PREFERENCE FORMATION, INCOMES, AND THE DISTRIBUTION OF WELFARE

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INTRODUCTION

Although economic models are usually built upon the assumption that tastes are immutable, this does not mean that economists actually believe this to be true. It is rather the case that the modeling of changing preferences hitherto has not been at the top of the research agenda. Gradually, now that various other issues have been addressed, the modeling of changing preferences becomes more important. One observes, for example, an increasing interest in habit formation in economic models of consumer behavior (for example, see Spinnewijn, 1981; Phlips and Spinnewijn, 1981; Blanciforti and Green, 1983; Muellbauer, 1986).

One of the areas where the notion of changing preferences is least prominent, yet most crucial, is the analysis of public policy. The economic theory of public policy is firmly rooted in welfare economics. In principle, proposed policy measures are to be judged on the basis of their effect on the welfare of the members of society. If preferences are immutable, it is often easy to decide whether a certain policy change will improve the welfare of citizens or not. For instance, if individuals prefer more income to less, then increasing one individual's income and leaving all other incomes unaffected amounts to a Pareto improvement (no one's welfare decreases and one individual's welfare improves). Generally, policies that generate Pareto improvements are considered to be desirable.

If, on the other hand, individuals are given to envy, so that as a result of the increase in income of one individual other individuals tend to feel worse off, one can no longer conclude that the income increase for the one individual constitutes a Pareto improvement.

In this article we review a so-called theory of preference formation, developed in Kapteyn (1977), which addresses precisely the problem that arises in the situation sketched above. Specialized to incomes,[1] the theory states that the welfare an individual

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derives from his income depends solely on the ranking of his income in the relevant income distribution. There are some subtleties with respect to the definition of the relevant income distribution and with the problem of how to account for variations in household composition, which will be dealt with, but these do not affect the basic idea. The theory is akin to the notion of "relative deprivation" (cf. Stouffer, Suchman, DeVinney, Star, and Williams, Jr., 1949), but also to "adaptation level theory" (cf. Helson, 1964).

Although the theory of preference formation can be formulated in quite general terms, to describe the welfare evaluation of vectors of commodities (where a commodity may be just about anything that yields pleasures), we shall for simplicity stick to the evaluation of incomes. In the next section we briefly describe the individual welfare function of income, due to Van Praag (1968, 1971), which measures an individual's evaluation of different income levels. Then the individual welfare function of income is liked up with the theory of preference formation and formulates an empirically testable model. We then present the results of estimation of the model for a household panel in The Netherlands.

Having done all this, the resulting model is used to study empirically the relation between the distribution of incomes and the distribution of welfare in society. We simulate the effects of various policy measures.

THE INDIVIDUAL WELFARE FUNCTION OF INCOME

The Individual Welfare Function (WFI, from now on) is measured by asking respondents[2] in a survey the following so-called income evaluation question (IEQ):

What after-tax family income	very bad	Dfl. ________
would you consider, in your	bad	Dfl. ________
circumstances to be very bad?	insufficient	Dfl. ________
And bad, insufficient, sufficient,	sufficient	Dfl. ________
good, and very good?	good	Dfl. ________
Please enter an amount on each line	very good	Dfl. ________

The formulation of the IEQ varies somewhat between different surveys (for example see Kapteyn and Wansbeek, 1985a). The wording given here comes from the survey that is used for the empirical analysis reported below. In the design of the questionnaire, care has been taken that before answering the IEQ, the respondent has gained a good understanding of the notion of after-tax family income. Actually the respondent has been asked to compute his own after-tax family income.

In Figure 1, a hypothetical response to the IEQ has been plotted. Income (denoted by y) is measured along the horizontal axis. The verbal labels "very good," "good," etc., have been associated with the midpoints of six equal intervals that partition the [0,1) interval on the vertical axis. As a result the verbal scale "very bad, bad,... very good" is transformed into a numerical scale (denoted by U(y)) 1/12, 3/12,..., 11/12. According to the theory developed by Van Praag (1968, 1971), the points should lie approximately on a lognormal curve. The lognormal curve is then the respondent's WFI. Because, generally, the points will not lie exactly on a log normal curve, the respondent's WFI is estimated by fitting a lognormal function to the scatter of points by means of least

