TIME AS THE ULTIMATE SOURCE OF UTILITY *

RICHARD ZECKHAUSER

The barebones model, 668. — What role for goods? 669. — The complexity of time-related decisions, 670. — Externalities and schedules, 671. — Inefficient allocations, 672. — Valuing time allocations, 673.

In this informal essay I take an extreme position on the importance of time. I argue that the only ultimate source of utility is the disposition of time. (Even the Becker (1965) and Linder (1970) analyses treat time primarily as a constraint rather than as the primary commodity whose allocation is to be optimized.) Our objective in life is to enjoy ourselves, to reap periods of high utility. Since continual bliss is not a possibility, each individual must undertake a variety of decisions that determine the flow of good and bad times over the course of his life.

THE BAREBONES MODEL

There are constraints on the situations within which an individual can spend his time. A pauper, lacking a yacht, cannot pass his days as a luxuriating yachtsman. An individual without legal education is barred from the practice of law. And a young man who never practiced his piano will not be able to play enchantingly for his friends.

An individual makes two types of decisions: both are subject to these constraints. Allocations a involve the disposition of his time, and doing this they are the source of utility. Allocations play a second role by opening up and foreclosing future decision possibilities. The just cited examples on law school and piano practice show this process at work.

Commitments c are decisions that involve negligible amounts of time. Their sole role is to alter the range of possibilities for future decisions. Purchasing a car, moving to Chicago, or investing in an electronics firm are examples of commitments.

The forward linkage between present decisions and future possibilities is most easily understood with the aid of some notation. In each discrete time period t, say a year, an individual must make an allocation a_t and a commitment c_t; either can be a vector. Just

* Emmett Keeler, Pamela Memishian, Fred Mosteller, Thomas Schelling, and the referees made helpful suggestions.

as an individual can spend his period budget on different goods, so can he allocate his time within a period to different purposes. Past allocations and commitments, indicated

$$A_{t-1}=(a_1, \ldots, a_{t-1})$$

and

$$C_{t-1}=(c_1, \ldots, c_{t-1}),$$

and endogenous factors beyond his control E_t impose constraints on his decisions. The uncontrollable allocations and commitments of others are included in E_t. (If uncertainty plays a role, E_t will have no time subscript.) Permissible choices within a period are denoted by an asterisk. They have the functional form

$$a^*_t=\dot{g}(A_{t-1},C_{t-1},E_t)$$

and

$$c^*_t=h(A_{t-1},C_{t-1},E_t).$$

The individual's welfare is solely a function of the way he spends his time, his pattern of allocations. Thus lifetime utility can be written as

$$U_L=f(a_1, \ldots, a_t, \ldots, a_n).$$

(Choices that might increase the number of periods in the life to more than n are not considered in this paper.) The objective then is to

maximize U_L,

subject to

$$a_t \in a^*_t \text{ and } c_t \in c^*_t \quad \text{for all } t.$$

That this may not be easy to do is the theme of what follows.

What Role for Goods?

Traditional economic formulations suggest that bundles of goods are the prime source of utility. Here goods play an indirect productive role. They enable an individual to create pleasure-yielding situations. A good can be of value then only to the extent that it can be combined with time. This in no way suggests that utility derived from a good is proportional to the amount of time it can be placed in use. (This implication would hold if the utility function were separable (see below). In this case, individuals would have no incentive not to allocate all of their time to the use of their good that yields the highest utility.) There may be a large utility gain to be derived from switching time allocations periodically. (Such a utility of variety would provide one explanation for the convex structure of indifference curves.)

In quite another realm, the possession of goods, not merely their use, may widen the choice of available time allocations. In a period when an individual does not use a good, he may derive pleasure from it by reflecting on its past or future uses. Alternatively, he can capitalize on his image as an individual in possession of such a good. This status-image value is somewhat different from conspicuous consumption or conspicuous use; it derives from conspicuous ownership.[1]

One aspect inherent in all time allocations of the man who owns the big house is the continuing public knowledge of his expensive possession. A description of each of his time allocations would begin, "Being known as the man with the big house. . . ." Past allocations can also lead to fame and notoriety. People who spend a lot of time doing good deeds may derive utility from doing good deeds; they may also like being known for the deeds they have done.

