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ABSTRACT

In general, recipients will not be indifferent between cash and in-kind transfers of equal market value. Using cash income as the basis of measurement, this paper presents a procedure to transform the in-kind program cost attributable to a recipient into benefit equivalent (real income equivalent) cash transfer units.

Apart from the size, age composition, urban or rural location, and race of the recipient unit, the ratio of the recipient's evaluation of the in-kind programs and their cost (the "benefit weight") appears to depend on the recipient's disposable cash income and the particular combination of in-kind transfers applicable to him as well as the specific characteristics of these programs (like size of the implied price subsidy, possible maximum or minimum restrictions on the quantities he can or must consume under the program, program induced changes in the availability of commodities to the recipient).

Conceptually "benefit weights" may range from negative values to values in excess of unity. Unless the empirical implementation of our evaluation procedure results in "benefit weights" close to unity for a decisive majority of recipient groups, the redistributive effect of in-kind transfers as measured by others on the basis of program market values or program expenditures will be misleading. Furthermore, recipients of different program bundles of the same market value will experience different real income transfers. The same is true for recipients of the same program bundles but different levels of disposable cash income. Another implication

of non-unitary "benefit weights" is that the benefit reduction rates or--in the context of some integrated negative income tax scheme--the effective tax rates faced by recipients depend upon the specific form and mix of programs in which they participate as well as their other socio-economic characteristics.

I. Introduction

The simplest and most frequently used method to measure the benefits of transfer programs is to add the market (dollar) value of the income or in-kind transfer to the recipients' pre-transfer income.[1] There are three major objections to this procedure.

(a) Unless interest is focussed on small programs or small program changes, the general equilibrium interdependency may cause changes in relative factor and commodity prices and, thus, pre-transfer incomes. Though this problem cannot be dismissed (and has received increasing attention in the tax incidence literature), we will ignore it in the context of this paper by assuming that, in the relevant range, changes in the demand and output structure do not influence relative prices and that transfer programs do not affect individual factor supplies.[2]

Of course, the assumption that factor supplies are independent of transfers cannot be sustained. The incentive effects caused by the high benefit reduction rates as income rises are substantial, especially since many programs are cumulative (e.g., certain cash transfers lead to automatic eligibility for a whole bundle of in-kind benefits). Although this objection is important for the choice of a proper counterfactual when the incidence of the government sector is under consideration, it loses its restrictiveness, to a large degree, in the context of this paper, where equivalent cash transfers will constitute the counterfactual to in-kind programs.

(b) Benefits of transfer programs might accrue not only to recipients but to other groups as well. If recipient characteristics create production or consumption externalities, which are affected by transfer programs, the

well-being of the whole, or part, of the population may be influenced in turn. If the political process is Pareto efficient in the special sense that the transfer programs make nobody worse off, the market value of the program is a lower limit estimate of total benefits to those who bear the program cost.[3] That is, the market value of the programs may be as appropriate a measure of benefits to non-recipients as to recipients. However, this objection will not be treated here.

(c) The objection to be dealt with is that recipients may not evaluate transfer benefits as equal to their market value (taxpayer cost). This is because recipients do not "purchase" these transfers in the market place, nor do they usually have any re-selling options (and even if they did, they would face below market prices or incur transactions costs), nor are the quantities transferred generally less than or equal to what recipients would have consumed had there been costless reselling opportunities.

Given that relative prices and individual factor supplies remain unaffected, welfare theory tells us that recipients are at least as well, but very likely are better-off, under direct income transfers than under equal cost in-kind transfer programs.[4] This means that a recipient's evaluation of the transfers he receives differs according to the form in which they are given. In this paper a measure of the evaluation by recipients of the various transfer programs is developed, which measure takes into account the form of the transfer.

II. Benefit Weights for Transfer Programs

(A) The Conceptual Issue

For all practical purposes, income (and/or wealth) seems to be the only manageable benefit measure. Accepting income as a measure of welfare

means that recipient benefits of direct income subsidies equal their cash value, but that for measurement purposes, in-kind transfer expenditures will need to be transformed by appropriate benefit weights into the same benefit units. To express in-kind benefits in income equivalent units, that cash transfer has to be derived which will leave recipients as well-off, if the in-kind programs were to be discontinued and a cash transfer simultaneously substituted.[5]

The benefit weight to be applied to each transfer received by each recipient will be the ratio of that recipient's evaluation of his benefits (the welfare equivalent cash transfer) and the market value of that transfer (the taxpayer cost). In light of the above mentioned theorem, the benefit weight is at most equal to, but very likely less than, unity.

There may be two exceptions to this statement. If recipients are unable to purchase transfer commodities at market prices due to discrimination or other recipient-specific market imperfections and if the in-kind program improves the availability of these goods to recipients, the benefit weights may exceed unity. The reason that this occurs is that the pre-subsidy price faced by recipients may be substantially lower under the in-kind program than under a cash transfer program. Put differently, the effective commodity subsidy rate is considerably higher than the nominal subsidy rate, such that the welfare equivalent cash transfer exceeds the program expenditures. A similar complication arises if program expenditures (taxpayer cost) diverge from the market value of the in-kind transfer. Again nominal and effective subsidy rates differ. Until stated otherwise, market values are assumed equal to program expenditures and independent of the form in which the transfer is given.

With these qualifications, the benefit weight reaches its upper limit (unity) for direct income transfers. Under certain conditions the benefit weight may equal unity for in-kind program expenditures as well. For simplicity let us assume that a recipient consumes only two goods, one of them being subject to an in-kind program. Then the benefit weight is unity, if:

(1) the other commodity is a perfect substitute for the subsidized good (that is, the indifference curves between the program commodity and the other good are linear), irrespective of whether there are restrictions on the individual consumption of the subsidized commodity or not;[6]

(2) the indifference curves between the program commodity and the other good are rectangular and the program imposes no restrictions on the consumption of the subsidized commodity;

(3) the program restricts the consumption of the subsidized good to the quantity the recipient would have consumed had he received the market value of the implied subsidy as cash transfer;

(4) the program restricts consumption of the subsidized commodity to less than the quantity just mentioned, but the recipient is free to purchase additional units at market prices and does so, such that the subsidy applies to infra-marginal units only.

