A THEORETICAL FRAMEWORK FOR THE MEASUREMENT OF WELL-BEING

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The conceptual framework of the system specifies that societal resources are limited by two basic factors: the amount of available human time, and the stock of wealth inherited from the past. Wealth is defined very broadly to cover not only the conventional tangible capital assets familiar to economists, but also intangible human and other capital assets, stocks of organizational capital reflected by networks of social support systems (the family, the neighbourhood), stocks of environmental assets (the sun and air), and stocks of socio-political assets (security, freedom of choice). Human time covers market work, household production, leisure, and biological maintenance.

Human time and capital stocks are used within households to produce a variety of tangible and intangible outputs, and these outputs in turn are used to produce a variety of satisfactions (utilities) or to augment stocks of capital, or both.

The basic sources of well-being in the system are ultimately of two types: well-being is produced as a consequence of the intrinsic benefits from all activities engaged in by individuals, which is to say that people have preferences over the way they spend their time; secondly, people derive utilities from the existence of various stocks or states of society, and these satisfactions are independent of the way in which time is used. The satisfactions associated with flows of goods are subsumed by satisfactions derived from activities associated with those goods.

The system contains a set of linkages among the various parts:

inputs of goods and time are used to produce tangible household output, using the familiar notions of household production functions and constrained optimization;

tangible household products, which are intermediate in the system, are used in conjunction with human time to produce direct satisfactions or to augment household capital stocks;

both household (micro) and societal (macro) capital stocks are linked directly to psychological well-being;

household activities are linked directly to flows of satisfactions, termed process benefits in the system;

household preferences and values relating to policy variables are linked to public policies of various sorts, and policies modify the constraints and opportunities relevant for household decisions.

The system also has dynamic linkages. Modifications of household or public stocks produce impacts on future flows of well-being; satisfactions from activities may adapt to the existence of constraints, hence changes in constraints can modify preferences and subsequently modify activities; and household behavior has a life-cycle dimension which is inherently dynamic.

1. INTRODUCTION

Much social science research involves conceptualizing, measuring, and understanding the level, distribution, and dynamics of change in well-being. These

1

problems are at the core of the research interests of two important groups of social scientists—economists concerned with material well-being as reflected in concepts like National Income and Gross National Product, and sociologists, social psychologists, and political scientists interested in the development of social indicators of well-being. In this paper, we sketch out a comprehensive system for the measurement and analysis of well-being which tries to bridge the gap between the way in which economists have thought about material well-being and the way other social scientists have thought about social indicators.

The theoretical basis for the focus of economists on flows of material goods and services is that individual and societal well-being depends on the combination of available goods plus available leisure. In the typical welfare function in the economic literature, leisure and goods are the sole arguments: utility is maximized by equating the marginal gain from time devoted to the market (i.e. to enhancing the flow of goods) to the marginal gain from increased leisure. An interesting feature of that function is the lack of any welfare connotation for time spent working, an absence that is symptomatic of a broader insufficiency in this view of well-being. In the conventional economic model of well-being, time spent working is a "bad" while leisure time is a "good," a theory that may be seriously flawed.

Concern among economists with the measurement of material well-being dates back to the early 1900s, when the first rough quantitative estimates of National Product were produced by Wilbur King.[2] The major conceptual work in defining the boundaries of material well-being, as reflected by the concepts of National Income and National Product, as well as in the development of increasingly refined quantitative estimates, is attributable to work by Simon Kuznets, Milton Gilbert, and George Jaszi during the 1930s and 1940s.[3] This early body of work on the concept and measurement of national income drew the boundaries of appropriate concern at the household door, so to speak, where goods and services produced in the market sector were acquired by households for final consumption purposes. Thus, national income was defined to include the "value added" to products at various stages of extraction, manufacture, and distribution, but quite specifically excluded value added within the household in the process of transforming purchased consumer goods into consumable services, e.g. the manufacturing and distribution costs of food were counted, but not the time spent in cooking or preparing food for eating.[4]

The measurement and conceptual work of King, Kuznets, Jaszi, and Gilbert was based on a rigidly defined notion of the proper boundaries of measurements related to National Income and Product accounting systems: the basic idea was that the Accounts should include activities taking place within the market sector,

[2]Wilbur I. King, The National Income and Its Purchasing Power, NBER, New York, 1930.

[3]Simon Kuznets, National Income and Its Composition, 1919–1938, NBER, New York, 1941; Milton Gilbert, Statistical Sources and Methods in National Accounts Estimates and the Problem of Reliability, In International Association for Research in Income and Wealth, Series III, 1951; George Jaszi, The Conceptual Basis of the Accounts: A Re-examination, In A Critique of the United States Income and Product Accounts: Studies in Income and Wealth, Volume 22, Princeton University Press for NBER, 1958; and Jaszi, the Statistical Foundations of the Gross National Product, Review of Economics and Statistics, 38, 205–214, 1956.

[4]This conception of appropriate boundaries for national income accounts is discussed at length in Simon Kuznets, National Product Since 1869, NBER, No. 46, New York, 1946.

but not within households, that the behavioral data reflected by monetary transactions should be faithfully reflected within the Accounts, and that the Accounts should record the resource costs of producing output in the business and government sectors without attempting to reflect the qualitative and sometimes costless dimensions of changes in real output. Thus the Accounts were thought of as a consistent, resource-based, record of business transactions with a prime focus on measuring activities with monetary price tags attached, and with a definition of final product that reflected the absence of further processing within the business enterprise and public sectors of the economy.

Starting late in the 1950s and continuing through the 1960s and 1970s, a set of critiques of the Income and Products Accounts began to surface. These critiques centered on issues of analytical relevance and appropriate boundaries, and warrant being associated more with a label like Social Accounts than that of Economic Accounts.

Writers like Kendrick, Ruggles, Eisner, Juster, Griliches, and Nordhaus-Tobin began to note a set of concerns with the Accounts relating to these analytic and boundary issues. For example, the absence of a distinction between capital and current accounts in the household and government sectors seemed to these writers a serious inadequacy in the Accounts structure. The focus on resource inputs and the absence of good measures of real output change, resulting from inadequate adjustment for quality change and inadequate distinctions between intermediate and final product, posed a potentially serious discrepancy between actual and measured levels or changes in real output. And there were extensive discussions of the need for both augmentation and modification of the Accounts to better reflect changes in outcomes, in contrast to the emphasis on activities with a monetary transaction base and a resource input focus. The issues here include the treatment of environmental benefits and costs, the (future) investment versus (current) consumption aspect of output in industries like education and health, the final vs. intermediate product nature of government sector activity as well as of outputs conventionally treated as final consumption goods, and a whole set of issues involving the treatment of nonmarket output in the household sector.[5]

These critiques of National Income and Product accounting systems have a set of common themes. One is that a better measure of the division of societal effort between current benefit flows and provision for future benefit flows would significantly enhance the value of accounting systems. A second is that more attention needs to be paid to measurement systems that emphasize outputs rather than inputs, or alternatively, to systems that provide better measures of material well-being even if they are less illuminating about the costs of resource inputs.

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[5] Relevant references include John W. Kendrick, *The Formation and Stocks of Total Capital*, NBER No. 100, New York, 1976; Nancy and Richard Ruggles, *The Design of National Accounts*, NBER, 1970; Robert Eisner, Measurement and Analysis of National Income (Nonincome Income), In NBER, *51st Annual Report*, 79–80, New York, 1971; F. Thomas Juster, *Household Capital Formation and Financing, 1897–1962*, NBER, New York, 1966; Juster, A Framework for the Measurement of Economic and Social Performance, in *The Measurement of Economic and Social Performance*, ed. by Milton Moss, NBER, 1973; Zvi Griliches, ed., *Price Indexes and Quality Change*, Price Statistics Committee, Federal Reserve Board, Cambridge, Harvard University Press, 1971; and William Nordhaus and James Tobin, Is Growth Obsolete?, *Economic Growth*, Fiftieth Anniversary Colloquium V, NBER, New York, 1972.

