TOWARDS A DEFINITION OF NON-MARKET ACTIVITIES*

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Recent attempts to measure value of household work and other non-market activities have been based on a simplistic interpretation of Opportunity Cost of Time Theory; this paper attempts to refine this and develop practical definitions from basic Utility Theory. First a distinction is made between economic and other activities, the former being the only ones subject to dollar-measurement; we recognize economic activities can occur outside the market and focus our analysis upon these latter. In the framework of Becker–Lancaster a Household-Production Function is posited which produces jointly such non-market economic activities—called indirect utility—and welfare or satisfaction—called utility. A criterion for identifying the indirect utility activities (Third-Person Criterion) is outlined, and related to time-use survey data.

Finally, four practical estimation methods are outlined: simple opportunity cost of time; gross replacement cost; individual function replacement cost; and the full production function approach. This latter, which includes evaluation of capital contributions, is deemed theoretically most valid but for present purposes least practical because of lack of data on domestic capital stock. The paper concludes that there exists both a theoretical basis for valuing non-market activities, and the necessary data to apply the formulas developed.

I. INTRODUCTION

One of the fundamental tenets of the social indicators movement states that the G.N.P. is an inadequate measure of societal well-being; on this there is widespread agreement. On the remedy to this inadequacy there is, however, considerable disagreement; some suggest replacing G.N.P. with entirely different measures, while others recommend modifications to G.N.P. in order to make *it* a better measure. Most of the "modifiers" accept that G.N.P. will always fall short of being a comprehensive measure and argue other, also partial, measures should be constructed and used alongside an improved G.N.P. It is in this latter spirit that the current paper proposes to deal with a very particular aspect of the problem—the value of certain activities *outside* the market, such as household work.

Much of what follows will perhaps be better understood if at the outset I delineate as precisely as possible the dimensions of the modification discussed here. Let me do this with respect to the simplified notions of Figure 1 and in terms of a number of specific propositions.

Proposition 1: Economic activity comprises only a part of human activity, but the part is important enough to merit the attention of social accountants.

Proposition 2: Market activities comprise only a part of economic activity.

Proposition 3: Non-market economic activities can, and hence should be measured in a way analogous to market activities.

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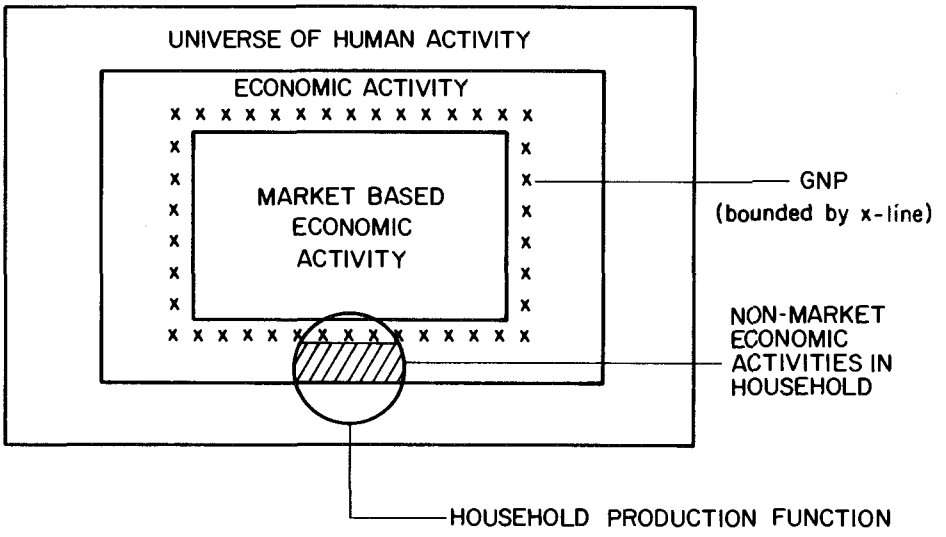


Figure 1

Proposition 4: Human activities outside the economic may be measured and valued, but not necessarily in the same fashion. That is, the different dimensions of human activity may each require different yardsticks for measurement.

Proposition 5: The activities of the household (in Figure 1: the Household Production Function), fall across the boundary between economic and other activities, hence measurement using an economic yardstick requires defining the location of this boundary.

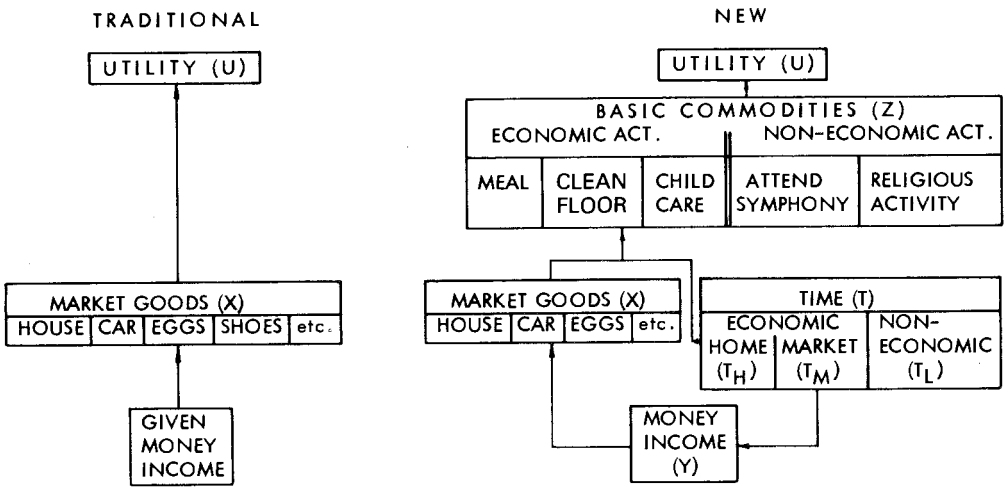
It is the purpose of this paper to attempt the delineation between economic and other activities and to elaborate the practicable methodologies of such a delineation, permitting an estimation of the economic value of household work consistent with all the above propositions.