Furthermore, if both commodities are subject to an in-kind program, the benefit weight is unity, if:

(5) both goods are subsidized at the same rate and consumption restrictions are absent.[7]

A sufficient condition for the lower limit of the benefit weight to be larger than zero is the absence of restrictions on the quantities

a recipient may purchase at the subsidized price. Even if there are consumption restrictions, the benefit weights are certain to be non-negative, if recipients are free to opt out of in-kind programs. In the absence of this option negative benefit weights are theoretically possible. They occur if the consumption restrictions force the recipient to a consumption point which lies outside his pre-transfer budget constraint but below his pre-transfer indifference curve surface.[8]

Deriving a system of benefit weights for each transfer for each recipient poses several conceptual problems:

(a) Since the welfare equivalent cash transfer has to be determined, the use of indifference maps and, thus, utility functions cannot be avoided. Since only the shape of the indifference surfaces matters, not their utility index, we only need to choose among classes of utility functions, where a class is defined as a set of utility functions which can be derived from one another by monotonic transformations. But, unless the choice among classes of utility functions is shown to have little influence on the derived benefit weights, or a certain class of utility functions turns out to be particularly suitable, an arbitrary element is thereby introduced.

For practical purposes, the utility function and its parameters have to be assumed identical for all recipients. A feasible exception to this rule may be to calculate different parameter estimates for recipient units which differ in location (e.g., central city, urban, rural), size, age composition and race;

(b) Even if utility functions are assumed to be the same for all recipients, the welfare weight for a program is, in general, dependent

on the recipient's income level. Utility functions which imply homothetic indifference curve systems would make the welfare weight invariant with respect to income if all in-kind programs consisted of outright price subsidization without any restrictions on the amounts consumed by recipients. If recipients are restricted to consume the same amount of the subsidized good the welfare weight invariance requires constant marginal utilities for all goods except the commodity subject to the consumption restriction. Clearly, there is no utility function which could guarantee this invariance for a bundle of programs with different characteristics. This means that recipients have to be disaggregated into income classes to compute the appropriate benefit weights;

(c) Since different groups of recipients are subject to different bundles of in-kind programs, the simplest procedure would be to derive the benefit weight of each program separately and compute the total benefits for each group as the weighted sum of the program expenditures applicable to this group. In addition, this method would simplify the task of determining the effect of program changes and program additions. Unfortunately, such a procedure is inadmissible, since the benefit weight of any one program depends on what other transfers are received by the group.

Computing the benefit weights of every program for each recipient income class on the basis of the assumption that either no other programs are in effect, or that the other programs that do exist may under-or overstate the aggregate recipient benefits from the existing bundle of transfer programs.[9] This means that for every recipient group within each recipient income class which is subjected to different bundles of programs a separate

benefit weight for this particular bundle has to be derived. And for each program change the same procedure has to be followed for the new "bundles", since the change will affect the benefit weight attached to the old bundle components.[10] Thus, the recipient benefits accruing to each recipient group will need to be calculated simultaneously for all transfer programs.[11]

(B) Deriving the Benefit Weights

Formally, the computation of the benefit weights would proceed as follows:

All recipient families e, e = 1, . . ., M, are assumed to have the same utility function,[12] with the vector $X_e = [X_{1e}, \ldots, X_{Ne}]$ as argument, where X_{ie}, i = 1, . . ., N, e = 1, . . ., M, is the amount of commodity i consumed by recipient e, i.e.,

$$(1) \quad U_e = U[X_e] \qquad e = 1, \ldots, M$$

Each recipient e has a certain actual net income, excluding direct taxes paid and including cash transfers received, y_e, e = 1, . . ., M, to be spent on the N commodities. And each recipient is confronted by a vector of market prices and some bundle of in-kind programs. These programs may influence the recipient's consumption decisions in two ways:

(a) They will reduce the prices of certain commodities to the recipient. If $p = [p_1, \ldots, p_N]$ is the (constant) vector of market prices in the absence of in-kind programs--assumed to be the same for all recipients[13]--a recipient e faces a price vector $p(1-S_e) = [p_1(1 - S_{1e}), \ldots, p_N(1 - S_{Ne})]$, where S_{ie} 100 is the effective percentage price

reduction for commodity i, i - 1, . . ., N, to recipient e, e = 1, . . ., M, and $1 \geq S_{ie} \geq 0$.[14] Which elements of the subsidy vector S_e are nonzero depends on what programs recipient e participates in;

(b) They might prescribe precipient e's consumption level of certain goods to which in-kind programs apply. Consequently, for each recipient e there exists some subset K_e of the N goods (K_e may be the null-set for all or some e, e = 1, . . ., M) for which $X_{Ke} = X'_{Ke} = [X'_{ke}]$, where X'_{ke}, $k \in K_e$, is the amount of commodity k which has to be consumed by recipient e if he participates in the program. The size of X'_{ke} will depend on some specified characteristics of recipient unit e. Note, that if recipient e is free to purchase less than X'_{ke} at the market price p_k or at the subsidized price $p_k\ (1-S_{ke})$ and does so, the commodity is not a member of the K_e set, since the demand restriction is ineffective. If he is allowed to purchase more than X'_{ke} without losing the subsidy on that amount and does so, paying $p_k(1-S_{ke})$ for X'_{ke} and p_k for any amount exceeding X'_{ke}, the commodity is not a member of the K_e set either; it should be regarded as not subsidized, but y_e should be increased by the amount of the subsidy $p_k S_{ke} X'_{ke}$. Since only the infra-marginal units are subsidized in this case, the in-kind transfer turns out to be equivalent to an outright cash subsidy (cf. case (4) on p. 5 above).[15]

Thus, recipient e maximizes (1) subject to his budget constraint:

$$(2)\quad y_e = \sum_{i \in (N-K_e)} p_i(1-S_{ie})X_{ie} + \sum_{k \in K_e} p_k(1-S_{ke})X_{ke},$$

$$e = 1, \ldots, M$$

and the restrictions following from (b):

(3) $X_{K_e} = X'_{K_e}$, $\quad e = 1, \ldots, M \quad K_e \in N$

The indirect utility function of recipient e resulting from this maximization can then be expressed as:

(4) $U_e = U' [y_e, \ p(1-S_e), \ X'_{K_e}] \quad e = 1, \ldots, M.$

To determine the income necessary to make recipient e as well-off as under the in-kind programs, y'_e, we compute the indirect utility function, which results from the maximization of (1) subject to a budget constraint involving pre-program market prices faced by the recipient:

(2') $y'_e = \sum_{i \in N} p_i X_{ie}$, that is

(5) $U_e = U'[y'_e, p]$.