And a third consistent theme is the importance of incorporating a variety of unpriced activities into economic accounting systems in a more systematic way.[6]

Much of the press for change in economic accounting systems had its intellectual roots in a new view of household production, the so-called new home economics. In the mid-1960s, Becker advanced the view that households can be thought of as mini-firms producing "commodities" which require inputs of goods purchased in the market and the use of nonmarket time. The "commodities" produced within households were argued to be the real objects of preference for consumers. Shortly thereafter, Lancaster proposed that utility stemmed from multiple characteristics of purchased goods, rather than from easily observable flows of such goods. That is, consumers derived utilities from the characteristics of transportation equipment—speed, maneuverability, and comfort—not from a particular piece of transportation equipment like a car of a particular make and model year. And finally, Pollak and Wachter noted the joint dependence of utility on both the end results of activities (income from market work, a meal on the table from inputs of time spent in cooking), and the preferences of individuals among activities themselves. Utilities were seen to depend not only on the objectives toward which activities were directed but also on the nature of time use itself.[7] Some of the implications of these notions for an appropriate system of economic accounts have been spelled out by Juster.[8]

While economists have focused on the association between well-being and flows of material goods and services, other social scientists have attempted to measure well-being using a somewhat broader brush. The terms "social indicators" and "quality of life" convey the flavor of this research. This literature views economic concerns with material goods and service flows as far too narrow, and holds that, for the most part, these flows are likely to be instrumental in securing the actual objects of utility. Moreover, some writers who have developed subjective assessments of people's general satisfaction with their lives appear to hold that utility is directly measurable, at least ordinally if not cardinally.

Social indicators can be thought of as indexes of ultimate societal outcomes— the degree to which society produces results which generate satisfactions for its members. Early work within the social indicators movement, by writers like Bauer, Olson, Sheldon and Moore, and Gross, relied upon aggregate social statistics of an objectively observable nature. Examples include measures of health status, such as disability-free days, infant mortality rates, and longevity;

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[6]All of the suggestions for elaboration and/or modification imply an accounting system with a greater focus on estimation and imputation, and a lesser focus on recorded transactions relating to observed behavior. For that reason, the more narrowly defined and bounded system reflected by the existing Accounts structure is not without its staunch defenders, and exchanges between proponents of change and proponents of stability have not lacked for vigor. For example, note the exchange between Jaszi and Juster, and the associated comments by Solow and Eisner, in *The Measurement of Economic and Social Performance*, cited above.

[7]The seminal article on household production functions is Gary S. Becker, A Theory of the Allocation of Goods and Time, *Economic Journal*, 1965. The importance of product characteristics derives from Kelvin Lancaster, A New Approach to Consumer Theory, *Journal of Political Economy*, April 1966. The jointness of produced goods and time use itself is discussed in Robert A. Pollak and Michael L. Wachter, The Relevance of the Household Production Function and Its Implications for the Allocation of Time, *Journal of Political Economy*, April 1975.

[8]See F. T. Juster, A Framework for the Measurement of Economic and Social Performance, cited earlier.

measures of security, such as victimization rates; and measures of family cohesiveness, such as divorce rates. The normative interpretation of these measures was usually taken to be self-evident although disagreements sometimes arose. (Higher divorce rates were assumed by most, but not all, to imply a lower "quality of life," for instance.) The linkage between these observable outcome measures and the subjective satisfactions associated with them was typically left implicit.[9]

The dominant strain in early social indicators work tended to be a concern with making public choices more rational and well-informed. This led to a focus on outcomes which could conceivably be manipulated by public policy; that is, on the level of skill development resulting from the educational system, on the health status of the population as maintained by the health care system, on the level of personal security as maintained by the police and judicial system, and so on. However, just as the linkage between objective measures and subjective satisfactions was left implicit, so too was the linkage between actual policy options and the objectively measured state of society. The social indicator movement, with the exception of Terleckyj's work, was not directly concerned with analysis of the technology by which resource use could improve the quality of people's lives.[10]

More recent writers have addressed themselves directly to assessment of the quality of life, on the grounds that "real" social indicators ought to be measures of subjective satisfaction with various domains of life. Thus sociologists and psychologists such as Bradburn, Cantril, Campbell, Converse and Rodgers, and Andrews and Withey[11] have studied subjective assessments of well-being derived from surveys of population samples. To these writers, objective conditions are interesting only insofar as they influence satisfactions; in a sense, objective conditions are "intermediate" social indicators, while subjective measures register "final output."

A capsule version of work done by social scientists on the theory and measurement of well-being is that considerable effort has been devoted to the development and refinement of concepts and measures relating to flows of material goods ansd services, which can be thought of as an important input into individual and societal well-being rather than a direct measure of it, and to the conceptualization and measurement of variables designed to reflect the final outcomes of complex societal processes. This paper represents an attempt to

[9]The explicit normative use of aggregate statistics as social indicators began in response to the shortcomings of GNP as a welfare measure. Some representative references are U.S. Department of Health, Education, and Welfare, *Toward a Social Report*, U.S. Government Printing Office, Washington, D.C., 1969; Raymond Bauer, ed., *Social Indicators*, MIT Press, Cambridge, MA, 1966; L. D. Wilcox, *et al.*, *Social Indicators and Social Monitoring*, Jossey-Bass, San Francisco, 1972; Mancur Olson, Jr., The Plan and Purpose of a Social Report, *Public Interest*, Spring, 1969; Eleanor Bernet Sheldon and Wilbert E. Moore, eds., *Indicators of Social Change*, Russell Sage, New York, 1968; and Bertram M. Gross and Jeffrey D. Straussman, The Social Indicators Movement, *Social Policy*, September–October 1974.

[10]See Nestor Terleckyj, *Improvements in the Quality of Life; Estimates of Possibilities in the United States, 1974–1983*, Washington, D.C. National Planning Association, 1975.

[11]The construction of "subjective" social indicators is exemplified by F. Andrews and Stephen B. Withey, *Social Indicators of Well-Being in America*, Plenum, New York, 1976; Angus Campbell, Philip Converse, and Willard Rodgers, *The Quality of American Life*, Russell Sage, New York, 1976; N. M. Bradburn, *The Structure of Psychological Well-Being*, Aldine Press, Chicago, 1965; and A. H. Cantril and C. W. Roll, Jr., *Hopes and Fears of the American People*, Universe, New York, 1971.

bridge the gap between analyses of goods inputs and of ultimate outcomes by developing a conceptual framework for analysing the generation and distribution of well-being in which both these strands of research have well-defined roles.

2. RESOURCES, ACTIVITIES, AND OUTCOMES

Introduction

The unifying analytical framework of our system is the notion that the ultimate constraints on individual and societal change can be found in the availability of human time and the stock of wealth inherited from the past. Human time can be allocated to the market, where it represents an input into the production of goods and services; it can be allocated to nonmarket production (cooking, cleaning, child care, etc.); it can be allocated to leisure activities (TV viewing, socializing, etc.); or it can be used for biological maintenance functions (eating, sleeping, etc.). The outputs associated with these inputs of time are of various sorts: command over market goods and services; nonmarket outputs like orderly houses, well- or ill-behaved children, gourmet meals, etc.; improved health, skills, or stocks of information; direct enjoyments or satisfactions from the activities themselves; and the capacity to continue the next day's and week's activities.

The levels of output produced by the allocation of human time to various market and nonmarket activities are contingent both on the goods and service flows used and on the capital stocks associated with time use. For example, time spent in camping out with a warm sleeping bag, a tent, and a smoothly functioning set of fishing tackle is subjectively distinct from the same amount of time spent camping out with none of the three; and cooking with a microwave oven will result in more output per unit time spent than cooking with either a regular oven or over an open fire. Much of the output-enhancing effect of capital stock on inputs of time resembles the effect of capital equipment per worker on the productivity of time spent in the market—a well worked field in conventional economic analysis.

The role of capital stock in this view of the generation of well-being is crucial, and has a rather unconventional flavor compared to the usual economic meaning of capital. By capital stock, we have in mind a very broad range of "states of being" which have the effect of conditioning the outcomes from the use of time in particular activities. Not only do we envision conventional tangible assets like factories and machinery, houses, cars, and other consumer durables as conditioning either the efficiency or the enjoyment of time spent in various activities, but we also regard as capital such tangible and intangible factors as human skills and knowledge, networks of personal associations within families, neighborhoods or communities, environmental assets like climate and water quality, socio-political assets such as the representational or the judicial systems, etc. In short, we tend to regard capital stock as an appropriate term to describe a broad range of factors that condition the result of applying human time to various activities, where the conditioning capital stocks can be thought of as reflecting some cumulative history of both endogenous decisions and exogenous events.

6

If time and capital stock are the resource constraints in the generation of well-being, what are the elements that determine well-being, and what are the processes by which resource inputs become changed into sources of well-being? One way to think about this question is to recognize that many of the outputs conventionally associated with well-being are in fact instrumental outputs, and are not in and of themselves direct objects of utility. Thus, the view that utility is associated with the consumption of goods and services would count food, clothing, cars and houses as representing material well-being. While all of these products clearly influence utility, all are instrumental: food influences both the enjoyment and health derived from the eating of meals, but food is an instrumental product and gastronomical enjoyment and health are the real outputs; clothing may both improve appearance and maintain a more reasonable body temperature, but appearance and the lack of discomfort from extreme temperatures are the output, while clothing is an instrumental product; cars are an input into going to work, visiting friends or relatives, or going on a vacation, but distance travelled with a certain degree of comfort (and perhaps style) are the outputs while cars are instrumental; and housing provides a place to maintain shelter from the elements, nurture one's family, entertain one's friends, or to enjoy one's leisure, all of which are the product with the house being an instrument.