Part II of the paper thus deals with the definition of economic activities in the context of the theory of a household production function, Part III develops more precise formulas for the estimation, and finally, Part IV summarizes the main points.

II. The Theory of the Household Production Function

A. *Development of the Main Concepts*

Traditionally economic theory has conceived of the household or family unit (a basic micro unit of decision-making in economic theory) as a maximizer of utility, which is said to be a function of the quantities of goods and services purchased on the market and consumed at home. This, plus the condition of



Algebraic Statement
Algebraically

Maximize Utility

$U = f(x_1, x_2 \ldots x_n)$

Subject to:

$\sum_{i=1}^{n} p_i x_i = \bar{Y}$ [Income Constraint]

Maximize Utility

$U = g(Z_1, Z_2, \ldots Z_n)$

Subject to:

$Z_i = h_i(x_1^i, x_2^i \ldots x_j^i, \ldots x_n^c, T_H^i)$ [Household Production Technology]

$Y = W \cdot T_M$ [Wage Transformation]

$T_M + T_H + T_L = T$ [Time Constraint]

$\sum_{i=1}^{n} p_i x_i = Y$ [Income Constraint]

Where

U	Utility
n	number of goods
x_i	quantity of good i
p_i	price of good i
$\bar{Y}$	Income level given exogenously
z_i	Basic Commodity i
x_j^i	good i used in "production" of basic commodity j
T_H^j	Home time used in "production" of basic commodity j
W	hourly wage
Y	Total income earned
T_M	Time in paid market work
T_L	Time in leisure activities
T	Total Available Time

Figure 2. Schematic Comparison of Traditional and New Theories of Household Behaviour

maximum feasible purchase determined by given prices and personal income (the budget constraint), yield the entire corpus of demand theory and household behaviour in consumption. (See left side of Figure 2.) Recently, an alternative view was set forth independently by Gary Becker [1] and Kelvin Lancaster [12].

Although the two works emphasize different aspects of household behaviour—Becker stresses the time element, Lancaster concentrates on the process of transforming physical "goods" into intangible "utility"—both criticize the traditional theory for oversimplifying the functional relationship between goods and utility, and both suggest an elaboration of this relationship.

Becker reintroduced[1] time into the analysis of the consumption of a household, noting that because of the large decline in the work week "the allocation and efficiency of non-working time may now be more important to economic welfare than that of working time."[2] Perhaps more importantly, however, he does this in the context of a *household-production function*, which states essentially that the household is a firm[3] whose outputs are "more basic commodities" (Z-goods)—such as seeing a play, caring for children, having meals—and whose inputs are the traditional market goods (x) and time (T). Behaviour by the household consists of maximizing the value of the Z-goods which are the only "things" that directly provide utility.

Lancaster's approach is only slightly different. He emphasizes that goods *per se* do not give utility but rather possess characteristics (Z) such as heat, transport, shelter, nutrition, etc., which in turn provide utility. He disregards the role of time-inputs to the process of producing utility by the household-firm. For our purposes, Lancaster's concepts may be viewed as a less comprehensive version of Becker's, since the latter contains all the implications of the former, plus the important statements on the use and value of time.

The above new views are summarized and contrasted with the traditional concepts of consumer behaviour in Figure 2, in which we see the major differences between the new and the old as being two in number. First, the new theory interjects a concept called basic commodities, such as the making of meals, watching TV, bathing children, etc., which directly yield benefits or utility by using some combination of goods. The second difference is the introduction of time as a component entering into the production of utility, a new element upon which an allocation decision must be made. Note however, that the factor time is allocated not only among the activities within the household-firm, but may also be sold on the market.

Three significant implications derive from this theoretical approach. First, it *provides a conceptual mode of dealing more directly with the sources of utility or well-being*, as opposed to the traditional method which is rendered helpless in the face of, for example non-homogeneous goods,[4] and often must turn to the catch-all explanation: "differences in taste". The new theory, however, by

[1]In assigning Becker credit for his seminal work on the theory of time value and allocation, one must recognize that the concept was certainly not new. It has been discussed at least as early as 1934 by Rosenstein-Rodan in "The Role of Time in Economic Theory", *Economica*, 1934, pp. 77–97. However one cannot deny Becker's significant pioneering contribution in providing a clear specification and analysis of the problem.

[2]Becker [1]. p. 493.

[3]This concept, too, is not new to Becker. Cairncross specifically points to it as an important gap in the theory [3]. Again, however, Becker goes far beyond, developing it in a thorough analytical fashion.