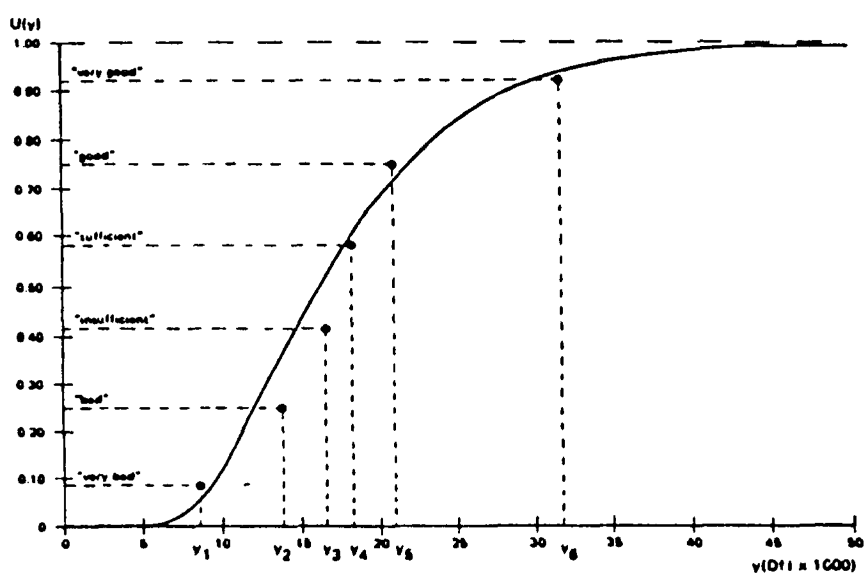


Figure 1.

squares. For further details, see for instance Van Praag and Kapteyn (1973) or Van Herwaarden and Kapteyn (1981).

One of the assumptions underlying measurement of the WFI is that verbal labels can be associated with equal intervals on a bounded scale. The validity of this assumption has been investigated by Buyze (1982) and Antonides, Kapteyn, and Wansbeek (1980). Both studies indicate that the intervals are not exactly equal, but that the quality assumption provides a good approximation.

The lognormal function is completely determined by its parameters μ and σ. The parameter μ is a location parameter; $\exp(\mu)$ is the income level evaluated by 0.5. Thus, the larger μ (or $\exp(\mu)$, for that matter) is, the more income one needs to attain a certain welfare level. The parameter σ determines the slope of someone's WFI. The larger σ is, the flatter a WFI will be.

By now tens of thousands of WFI's have been estimated in the countries of the European Community and in the United States (for example, see Van Herwaarden, Kapteyn, and Van Praag, 1977; Colasanto, Kapteyn, and Van der Gaag, 1984).

PREFERENCE FORMATION AND THE WFI

It has often been found that the size distribution of incomes can be approximated rather well by a lognormal distribution function. The fact that an individual's WFI can also be approximated by a lognormal distribution function might suggest a relationship between a WFI and the size distribution of incomes. In fact, this is exactly what the theory of preference formation implies, but with two qualifications.

First, we should note that different people "see" different income distributions. For instance, someone with a limited education and a low income may have friends and acquaintances who generally have low incomes. Thus this person sees an income distribution with mostly low incomes. We call the income distribution an individual sees a *perceived income distribution*. A more precise definition will be given in this article.

Second, the economic unit that shares a given income is the household. A large income for a large household need not generate more consumption possibilities than a small income for a small household. If we say that someone perceives an income distribution, then we really mean that he observes the expenditures other people make out of the income. Expenditure levels are thus indicators of incomes. In the case of the large household with the large income the observed expenditure level may actually be modest. The relevant income concept is therefore *standardized income*, that is household income divided by the number of equivalent adults in a household. The computation of the number of "equivalent adults" per household is a matter we will turn to later.

Essentially, the theory of preference formation states that an individual's WFI is *identical* to his perceived income distribution. We turn now to a more formal statement of the theory.

Let there be N individuals in society. Time is measured in years, $t = -\infty, \ldots, 0$ where $t = 0$ represents the present. At each moment of time an individual n ($n = 1, \ldots, N$) is assumed to assign nonnegative reference weights $w_{nk}(t)$ to any individual k in society ($k = 1, \ldots, N$),

$$\sum_{k=1}^{N} w_{nk}(t) = 1.$$

The reference weight $w_{nk}(t)$ indicates the importance individual n attaches to the income of individual k at time t. Obviously, quite a few of the $w_{nk}(t)$ will be zero. On the other hand, $w_{nn}(t)$, i.e., the weight that individual n attaches to his own income at time t, may be substantial. The set of individuals with $w_{nk}(t) \neq 0$, $k \neq n$, will sometimes be referred to as n's social reference group at time t.