The Complexity of Time-Related Decisions

Time-related decisions involve complexities not encountered in a well-behaved, goods-oriented, neoclassical consumption model. The mechanics of the dynamic linkages, both in terms of constraints on choice and valuation procedures, are most intricate. Intricacy in itself would pose no problem if a convenient optimization algorithm were available. But time allocations, alas, introduce the nonconvexities of increasing returns. These nonconvexities make it impossible for a decision maker to optimize on an incremental basis.

Indivisibilities create one source of increasing returns for time allocations. The process of preparation may be enjoyable, but surely the payoff to a half-completed painting, manuscript, or medical education is not proportional to the payoff for the whole.[2] A different form of increasing returns arises because time allocations may serve as capital investments. The more one plays the piano, the greater one's skills, and quite conceivably the more pleasure one

1. Many material goods that are owned spend most of their hours not in use. Why should they not be rented to others, or alternatively not rented from commercial sources? In some cases, say with clothes, the transactions costs of rentals would outweigh efficiency gains. Other goods would impose severe problems of monitoring maintenance or coordinating schedules of use. But in many cases, it seems that individuals like sole use of an item, even if that use will be infrequent. (Love objects, though not material possessions, perhaps provide the best example of the utility of "owning.")

2. The graph of lifetime utility as a function of time devoted to one of these activities (assuming optimization on all other decisions) would decline until the amount required for completion had been allocated; then it would take a jump.

receives from an hour at the keyboard. Professors build reputations by writing papers in their field.[3] The prevalence of the learning-by-doing phenomenon in the context of time allocation suggests that we will observe individuals specializing themselves in both recreational and vocational activities.[4]

Time allocations and commitments have significant future impacts. Uncontrollable factors are likely to creep in before the final effects are played out, before the utility score sheet is tallied. The uncertainties will be of at least two types, on the levels of production that will be achieved and on the utility valuations that will be attached to different mixes of outputs.

The likely presence of such uncertainties compounds the problems of the nonconvexities just mentioned. An individual may get trapped into a particular type of allocation. Many is the businessman who wished he had been a lawyer, or the arts and science professor who wished he had gone into medicine. Blessed with the wisdom of the future, they can see that they would have been happier or more successful had their time allocations and commitments of earlier years been oriented in a different direction.

Externalities and Schedules

The recalcitrance of time-related decisions stretches into the field of externalities; indeed it produces a new wrinkle. We care not only how much time other individuals allocate to particular activities, but also when. Fortunately, we have developed institutional mechanisms designed to handle these "when externalities." Schedules are pricing schemes that charge different amounts for particular time allocations at different points of time.

Simultaneity of use may be bad. Thus physicians schedule appointments to shorten patient queues. At least in theory, we have off-peak charges for electricity and transport; they encourage individuals to take advantage of these services at unpopular hours.

3. Women's rights advocates correctly point out that the cumulative nature of the academic profession makes it most difficult to create a successful half-time career. Phasing of experience is important as well. The skills derived from distant past time allocations may deteriorate, or merely become out of date.

4. The increasing returns phenomenon can be mitigated by the transferability of skills and the joint product nature of many time allocations. When we play tennis, for example, we are getting exercise, developing general coordination, and picking up a suntan, as well as furthering our nontransferable abilities as a tennis player. Many individuals go to law school, we are told, so that they can acquire a training and a credential that can be usefully applied in many areas.

Frequently, we like to do things together. Classes meet at appointed hours, as do bridge evenings. Employers, perhaps even more concerned about this type of positive coordination, pay wages not for eight hours of labor, but rather for work from nine to five. On a more pinpointed basis, schedules may enable us to take advantage of significant economies of scale. Media news is usually made available at appointed moments during the day.[5]

Inefficient Allocations

We often hear an individual assert that he has wasted his time. This would seem to convey the notion that he allocated time to activities that would not have been included had lifetime utility been his maximand. The model allows at least four explanations for such self-recriminations.