Equating (4) and (5) we can solve for the unknown y'_e. Consequently, recipient e's evaluation of the in-kind programs is measured as $y'_e - y_e$. That is $(y'_e - y_e)$ represents the cash transfer which could be substituted for the bundle of in-kind transfers without altering the welfare of recipient family e and constitutes the numerator of the benefit weight.[16]

The denominator of the benefit weight is given by the cost of the in-kind programs incurred on behalf of recipient e:

(6) $T_e = \sum_{i \in (N-K_e)} p'_i S'_{ie} X_{ie} + \sum_{k \in k_e} p'_k S'_{ke} X'_{ke}$

$$= \sum_{i \in (N-K_e)} [p_i S_{ie} + (p'_i - p_i)] X_{ie} + \sum_{k \in k_e} [p_k S_{ke} + (p'_k - p_k)] X'_{ke},$$

where p_h is the market price in the absence, p_h' the pre-subsidy price in the presence of in-kind programs, S_{he} is the effective, S_{he}' the nominal percentage subsidy rate, h = 1, . . ., N. Aggregation of (6) over all recipients results in the total expenditures on in-kind programs or the total cost of in-kind programs to taxpayers.

As long as in-kind programs consist of outright market price subsidization without direct or indirect governemnt provision $p_h' = p_h$ and, thus, $S_{he}' = S_{he}$, h = 1, . . ., N, and T_e represents the difference between the income a recipient would need to purchase the same bundle of goods as under the in-kind programs paying market prices and the recipient's actual cash income, sufficient to purchase this bundle at subsidized prices.

If, alternatively, in-kind programs combine pure subsidization with direct or indirect government provision, p_h' may not be equal to p_h and the preceeding definition of T_e may no longer hold. The program cost attributable to recipient e can exceed or fall short of the income change necessary to enable recipient e to purchase the same bundle of goods in the absence of in-kind programs.[17]

Given the in-kind program cost distribution over recipients, the benefit weight to be applied to the program expenditures attributable to recipient e such as to transform the cost measure into the income measure of recipient benefits is

$$(7) \quad E_e = \frac{y_e' - y_e}{T_e} = E(y_e, p, p', S_e, X_{ke}'), \; e = 1, \ldots, M$$

If recipients are able to opt out of in-kind programs, E_e is certain to be non-negative. A sufficient, though not necessary, condition for E_e not to exceed unity is that $p' \geq p$.

Relation (7) implies that E_e will differ among groups of recipients even if they live in the same location (identical p and p' vectors) and even though the U-functions and, thus, the E-functions are assumed to be identical.[18] First, vectors S_e and X'_{ke} might vary from one recipient to another, because recipients participate in different programs and/or to a different extent in the same programs. Second, initial net incomes, y_e, differ (cf. (b), p. 7 above). In addition, geographical and urban-rural differences will influence p and p', which might lead to further variations in the benefit weight.

If it turns out that there is little correlation between the y_e and the structure of the S_e and X'_{ke} vectors even after a geographical (e.g., by state) and urban-rural disaggregation is carried out, general statements about the redistributive effect of in-kind programs within the lower end of the income scale become virtually impossible, unless these differences have little effect on the benefit weights.

The above procedure to determine benefit weights ignored the problem of recipient saving. To derive the redistributive effect of in-kind programs y_e and y'_e have to be defined as net income. Alternatively, the only arguments in the utility function (1) are commodity quantities consumed during a certain time period. Consequently, the limiting variable in the budget constraints (2) and (2') is not net income, but net income minus current saving plus current dissaving. That is, in our model y_e and y'_e are implicitly defined as total expenditures on goods and services during a certain period. A consistent integration of savings decisions into the utility function and budget constraint seems to be out of the question. The two simplest ways to deal with (avoid) this difficulty are either to assume

that on the average total expenditures equal net income for low income families, or to assume that saving or dissaving is strictly proportional to total expenditures, y_e or y'_e and then adjust $(y'_e - y_e)$ correspondingly.[19]

(C) Significance of Benefit Weight Calculations

Conceptually benefit weights can range from negative values[20] to values in excess of unity. This means that the program cost attributable to a recipient (T_e) might not be an acceptable measure of the improvement in his economic position. Unless benefit weights turn out to be close to unity, the redistributive effect of recipient in-kind benefits should be measured in terms of the welfare equivalent cash transfer $(y'_e - y_e)$.[21]

The welfare equivalent cash transfer measure is not only important to judge the extent of effective redistribution, but is vital for any attempts to integrate transfer programs with the goal of promoting horizontal and vertical equity as well as work incentives.

The effective tax rate (benefit reduction rate) cannot be derived by looking at the change in T_e induced by the income variation. This is not only true when the initial program bundle leads to $E_e \neq 1$, but also when the income change modifies the program bundle such that the "before" and "after" benefit weights differ, since a change in any one program may influence the evaluation of the others.

Similarly, adding program cost to recipient income before a uniform negative income tax schedule is applied may not lead to equity, because cash and various in-kind program combinations need not be evaluated in the same way. Furthermore, the sequential application of tax rates, with ceilings below 100%, does not guarantee an overall tax ceiling of

less than 100%, if in-kind programs are present and the taxes are based on program cost. It will make a difference, too, whether the tax consists of a loss in in-kind benefits or cash income.

Consequently, the two most important questions for which the implementation of the procedure outlined above has to provide an answer are:

(a) Is the structure of in-kind programs such as to cause benefit weights to approach unity for a decisive majority of recipient groups?

(b) If deviations of benefit weights from unity do occur and cannot be ignored, is there a systematic relationship between the size of these deviations and tractable socio-economic characteristics of the different recipient groups? In particular, does there exist a relationship between the benefit weight and recipient income, defined on either a before or an after tax and cash transfer basis?

The present state of ignorance about the specific characteristics, the allocation, and the overlap of in-kind programs does not even permit a guess as to what the answer to these questions might be.

Following, some general considerations are discussed which may aid our intuition and facilitate the actual benefit weight calculations, and which may indicate the significance of different answers to the two questions cited above.