Further, let $y_k(t)$ be the income of individual k at time t.[3] Let $f_k(t)$ be the number of equivalent adults in family k at time t. Then we defined the income per equivalent adult (or "per capita" as we will often say) of family k at time t by:

$$\tilde{y}_k(t) := y_k(t)/f_k(t) \tag{1}$$

We will also refer to $\tilde{y}_k(t)$ as the "standardized income" of family k at time t.

This bit of notation allows for the definition of a perceived income distribution at time t for individual n,

$$G_n(\tilde{y}|t) := \sum_{\{k|\tilde{y}_k(t) \leq \tilde{y}\}} w_{nk}(t) \tag{2}$$

One can get some intuition for this definition by working out some examples (cf. Kapteyn and Wansbeek, 1985, Section 5). Notice, for instance, that if everyone in society gets the reference weight (*so* $w_{nk}(t) = 1/N$ for all k), then $G_n(\tilde{y}|t)$ is simply the cumulative frequency of all households who have a standardized income less than or equal to ȳ. In this case $G_n(\bar{y}|t)$ represents the size distribution of standardized incomes in society at time *t*. Generally the reference weights $w_{nk}(t)$ are not all equal, since individual *n* does not assign equal weight to all families, but will tend to overweigh his friends and acquaintances and underweigh people he hardly knows.

In each period *t* individual *n* perceives a new income distribution $G_n(\bar{y}|t)$. At time zero, he has perceived a sequence of income distributions that will affect his present idea about what constitutes a high income or a low income, say. We can aggregate the $G_n(\bar{y}|t)$ to one *presently perceived income distribution* $G_n(\bar{y})$. To that end a nonnegative "memory function" $a_n(t)$ is introduced, which describes individual *n*'s weighting of perceived incomes over time. We assume,

$$\sum_{t=-\infty}^{0} a_n(t) = 1 \qquad n = 1, \ldots, N. \tag{3}$$

The memory function is introduced to allow for the fact that possibly events that took place a long time ago will have less influence on the present perceptions of individual *n* than events that took place recently.

The presently perceived income distribution function $G_n(\bar{y})$ is now defined as

$$G_n(\bar{y}) := \sum_{t=-\infty}^{0} a_n(t) G_n(\bar{y}|t) \tag{4}$$

Let $U_n(\bar{y})$ be the WFI of individual *n*, that is U_n describes how he rates standardized incomes on a [0,1]-scale. The theory of preference formation states that

$$U_n(\bar{y}) = G_n(\bar{y}) \tag{5}$$

Thus, according to the theory utility is a completely relative concept. The utility of a certain per capita income is equal to its relative ranking in the presently perceived income distribution.

The Empirical Model

To operationalize the theory and to keep this article self-contained we have to go through a rather lengthy and technical analysis. Those readers who are mainly interested in the general idea and the simulations are advised to skip to "Preference Formation, Incomes, and the Distribution of Welfare" below.

First consider the WFI in some more detail. The assumed lognormality implies that it can be written as follows:

$$U_n(\bar{y}) = N(\ln \bar{y}; \tilde{\mu}_n, \sigma_n) = N((\ln \bar{y} - \tilde{\mu}_n)/\sigma_n; 0,1) = N((\ln y - \mu_n)/\sigma_n; 0,1) = \\ = N(\ln y; \mu_n, \sigma_n) \tag{6}$$

where $\mu_n = \tilde{\mu}_n + \ln f_n$[4] and $N(\cdot; \mu_n, \sigma_n)$ is the formula for the normal distribution function with mean μ_n and variance on σ_n^2. The parameters μ_n and σ_n completely determine the WFI of individual n. We will refer to μ_n and σ_n as the "welfare parameters" of individual n. Formally, μ_n and σ_n^2 are the log-moments of the lognormal distribution function. There holds $\Lambda(\mu_n; \mu_n, \sigma_n) = 1/2$, as mentioned before.