At the other end of the resources/instrumental outputs/outcomes spectrum are the psychological satisfactions obtained from states of being and activities themselves. A close and supportive relationship with one's spouse and children, ownership of an attractively equipped home, location in a congenial climate, or in a society with equity in its administration of justice, honesty in its election processes and both personal and national security, possession of marketable skills which enable command over a relatively large flow of goods and services, all represent states of being which are apt to be associated with a high flow of psychological satisfactions or utilities. But the question is: how does one enhance these states of being in order to expand the associated flow of psychological satisfactions?

A framework in which time use is the core and associated "stocks" or "states of being" are the conditioning factors which influence the outputs derived from the use of time is proposed as a way to think systematically about all of these facets that influence the generation and distribution of well-being. Moreover, we argue that creation of a data base that simply provides a coherent organization of all of the resources, measurable outcomes and satisfactions associated with individuals is, in and of itself, an important and useful exercise. One could describe such a system as a loosely knit information system, or one might attempt to create a much more tightly bounded social accounting system, with the appropriate double-entry characteristics associated with conventional economic accounting systems such as the National Income and Product Accounts.

Specification of System Elements

A comprehensive and useful social accounting system must have at least two characteristics. If it is to be comprehensive, it must recognize the intermediate nature of tangible goods and observable states of the world in generating

7

psychological well-being. We view this as the central insight of those writers concerned with subjective social indicators. To be useful an accounting system must also identify, and where possible measure, the tangible aspects of the world which restrict ultimate well-being. Only if it does this can the system provide a framework for social policy.

The implementation of purposive change comes about only through the use of human time. We therefore assign a crucial role to activities, or time use, in mediating between the actual state of the world and desired conditions. It is time use which links tangible constraints with the achievement of ultimate psychological well-being. Viewed technologically, the causal flow in our system is from resources (the current state of the world and available time) to the allocation of time to a changed state of the world, and then to psychological outcomes and well-being.

In reality these relationships cannot be placed in a static framework. Psychological factors (aspirations, expectations, preferences, satisfactions) help determine the choice of time allocation and thus the future state of the world. This psychological view yields a causal flow which is the reverse of that just described. In a dynamic conception of behavior, both causal directions are important. However, for the purpose of describing the elements in our accounting system, it is helpful to choose one sequence or the other, and we will make use of the first.

The state of the world at a point in time is described in our system by "stocks" and "contexts." As the term context implies, the state of the world provides the environment within which activities take place. Stocks are aspects of the world which can be measured at least in an ordinal sense; a context is a feature of the world which can take on one of a number of potential states. A context can therefore be described and can change over time, although it is not ordinally or cardinally measurable.

Stocks and contexts exist at a point in time independently of ongoing activities. Time can be used to modify stocks over some accounting period by generating corresponding rates of flow, which build up to or draw down stocks. Nonetheless, the current state of the world, expressed in terms of stocks and contexts, constrains the opportunities available for creating future states through activity of one sort or another.

The second major constraint in the system is on the availability of time itself. Over any chosen accounting period, there is a limited amount of total time available for the generation of outcomes. Expressing the same idea differently, there is always a restriction on the allocation of time among alternative activities due to the fact that the fractions of time allocated to various purposes must sum to unity. Given a technology which describes how time can be used to alter the state of the world, the constraint on time restricts the rate at which the world can be changed (or the range of possible changes during some finite interval).

There is room for a good deal of disagreement concerning how to categorize the world in terms of stocks and contexts. An appropriate scheme must be both conceptually manageable and informative, as well as (at least potentially) implementable. We have found the following six categories to be a useful framework for the analysis of well-being and time use.

8

(1) TK: Conventional stocks of tangible assets, such as machinery and houses.
(2) KK: Stocks of abstract knowledge about the history and properties of the world, not embodied in specific individuals.
(3) HK: Human capital associated with specific individuals, such as health, skills and knowledge.
(4) OK: Organizational capital reflecting networks of relationships among the particular people populating society. Types of networks include families, associations of friends and neighbors, public associations such as towns and state and federal governments, and various voluntary organizations.
(5) SK: Social-political capital stocks reflecting the institutional arrangements for the performance of collective or societal activities, and the context for individual behavior provided by legal and habitual rules for social interaction.
(6) EK: Environmental stocks reflecting the physical and biological surroundings of human society. These include the weather and the availability of natural resources.

These stocks and contexts play multiple roles in our accounting system. On the one hand, they constrain the use of time by individuals and the outcomes which can be achieved through the use of time. In this sense, their role is technological. However, they also influence psychological well-being directly in many cases. For this reason, their inclusion in a comprehensive social accounting system is crucial, regardless of the technological role played by stocks and contexts.

A number of measurable outcomes from the use of time are specified in the system. The most obvious is a set of observable activities engaged in by individuals. The time allocated to various activities can be denominated in minutes, hours, or perhaps fractions of the accounting period.

A second outcome is the set of tangible flows associated with activities. These are flows of goods which are either produced or used. Examples include the use of gasoline in driving or the production of home-cooked meals. We argue that such flows can always be associated with some corresponding use of time; it is not possible to conceive of a flow of goods being produced or used without some activity being engaged in by one or more persons. Thus, in principle, the entire market economy as well as the production and use of goods within the household can be understood in terms of the allocation of time across alternative activities.

A third outcome of time use has already been alluded to, namely the change brought about in the state of the world, categorized in terms of stocks and contexts. Flows of goods are closely connected to this type of outcome, since all of the flows described above can be viewed as augmenting or depleting inventories, and inventories can be treated as stocks. However, other stocks are better viewed as existing independently of identifiable flows and responding directly to the allocation of time. An example would be health, which is influenced directly by the amount of time spent eating, sleeping, in active sports, and so on.

Whether it is preferable to incorporate particular aspects of the world into the accounting system as flows, stocks, or both depends upon a variety of factors, including the length of the accounting period. If the period is a year, there is little

point in treating hamburgers as having a stock dimension. Virtually everything of interest concerning hamburgers can be captured by recording flow rates. On the other hand, if the accounting period is ten minutes, one might make a more plausible argument that the inventory of hamburgers needs attention.

Contexts pose a special problem because it is not obvious how they change through time; there is no flow dimension for a categorical variable as there is for a stock. This is essentially a problem of formulating a technology which describes how such changes come about. We will not attempt to resolve this problem here. Instead, we will simply provide a place for contexts in the accounting system and describe their conditioning influence on other elements of the system (e.g. the efficacy of time use or direct psychological well-being).

A special mention of public goods as an outcome of time use is warranted. In our system, a public good would typically be treated as a stock whose level and/or rate of change is not primarily responsive to individual time allocation decisions. Instead, some form of collective action is required, either for technological or incentive reasons, to determine the level of such stocks. Examples include the probability of nuclear attack and the probability of an epidemic. These stocks tend to be parametric for individual time allocation decisions, but they may influence such decisions and their outcomes in significant ways. Investments in these stocks are typically the result of some collective choice mechanism which needs to be specified. As with the technology for altering contexts, we will not undertake this specification, but the reader should note the role of public goods in shaping the time allocation and well-being of individuals.

Finally, we turn to intangible outcomes of time use. We believe that (at least) two fundamentally distinct psychological consequences of human activity must be noted. First, there are direct subjective consequences from engaging in some activities to the exclusion of others. We term these subjective outcomes of time use "process benefits." Process benefits are an important facet of overall well-being for the simple reason that people have preferences over how their time is used, independently of the tangible outcomes of their activities. For instance, how much time one spends painting houses is an important determinant of well-being independently of how one feels about having a painted house afterward.

The second subjective outcome in our system is the evaluation of the state of the world. Using the terminology developed above, people may be said to experience a direct sense of well-being or ill-being as a result of the stocks and contexts prevailing at a point in time. To the extent that the state of the world is the result of previous purposive activity, this may be regarded as an indirect or dynamic outcome of time use decisions. However, it is not necessarily true that evaluations of the state of the world are related to any current or even previous use of time. For example, one's sense of well-being may be influenced by the arrival of a new ice age, or the fact that the universe is expanding.

More significant for our accounting system are states of the world which, while not related to current individual uses of time, are potentially susceptible to individual or societal modification over some period of time. Examples include the income distribution, the number of national parks, and health status. Many stocks and contexts of this type resemble conventional social indicators. While our system does give a place to objective measures of such variables, we believe it is

10

also important to attempt to register subjective perceptions and evaluations of such states of the world. Indeed, whether a particular feature of the world is regarded as important enough to be recorded in the social accounts may depend upon whether it has salience for a significant portion of the population.