[4]Note that the literature attempting to deal with such problems as differences in quality—be it cross-section or over time—has had to deal with the characteristics of goods more directly, such as for cars: horsepower, roominess, etc. See, for example, Z. Griliches, "Hedonic Price Indexes for Automobiles: An Econometric Analysis of Quality Change", in NBER, *The Price Statistics of the Federal Government*, General Series #23, 1961.

considering explicitly the "technology" of producing utility-yielding commodities from goods (the function h_i), can often better explain "deviant" behaviour by references to changes in this technology. Thus, for example, the traditional theory, looking at the sharp decline in movie theatre attendance despite income growth over the period 1950–1970,[5] might explain this by changes in taste, i.e., people have come to prefer TV. The new approach, on the other hand, would say that the introduction of television has changed the technology of producing the basic commodity, entertainment (Z_e). Tastes are the element we as economists do not know about, but they enter only at the utility function level ($U = g(Z_1\, Z_2 \ldots)$) in effect determining how individuals "weight" the Z in combining them to maximize utility. The explanation is then not in the change of tastes, but in the substitution of TV for movies (two potential inputs in the entertainment production function $Z_e = h_e(x_1, x_2, \ldots T_1, T_2)$. This revision is in fact only valuable to the extent that a demand function for Z_e, and the "price" of that commodity can be observed. If it cannot be observed empirically, then either explanation may be satisfactory for prediction purposes, though clearly, thinking in the "basic commodities" mode would often give better explanations—as above.

Secondly, *the new theory integrates the factor market and goods market relations in a household*—i.e., the sale of labour services and the purchase of consumer goods. The old theory of consumer behaviour took as given the earned income (budget constraint), and dealt with the supply of labour time decision in a separate (and relatively snubbed) box called labour economics. The new theory, by including time in the analysis, reflects the true interdependence of the labour supply and the goods purchase decisions.

In addition, the inclusion of time further elaborates the process of "creating" well-being from goods. The importance of this should be obvious to the amateur chef: a meal can be made from ingredients x_1, x_2, x_k, and time; the traditional theory correctly implies that the meal's value is higher if we use higher-priced, top-quality filet mignon for a steak-tartare;[6] the new theory, unlike the traditional, explicitly recognizes that increasing time input to whip cream instead of using equally costly Redi-Whip in Strawberries Romanoff *further* increases the value of the meal.[7]

The third, and to the present most widely used implication, concerns the value of non-market time. Simply put, the *theory states that in equilibrium the value of time spent at home equals its "opportunity cost" elsewhere*, which clearly is its wage on the market. The rational household applying the optimization rule will use the factor "time" in the household to the point where its marginal product equals its price. Thus its own valuation of non-market time at the margin is revealed as being equal to its hourly market wage.

Valuing non-market time at the market wage has become quite commonplace in transportation studies, [2], [11], and has also been used to estimate a dollar value for non-market activities—leisure and household work [9], [15], [19].

[5]See Table 5.19, p. 110 in Statistics Canada, *Perspective Canada: A Compendium of Statistics*, Ottawa, 1974.

[6]As recommended by Craig Claiborne, *The New York Times Cook Book*, Harper and Row, N.Y., 1961, p. 89.

[7]I am indebted to H. J. Adler *et fils* for demonstrating this point to me.

While the first use of the opportunity cost concept is conceptually valid—some practical modification might be needed—I argue below (Part IIB) that the second is much more questionable, not only for practical, but indeed for theoretical reasons.

B. *Criticism of the "Becker–Lancaster" Theory*

Though the new theory has evoked some panegyrics on the part of economists,[8] the Z-goods approach does not lack critics. A recent sharply contrary statement by Pollak and Wachter[9] for example, addresses itself in effect to the first important implication, the shift of emphasis to basic commodities. They demonstrate that because of scale economies and joint production, little can be learned from this approach. Indeed, under such conditions it is much better to carry on the analysis in terms of the observable elements of markets (prices, goods quantities, wages) in the context of the old theory.

Pollak–Wachter contend, as does the present author in [8], that joint production of Z-goods is pervasive, because many "consumption" goods are used for the simultaneous production of several commodities. Thus, the stove is used to produce nutrition and gourmet pleasures, the house provides shelter, rest, and recreation and the car provides both transport and status. Even more significant is the jointness in the time input used to produce commodities, a phenomenon reflected in the ubiquitous plaint of mothers who can't but must do ten things at one time. In terms of the utility of a household, I suggest this jointness is best expressed in the notion that an hour of time in such household activities often produces both *direct and indirect utility*.[10]

The effect of such a reformulation of the household production function is—just as in any joint production situation—that the marginal cost of production of a given commodity cannot be determined independently of the level of production of all commodities, and one must again have resort to traditional analysis in terms of goods prices.[11] For present purposes however, the problem is less theoretical than empirical; an hour of time is still valued at w (wage), but in evaluating activities, we must be careful in defining time-inputs when joint production occurs.

Rather similar conclusions are derived by De Serpa [4]. He respecifies the model somewhat, positing that there is a minimum amount of time that a household must combine with each unit of a good x_i in producing a commodity, but the household may, and does, sometimes devote more time.[12] De Serpa

[8] A laudatory summary of the main points and implications is to be found in R. T. Michael, *The Effect of Education on Efficiency of Production*, NBER, 1972. See also Michael and Becker, [14].

[9] R. A. Pollak and M. L. Wachter, "The Relevance of the Household Production Function and Its Implications for the Allocation of Time". *Journal of Political Economy*, April 1975, pp. 255–77.

[10] A case in point is commuting time; an hour's time to get to and from work provides indirect utility inasmuch as transport is provided to allow money earnings, but it may also provide utility more directly as one reads during the trip, or, if lucky, relaxes on the drive along the river after a hectic day at work. See Hawrylyshyn [8], p. 19.