Among the five cases listed which would lead to $E_e = 1$ under the condition that $p = p'$, only case (1), where goods need to be perfect substitutes, can be excluded a priori. The other cases may--singly, or in combination--cause benefit weights to come considerably closer to unity than the high single-program subsidy rates might lead one to expect.

Since all programs are dealt with simultaneously, the single-program distortions which tend to lower the benefit weight may partly compensate one another, if a recipient is subject to more than one program and the program commodities are largely substitutes.

Furthermore, if the arguments in vector X'_{K_e} correspond to the nonzero arguments of vector S_e, i.e., if consumption restrictions apply to every subsidized commodity, there exists some $X'^{*}_{K_e}$ which will make E_e equal to unity, given that $p = p'$. That is, for every set of subsidies confronting recipient e there exists a set of consumption restrictions which leave recipient e indifferent between his in-kind transfers and a cash transfer equal to the cost of the in-kind transfers he receives, T_e.[22] Now it is clear that these two maximizations must lead to the same consumption vector X^*_e and, thus, the same utility level U^*_e, if $X'_{ke} = X^*_{ke}$ for all $K \in K_e$. Thus, we found a vector $X'^{*}_{K_e} = X^*_{K_e}$ which will make $y'_e - y_e$ equal to T_e and, hence, E_e equal to unity. The same conclusion holds, if all goods $i \in (N-K_e)$ not in the set K_e are subsidized at identical rates. The zero subsidy rate was only assumed for simplicity. As mentioned earlier, the outstanding characteristic of the vector of consumption restrictions $X'^{*}_{K_e}$ which will lead to the equality of recipient benefits and program cost is that recipients are constrained to consume the same amounts of X_{ke}, $k \in K_e$ they would have consumed if the in-kind transfers had been given as an outright income subsidy.[23]

For certain recipient groups the quantity restrictions of in-kind programs may be such as to subsidize infra-marginal units only, i.e., $X'_{K_e} < X'^{*}_{K_e}$. If $p = p'$ and these recipients are able to purchase additional quantities at market prices, this would again lead to a unitary benefit weight.

For the very poor substitutability may be virtually absent, such that the price distortion, as such, is of no consequence and a unitary benefit weight would result, if consumption restrictions are ineffective and $p = p'$.

The above discussion suggests that benefit weights in the neighborhood of unity may not be unlikely for a considerable number of recipient groups (we will return to the implications of this possibility below, pp. 19-20). But it does not shed much light on the question of whether or not there exists a systematic relationship between the benefit weight and recipient income levels.

On the one hand, poorer recipients may participate in a larger number of programs and the income effect may outweigh the substitution effect of a price reduction by far, both of which factors will, ceteris paribus, tend to raise the benefit weight. On the other hand, subsidy rates of certain programs are inversely correlated with income, which would tend to reduce E_e for poorer recipients. Program restrictions work in the same direction, since it is less likely for poorer recipients that X'_{K_e} is equal to or falls short of $X'^{*}_{K_e}$. These latter factors may very well outweigh the former ones. This means that the benefit weight rises with the income level such that recipient benefits per unit of program expenditures decline as income rises, and in-kind programs are less redistributive than appears from program cost allocations.

Since benefit weights close to unity may not be exceptional, some further implications of this case should be pointed out. Apart from the unitary benefit weight cases listed above, where $p = p'$, $E_e = 1$ can occur, because the consumption distortion loss is compensated by lower post-program commodity prices due to government provision ($p \geq p'$ and $p_i > p'_i$ for some i),[23a]

such that the effective subsidization exceeds the taxpayer cost of the subsidies. Although it does not matter for the recipient benefit evaluation how a certain benefit weight magnitude occurs, the two cases need to be distinguished for the following reasons:

In recent years the benefits of redistribution activities to donors who are either taxpayers or private charitable donors have received increasing attention in public finance literature.[24] In this literature, the existence of in-kind transfers side-by-side with cash transfers has been justified by postulating that donor utility levels depend not only on the overall welfare (income) of recipients but on certain aspects of the recipients' consumption behavior as well.[25] That is, the fact that recipients may evaluate in-kind transfers at less than their cost value is compensated for by the additional benefits accruing to donors due to the direct influence on the recipient's consumption bundle.

A benefit weight of unity means that recipients are indifferent between the bundle of in-kind transfers and an equal value cash subsidy. But in addition, $E_e = 1$ implies that the consumption pattern of recipient e is exactly what it would have been under a cost equivalent cash transfer program as long as in-kind programs do not change pre-subsidy prices directly, i.e., as long as $p = p'$. An important corollary to this proposition is that E_e must be less than unity, if a--from the donors' point of view--desirable recipient consumption response is to be achieved efficiently, in case the externalities are caused by certain items of a recipient's consumption bundle and not by the income differential as such.[26] Consequently, if $p = p'$ and if benefit weights turn out to be close to unity, in-kind programs cannot be justified along the lines indicated by the

Pareto optimal distribution literature, since donors would have no interest in maintaining the in-kind program bundle, which is presumably more expensive to administer than a consolidated cash transfer program. This means that either in-kind transfers should be terminated, or that the professional discussion about in-kind transfers should return to where it was in 1968. Up to this date the general opinion was, roughly, that donors simply prefer giving goods to giving cash, regardless of the consumption response by recipients.

The justification of in-kind programs on the basis of consumption externalities can be maintained in spite of unitary benefit weights, if these programs tend to alleviate market imperfections. Improved availability of certain commodities to recipients, reduced discrimination against recipient groups, etc., will lower effective pre-subsidy prices to recipients, such that $p \geq p'$ and $p_i > p_i'$ for some i. This implies that recipients' consumption behavior will differ from the behavior under a cash subsidy system.[27]

III. Problems of Implementation

(A) Choice of Utility Function

As mentioned earlier, the benefit weight depends on the choice among classes of utility functions, where members of a class are related to one another by monotonic transformation.[28] There are several considerations which could be used to restrict the wide range of choices.[29] Whether we derive the benefit weights by estimating or by simulating utility function parameters, our choice must be biased toward those classes of utility functions which can be described by a manageable number of parameters. This parameter economy is important, since the commodity classification

used must match the degree of disaggregation dictated by the various in-kind programs. Furthermore, the properties of the system of demand functions implied by a certain utility function should be such as to allow for "reasonable" commodity substitution and income elasticities, given the degree of commodity disaggregation and given that we are concerned with low income consumption units.[30]