A third candidate as a source of direct subjective well-being is the consumption of flows of goods. Indeed, in most economic models of welfare, the utility function of an individual depends solely upon the levels of these flows. (Leisure time, an activity in our system, is sometimes added as an argument of the utility function.) For reasons discussed below in Appendix A, we believe that this source of well-being can be accounted for with a comprehensive set of time uses. Since consumption flows can always be identified with some time use, a proper specification of the process benefits from time use should incorporate whatever benefits arise from the consumption of goods. If so, there is no need to register the subjective rewards of consuming tangible goods independently of the subjective benefits of using time.[12]

Linkages

One test of the usefulness of a social accounting system is whether, as a method of organizing data, it suggests interesting avenues for research. We believe that the proposed framework meets this criterion. Employing the sequence which runs: 1. Resources; 2. Time use; 3. Tangible outcomes; 4. Subjective outcomes; we can identify two general areas for research. The first involves the first three elements in this sequence, and the second involves the last three.

The first general area of linkage research involves the following questions:

(1) How are potential uses of time constrained by the current state of the world?

(2) How does the allocation of time to alternative activities influence tangible outcomes (flows of goods and altered states of the world)?

(3) Why, given the state of the world and the technology by which it can be altered, is time allocated as it is?

These questions seem amenable to analysis using conventional tools of economics, such as production functions and constrained optimization. Given data on actual uses of time and other observables (stocks, contexts, tangible flows), answers to questions 1 and 2 can be obtained in principle by estimating the relevant production functions. Likewise, if one is given certain data on preferences concerning the use of time and future states of the world, along with the

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[12]This is not to say that flows of goods do not condition process benefits. They certainly do. For instance, one presumably prefers to spend an hour eating tasty, high-quality food to an hour eating stale bread or vitamin pills. Our argument is merely that if one would somehow assess the subjective well-being associated with each of these alternatives, the difference in goods consumed ought to be reflected in differential levels of enjoyment for each activity. If the consumption of goods does not influence well-being either through the use of time or through the state of the world, it is hard to conceive of how else it can be important.

technology by which time use influences the latter, it is reasonably straightforward to formulate an optimal plan for the allocation of time.

One value of this type of analysis is that it clarifies the ways in which policy at a societal level may be expected to influence individual behavior; another is that it clarifies the constraints which surround purposive change. The main omission from constrained optimization is an explanation of how preferences originate and evolve. Any predictions based on such an analysis are necessarily conditional upon invariance in the criteria for evaluating the desirability of actions and their consequences.

The second general area of linkage research would treat the determination of preferences as endogenous. Here the relevant questions are:

(1) What determines how a particular set of time uses is evaluated subjectively?
(2) How does the state of the world influence perceptions of well-being?
(3) What interactions are there between time uses and surrounding circumstances in determining subjective well-being?
(4) What are the dynamics of change in preferences, aspirations, and expectations? How will these dynamics influence the choice of activities in the future?

In answering these questions, economic tools of analysis appear to be of little or no use. Psychological and social-psychological theories are called for. However, these two general areas of linkage research are themselves related, since as preferences are revised through time, the allocation of time will also change, leading to further direct and indirect repercussions on subjective variables.

We remain very far from an integration of psychological theory with economic analysis. For this reason, it seems realistic to pose these two general areas as distinct items on a research agenda. Nonetheless, it may not be too much to hope that research in both areas of linkage can be promoted by the collection of data within the framework we describe, and that eventually a more integrated theory of behavior and subjective well-being may be obtained.

We will not attempt to suggest theoretical avenues for exploring the second set of linkages described above. However, a sketch of how the first set might be approached using conventional economic modeling can be provided. A preliminary framework already exists in the literature on household production theory. After a brief review of this approach to time allocation, we will outline the modifications which might be undertaken in order to adapt household production theory to our general framework.

Household Production Theory

In economic accounting systems, the end products of market activity are the goods and services purchased by households. Once a product—food, a car, a haircut—has been purchased, it passes out of the economic system and is no longer subject to analysis. In such a system, the dollar values of transactions assume great importance, while the uses to which products are put by households are not of interest.

12

Recent modifications of this view have occurred in the literature on household production.[13] In this literature, the goods traded in markets are treated as inputs to further production processes occurring within the household. Market goods are combined with the time of household members and perhaps the services of durable equipment owned by the household to produce "commodities" which are the "final" products in the model. Thus, acquisition of groceries or gasoline does not contribute directly to well-being. Instead, well-being is generated by produced commodities such as a home-cooked meal or a visit to friends. To use the economist's terminology, household-produced commodities rather than purchased goods are the arguments of the household utility function. This treatment of household behavior is closer in spirit than the usual version of consumer theory to our social accounting framework. In particular, the "new home economics" gives a central role to the allocation of time within the household. However, this view is still incomplete.

Time use in the household production literature does not enter into anyone's utility function. Rather, time is only important as a scarce input which must be allocated among alternative productive activities. The tangible outputs of these activities comprise the arguments of the utility function. Therefore, the pattern of time allocation influences well-being only through the production and consumption of material commodities, not through the enjoyability of activities themselves. In short, there is no room in the model for process benefits.

One reason for this omission is the desire among writers on household production theory to construct a measure of "full income" which would be analogous to conventional purchasing power in the market.[14] Much of the literature is devoted to establishing the existence of "shadow prices" for household-produced commodities and understanding their properties. These shadow prices are constructed out of the market prices of inputs to household production, the wage rates of household members, and the technology by which goods and time are used to produce the final commodities.

Interestingly, when time uses are introduced directly into the utility function, the shadow price method breaks down. Pollak and Wachter[15] have treated this situation as a case of joint production. That is, the activity of cooking may be seen as having two outputs. One is a tangible meal, and the other is "the subjective experience of having cooked for x minutes"—a process benefit. If both of these outputs from the single activity "cooking" influence utility, the shadow price of the produced good, the meal, cannot be determined independently of the preferences of the household for goods and time uses. Since preferences and shadow prices are inextricably linked in this situation, it becomes difficult to characterize a household's material well-being by a summary measure analogous to income.

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[13]The seminal article on household production theory is Gary S. Becker, A Theory of the Allocation of Time, Economic Journal, 75, 299, 493–517, September 1965. Elaborations of this approach may be found in Robert T. Michael and Gary S. Becker, On the New Theory of Consumer Behavior, Swedish Journal of Economics, 75 (378–396), 1973, and George J. Stigler and Gary S. Becker, De Gustibus Non Est Disputandum, American Economic Review, 76–90, March 1977.

[14]See Becker (1965) for example.

[15]Robert A. Pollak and Michael L. Wachter, The Relevance of the Household Production Function and Its Implications for the Allocation of Time, Journal of Political Economy, April 1975.

While recognition of process benefits thus complicates household production theory if one continues to focus on the optimal consumption of tangible goods, we see no reason not to tackle the problem directly by incorporating both time use and flows of tangible goods as arguments of the household utility function. Indeed, stocks and contexts also can be introduced into the utility function, both as independent determinants of well-being and also because these variables will often condition the benefits derived from particular activities.

Space limitations preclude a full derivation of optimizing behavior for such a model, but it may be helpful to suggest how the constraints on behavior can be formulated. First, some notation will be introduced. Define:

(1) $\mathbf{t} = (t_1, \ldots, t_n)$ a vector giving the time devoted to each of n activities.

(2) $\mathbf{K} = (K_1, \ldots, K_r)$ a vector of levels for r stocks.

(3) $\mathbf{x} = (x_1, \ldots, x_m)$ a vector of quantities of m goods purchased in the market.

(4) $\mathbf{p} = (p_1, \ldots, p_m)$ the price vector corresponding to $\mathbf{x}$.

(5) $\mathbf{J} = (J_1, \ldots, J_q)$ a vector of q commodities produced within the household.

In addition, we will want to distinguish goods used in connection with one activity from those associated with other activities. For this purpose, double subscripts will be used. Thus, x_{ij} refers to the quantity of market good j used in activity i. We will also adopt the convention that if a J good is used as an input, the value of J is negative, while if it is produced, J will be positive. Since activities are mutually exclusive and exhaustively account for time, it will always be possible to partition flows of goods across one or more activities.

Consider a two-period model of time allocation. This will require distinguishing between stock levels at the beginning of the first period and at the beginning of the second. Let the initial stock levels be denoted by $\mathbf{K}^0$ and the levels at the end of the first period be denoted by $\mathbf{K}^1$. Because $\mathbf{K}^0$ is simply given, no use of time can change it. On the other hand, it is certainly possible that the allocation of time in the first period can influence $\mathbf{K}^1$. These effects are an important consequence of time use in the first period because the levels of stocks given by $\mathbf{K}^1$ will prevail throughout the second period, both conditioning well-being directly and also determining the constraints on second period time use.