[11] Analytically this means that the marginal cost of producing commodity i is now a function not only of goods prices P_i and technology h_i, but also of the quantities produced for *all* Z_i.

[12] Thus in contrast to Becker's equation (Appendix A), De Serpa gives: $T_i \geq a_i x_i + T_{\min} = a_i x_i$. See [4], p. 830 and Appendix B.

concludes that in such a formulation, if the amount of time used exceeds the minimum "time prices have no effect upon the consumer's decision".[13] In his mathematics this is so because time is clearly not the constraining factor in the production process; it is "free" as manifested by its "excessive" use, or in linear programming parlance, it is a "slack" variable with zero price. This appears to overstate the case against the Becker–Lancaster theory, for the suggestion that the price of time no longer matters stems from the implicit view that the excess time is in some sense wasted.

If one considers, as do Pollak–Wachter and the present author, that this time is not wasted but produces some direct utility or satisfaction, the two modifications to the Becker–Lancaster theory can be considered equivalent. Thus, if one presumes the household is rational, it will be devoting more than the minimum required time to an activity only because it in fact obtains some satisfaction directly from that time, in addition to any indirect value that obtains from producing a commodity—that is, there occurs joint-production of indirect and direct utility. This, I contend, is true at the margin and not only for infra-marginal units, as is the case for consumer surplus or "worker" surplus.[14]

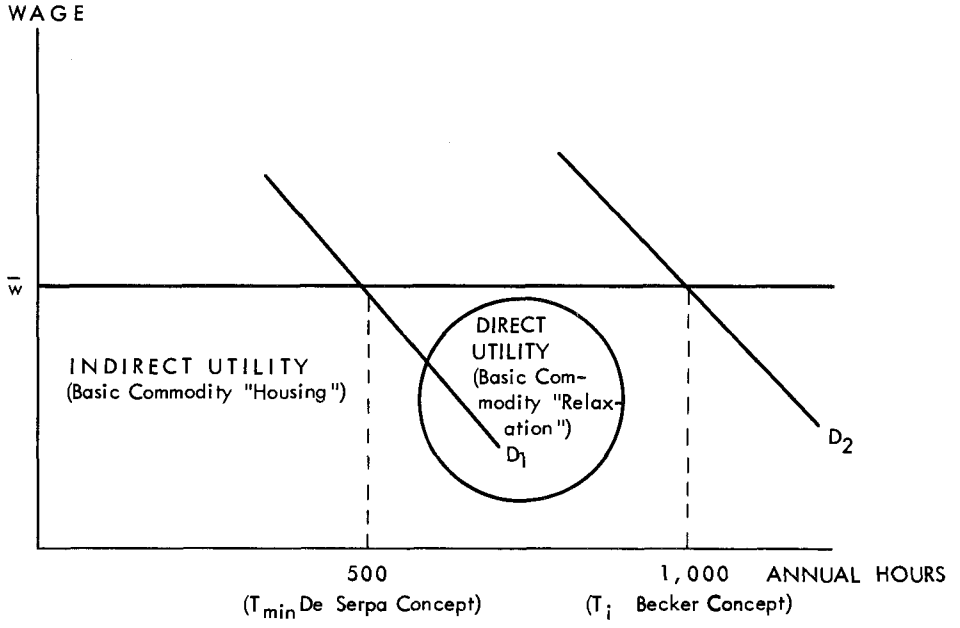
One can see the meaning of these criticisms and their similarity in an example taken from Hawrylyshyn [9], p. 36. A small-town university professor with a penchant for old stone farm houses devotes 1,000 hours in a year to the task of restoring an old farm house, whereas the minimum time required to do the job—combining the time with goods such as nails, saw, lumber, paint, etc., to produce a basic commodity called housing—is 500 hours. This is reflected in Figure 3 by the demand function for time D_2. D_1 shows the case of a colleague who much prefers R^2's to T-squares and whose only benefit from such an activity would be the housing produced. If we assume for simplicity that both our subjects are as productive in this activity as a carpenter and all earn a wage $\bar{w}$, in our (simplified) example, the person with the D_1 demand would be indifferent between doing the job himself and hiring a carpenter, or if he had positive direct utility for R^2's he would undoubtedly hire a carpenter.

In De Serpa's terms, the excess 500 hours suggests that the wage price of time is not pertinent. However, if we admit that the 1,000 hours of activity produce utility indirectly (housing) and simultaneously produce utility directly, for our professor derives mental relaxation and replenishment from the activity, then De Serpa's strong conclusion that time price is not pertinent to the allocation decision does not hold. If the professor is rational, such an allocation of time reveals that his valuation of direct and indirect utility of the last hour (the 1,000th) equals the opportunity cost or wage. If, as national accountants must, one disregards the consumer's surplus portion above $\bar{w}$ and multiplies marginal value estimates (market prices) by total quantities, one can readily estimate a dollar value for each of the two components: housing produced $\simeq 500 \times \bar{w}$ (excluding materials), and relaxation produced $\simeq 500 \times \bar{w}$, as shown in Figure 3 below.[15]

[13]Ibid., p. 843.

[14]I recognize that the production of direct utility—or consumption benefits—may also occur in market activities. However, in the market case it is likely that such consumption benefits accrue only to infra-marginal units, and therefore the marginal-product wage reflects only the indirect utility value.

[15]We must continue to assume neoclassical equilibrium is attained.



D_1 = Time demand (allocated for activity i if activity yields only indirect benefit (restored limestone house) and no direct pleasure.)

D_2 = Time demanded (allocated for activity i if activity yields direct utility in addition to indirect benefit).