Estimation of utility function parameters restricts our choice to those classes of utility functions which lead to explicit systems of demand or expenditure equations suitable for econometric estimation. The demand and expenditure system resulting from a quadratic utility function, for example, inhibits estimation due to the large number of parameters $[\frac{N(N+3)}{2}]$ [31] and the extreme non-linearity. Though more economic, with respect to the number of parameters (2N), the class of direct addilog utility functions does not in general lead to explicit demand or expenditure systems.[32]

Among those demand or expenditure systems which have been estimated, some can be eliminated from consideration because they are either associated with utility functions that are not solidly based on classical consumer theory, or because they have no utility base associated with them at all. The most commonly estimated demand functions are based on constant (uncompensated) price and income elasticities of demand. These functions are inconsistent with classical demand theory, except as approximations when price and income variations are small.[33] For the relatively large price and income changes experienced by recipients, no utility function counterpart exists for these easily estimated demand relations. Although the Rotterdam system of demand equations fulfills

the requirements of classical demand theory approximately, the direct or indirect utility functions from which this system derives are also not known.

One frequently estimated system of expenditure functions, which is based on a class of utility functions (the Stone-Geary utility function and its monotonic transformations),[34] is the Stone-Geary linear expenditure system. Although non-linear in the (2N-1) parameters, the system is linear homogeneous in prices and income. Again the parameter economy turns out to be costly: The resulting Engel curves are linear, there are no inferior or complementary goods, and in the normal case, all own price elasticities of demand are at most, unity. Though these restrictions may not be defensible for relatively fine commodity classifications in general, they might be acceptable for our purposes.[35]

Recently a more general class of utility functions (the so called S-Branch function) has been estimated from a complete set of demand equations for a very detailed commodity classification.[36] The S-Branch system consists of a two-stage application of a generalized CES function (generalized by a Stone-Geary type of origin displacement). In the first stage the generalized CES function is applied to goods within a certain class (branch) of commodities in the second stage it establishes the relation between the branches.[37] This procedure allows for Hicks-Allen complementarites and imposes no restrictions on the own price elasticities. Although the parameter economy is preserved, the computational difficulties as far as the indirect utility function in the presence of consumption restrictions is concerned are substantial.

Instead of estimating utility function parameters from demand or expenditure systems, we could simulate benefit weight values by assuming

different sets of "reasonable" parameter combinations for various classes of utility functions. This method would not only permit an assessment of the effect various functional forms might have on the benefit weights but has a further advantage over the estimation procedure.

Since most computationally feasible utility functions are plagued by parameter restrictions (for example, linear income-consumption curves), parameter estimates cannot be derived from national averages, but would have to be based on the demand or expenditure system of a low income population. But the budget data of lower income classes, which include a large percentage of transfer recipients, are relatively poor indicators for consumer equilibria and "true" demand functions. These population groups may not only experience large income fluctuations, but are subject to non-uniform price discrimination, subsidized prices, commodity availability constraints, consumption quantity restrictions, etc., which makes it virtually impossible to arrive at "good" utility function parameter estimates. Although the simulation technique is conceptually more arbitrary, it may lead to less objectionable results, if it provides us with a (hopefully narrow) range of benefit weight magnitudes on the basis of some a priori significant parameter combinations.

Again, our choice among classes of utility functions to be used for the simulation is limited by practical considerations. If costly trial and error procedures in the computation of indirect utility functions are to be avoided, the utility function chosen should result in a system of explicit demand relations. For the simulation method parameter economy is even more important than for the estimation procedure. Not only does the number of parameter combinations increase exponentially

as the number of parameters rises, but our "intuition" as to what reasonable parameter values are tends to decline, since their relation to observable demand characteristics becomes more complex. This explains why Cobb-Douglas [(N-1) parameters] and CES [N parameters] utility functions have been used in the past to simulate benefit weights for single in-kind programs.[38] But the larger number of parameters of the "generalized Cobb-Douglas" Stone-Geary or the "generalized CES" utility function does not seem prohibitive.[39]

If feasible, the parameters of the class of utility functions chosen should not be assumed the same for recipient units of different size, age composition, race and, possibly, locational characteristics, unless urban-rural variations in consumption patterns are satisfactorily accounted for by price (budget constraint) differences.

(B) Further Problems of Implementation

To solve for the indirect utility functions (4) and (5), after the utility function parameters have been determined, and to compute the "recipient specific" program cost (6) (cf. pp. 11-12 above), we need to know the independent variables which enter these relations.

General vs. Particular In-Kind Benefits

The first question that has to be answered is: what are the programs to which benefit weights should be applied? Most government expenditures lead to in-kind benefits which create very similar evaluation problems in the absence of (marginal) benefit taxation. But a large part of these expenditures are motivated by the "publicness" of the goods provided.[40]

In-kind transfer programs have no such public-goods characteristics for the transfer recipient. This means that the cost of the transfer programs, incurred on behalf of recipient e (T_e), can be determined, while the cost of non-private goods cannot be regarded as being caused by individual "recipients", but only by the affected population group as a whole.[41]

In addition to non-private goods, our procedure cannot be applied to the direct or indirect (via regulation) government provision of decreasing cost commodities (like public utilities, transportation, communication), although the pricing policies may have similar effects to those of in-kind transfers proper. Apart from the fact that only the variable part of the cost can be allocated to individual "recipients", the evaluation of benefits as the "all-or-nothing" cash equivalent is fundamentally inconsistent with the marginal evaluation of non-decreasing cost commodities. The above method could only be used to derive benefit weights for the in-kind transfers implied by price discrimination among individual, final consumers.

This brings us to another class of programs for which the above procedure would have to be modified: government subsidization or regulation of private production. These programs have in-kind transfer character as far as they affect consumer prices, and cash transfer character with respect to changes in factor earnings. But the allocation of program cost, the implied (positive or negative) effective commodity subsidy, and, thus, the benefit weight calculation can only be carried out after the shifting question is resolved.

It was established earlier that the cash income equivalent evaluations of in-kind programs should be based on all programs applicable to a

recipient simultaneously. The difficulties connected with in-kind benefits, which are not in-kind transfers in the usual sense, prevent such a comprehensive evaluation. Consequently the implementation has to be confined to in-kind transfers proper, which have the explicit intent of redistributing real income toward low-income consumers: the subsidized provision of food, shelter, health care and, possibly, certain forms and levels of education and training.

