effects. Hence, investments in adolescence have much larger payoffs when earlier investments are made. Galama and van Kippersluis (2015) also use the household production function approach to develop a model in which the stocks of health and knowledge are determined simultaneously. Gary himself became a bona fide health economist in 1988 when he developed a framework to explain why some consumers demand inputs such as cigarettes, alcohol, and illegal drugs that have negative marginal products in the health production function. Of course, I am referring to his seminal paper on rational addiction (Becker and Murphy, 1988).

In his *EJ* paper, Gary put technological advances in the productivity of time in the household or nonmarket sector on an equal footing with similar advances in the productivity of time in the market sector. With earnings held constant, he showed that increases in the productivity of consumption time would raise real 'full' income, alter the shadow prices of home-produced commodities, and alter the demand for commodities and the derived demand for inputs into their production. When he discussed a dissertation topic with me, he suggested that increases in formal schooling could be viewed as advancing productivity in the nonmarket sector. He broadened the productivity effect to include both goods and time inputs, urged me to explore the implications of a framework in which the more educated were more efficient producers of health than their less educated colleagues, and developed it in more detail in Michael and Becker (1973) and Becker (2007). That led to a massive empirical literature in health economics on the effects of education on health outcomes, health inputs, and health behaviors. Since 1990, the focus of that literature has been on whether more schooling really causes better health and health behaviors that contribute to this outcome. I count 38 such studies that appeared in the period from 2010 through 2014 (Grossman, forthcoming). And that count excludes the more than 20 papers that appeared in a special issue of *Social Science and Medicine* in February 2015 entitled 'Educational Attainment and Health: Contextualizing Causality' (Karas Montez and Friedman, eds., 2015). My 'take' on this literature is that there is enough conflicting evidence in it to warrant more research on the question of whether more schooling does in fact cause better health outcomes.

Gary's emphasis on decision-making based on the value of time is especially relevant to investments in health because both the benefits and the costs of these investments are positively related to the consumer's wage rate. Benefits rise because these investments reduce morbidity and mortality and thus increase the amount of time available to engage in a variety of productive activities. The monetary value of this expanded amount of time is greater the greater is the wage rate. Costs rise because the consumer's time is an input into the production of health investments and also may be required to obtain medical care and other market inputs. As long as some of the market goods in the health production function have positive money prices, the marginal monetary return on an investment in health is positively related to the wage rate. Hence, in a pure investment model of the demand for health—one in which health does not enter the utility function directly—the optimal quantity of health is a positive function of the wage rate or value of time. This prediction becomes ambiguous in a pure consumption model in which health is demanded solely because it enters the utility function. In the latter model, the relative price of health would rise with the wage if time costs were relatively more important in the production of health than in the production of other commodities.

In both models, higher wage individuals have incentives to substitute medical care for their own time in the production of a given amount of health. In a pure investment model, this substitution in production effect is reinforced by an output effect. In a pure consumption model, the output effect may go in the opposite direction. Both models, however, point to the wage rate as an argument in the demand function for health and in the demand function for medical care. Both models also contain the prediction that an increase in the amount of time required to travel to the physician's office or to wait in the office before receiving services will lower the quantity of medical care demanded.

Considerable empirical support for the above propositions has accumulated during the past four decades. Grossman (1972b, 1976); Wagstaff (1986); and Erbsland *et al.* (1995) find positive effects of the wage rate on a variety of health outcomes. Waiting and travel time ration the demand for physician visits in the United States (for example, Acton, 1975; McCarthy, 1985) and in developing countries (Dor *et al.*, 1987 for the Ivory Coast; Gertler *et al.*, 1987 for Peru). Meltzer and Jena (2010) report that individuals with higher wage rates substitute exercise intensity for duration in the production of health.

Ruhm (2000) provides empirical evidence that a reduction in the opportunity cost of time allocated to the production of infant health, with little or no change in income, increases the quantity of health demanded. Using aggregate data for nine European countries for almost three decades, he shows that entitlements to parental leave following delivery lower postneonatal mortality (deaths between 28 days and 1 year) and child mortality (deaths between 1 and 5 years of age). Presumably, the presence of a paid leave and an increase in its length lower the relative price of infant and child health because its production is a time-intensive activity.

Ruhm's study and many other investigations of the determinants of children's health employ Gary's ideas in his *EJ* paper and elsewhere (for example, Becker, 1960, 1981) that the demand for certain commodities involves a tradeoff between the quantity of that commodity and its quality. Thus, mothers with relatively high wage rates have incentives to demand a smaller number of healthier children. These incentives explain in part the positive effect of mother's schooling on infant and child health outcomes (for example, Currie and Moretti, 2003 who show that this effect is causal).

Courtemanche *et al.* (2015) indicate a subtle effect of an increase in the value of time that has accompanied technological progress. They report that variables related to caloric intake, especially restaurant and very large discount grocery store densities are the main sources of the rapid rise in obesity in the U.S. since 1990. In turn, the growth in restaurants and large supermarkets can be traced in part to attempts to economize on what Gary termed in conversations and lectures many times as the ultimate scarce resources—the own time of the consumer.

I would be remiss if I did not conclude by indicating the fate of the paper by Auster, Leveson, and Sarachek that stimulated Gary's initial interest in the field of health economics. I am delighted to report that it was published in an early volume of the *Journal of Human Resources* (Auster *et al.*, 1969). The authors concluded that the rate of return to investing in health by increasing education far exceeded the rate of return to investment in health by increasing medical care. That conclusion was responsible, in part, for the subsequent literature that has investigated whether more schooling causes better health.

I also would be remiss if I did not relay something that my friend and colleague, Fred Goldman, once told to me. He commented that I should demand a royalty payment each time someone said or wrote that what people demand when they purchase medical care services are not these services per se but rather good health. As I hope I have demonstrated in this editorial, Gary is the one who deserved those payments.

CONFLICT OF INTEREST

There are no conflicts of interest.

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