Figure 3. Direct and Indirect Utility of Time. Do-it-Yourself Activity (i)

The above example serves to illustrate the view that the opportunity cost of time equilibrium is correct only in the case where we mean by utility of non-market activity the total utility including both direct and indirect components. Clearly, a rational individual will attempt to reach the "optimum" point where his value of the last hour of market-work (the wage rate) equals his valuation of the marginal hour of non-market time. But should economists or national income accountants attempt to evaluate the latter? Does this not include the "psychic income" that we so assiduously avoid in our accounting? If we put a dollar figure on this in evaluating household work by women, what we are estimating is the economic value of a housewife, in contradistinction to *the value of economic services provided by the housewife*. By the latter I mean those services which do not *per se* yield utility, but rather produce an indirect benefit[16] (which then gives satisfaction to the household, like a meal or a clean house), and exclude explicitly elements of household behaviour which directly result in satisfaction or well-being. I contend that the direct utility components are not and should not be subject to dollar valuation, and that any dollar valuation of non-market activities should be limited to the indirect utility components. Thus, "results" of household behaviour which are themselves utility, such as parental pride, cultural and aesthetic satisfaction, should be explicitly excluded from evaluation.

[16]Pollak–Wachter [16] stress the danger of confusing utility and Z-goods which only indirectly provide utility, pp. 28–29.

How can one identify economic services (or Z activities)? I suggest the following criterion: *An economic service (or Z activity) is one which may be done by someone other than the person benefiting therefrom.* The question can be asked; can one hire labour to achieve the same results? If yes, then the activity is one which produces Z-goods; if not, the activity is a direct utility one and cannot be measured in any meaningful way. In effect, this criterion is exactly the same as that always used by national income accounts (namely the market criterion) simply extended to its full logical possibilities.

Clearly then, the dollar value that economists might justifiably place on the contribution of a wife and mother to the household must be limited to the chores and tasks of household operation that the very wealthy have usually purchased on the market. Child care values must exclude the satisfactions of developing an effective human being, but may include the teaching of accepted social mores; spouses' "services" would include the meals and clean shirts, but exclude personal affection and companionship. To respond immediately to the inevitable jokes about market replaceability for conjugal relations, let it be said that of course one can find a market alternative price for sex in dollar terms, but this has little relation to, and does not change the fact that the price of love is, well, love.

C. *Extension of the Theory to a Full Production Function Approach*

The literature on household production has taken a view that is quite different from the conventional one of production function theory. The latter term usually connotes a relationship between output on the one hand and factors of production on the other, such as labour, capital, land (in the Leontief system where output is defined as gross value, factors include intermediate inputs). In contrast, Becker's function distinguishes only labour (his time inputs) and all goods. I suggest here that it is more correct and fruitful to view the household-firm as having in fact a production function of the traditional form:

$FZ_i = F(L_i, K_i, R_i,)$ where FZ_i = output of basic commodity i
L_i = labour time input to production of i
K_i = capital stock used in production of i
R_i = intermediate inputs, or raw materials used in i

The problem of joint production still remains, for clearly a unit of capital or material input is very frequently an input into the production of several different i's. However, such a framework readily lends itself to application of activity analysis concepts, allowing one to gain a great deal more insight into the operation of this peculiar "firm". Simplifying somewhat, one can say that activity analysis is merely a consideration of several possible production processes of each Z_i (or globally several possible input-output structures) and either a minimization of costs given the input prices or a maximization of output given resource limits.[17]

[17]Pollak-Wachter in fact clearly allude to activity analysis when they speak of minimizing the cost of producing a commodity vector Z "subject to $(X, Z) \simeq 0$ where Ω is the production set whose elements are technically feasible input-output vectors" [16]. Elaboration of activity analysis concepts is to be found in R. Dorfman, P. Samuelson and R. Solow, *Linear Programming and Economic Analysis*, Chapter 12.

It is not the purpose of this paper to work out the conventional analytics for such a production function; I wish rather to indicate how the interesting empirical questions about household production can be better answered using such a framework.

Information available in time-use surveys and consumer expenditure surveys allow the construction of the feasible activity vectors: for each micro-unit in any survey, the ex-post "optimal" choice of activity structure is revealed; but fortunately people's tastes vary, hence different units with similar constraints will probably reveal alternative structures. Thus for example one can observe the variation in time inputs to each of the i activities, and thereby arrive at an estimate of De Serpa's minimum under given constraints. As I have argued above, the excess of time spent over this minimum corresponds to the production of direct utility, and if we seek measures in dollar terms, the minimum may be the appropriate measure.

Another very important advantage of this approach is the separate consideration of capital goods, which allows ready derivation of demand for household capital or consumer durables as they are known. This picture of the household also clearly relates the "flow" of current inputs (labour and intermediate goods) to the *available level* of capital stock, a cause-effect relation which is explored in the recent "related goods" or "conditional demand functions" literature in demand theory.[18] This framework is consistent with the notion of conditional demand functions which, as Pollak states, "are directly relevant to the analysis of consumer behaviour in the short run, when fixed commitments prevent instantaneous adjustment to the long run equilibrium."[19]

Perhaps the most serious problem with this global framework is the practical one familiar to input-output specialists—the classification of activities. The resolution to that problem lies in the true and *not* trite phrase: it depends on the questions you will be asking of the data. In the next section, I will consider the specific question of valuation in dollar terms of "household work", i.e., of GNP-like extensions into productive activities outside the market.