Recipient Group Classification

The benefit weights depend on the choice of a utility function, which determines the functional form of relation (7) (p. 13 above), and the magnitudes of the independent variables that enter this relation. Consequently, recipient units can only be aggregated into recipient groups, if the group members are sufficiently homogeneous with respect to the following criteria:

(1) size, age composition, race and, possibly, urban-rural location, if utility functions are assumed to vary according to these characteristics;

(2) net income, excluding in-kind transfers, i.e., income after direct taxes, but including cash transfers;

(3) bundles of in-kind programs received and their specific characteristics, like pre-and post-transfer prices, effective or nominal subsidies, consumption restrictions and their effectiveness.

If a cross-classification of family units by these three criteria results in small cell populations, especially, if there is little correlation between (2) and (3), after a disaggregation according to (1) has

been carried out, the computation and usefulness of benefit weights are severely hampered. The practical problem of calculating a large number of benefit weights would be less serious than the policy implications of small cells. Only if it could be shown that benefit weights are close to unity for a large majority of cell populations, can an acceptable policy conclusion be drawn, namely, that in-kind and cash transfers should be treated alike for all practical purposes as far as recipients are concerned.[42] But legislators would be unwilling to take significant benefit weight differences into account, unless they are strongly correlated with socio-economic characteristics like (1) and (2). This means that important horizontal and vertical equity considerations may be disregarded.

At this stage any discussion about cell sizes and patterns is rather hypothetical because most of the relevant information is virtually nonexistent. Information about in-kind program overlaps generally, let alone by recipient characteristics is practically nonexistent.[43] The link between (3) and (1) plus (2) is established via the eligibility rules. These rules vary widely from state to state, such that disaggregation by state becomes mandatory. Apart from the use of subsidiary criteria for eligibility, the income definitions employed do not correspond to (2) and may differ from one program to another. Furthermore, eligibility need not imply that the good is available to the recipient.

This brings us to the more particular data problems, like: What are the effective prices a recipient group in a certain location faces in the absence and presence of in-kind programs, if these programs cause quality or availability changes? Should the effective subsidy implied

by health programs be measured on the basis of "units of health insurance" or "units of medical services"? How do effective or nominal subsidies and consumption restrictions vary with recipient characteristics? How do we find out whether program consumption restrictions are effective or ineffective?

Except for the unlikely event that in-kind transfers should vanish from the redistribution scene, the information necessary to form recipient groups is vital to judge the redistributive impact of present and proposed transfer programs.

NOTES

[1]For example, Gillespie, W. Irwin, "The Effect of Public Expenditures on the Distribution of Income: An Empirical Investigation," Ph.D. dissertation, Johns Hopkins University, 1963, or Gillespie, W. Irwin, "Effect of Public Expenditures on the Distribution of Income," Essays in Fiscal Federalism, ed. R.A. Musgrave, The Brookings Institution, Washington, D.C., 1965.

[2]If factor supplies are independent of the income distribution, sufficient conditions for the invariance of relative market prices are constant returns to scale production functions, identical factor proportions for all industries and perfect markets (including government market activities). Homothetic isoquants and identical factor proportions make the factor demand addition, production functions exhibit constant returns to scale, the production possibility surface is a flat, and commodity prices are invariant under output changes.

Note that certain market imperfections - like constant relative price differentials - would not impair the independence of relative prices from demand and output structure changes. The more stringent assumption of perfect markets eliminates some complications when the benefit and cost sides are integrated: market values equal resource cost. But it is likely that certain in-kind programs are motivated by market imperfections. For example, the oversupply of farm products and the negative effect on the non-farm poor caused by the agricultural price-support program may have provided the incentive for many in-kind programs administered by the Department of Agriculture.

[3]If the programs make those who finance them better-off, total donor benefits exceed the program cost. This statement does not imply that donor benefits should be accounted for at a higher value than their cost price, unless transfer programs are of an all-or-nothing type. If donors are in a position to decide on the extent of these programs in the same way they determine their "private goods" consumption, infra-marginal program units should be evaluated at marginal benefits. That is, if donors equate marginal program benefits to marginal program cost, donor benefits equal donor cost, irrespective of the "donor surplus" involved.

[4]The welfare theoretical argument follows the salvageable part of the standard pre-Little argument concerning the superiority of an income over an excise tax. It will be assumed throughout that indifference curve maps are convex.

Irrational behavior, lack of information and, especially, multi-person households, where budget decisions are made by "proxy," may lead to a non-maximizing use of income. This gives rise to the argument that in-kind transfers may yield higher benefits to recipient units than cash programs. But, unless it can be shown that recipient budget decisions are systematically inferior to those of non-recipients (from the individual spending unit's point of view), this objection applies to all households and would necessitate adjustments in the valuation of national income in general.

[5]In an analogy to the taxpayer benefit evaluation (see footnote 3), it could be objected that recipient benefits of in-kind programs should be evaluated according to the marginal cash transfer necessary to compensate for a marginal reduction of in-kind programs, if consistency with the evaluation of other goods is to be maintained. But recipients do not have the option to substitute equivalent cash transfers for in-kind transfers at the margin, i.e., for recipients in-kind programs are of the all-or-nothing type, and the "average" evaluation of marginal and infra-marginal program units, as outlined above, is legitimate.

[6]By consumption restriction we mean that the recipient is required to purchase a certain quantity of the commodity, which may exceed or fall short of the amount he desires at the subsidized price.

[7]For policy implications it should be noted that the recipient's consumption pattern in cases (2) to (5) is identical to the pattern that would have resulted had the in-kind transfer been given in form of a direct cash subsidy. [For a further explanation of this statement see p. 8--case (5)--p. 18--case (4)--and pp. 17-18--case (3)--]. The same is true in case (1), if perfect substitutability means that the two commodities are de facto, regarded as the same good.

[8]A point above the pre-transfer budget constraint implies positive program cost, that is, the denominator of the benefit weight is positive. A point below the pre-transfer indifference surface implies a negative welfare equivalent cash transfer, that is, the numerator of the benefit weight is negative.