First, scheduling, as just mentioned, may constrain an individual's time decisions. If work ends at five and the cocktail party does not commence until six, there may be a relatively unproductive hour to allocate. If the individual could allocate at his convenience, this waste could be avoided.[6] Second, the time-allocation process is complex. An individual may have made an outright mistake that he just now realizes.[7] Third, he may have made an allocation that looked good at the time but turned out poorly. What is optimal ex ante may look undesirable in the light of new events. A fourth explanation relates to the possible attitudes of hindsight. If he enjoyed it at the time, but it did not do much for expanding future horizons, then it is only natural that the individual be a little disappointed once the future arrives.[8]

5. In some circumstances our objective may just be to coordinate on completion times. Completion scheduling requires that sufficient time to finish a chore be allocated by a particular instant; patterns within that constraint are not of consequence.

6. This type of wastage may relate to the differential productivity of time allocations at different locales and periods of the day. Stuck at work at noon, we might prefer to be home napping.

7. Economists, always drawing on the analogy of the skilled billiard player who behaves like a geometer, are not attuned to allocation errors. The time-allocation equivalent of the billiard game would have the player guiding his ball through four dimensions.

8. There may be an uncompensated externality if Jones today does not fully value Jones twenty years hence. To posit such an externality would be to create an argument for, say, banning cigarettes.

Some religions have as a primary purpose, consciousness raising on the linkage between present time allocations and allocation possibilities (locales) for periods beyond n.

Valuing Time Allocations

The most basic problem of time allocation I have left aside. How should one tally up lifetime utility from a series of allocations? Some fortunate individuals may find it possible to express their lifetime utility in the separable form,

$$U_L = r_1(a_1) + \ldots r_2(a_2) + \ldots r_n(a_n).$$

Preferences of this sort seem particularly unrealistic once we recognize that their possessors pay no heed to remembrance or expectation, reap no utility from variety, never regret their past, nor worry about their future.

Those of us with less tractable forms of utility functions must worry about the ways anxieties and uncertainties will be resolved. We must choose among rising and falling paths of temporal pleasures, or alternatively among those that are constant or wavy.[9]

If we could solve the individual's valuation problem, then we might develop new metrics for social welfare valuation. (Willingness to pay might be replaced with some equally unsatisfactory time-related measure such as willingness to work.) Even barring successes in the valuation area, if time allocations are seen to play a central role in the creation of welfare, then the study of new issues will prove a profitable time allocation. What does it mean if a poor man will use a new material good twice as much as a rich man? How do we value privately possessable goods, such as television sets or XKE's, that offer little enhancement to welfare unless combined with attractive public goods such as first-rate programming or uncrowded streets? A rowboat on a crystal stream may offer more pleasure than a power launch on a reeking river. Are there workable measures that show this? Such would be useful, for only a Hearst or a hermit can create a world where the commitments (goods bundles) and time allocations of outsiders need not enter his welfare.

To tote up the welfare of society under ground rules dependent on time, we would have to assess how much each individual is enjoying himself. This might provide one way to let denizens of the counterculture contribute more than at present to the computed social product.

Harvard University

9. Emmett Keeler recalls a European who refers to a preference for constancy as German, for waviness as French.

References to Symposium

Arai, S. *An Intersection of East and West: Japanese Business Management* (Tokyo: Japan Publications, 1971).

Bauer, R., I. Pool, and L. A. Dexter. *American Business and Public Policy* (New York: Atherton Press, 1968).

Baumol, W. J. "On the Social Rate of Discount." *American Economic Review.* LVIII (Sept. 1968), 788–802.

Baumol, W. J. "Toward the Construction of More Useful Models," in A. R. Oxenfeldt, ed. *Model of Markets* (New York: Columbia University Press, 1963), pp. 172–88.

Baumol, W. J. and R. E. Quandt. "Rules of Thumb and Optimally Imperfect Decisions." *American Economic Review.* LIV (March 1964), 23–46.