III. Methodological Implications for Value of Non-market Work

Before I elaborate the implications of the Household Production Function for evaluation of household work, it is first necessary to define clearly what one means by household work, or household services.

A. *A Definition of Productive Non-market Activities*

Let me classify household activities within the 24-hour day into four basic groups or types of activities: biological needs, market activities, productive non-market activities, and leisure activities as shown in Figure 4. "Productive" in III is used to suggest activities that are not done on the market for pay, but are

[18]See for example a recent contribution by C. Lloyd, "Durables and Demand", February 1973, Working Paper, University of Iowa, Department of Economics.

[19]Robert D. Pollak, "Conditional Demand Functions and Consumption Theory", *Quarterly Journal of Economics*, February 1969, pp. 60-78.

similar to these in that they produce indirect utility, in the form of services; IV on the other hand, produces *only* direct utility.

I	II	III	IV
Biological Needs	Market Activities	"Productive" Non-market Activities	Leisure–Pleasure Activities
—sleep	—work for	—housework	—*dolce farniente*
—personal care	pay	—child care	—home entertainment
		—study	—public entertainment
		—volunteer time	—outdoor recreation

Figure 4

The element of present interest is only one part of III, for which I suggest the following definition:

> *Housework* consists of non-market activities which produce goods or services for the members of the household not desired in and of themselves, but rather for the utility which they yield.

Let me call these *economic household services* and identify them by the fact that the provision of these services may conceivably originate in the market. In a complete inventory of activities by households, these are distinguishable from Type IV activities (and student time under III) by the fact that the latter can only be performed by the household in question, whereas the former may be done by someone else, hence the criterion suggested earlier: direct utility in the household can be produced by a member of the household; indirect utility may be produced by a *third person* (e.g., purchased on the market). Economic services are then defined conceptually as those producing indirect utility, and identified in practice by reference to the criterion: is it conceivable to have a third person (e.g., market) do it?

The "third-person" criterion may be applied to the framework existing in time-use studies which have developed a standardized classification described in a well-known international time-use study (see Szalai (ed.), *The Use of Time* [18]).

TABLE 1

AGGREGATION OF SZALAI TIME USE CLASSIFICATION

Aggregate Grouping (Figure 4)	Classification Numbers as in *The Use of Time**
I.—Biological needs	40 to 49
II.—Market activities	00 to 09
III.—"Productive" non-market activities	
Housework	10 to 39
Study	50 to 59
Social organizations	60 to 69
IV.—Leisure-pleasure activities	70 to 99

*For this classification, I have used the 99 activities and corresponding codes as described in [18], p. 561.

For the present purpose, I aggregate these into the four groups of Figure 4 and isolate in Group III the housework component as shown in Table 1. Thus, we not only have a conceptual definition of housework that rests on extension of accepted theoretical grounds (utility theory in economics) but a practicable definition which can rely upon existing data sources.

Practical problems of empirical nature remain, for there are surely difficulties in obtaining accurate observations of human behaviour which is in practice far less clear-cut than the classification in reference [18] suggests. Further, many "gray zones" remain in the indicative aggregation of Table 1. As only one example, consider the case of "restaurant meals" (coded as number 44 in [18]) which is partly a Type I activity (biological needs) and partly a Type IV (leisure-pleasure).[20] Nevertheless, it should be clear that a viable starting point is provided for discussion purposes.

In the rest of this paper I adopt the definition of non-market activities and their separate components as given by the classification of Group III Figure 4. Let me now go on to discuss the problem of estimating the value of the economic services provided by such activities, deriving specific formulas from the theoretical framework discussed in Section II, and focusing upon household work.

B. *Methodologies of Estimation and Evaluation*

A simple unqualified interpretation of the "new" theories of demand and household production yields the marginal equilibrium condition that: the value of a marginal hour of time in each activity equals its market price, that is the wage of labour. Such an approach to the question has in fact been taken by several studies attempting to estimate the value of household work, as described in a survey by the author [9].

Let HW = dollar value of household work, T_i = time spent in household work activity i, n = number of household work activities, and W = opportunity cost of time (market wage) of individual doing household work. Then, the basic formula is:

$$HW = W\left(\sum_{i=1}^{n} T_i\right). \tag{1}$$

This has been used by Nordhaus–Tobin, Sirageldin, Weinrobe, and the Japanese NEW committee in their estimates of household work (see [9]). We shall henceforth refer to this method as WOCT (wage equals opportunity cost of time) method.

Criticism of the above naive Becker–Lancaster Model (WOCT) centers on the occurrence of joint production in the household-firm, which implies that the value of the marginal hour in non-market activities equated to the value in the market includes more than the purely economic, non-psychic, non-utility elements that have been defined in IIIA as comprehending household work.[21] This has three possible implications for the household work estimation formula.

[20] Another significant one is my rather arbitrary inclusion of all activities pertaining to social organizations under III; surely some of these would fall under IV while for others disagreement among reasonable people would always remain.

[21] This supports the view that WOCT imparts an upward bias to the estimation of household work as I have discussed in [9].