Because $\mathbf{K}^1$ is anticipated to influence well-being in the future, utility in the first period must be a function of $\mathbf{K}^1$. This provides the possibility of investment motives for the use of time; it may be worthwhile to engage in an activity in the first period which is not particularly enjoyable in itself, if this activity leads to a favorable $\mathbf{K}^1$ vector. These considerations suggest that the utility function for the first period might be written:

(6) $$U = U(\mathbf{t}, \mathbf{J}, \mathbf{x}, \mathbf{K}^0, \mathbf{K}^1).$$

14

We believe it is reasonable to posit separability among activities and between activities and terminal stock levels. If so, the utility function becomes:

(7) $$U = \sum_{i=1}^{n} V_i(t_i, \mathbf{x}_i, \mathbf{J}_i, \mathbf{K}^0) + V_k(\mathbf{K}^1).$$

Here the subscripted vectors indicate the flows of tangible goods (either positive or negative) which are specifically associated with activity i. Note that while flows can be partitioned among activities, we do not assume that any such partitioning is possible for stocks. A given stock may influence the utility derived from any or all activities.

We now want to describe the constraints which restrict the maximization of this utility function in the first period. Two basic types of constraint can be defined: resource constraints and technology constraints. Resource constraints refer to given quantities which restrict attainable utility. These are, first, a limitation on total time available which is given by the length of the accounting period, and second, a state of the world which is described by $\mathbf{K}^0$. Both total time and inherited stock levels must be treated as given in formulating an optimal plan for time use.

Technology constraints state the restrictions on the tangible outcomes from time use. These outcomes either take the form of household produced goods—the J variables—or final stock levels as given by $\mathbf{K}^1$. Restrictions on the former may be termed "intermediate technology" and restrictions on the latter may be termed "investment technology."

Resource constraints may be written quite simply:

(8) $$\sum_{i=1}^{n} t_i = T \quad \text{(where T is the length of the period)}$$

(9) $$\mathbf{K}^0 \quad \text{given.}$$

Technology constraints are somewhat more subtle. If there is no restriction on the rate at which goods can be consumed by activities (or if goods can be thrown away), one restriction on intermediate technology is that the amount of any J good produced must be at least as great as the amount consumed by all of the various activities. Recalling the convention that consumption or use is given by a negative value of J and production by a positive value, we therefore have:

(10) $$\sum_{i=1}^{n} \mathbf{J}_i \geq \mathbf{0}.$$

Moreover, for those activities involving positive values of some J (i.e. household production activities), there is likely to be a maximum amount of intermediate good which can be generated using given time, market goods, and capital stocks:

(11) $$G_{ij}(t_i, \mathbf{x}_i, \mathbf{K}^0) \geq J_{ij} \quad \text{if} \quad J_{ij} \geq 0.$$

Equations (10) and (11) taken together constitute the household's intermediate technology.

15

Investment technology specifies the attainable levels of $\mathbf{K}^1$ consistent with a certain allocation of time among activities, the production and use of tangible goods in those activities, and the initial stock levels. This restriction can be written as

$$(12) \qquad G_k(\mathbf{t}, \mathbf{J}_1, \ldots, \mathbf{J}_n, \mathbf{x}_1, \ldots, \mathbf{x}_n, \mathbf{K}^0) \geq \mathbf{K}^1.$$

A final constraint which does not fit neatly into the above categories and which deserves special attention concerns purchases in the market. It is clearly not possible to purchase market goods worth more than current income plus accumulated savings.[16] Let the vector of market wage rates for activities $i = 1, \ldots, n$ be

$$(13) \qquad \mathbf{r} = (r_1, \ldots, \mathbf{r}_n)$$

and the stock of financial savings initially be K_f^0. (Most of the elements r_i will be equal to zero, since most activities are not compensated in the market. However, some activities involve the sale of labor time, and the vector $\mathbf{r}$ reflects this by including positive wage rates for these activities.)

The budget constraint is therefore:

$$(14) \qquad K_f^0 + \mathbf{r}'\mathbf{t} = \mathbf{p}'\mathbf{x} + K_f^1.$$

We can now express the household optimization problem as one of choosing $\mathbf{t}$, $\mathbf{x}_i$ $(i = 1, \ldots, n)$, and $\mathbf{J}_i$ $(i = 1, \ldots, n)$ so as to maximize the utility function (7) subject to the constraints given by (8), (9), (10), (11), (12), and (14).

We will not pursue this problem to the point of deriving necessary conditions for optimality here. Our purpose is only to indicate how the tools of economic analysis might be applied to the behavioral framework we describe. In our view, a modification of household production theory along these lines can provide the first of linkages described above on page 11, by expressing the optimal allocation of time in terms of preferences and the current state of the world. This approach permits explicit consideration of process benefits, constraints on time allocation, investment motives for time use, technological constraints on time allocation, and the use of market goods. As indicated above, the social accounts data base should provide the necessary raw material for estimating the technologies involved and for determining the behavioral responses to be expected from changes in surrounding circumstances.

Research into the second set of linkages described on page 12 can shed light on the formation of the preferences which were taken as given in equation (7). If so, a fully dynamic theory of behavior and preferences through time may begin to emerge.

[16]It should be noted that while this constraint holds at the micro level as stated, there is no simple macro counterpart to this constraint. At the individual level, accumulated savings are given by a stock of financial claims. These claims can be transformed into current consumption at any time by trading in the appropriate market; the opportunity to make such transactions rests upon the existence of other individuals willing to forego current consumption. The market interest rate equilibrates the supply and demand for financial claims. At the macro level, on the other hand, accumulated savings take the form of tangible productive facilities which cannot be liquidated at will and transformed into current consumption. In the aggregate, current consumption is bounded by the gross productive capacity of existing wealth.

Design of the Data Base and Construction of Social Indicators

We conceive of the social accounts as based upon survey observations at the micro level. In light of the central role of time use, the collection of time diaries from members of households is vital. A large amount of other data would also be needed from surveys of households, as is described in detail in section 3. In addition to households, data of firms and governmental units would also be important facets of the data base.

Constructing the accounts from records obtained at the micro level is essential because of the emphasis given in our framework to behavioral and psychological research. While a broad conceptual scheme is needed to provide an overall structure for the collection and organization of data, excessive rigidity is to be avoided. We anticipate that empirical research aimed at identifying and quantifying the linkages among various elements in the system will generate a long-term process of revision and extension in the conceptual framework as well as a gradual expansion in the scope of the data base itself.

As explained in section 3, we have designed the social accounting framework to incorporate the existing National Income and Product Accounts in a relatively straightforward way. These existing Accounts will in effect become an area in which the system's micro records can be aggregated to provide a macro perspective. The same can be said for a large number of other "objective" social indicators. Any characteristic of individuals or their surrounding circumstances which is deemed relevant to well-being can be incorporated into the system through micro observations. An aggregation process can then generate summary social indicators of the conventional sort. Similarly, subjective indicators can be collected from survey respondents and aggregated if this is desired.

An advantage of a social accounting system based on micro records is that the interpretation of aggregate indicators can be clarified through micro-level research. When the evaluative statements of respondents appear to coincide with the conventional interpretation of social indicators, this would constitute support for the use of aggregate statistics; when matters appear more complex at the micro level, caution would be indicated.

Another virtue of a micro-oriented system is that the selection of "objective social indicators" can be democratized somewhat by choosing stocks and contexts which respondents themselves indicate to be significant aspects of well-being. If, as is usual, there are a number of alternative ways to construct a proposed social indicator (such as health status of the population), one might wish to construct indicators from measures which are closely related to respondents' own sense of healthiness. Procedures of this sort seem more likely to give a meaningful assessment of well-being than the selection of social indicators by the intuitions of social scientists.

3. FRAMEWORK OF THE ACCOUNTS SYSTEM

Introduction

Any accounting system—social, economic, or financial—is simply a device for organizing data to illuminate relationships and facilitate analysis. For example,

17

analysis of macro changes in the economy is greatly influenced by the way in which goods and services are classified in the National Income and Product Accounts: the division of goods and services into investment outlays, consumer outlays, and purchases of goods and services by governments underpin much of the resulting analysis, which is cast in terms of decision-making by business firms, households and public bodies. If instead goods and services had been classified by durability, or by relative unit cost, one would find different types of macro analyses than at present, and (perhaps) different assessments about the state of economic activity.

In order to design an effective system of social accounts, it is essential to organize the data in such a way as to throw as much light as possible on the decision processes of individual elements in the system. For this reason, the discussion here about system elements includes a good deal of analysis relating to household production functions, since it is only by analysis of the relation between resources, activities and outcomes within households that development of a household-based social accounting system has a reasonable prospect of becoming an analytically useful framework.