[9]Aggregate recipient benefits are likely to be understated, if the bundle of subsidies affects commodities which are mainly substitutes for each other. Loosely speaking and ceteris paribus, the benefit weight is larger the smaller the substitution effect, and the substitution effect is reduced as more substitutes are subsidized at similar rates. Consequently, the weighted average of program-by-program benefit weights may be smaller than the benefit weight attached to the program bundle as a whole. [Cf. footnote 10.].

Alternatively, aggregate benefits may be overstated, if the bundle of subsidies affects largely complementary goods. If we regard this bundle of complementary goods as one composite commodity, the effective subsidy on this commodity is low and, thus, the benefit weights high, if they are computed on a program-by-program basis. But the cumulative effect of the bundle of subsidies raises the effective subsidization of the composite commodity. And in general, the benefit weight declines as the effective subsidy increases. Consequently, the benefit weight attached to the program bundle may be lower than the weighted average of the program-by-program benefit weights.

[10]To give an example: Suppose that all but one item in a recipient's budget is subsidized at the same rate and that there are no restrictions on the quantity he can demand. Suppose further that the benefit weight for this program bundle is less than unity. If the last item is now subsidized as well (at the same rate), the benefit weight of this change is at most unity, whether it is computed on the basis of the existence or non-existence of the other programs. This implies that after the addition of the new in-kind transfer, recipient benefits are still less than the market value of the new program bundle, though we know that the new program bundle is completely equivalent to a cash transfer.

[11]This means that the increasing number of studies which try to measure recipient benefits of various in-kind programs, concentrating on one program at a time, cannot be used to determine the redistributive effect of the existing set of in-kind transfers, unless it can be shown that as a matter of fact the aggregation of program-by-program results comes close to the benefit measures based on program bundles.

[12]If the number and age of family members or some other characteristics influence the budget pattern of recipients in the same income class considerably, the utility function parameters should be estimated separately for different family unit characteristics, if the data available permit such a procedure.

[13]Data permitting, this assumption can, of course, be relaxed. Some locational differentiation seems important and feasible. In addition to the problem of finding the market prices of certain goods, these prices may not be the same to recipients and non-recipients as well as among recipient groups with different socio-economic characteristics. But it is likely that many of these latter differences are sufficiently captured by the locational variable.

[14]Note that S_{ie} is the effective subsidy rate, computed on the basis of the price faced by the recipient in the absence of in-kind programs (p_i), not the nominal subsidy rate (S'_{ie}) based on the post-program, pre-subsidy price of the commodity (p'_i), which may differ due to direct or indirect government provision. The relation between the two price subsidies is given by $p_i S_{ie} = p'_i S'_{ie} + (p_i - p'_i)$.

[15]Although it might be difficult to test empirically whether restrictions on the quantity of program commodities consumed are effective or ineffective, the distinction is important, since it may exert a considerable influence on the magnitude of the benefit weight. [For a diagrammatic exposition of various cases of program restrictions cf. Olsen, Edgar O., "Some Theorems in the Theory of Efficient Transfers," Journal of Political Economy LXXIX, (January/February, 1971), 166-76].

[16]The two budget relations (2') and (2) imply that $(y'_e - y_e)$ represents the difference between the money value of the quantities the recipient would consume given his welfare equivalent cash transfer (where the value weights are the unsubsidized market prices) and the money value of the quantities the recipient family is actually consuming given the in-kind transfers (where the value weights are the subsidized prices). If we chose one commodity as numeraire and if all in-kind programs were simply price subsidies (i.e., if they did not involve restrictions on the quantities of the subsidized goods consumed), the value weight attached to a certain commodity quantity would equal the rate of substitution between that commodity and the numeraire good.

[17]In the case of public housing, for example, p'_h exceeds p_h, possibly because of side effects or subsidiary goals unrelated to redistribution. On the other hand, any program related improvement in the availability of commodities to recipients will, ceteris paribus, be reflected in a positive $(p_h - p'_h)$ differential. Some insurance type programs might lead to a price decline due to the risk reducing effect of large scale coverage. It should be noted, though, that even in the absence of legal consumption restrictions the nominal pre-subsidy program price p'_h might have to be adjusted, if indirect rationing occurs caused by supply-limitations of the program commodity.

[18]We labelled the benefit weight "E", because E is often described as the "efficiency ratio" of in-kind transfer programs, since it is the ratio of the recipient's valuation of his in-kind transfers (which is equal to the taxpayer cost of the welfare equivalent cash transfer) and the market evaluation of the program expenditures (which is equal to the taxpayer cost of the in-kind programs); the percentage "inefficiency" of in-kind transfers usually being measured as I = 1-E, where I is the ratio of the valuation difference and total program expenditures. If there are non-recipient benefits associated with in-kind transfers, both of these labels are misleading.

[19]Only the first alternative is consistent with the assumption of fixed individual factor supplies.

[20]If "free" education combined with high minimum school attendance laws, were the only major program open to some recpients, a negative benefit weight might be more than just a theoretical possibility.

[21]If program costs deviate from recipient benefits, the equivalent cash transfer measure makes a revision of National Accounting procedures necessary. The present authors have suggested a procedure to eliminate the valuation inbalances resulting from various in-kind programs. (Cf. L. Stiefel, E. Smolensky, M. Schmundt, "Modifications for In-Kind Transfer Entries in the National Income Accounts," The Impact of Selected Programs on the Distribution of Income, Working Paper No. 7).

[22]The proof is as follows. Let the in-kind program characteristics be such that for all $i \in (N-K_e)$ $S_{ie} = 0$, while for all $k \in K_e$ $S_{ke} > 0$. This means that the program cost on behalf of recipient e amounts to $T'_e = \sum_{k \in K_e} p_k S_{ke} X'_{ke}$. Now let X^*_e be the vector of commodity quantities recipient e would consume, if he received a cash subsidy of T'_e and paid market prices. That is, X^*_e results from maximizing (1) subject to

$$y'_e = y_e + T'_e = \sum_{j \in N} p_j X_{je} = \sum_{i \in (N-K_e)} p_i X_{ie} + \sum_{k \in K_e} p_k X_{ke}.$$

If confronted with the in-kind programs, recipient e maximizes (1) subject to

$$y_e = \sum_{i \in (N-K_e)} p_i X_{ie} + \sum_{k \in K_e} p_k (1-S_{ke}) X'_{ke},$$

or equivalently

$$y_e + T'_e = \sum_{i \in (N-K_e)} p_i X_{ie} + \sum_{k \in K_e} p_k X'_{ke}$$

[23]Aaron, Henry J. and George von Furstenberg [Western Economic Journal IX, 2 (June, 1971), 184-91] show that the "efficiency ratio" E for public housing programs is quite close to unity. They use a two commodity model (housing services and all other goods) and derive E = .96, if a Cobb-Douglas utility function is employed and housing service expenditures amount to 25% of recipient incomes. Their high E ratio is mainly due to the fact that the restriction on the consumption of housing services by recipients comes quite close to what recipients would have consumed had the housing program cost been distributed as direct income transfers. It should be remembered, though, that single-program benefit weight calculations might be quite inaccurate.