First, one may simply say the value of time (W) is less than the market wage by some amount which correctly nets out the direct utility component, or one may make this adjustment by netting out some portion of the time spent that may be attributed to direct utility. In the latter solution, the correct time spent would be akin to De Serpa's "minimum necessary time" (which bears an uncanny resemblance to Marx's socially necessary labour time) and in practice might for example be approximated by the time spent by women who are also engaged on the market and must thus be "more efficient" in their housework.[22] As there does not appear to exist an obvious practical procedure to determine what proportion of the wage is attributable to direct utility, it would seem better to adjust equation (1) by replacing actual time spent with the minimum required time. Thus, if we let TM_i = Min. Necessary Time to Perform Activity i, the modifications implied by the joint-production and minimum time criticisms of the naive model give rise to an evaluation formula as follows:

$$HW = W\left(\sum_{i=1}^{n} TM_i\right). \tag{2}$$

A *second* implication results not simply in a modification of the WOCT method but gives rise to two entirely different methods. The minimum time needed may be manifested by the performance of similar activities on the market, where we assume the individual does not derive any direct utility, and hence has absolutely no utilitarian reason to expend extra time.[23]

If D = the market cost of hiring domestic service to perform all the required household work, then the gross "replacement cost" of all household work services in question is given by:

$$HW = D. \tag{3}$$

I refer to this as the MAHC (Market Alternative = Housekeeper Cost) method.

One might argue that replacement can occur by hiring a number of market agents to perform the different household work services: a cook, a gardener, a launderer, a cleaner, a baby sitter, a tutor, etc. In such an event, letting D_i = cost of service i and m = number of market agents or specific services hired, the formula would be:

$$HW = \sum_{i=1}^{m} D_i. \tag{4}$$

A *third* approach results in a hybrid-formula which relies on the market only to determine the appropriate wage to be used, and refers to actual time spent in the household. Thus, if i denotes component activities of household work (as in Table 1), T_i = time spent on activity i, W_i = market wage for service equivalent to i (e.g., cook, cleaner, nursemaid, etc.), then:

$$HW = \sum_{i=1}^{n} T_i W_i. \tag{5}$$

[22]At the least working women's time-use might serve as a lower bound estimate.
[23]See footnote 14.

I refer to this as the MAIFC (Market Alternative—Individual Function Cost) method. Note that (5) avoids the joint-production criticism of WOCT by using not the wage of the individual household member to value the time-use, but rather the market-equivalent wage for specific services. Thus, for a housewife whose market occupation as a hairdresser would earn her \$10/hour, one would evaluate an hour of cooking at \$4/hour—the market wages for a cook.

However, a serious conceptual problem arises with MAIFC when one considers the organizational complexities encountered in purchasing all the services individually on the market and any scale economies that exist if one person performs all the services. This argues for care in applying MAIFC and may in fact make MAHC appear more accurate, inasmuch as it largely avoids these two problems.

A further difficulty—whether the time-spent figures used should be actual (T_i) or estimates of minimum necessary time (TM_i)—may be considered in the same way as above for (2), resulting in a slight modification of the MAIFC formula:

$$HW = \sum_{i=1}^{n} TM_i \cdot W_i. \tag{6}$$

Though one normally does not think it necessary to correct time spent in paid employment, the jointness of utility production, and other sociological factors should lead one to expect excessive time use to be greater in households, requiring at the very least more care with actual time-use data.[24]

In summary then, the direct–indirect utility criticism of the naive opportunity-cost model suggests two important alterations in the formula evaluating *HW*. First, one should seek a time-use figure that reflects some technical minimum to produce the economic services in question, and secondly, one may resort to the market not to find the opportunity cost of the person performing the household work, but to find the market-value (= replacement cost) of the services performed.

D. *The Full-Production Function Value of Household Work*

If one treats the household as a firm in theory, then one might also do so for national income accounting. Thus the value of output in this sector might be estimated as in other sectors in two ways—the output or expenditures approach, or the value of factor inputs. The former is rendered impossible by the fact that no market operations take place to manifest this value directly. One must turn to the factor-input estimation of value-added, as is done currently for government sectors in the System of National Accounts (SNA). Conceptually, let me define the value-added here, analogously to the market firm case as:

$$HVA = WT + RK \tag{7}$$

[24] I have discussed this in [9], Section IV.5.

where

HVA = Value-Added in Household Production
WT = Value of Labour Services
RK = Value of Capital Services.[25]

Let us digress briefly and go one step further, as is done by input-output flow tables for firms. If one adds the value of intermediate or raw material inputs (HI) to the value-added, one arrives at the value of gross output (HX):

$$HX = HI + HVA \tag{8}$$

Though the present paper does not pursue the implications of this valuation, it does open up yet a fourth alternative to the three already mentioned (WOCT, MAHC, MAIFC). If we suppose that the household technology (the h_i functions in Figure 2) is described by fixed coefficients of production for intermediate inputs and for factor inputs, it may be possible to infer from HI the value of HVA.

Consider the production of one household service only, washing floors. Either from observation of marketed operations (which do exist) or from experimental survey data, we may be able to construct a production-vector à la Leontief showing the amount of all raw materials, labour, and capital services needed to "produce" 1,000 square feet of washed floors. This permits the evaluation of technical-coefficients as for input-output tables. The non-market operations that take place in large number in the economy do not yield any observable facts on the input of the labour factor to washing floors (WT_{floors}) *but* the capital stock (KD) and the intermediate inputs (HI_{floors}) are necessarily purchased on the market, where one may observe their values and amounts. If we assume (1) such technical coefficients can be constructed, (2) domestic capital stock usage for household work (RK) can be distinguished from its use for direct utility production, and (3) we are able to obtain the data on purchases of household-production-related goods as distinct from true consumption purchases, we can then impute the total gross output (HX) and the labour-factor inputs (WT) from the observed values of HI and KD.