The social accounting system described in this paper hinges on the availability of micro-level data. As discussed above, the system can best be understood in terms of the way it treats resource constraints and the linkages between these constraints and the generation of preferred outcomes. Individual choice is viewed as constrained by two fundamental factors: a finite amount of time which can be allocated among alternative activities, and a given set of "stocks" or "states of the world" inherited from the past.

The use of time, in conjunction with inherited stocks, results in subjective satisfactions ("process benefits"), flows of material goods, and alterations in stock levels. In turn, material goods may be consumed in other activities, yielding subjective satisfactions in the process. Also, subjective benefits may be derived directly from the current levels of stocks; for this reason, the use of time for investment purposes can enhance future well-being.

Implementation of this system requires, at a minimum: (a) definition of a mutually exclusive and exhaustive list of alternative activities; (b) identification of key states of the world which, from the perspective of individuals, either significantly constrain time uses or significantly contribute to subjective well-being; (c) identification of the flows of material goods associated with various activities, either as production or consumption items; (d) evaluation of the subjective "process benefits" associated with various activities; (e) estimation of the constraining influence of current stocks on the allocation of time; and (f) estimation of the effect of time uses on stock levels (i.e. the technology of investment). As this list suggests, both conceptual work and behavioral modeling is needed, and micro-level data on time use and related variables are essential.

We conceive of the accounting system as a coherent arrangement of micro-data whose structure is determined in part through behavioral research, rather than wholly by *a priori* conceptual notions. In turn, a set of macro accounts depicting aggregate time use, flows of GNP-style goods, stock levels, and a variety of objective and subjective social indicators could be constructed by aggregating data from the micro records. For the measurement of social change, one could

either employ successive cross-sections of such data, or a continuing panel of respondents.

Basic System Elements

The basic analysis framework of the system can be thought of either as a loosely knit system of measurements that might be termed an information strategy, or a much more tightly bounded set of measurements that have the characteristics of a well-defined system of social accounts. The characteristics of the basic data elements that would go into either an information strategy system or a bounded social accounting system would be much the same, although development of the details of the data base (e.g. the existence of depreciation accounts) would be essential for the bounded accounting system but not for the other.

Before turning to a more detailed description of the accounts structure, it might be well to define the various kinds of data elements required by the system, and some of the types of classification and measurement issues that arise.

The basic types of data elements contained in the system consist of:

—GNP-type goods produced in the market;
—the time allocated to all activities by the population;
—a set of capital stocks that range from tangible capital assets like structures and equipment through stocks of intangibles like skills, health, and environmental quality;
—a set of contexts in which activities take place, which are essentially non-measurable counterparts to capital stocks (e.g. marital status, family composition, and geographic location);
—a set of outputs of the household production process, typified by the quantity and quality of children, meals, and orderly living quarters;
—a set of objective indicators of societal conditions, typified by such measures as disability-free days, hours of leisure time, the proportion of households with present and prospective incomes above some minimum standard, etc.;
—a set of subjective measures of satisfactions associated with the various conditions that exist in the population (satisfaction with income, job, marriage, neighborhood, etc.);
—a companion set of subjective satisfactions or enjoyments associated with the set of activities that people do;
—a set of (unobservable) elements of individual and societal well-being (for which observable indexes exist).

Simply outlining the types of data required to implement the social accounting system, and by implication the types of data required to understand the sources of well-being, suggests the magnitude of the task involved in empirical implementation. Many of the variables in the system are difficult to measure, and some may be impossible to measure given present technology. However, we have taken the view that sketching out the full dimensions of a social accounting system required to understand the sources of well-being is a fruitful exercise, even if empirical implementation is bound to be incomplete in crucial respects for many years.

19

Table A: Household Output Account

Activities	GNP Goods			Tangible Household Output		Intangible Household Output
	Private	Public	Total	Intermediate Product	Gross Investment	
Investment $K_1, \ldots, K_j$						
Intermediate $I_i, \ldots, I_j$						
Consumption $C_i, \ldots, C_j$						
Biological Maintenance $B_i, \ldots, B_j$						
Total						

Table B: Capital Account

Category	Beginning Year Level	Gross Investment	Depreciation			End Year Level
			Active	Passive	Total	
Tangible Business Gov't Household Net Foreign						
Abstract Knowledge						
Human						
Organizational						
Socio-Political						
Physical Environment						

Table C: Social Output Account

Produced within:	Social Indicators of Well-Being		Process Benefits	Social Welfare Indexes
	Objective	Subjective		
Households				
Public Sector				
"Nature"				

Figure 1. Key Elements in Social Accounting Framework

The basic outlines of the accounts system in its present crude form is displayed in Figure 1, where truncated outlines of a household output account (Table A), a capital account (Table B), and a social output account (Table C) are displayed. Tables 1, 2, and 3, which follow Figure 1, contain somewhat more detailed descriptions of the various data elements in these three key accounts shown in Tables A, B, and C.

In brief, Table A traces through the way in which household activities combine with GNP-type goods used directly by households to produce tangible and intangible household output. The activity category is simply a description of the way in which time is used by households, while the GNP-type goods columns reflect those parts of GNP, such as food, clothing, housing services, and government services (such as teachers' services and public health care facilities) which are combined with time use to produce a variety of household outputs. The household outputs, in turn, are divided into two types of tangible output (intermediate product, used up completely within the household in the process of production, and net investment, which modifies various household capital stock elements), and intangible household output, which is simply the process benefits described earlier in the paper. As argued below in Appendix A, the only "net" outputs coming out of household sector activity are the intangible household outputs represented by process benefits, and the net stock augmentation reflected by gross investment minus depreciation.

Table B is the capital account, which shows the various forms of societal capital stocks ranging from tangible capital assets through knowledge, human capital, organizational, socio-political and physical environmental capital. Table B contains beginning year stock levels, and both gross investment and depreciation accounts designed to yield end-year capital stocks. Table C arrays various types of social output measures, with the first two columns providing measures reflecting objective and subjective social indicators of well-being, the third column reflecting the process benefits from household activities, and the fourth column a set of social welfare concepts that are in principle unobservable but are thought of as the ultimate objects of individual and societal utility.

This primitive accounting structure has two unambiguous control totals— GNP and time. Total available time would be reflected by the sum of time allocated to all the activities shown in the first column of Table A. Total GNP is the sum of GNP-type goods used directly by households, and the GNP goods part of the gross investment category in Table B. In this system, all GNP goods are either used directly by households, where they may or may not augment household-owned capital stocks, or they are treated as investments in various other kinds of capital stocks—conventional tangible assets owned by business or governments, claims against the "rest-of-the-world," or investments in various kinds of human, socio-political, or physical environmental capital assets.

Table 1 contains a more detailed description of the household output account shown in skeleton form as Table A. Here, we divide household activities into four categories—investment activities, intermediate product activities, consumption activities, and biological maintenance activities. Many of the activities could actually be placed in more than one of these categories. For example, sports and active leisure, which we categorize under consumption, are likely to have some

TABLE 1
DETAILS OF HOUSEHOLD OUTPUT ACCOUNT

| Activities (hours/year) | GNP Goods (constant dollars) | | | | | | Tangible Household Output (natural units) | | | | | Intangible Household Output Process Benefits (utility) |
| | Private services | | Non-Durables | Depreciation of Durables | Government Purchases | Total | Intermediate Product | | Investment | | | |
	Housing	Non-Housing					Production (+)	Use (−)	Gross (+)	Depreciation (−)	Net	
Investment												
Education										Skills		
Child Care										Child Development		
Medical Care										Health		
Home Improvement										Housing		
Social										Social Networks		
Organizational										Social Networks		
Interpersonal										Social Networks		
Communication												
Intermediate												
Home Maintenance							Orderly Home					
Personal Care							Personal					
							Appearance					
Shopping/Administration							Goods and					
							Services					
Cooking							Meals					
Market Work							Income					
Consumption												
Sports												
Spectator												
Events												
Active Leisure												
Passive Leisure												
Reading												
Biological Maintenance												
Eating												
Sleeping												
Unallocated												
Grand Total												

effect in enhancing the stock of health, and hence are partly an investment. At this stage we have simply classified activities where we judge them to have their dominant influence, fully recognizing that many activities influence more than one type of household output or stock. The GNP goods categories are categorized according to private services, divided into housing and nonhousing services, nondurables, services of capital as reflected by depreciation on stocks of durables held by households, goods and services purchased by government but used directly in household production, and depreciation on stocks maintained by government but used by households.

The tangible household output categories—those where some measurable product of household activity can be observed—consist of intermediate product and outputs that modify household stocks or contexts. Household intermediate products are defined as those which are both produced and used entirely within the household sector, either in the generation of other intermediate outputs, of larger household stocks, or in consumption activities that generate process benefits. By convention, household intermediate product sums to zero; the accounts therefore show a production column $(+)$, a use column $(-)$, and an inventory change column (to account for minor accumulations or decumulations of household inventories of goods with short expected lifetimes). For example, the use of goods, capital stocks, and time produces the output of an "orderly home," which is then used up in the process of raising children, entertaining friends, etc.