Becker, G. "Crime and Punishment: An Economic Approach." *Journal of Political Economy.* LXXVI (March–April 1968), 169–217.

Becker, G. *Human Capital* (New York: Columbia University Press, 1964).

Becker, G. "A Theory of the Allocation of Time." *Economic Journal.* LXXV (Sept. 1965), 493–517.

Chandler, A. D., Jr. *Strategy and Structure* (Cambridge: MIT Press, 1962).

Dimock, M. E. *The Japanese Technocracy* (New York: John Weatherhill, 1968).

Georgescu-Roegen, N. *Analytical Economics* (Cambridge: Harvard University Press, 1966), Part I.

Goffman, E. *Relations in Public* (New York: Basic Books, 1971).

Hansen, W. L. "Total and Private Rates of Return to Investment in Schooling." *Journal of Political Economy.* LXXI (April 1963), 128–40.

Houthakker, H. "Education and Income." *Review of Economics and Statistics.* XLI (Feb. 1959), 24–28.

Illich, I. *Deschooling Society* (New York: Harper and Row, 1971).

Leontief, W. "Theoretical Assumptions and Nonobserved Facts." *American Economic Review.* LXI (March 1971), 1–7.

Linder, S. B. *The Harried Leisure Class* (New York: Columbia University Press, 1970).

Little, I. M. D. *A Critique of Welfare Economics* (Oxford: Oxford University Press, 1970).

Lowi, T. J. *The End of Liberalism* (New York: W. W. Norton, 1969).

March, J. G. and H. A. Simon. *Organizations* (New York: John Wiley and Sons, 1958).

Nichols, D., E. Smolensky, and T. N. Tideman. "Discrimination by Waiting Time in Merit Goods." *American Economic Review.* LXI (June 1971), 312–23.

Pareto, V. *Manual of Political Economy* (New York: Augustus M. Kelley, 1971).

Roberts, M. J. "Alternative Social Choice Criteria: A Normative Approach." Harvard Institute of Economic Research Discussion Paper No. 223. Dec. 1971.

Roberts, M. J. "Models and Theories in Economics." Ph.D. thesis, Harvard University, 1969.

Schultze, C. L. *et al. Setting National Priorities, The 1973 Budget* (Washington: The Brookings Institution, 1972).

Simon, H. A. "A Behavioral Model of Rational Choice," *Models of Man* (New York: Wiley, 1957), Ch. 14.

Spence, A. M. "Job Market Signaling." This *Journal.* LXXXVII (Aug. 1973), 355–74.

Stigler, G. "The Economics of Information." *Journal of Political Economy.* LXIX (June 1961), 213–25.

Swedish Ministry of Education and Cultural Affairs. *The State and Culture in Sweden* (Stockholm, 1970).

Thomas, Keith. "The Social Origins of Hobbes's Political Thought," in K. C. Brown, ed. *Hobbes Studies* (Oxford: Blackwell, 1965).

Today, M. "The Design of a Fungus Eater." *Behavioral Science.* VII (1962), 162–183.

U. S. Department of Commerce. *Statistical Abstract, 1972*, p. 235.
U. S. Department of Commerce. *Survey of Current Business* (March 1972), p. S–14.
Weber, M. "Objectivity," in "Social Science and Social Policy," *Archiv fur Sozial Wissenschaft und Socialpolitik* (1904), reprinted in E. A. Shils and H. A. Finch, trans. and ed. *The Methodology of the Social Sciences* (New York: The Free Press, 1949), pp. 49–112.
Weiss, Y. "Investment in Graduate Education." *American Economic Review*. LXI (Dec. 1971), 833–52.
Wolf, C., Jr. "The Present Value of the Past." *Journal of Political Economy*. LXXVIII (July–Aug. 1970), 783–92.
Wolfe, T. *Radical Chic and Mau-Mauing the Flak Catchers* (New York: Farrar, Straus and Giroux, 1970).
Yoshino, M. Y. *Japan's Managerial System* (Cambridge: MIT Press, 1968).