There are of course serious difficulties, the nature of which I shall briefly indicate. Consider the RK component, the value added emanating from the capital used in household production. Clearly this value is buried somewhere in the midst of the consumption values in the national accounts. There is first a problem of distinguishing between intermediate inputs, capital investment and direct final consumption of households, as discussed by the author in [8]. Even if one is able to resolve the problem of identifying capital goods and properly count them as investment rather than consumption, the problem of joint-production still remains, for not all of the capital stock is used to produce the economic services we attempt to evaluate. Some are used only for direct utility (camera equipment?), while others are used for both (the stove and cookware make bacon and eggs on Wednesday, and eggs benedict on Sunday). Though estimates have been made in

[25] I consider only a two-factor production system; rental payments may be subsumed under value of capital services. Note also that equation (7) makes the usual neoclassical assumption of zero-excess-profit, or Euler's theorem, which states that the sum of factor payments fully exhaust the value of the output.

a very crude way of the benefits yielded by consumer durables (Nordhaus–Tobin, Japanese NEW; as described by the author in [8]) these estimates encompass *all* consumer durables and are thus far greater than the value *RK* we seek in this context. Though conceptually more correct, the Full-Production approach is far too intractable in practice. As indicated earlier the problem of jointness may be evaded in the case of the labour input by having recourse to potential (and existing) market alternatives, but for the capital inputs, which are as much confounded by joint production, it would appear far more difficult to look at market-alternatives. That is, hiring housekeepers is likely, renting or leasing all one's durable goods is far less so.[26]

The labour-factor inputs are far easier to estimate in practice and have been discussed earlier in connection with the other approaches. Indeed, that is the *only* component which the other approaches discussed above consider! Such a limited view of household services comprising only the labour component is not a necessary conclusion to be drawn from the theory of the household production function, but clearly this has been the approach taken so far. It is interesting to note that this is very similar to the treatment accorded the government sector in the accounts. One should not conclude from this that a complete factor-payments approach must be taken in valuation, for surely the partial estimate of labour value is of great interest by itself. However, one should recognize most explicitly that this is a *partial* estimate of the value added in this sector.

Partly in conformance with earlier thought on household service value which has developed along the partial, labour-input lines, but more importantly because of the intractable problems of estimating the *RK* component, it seems reasonable for the present to maintain this limitation in the measurement of household work. Viewed in this manner, *HW* in the first 6 formulas above is exactly equal to the *WT* portion of equation 7. The full production function approach does not have anything different to say on the *WT* portion than has already been outlined. It does nevertheless serve to locate more precisely the meaning of *HW* in conventional economic theory and national income accounting concepts.

IV. Summary

To summarize the preceding discussion let me clarify the definition of the elements I am attempting to measure.

> *Household Work* is the value added by the factor labour in the production of economic services within the household sector.
> *Economic Household Services* are those activities that either can now be purchased on the market by the households in question, or that might be purchasable on the market under some reasonably conceivable arrangement of market institutions.

[26]This is not to deny the possibility of some such arrangements—car leasing—but this may be far too limited to provide any useful values for estimation. More important, there is a far greater number of elements to consider here, making at the least for a considerably more complex task in practice. There is, of course, an alternative in the market for all of these components, namely institutional provision of such services in nursing homes, prisons, etc; this is in fact the basis of an *HW* estimate made by Colin Clark for Britain. (See [9]).

I have shown that currently existing classifications of time-use applied in practical surveys provide a tractable means of delineating which activities of the household are to be considered as producing economic services, and have suggested the potential use of a "minimum-necessary-time" value as a possible resolution of the joint-production problem.

Recent theoretical considerations of the household as a producing unit provide the accountant with a most suitable framework for estimation, and indeed may be used to derive very specific methodologies for the estimation of *HW*. There are in fact three practicable methodologies one might use:

—Wage Equals Opportunity Cost of Time (WOCT—Equations 1, 2
—Market Alternative—Housekeeper Cost (MAHC)—Equations 3, 4
—Market Alternative—Individual Function Costs (MAIFC)—Equations 5,6.

These approaches indicate clearly the basic data requirements for an estimation:

(1) data on time use for activities delineated as producing economic services, by different family categories (size of family, market-status of wife, etc.);

(2) data on hourly wages for women and men in the aggregate, and for specific occupations in the market providing similar services to those in fact produced in the household;

(3) data on costs of housekeepers.

Though the basic approaches are more or less clearly laid out, some serious problems remain. On the conceptual plane, there remains the problem of joint production of direct and indirect utility, which in essence implies the actual time use data for the economic services activities overestimate the value attributable to the services provided. The "minimum-necessary-time" value may be a solution to this; however, it is not clear how one is to find this figure. Further thought along this line is warranted. Data on time-use, though available from a few surveys, is relatively incomplete—there are only three Canadian surveys. Data on costs of housekeepers are quite unreliable as this labour market is insufficiently developed to permit regular statistical monitoring.

Despite these difficulties, it is by no means impossible nor even very difficult to undertake some estimates of dollar value of such non-market activities, and thereby take a long step towards extending GNP-like measures to encompass *all* Economic Activity. Though this will not re-enthrone GNP in its place of supremacy among social indicators, it will perhaps improve the social indicators picture by adding a useful element to the SNA which serves a function GNP does not. Such an "improvement" in SNA however, by no means precludes other measures being added to the social indicators inventory; indeed, the discussion in this paper emphasizes the need to locate the limits of *economic* measurement, which view necessarily implies there exist phenomena outside these limits that are not subject to economic measurement.

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