The other household output, net investment, reflects the fact that many household activities and goods produce additions to stocks, while other activities deplete stocks. Thus time devoted to training children produces additional human capital, time devoted to social interaction produces augmented social support networks, and time devoted to active sports enhances health. On the other hand, if one only reads and sleeps, one's social support networks are likely to decline and if one only eats, one's health is likely to be diminished.

For any particular investment activity, output is best viewed as gross investment, in order that the effects of individual activities can be distinguished from the net effects of a person's lifetime allocation overall. We will reserve the term "net investment" for the effect of an entire set of time uses on stocks. Also, it is well to note that virtually every activity has some consequence of a stock-augmenting or stock-depleting variety. Even the archetype leisure activity, television viewing, may be argued to enhance human capital by conveying information. Therefore when we distinguish investment from consumption activities (and both of these from intermediate production), the reader should recognize that the classification is a matter of relative emphasis, not absolute distinctions.

The final column of the household output account registers the existence of the process benefit (enjoyment through doing) that attaches to all household activities. In principle, the right units in which to measure process benefits are some sort of utility or psychological satisfaction scale. As discussed in Appendix A, the only net outputs of the household output production process consist of process benefits, presuming they are accurately measured to reflect the differential satisfactions associated with activities of different goods intensities, and the stock-augmenting aspects of tangible household outputs, which by virtue of

23

enhancing stocks enhance both current satisfaction from stocks as well as a variety of future flows of utility.[17]

Table 2 provides some additional details of the capital account in this structure. As discussed above in section 2, capital stocks or context are divided into six categories: tangible capital assets (subdivided into business-owned nonresidential assets, governmental-owned nonresidential assets, household-owned or used assets, and claims against the rest-of-the-world, or net foreign claims), and abstract knowledge, human capital, organizational capital (reflecting various networks of social relationships), socio-political capital, and physical environmental capital. In these capital accounts, we register both the effects of purposive activity in which individuals make decisions to invest in order to add to total wealth, and totally exogenous phenomena which simply add to or subtract from individual and societal wealth (natural catastrophes, improvements in climatic conditions, and so forth). The table shows a beginning-of-year stock level, gross investment during the year divided into investments taking the form of GNP goods and other investment activities or events, a depreciation or depletion account divided into active, passive, and total, and a resulting end-of-year capital stock.

The distinction between active and passive depreciation or depletion is an important one. Most conventional economic stocks suffer active depletion, that is, depletion through use in the conventional way that using an asset tends to wear it out. But many of the capital stocks in this system tend to depreciate when not used, and to *appreciate* when used to produce outputs. For example, the stock of human capital is apt to become enhanced when it is used as additional skills are acquired, and to deteriorate when left idle. In addition, human capital deteriorates with aging. Similarly, various stocks and contexts reflected by networks of associations among individuals (organization capital) will deteriorate if not exercised, and will grow when in use. In the socio-political arena, it is a commonplace that "the price of liberty is eternal vigilance"—a notion consistent with the passive depletion of socio-political stocks if left unexercised.

Finally, the capital account provides the location of all GNP goods that are not used directly by households. In the system as we envision it, not only are business investments appropriately categorized as gross investment in tangible capital assets, and similarly for the production of government-owned assets like highways, school buildings, hospitals, etc., but other government expenditures not used directly by households are appropriately categorized as representing gross investments in one of the other types of capital or contexts in the system. For example, expenditures on the judicial system are categorized as investments in socio-political capital; expenditures on national defense are investments in national security; expenditures on regulation and enforcement of laws are investments in another form of socio-political capital; and so on. At this stage of our thinking we think it appropriate to categorize all GNP goods as either being used within the household sector to produce various types of outputs, or used within the business, nonprofit or public sector to enhance various types of societal capital. Obviously, depreciation or depletion may fully offset, more than offset, or

[17]See Appendix A, pp. 28–31.

TABLE 2
DETAILS OF CAPITAL ACCOUNT

	Beginning of Year	Gross Investment		Depreciation/Depletion			End of Year
		GNP Goods	Other	Active	Passive	Total	
A. Tangible Capital							
1. Business-Owned (non-residential)							
Structures							
Equipment							
Inventory Check							
Subtotal							
2. Government-Owned (non-residential)							
Int'l Affairs							
Development							
Administration							
Education							
Health and Hospitals							
Civilian Safety							
Transportation							
Utilities and Sanitation							
Public Relief							
Postal Service							
Subtotal							
3. Household-Owned (or Used)							
Residential Buildings							
Owner-occupied							
Business-owned							
Gov't-owned							
Motor Vehicles							
Non-automotive							
Furniture							
Furnishings							
Equipment							
Leisure Capital							
Paraphernalia							
Subtotal							
4. Claims Against Rest-of-the-World							
B. Abstract Knowledge							
C. Human Capital							
D. Organizational							
E. Socio-Political							
F. Environmental							
TOTAL							

TABLE 3

DETAILS OF SOCIAL OUTPUT ACCOUNT

Produced within	Social Indicators of Well-Being		Process Benefits	Social Welfare Indexes
	Objective Indexes of	Subjective Satisfaction with		
Households	Social Environment Employment Working Life Leisure Choice Personal Economic Situation Health Individual Development	Neighborhood Housing Friendships Marital Relations Work Leisure Savings Standard of Living Religion Organizations Health Education	(From Activities in Table 1)	Subsistence Security Vigor and Vitality Personal Satisfactions Sense Pleasure Relations w/Family, Standard of Living Competence, Mastery
Public Sector	Personal Safety Justice Social Opportunity, Participation	National Gov't Life in U.S. Community		Order and Continuity Freedom of Choice Societal Belonging, Recognition Hope for the Future
"Nature"	Physical Environment			

less than offset gross investments in the rather unconventional types of capital that are contained in the system.

The final table in this system of accounting for societal well-being is the social output account, with illustrative categories as shown in Table 3. We distinguish four types of welfare-related measures in this table: objective social indicators of the sort conventionally displayed by various governments when they report the states of their societies; subjective social indicators of the types measured by sociologists and social psychologists, reflecting the subjective satisfaction of individuals with the quality of their lives; process benefits as detailed in Table 1; and a set of social welfare indexes which reflect the ultimate objects of utility for individuals and which we think of as in principle unobservable but indexed either by objective or subjective indicators of well-being.

The categories described in Table 3 are designed to be illustrative, although in some cases they reflect a considerable amount of thought on the part of various social science groups or individual scholars about the nature, definition, and substantive content of various social indicators or welfare indexes. For example, the list of objective social indicators comes from the most recent set of "social concerns" agreed on by the OECD working group concerned with the condition of society;[18] the subjective well-being indicators come from the Campbell,

[18]Provisional Working List of Social Concerns and Indicators, compiled by OECD.

Converse, and Rodgers study on the quality of American life;[19] and the social welfare indexes come from an earlier paper by the authors.[20] At this stage, however, we can provide only a simple listing of the kinds of measures that ought eventually to appear in such an account, governed by the simple analytic notion that objective social indicators are measurable from various public data sources, subjective indicators are measurable by population surveys (and have been so measured), process benefits are also measurable from population surveys and have been measured, and the elements of our social welfare index are in principle unobservable but can be indexed by either objective or subjective social indicators.

Basic System Characteristics

The above brief description of our proposed accounting system can be supplemented by noting a number of important general characteristics of the system and framework.

(1) The distinction between stocks and flows is crucially important in the analysis of well-being. We see stocks (or contexts, which are really stocks that are inherently categorical, such as marital status or location) as generating well-being directly or as conditioning the flow of well-being from activities. Thus in a general sense society produces some level of current satisfactions derived from various sources, as well as some change in capacity to provide future satisfaction, with the latter involving use of current resources to augment stocks or improve contexts. The distinction is similar to that between consumption and investment in economic terminology where consumption measures current benefits and investment future benefits. Our view of stocks or contexts is a very generalized view of capital stocks, and is associated with an equally generalized view of investment.

(2) The focus of our behavioral analysis is on households, which we visualize, as in the "new home economics," as being miniature firms using goods and time to produce outputs. However, the production of well-being within the household is conditioned by various societal states that cannot be directly impacted by individual households, but which can change over time as a consequence of collective actions by groups of households, i.e. by political decisions.