[23a]This formulation represents a sufficient, but not necessary, condition for the effective to exceed the nominal subsidization.

[24]Cf. Hochman, Harold M. and James D. Rodgers., "Pareto Optimal Redistribution, The American Economic Review LIX (Part 1, September 1969), pp. 542-57 and subsequent discussion.

[25]See, for example, Johnson, David B., "Some Fundamental Economics of the Charity Market," The Economics of Charity, Center for the Study of Public Choice, Blacksburg Va.: 1970, p. 94; Olsen, Edgar O., "A Normative Theory of Transfers," Public Choice Spring, 1969, p. 42; Olsen, Edgar O., "Some Theorems in the Theory of Efficient Transfers," Journal of Political Economy LXXIX, (January/February 1971), 166-176; Pauly, Mark "Efficiency in the Provision of Consumption Subsidies," Kyklos XXIII, No. 1, 1970, pp. 33-57; De Salvo, Joseph D., "A Methodology for Evaluating Housing Programs," Journal of Regional Science Vol. II, No. 2, 1971, pp. 178-179.

[26]This corollary is implicitly contained in Pauly's article on optimal consumption subsidies (cf. op. cit.).

[27]The proof of this statement runs as follows. If the recipient was given a cash subsidy equal to the in-kind program cost, he would not be able to purchase the same bundle of commodities as under the in-kind transfer programs. Let $\bar{X}_{ie}$, $i = 1, \ldots, N$ be the amount of commodity i consumed by recipient e under the in-kind programs. Then the program cost incurred on behalf of recipient e is $T_e = \sum_{i \in N} [p_i S_{ie} + (p_i' - p_i)]\bar{X}_{ie}$. The cash subsidy recipient e would need to buy the same bundle of goods at pre-program prices p_i, $i = 1, \ldots, N$ is $\sum_{i \in N} p_i S_{ie} \bar{X}_{ie}$, which exceeds T_e, if $p \geq p'$ and $p_i > p_i'$ for some i. Consequently, recipient e is certain to be at a different point on the same indifference curve ($E_e = 1$), if he receives T_e as an outright cash subsidy.

[28]Monotonic transformations will neither change the resulting system of demand functions, nor effect the income needed to maintain a certain utility level as prices change and restrictions on quantities consumed are eliminated.

[29]The discussion of suitable utility functions, expenditure and demand systems and their estimation relies largely on the treatment of these matters by Arthur S. Goldberger ["Functional Form and Utility: A Review of Consumer Demand Theory," Systems Formulation, Methodology and Policy Workshop Paper No. 6703, Social Systems Research Institute, University of Wisconsin, (October, 1967)].

[30]Unfortunately, these two considerations may not be compatible, since parameter economy usually implies restrictions on the range of commodity substitution and income-consumption curve possibilities.

[31]Where N is the number of commodities in the consumption vector.

[32]The CES function is a special member of this class for which explicit demand and expenditure systems can be derived. The price for the CES parameter economy (N) is paid for in form of constant commodity substitution elasticities and unitary income elasticity of demand.

[33]Unless all income elasticities are unity, the budget constraint is certain to be violated, because the high elasticity goods will take a larger budget share as income rises. This means that the sum of the budget share weighted elasticities is sure to exceed unity as income increases, thus violating the Engel aggregation condition.

[34]The Stone-Geary utility function is a generalization of the Cobb-Douglas function. The generalization allows a displacement of origin for the otherwise Cobb-Douglas indifference curve map, which adds N parameters and permits substitution and income elasticities to deviate from unity.

[35]There are several existing estimates of Stone-Geary linear expenditure functions. [Goldberger, A.S. and T. Gamaletsos., "A Cross-Country Comparison of Consumer Expenditure Patterns," European Economic Review Vol. 1, Spring 1970; Stone, R., "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand," Economic Journal V, 64, September, 1954; Yoshihara, Kunio, "Demand Functions: An Application to the Japanese Expenditure Pattern," Econometrica Vol. 37, No. 2, April, 1969, to cite a few]. The estimated systems are all more or less inadequate for our purposes. Some are based on data from countries other than the United States; most of the systems include only five broadly defined goods which do not correspond to commodities subject to in-kind programs in the U.S.; none of the systems are estimated using low income individuals, a critical factor because of the linear Engels curves resulting from the Stone-Geary utility function.

[36]Brown, Murray and Dale Hein., "The S-Branch Utility Tree: A Generalization of the Linear Expenditure System," Econometrica (forthcoming).

[37]Cf. Sato, K., "A Two-Level Constant-Elasticity-of-Substitution Production Function," Review of Economic Studies XXXIV, April, 1967, pp. 201-218.

[38]Cf., for example, Aaron, Henry J. and George Von Furstenberg, op. cit.

[39]A variant of the simulation technique for small numbers of parameters would be to constrain the resulting benefit weight to unity. The different combinations of parameters derived under this constraint could then be evaluated on the basis of how closely they correspond to other research results or subjective a priori notions.

[40]One "recipient's" consumption does not reduce other "recipients" consumption by the amount consumed.

[41]Put differently, although we could (conceivably) compute the cash value of non-private goods to "recipients", this sum would not represent an acceptable counterfactual.

[42]This would be an important result, because it eliminates the major problem connected with any integration of cash and in-kind benefits.

[43]Cf. the "not available" entries of Table 8 (p. 26) in Storey, James R., Public Income Transfer Programs: The Incidence of Multiple Benefits and the Issues Raised by Their Receipt, Studies in Public Welfare, Paper No. 1, Subcommittee on Fiscal Policy of the Joint Economic Committee, Washington, D.C., 1972.