(3) While much of the empirically operational portion of the system revolves around conventional household constrained optimization analysis, the system recognizes the considerable importance attached to sources of well-being associated with societal variables that cannot be modified by individual household action—e.g. the state of tensions in the Middle East,

[19]Angus Campbell, Philip Converse, and Willard Rodgers, *The Quality of American Life*, Russell Sage, New York, 1976.
[20]Juster, Courant, and Dow, Social Accounting and Social Indicators: A Framework for the Analysis of Well-Being, in N. Terleckyj, ed., *Production of Well-Being*, Washington, D.C., National Planning Association, 1979.

the opportunity for economic advancement, and so forth. These variables are typically regarded as capital stocks that take the form of contexts.

(4) In principle, the system recognizes the importance of ethical, moral, and altruistic values in the analysis of societal well-being: our social welfare function has elements with labels like sense of fairness and justice, etc.

(5) The system is based entirely on micro-level data: all activities are carried on by individuals; stocks or contexts are associated with individuals or collections of individuals (families, firms, governments); outputs are produced by activities in conjunction with flows of goods or capital stocks; and these activities generate new "initial conditions" in successive time periods—new values for stocks or new states for contexts, new societal variables like distributions or perceived opportunities, new expectations relating to future values, etc. A macro representation of the system can of course be obtained by aggregation.

(6) The system is designed to permit analysis of trade-offs between the market and nonmarket sectors of society, and between the public and private sectors. For example, a new technology (television) can reduce market sector output (movie attendance) and increase nonmarket output (viewing TV movies at home) with the major net impact of reducing expenditures for transportation. And the provision of publicly financed day care facilities or nursery schools can increase government activity devoted to skill development in children, while simultaneously decreasing nonmarket investment of parental time devoted to child care, without having any impact at all on the aggregate level of skill development in children.

(7) The micro basis of the system permits an analysis of the distribution of well-being as conceived in various ways (income, satisfaction with life, satisfaction with time uses, etc.). Just as aggregation can give social indicators for the population, it can provide comparisons across segments of the population. Moreover, if behavioral research becomes sufficiently sophisticated, there is no reason why the distributional consequences of alternative public policies could not be modeled using the social accounting data base.

APPENDIX A

THE VALUE ADDED PROBLEM IN MEASURING NET SOCIAL OUTPUT

Recognition of the existence of process benefits immediately raises the issue of how activities on the one hand, and flows of goods on the other, are to be integrated into a comprehensive view of well-being. To what degree do process benefits reflect the production and consumption of tangible goods? Are all tangible goods intermediate? Can the welfare implications of time use and goods be distinguished? We will argue that in certain respects, these issues in social accounting are similar to the problem of "value added" in conventional economic accounts.

An an example, consider the technical characteristics of time use and well-being for Robinson Crusoe IV. This descendant of the original Crusoe has no desire for rescue; indeed, he is quite happy as the sole inhabitant of his island.

28

However, Crusoe has discovered the existence of a large number of other islands where his labor services are in demand and where certain useful items can be acquired in return, specifically food and clothing. Therefore he devotes a certain amount of his time to laboring on other islands. Since market prices for food and clothing are established by trade throughout the local archipelago, Crusoe is restricted to payment involving fixed proportions of food and clothing.

Crusoe has four uses of time: market work, cooking, eating, and sleeping. He uses the food acquired from other islands when cooking and thus produces meals. He then eats these meals (and subsequently falls asleep). There is a technology which governs the maximum number of meals which can be cooked, given a certain amount of food and time spent cooking.

We assume that the pleasure (utility) derived by Crusoe from each of his activities depends upon the goods associated with each use of time, as well as the time devoted to the activity itself. Thus, his pleasure from market work, cooking, and eating depends in each case upon the amount of clothing he wears. The pleasure from eating depends additionally upon the meals he has to eat.[21] We also assume that the process benefit obtained from each activity is independent of the time and goods devoted to other activities, an assumption that makes sense if one considers that any stocks produced by activity *i are* permitted to affect the process benefits from other activities.

To describe this situation formally, define the following notation:

t_1 = time spent in market work x_f = amount of food obtained by work

t_2 = time spent cooking x_c = amount of clothing obtained by work

t_3 = time spent eating x_m = number of meals cooked

t_4 = time spent sleeping.

Since the process benefits from activities are separable, utility can be written:

(1) $\qquad U = V_1(t_1, x_c) + V_2(t_2, x_c, x_m) + V_3(t_3, x_c, x_m) + V_4(t_4).$

Crusoe faces certain restrictions in maximizing this quantity over a given interval of length T:

(2) $\qquad wt_1 = p_1 x_f + p_2 x_c$ (market or trading constraint)

(3) $\qquad x_m \leq f(t_2, x_f)$ (production constraint)

(4) $\qquad \sum_{i=1}^{4} t_i = 1$ (time constraint).

For social accounting purposes, the point of this example is as follows. If we were to ask Crusoe about the process benefits derived from each activity, would it also be sensible to add the contribution of x_f, x_c and x_m to these process benefits in estimating overall well-being? Probably not, since Crusoe's utility from each category of time use would already incorporate the role of these goods. If we

[21] If Crusoe can vary the intensity or effort of time spent cooking, one could argue that his physical productivity in this task influences the process benefits of cooking. Thus the flow of meals produced would have a dual impact on process benefits, appearing both in V_2 and in V_3, as shown in equation (1). In general both production and consumption of tangible goods can influence the process benefits of activities.

29

succeeded in eliciting accurate evaluations of $V_1, \ldots, V_4$ (or the corresponding process benefits per hour, $V_1/t_1, \ldots, V_4/t_4$), this would clearly be the case.

In the example all goods are intermediate in nature, while only process benefits are truly final outputs for Crusoe. To take the example of food: food is acquired by working, it is transformed into meals by cooking, but it influences well-being only in conjunction with eating—keeping in mind that well-being can be influenced by any satisfaction obtained from the process of working or cooking. We would argue that all flows of goods, whether purchased in the market or produced outside it, have this property of "intermediateness," since it is only possible to produce or consume flows in conjunction with some definable time use. Therefore, if process benefits could be measured perfectly, they would reflect any welfare implications of goods flows.

Can similar statements be made about the welfare implications of stocks? In general, we believe that this is not so. To see why, suppose a stock, "health," is introduced into Crusoe's planning. Once such a stock is introduced into the model, the time allocation problem must become at least implicitly multi-period. For simplicity, suppose that Crusoe begins the current period with a degree of health H^0, and ends with H^1. The level of H^1 depends upon the time spent in eating and sleeping, and also upon the quantity of meals consumed and the amount of clothing worn:

(5) $$H^1 = g(H^0, t_3, t_4, x_c, x_m).$$

The interesting question is how H^0 and H^1 enter into Crusoe's utility function. One can certainly argue that the process benefits obtained from various activities depend upon current health, H^0; this would argue for the inclusion of H^0 in each of the functions $V_1, \ldots, V_4$. However, it also seems plausible that good health generates a beneficial influence which is independent of particular time uses. If so, we might include an additional function $V_H(H^0)$ in the definition of utility. This contribution to well-being would not be captured by the process benefits associated with Crusoe's various activities.

By the same reasoning, the role of H^1 in Crusoe's utility function could be independent of process benefits. It is certainly independent of process benefits in the current period, since H^1 gives the level of health which will prevail in the subsequent period. However, this would not be fatal to the notion that process benefits incorporate health effects—H would simply influence future rather than present process benefits. If health influences well-being simply by its existence apart from any time use, though, H^1 would have to be assigned a role in Crusoe's utility function separate from any particular activity.[22]

[22] The direct influence of stocks or contexts on well-being seems to be a quite pervasive phenomenon, and one that is unlikely to be well captured in measurements that relate to more complex economic and social systems. For example, the state of health, the level of skill and learning, the state of national security, one's satisfaction with the distribution of income, and one's relationship with spouses and children can all be thought of as representing states of the world that have a direct and important influence on well-being. Most of those states of existence do not produce well-being in conjunction with some particular activity, but rather they cast a pervasive influence over all activity. Alternatively, one could argue that they are not associated with specific activities at all, or at least not in any carefully structured way. Thus it seems unclear just how one should handle flows of psychological satisfactions arising out of various states of the world which clearly influence well-being but which are not closely associated with activities at all—e.g. the state of national security or the distribution of income.

The upshot is that a properly designed social accounting system would show a series of intermediate products and final products, but all the final products seem to be process benefits after the intermediate products are appropriately netted out, much as the National Income and Product Accounts show only the value of automobiles produced, not the value of fenders and engines, or of steel going into fenders and engines, or of iron ore going into steel. The only "final products" associated with various activities are the process benefits from the activities themselves, with the qualification that investment in various stocks may produce future well-being either directly or by affecting future process benefits. To the extent that stocks influence well-being directly, stock levels may also be viewed as a form of final product from the use of time. However, if a stock is only significant through its influence on process benefits, it too must be regarded as "intermediate" (though possibly over a long-time horizon).