Formally, both U_n and G_n are distribution functions and their equality implies the equality of their log-moments. The first two log-moments of G_n are defined as

$$\bar{m}_n = \int_0^{\infty} \ln \tilde{y}\, dG_n(\tilde{y}) = \sum_{t=-\infty}^{0} a_n(t) \sum_{k=1}^{N} w_{nk}(t) \ln \tilde{y}_k(t) \tag{7}$$

$$s_n^2 = \int_0^{\infty} (\ln \tilde{y} - \bar{m}_n)^2\, dG_n(\tilde{y}) = \sum_{t=-\infty}^{0} a_n(t) \sum_{k=1}^{N} w_{nk}(t)[\ln \tilde{y}_k(t) - m_n]^2, \tag{8}$$

The equality of log-moments implies

$$\mu_n = \tilde{\mu}_n + \ln f_n = \sum_{t=-\infty}^{0} a_n(t) \sum_{k=1}^{N} w_{nk}(t) \ln \tilde{y}_k(t) + \ln f_n \tag{9}$$

$$\sigma_n^2 = \sum_{t=-\infty}^{0} a_n(t) \sum_{k=1}^{N} w_{nk}(t)[\ln \tilde{y}_k(t) - (\mu_n - \ln f_n)]^2 \tag{10}$$

Thus the location parameter μ_n is a reference weighted mean of standardized log-incomes. If individual n has perceived many high incomes, his WFI will be located far to the right. If he has mainly seen low incomes the WFI is located more to the left. The parameter σ_n, which determines the slope of the WFI, is large if the dispersion of incomes he has perceived is large (the WFI then has a flat slope) and is small if the dispersion is small (the WFI then has a very steep slope).

Equations (9) and (10) explain the variation of the welfare parameters μ_n and σ_n over individuals. In order to test the validity of the explanation, we first need to take care of the unobservable reference weights $w_{nk}(t)$. This is done by means of a string of simplifying assumptions.

First, we assume that all individuals give themselves the same weight which, moreover, is constant over time. We write $w_{nn}(t) = \beta_2$ and define $\beta_3 := 1 - \beta_2$. For the specification of the number of equivalent adults in the family we adopt the simple assumption that $\ln f_k(t) = \beta_0 + \beta_1 \ln fs_k(t)$, where $fs_k(t)$ is the number of persons in family k at time t. The memory function is taken to be identical across individuals as specified as $a_n(t) = (1-a)a^{-t}$. Further we define

$$\begin{aligned} q_{nk}(t) &= w_{nk}(t)/\beta_3, \; k \neq n \\ &= 0 \qquad\quad\;\; , k = n, \\ \bar{m}_n(t) &= \sum_k q_{nk}(t) \ln y_k(t), \\ \bar{f}n(t) &= \sum_k q_{nk}(t) \ln f_k(t) = \beta_0 + \beta_1 \{\sum_k q_{nk}(t) \ln fs_k(t)\} \\ &= \beta_0 + \beta_1 \bar{f}s_n(t), \end{aligned}$$

where $\bar{hs}_n(t)$ is defined implicitly. So, $\bar{m}_n(t)$ and $\bar{hs}_n(t)$ are the log means of incomes and family sizes in family n's social reference group at time t.

All this makes it possible to rewrite Equation (9) as

$$\mu_n = \ln f_n + (1\text{-}a) \sum_{t=-\infty}^{0} a^{-t}[\beta_2\{\ln y_n(t)\text{-}\ln f_n(t)\} + \beta_3\{\bar{m}_n(t)\text{-}\bar{h}_n(t)\}]. \quad (11)$$

Next we apply the Koyck transformation and use the expression for $\ln f_n$ to write equation (11) in lagged form as follows:

$$\mu_n = [1-\beta_2(1-a)]\beta_1 \ln fs_n - a\beta_1 \ln fs_n(-1) + \beta_2(1-a)\ln y_n + \beta_3(1-a)\bar{m}_n - \beta_3(1-a)\beta_1 \bar{h}s_n + a\mu_n(-1). \quad (12)$$

We can derive a similar expression for σ_n^2. This expression has been given for instance in Kapteyn, Van de Geer, and Van de Stadt (1985, equation A1). For estimation purposes it turns out that it is more convenient to consider an expression for $\mu_n^2 + \sigma_n^2$ (the second log-moment around zero) than for σ^{n2}. This expression turns out to be

$$\mu_n^2 + \sigma_n^2 = a\left[\mu_n^2(-1) - 2\beta_1\mu_n(-1) + \sigma_n^2(-1)\ln fs_n(10) + \right] + a\beta_1^2 \ln^2 fs_n(-1) + (1-a)\sum_{k=1}^{n} w_{nk}\left(\ln y_k - \beta_1 \ln fs_k\right)^2 + 2\beta_1\mu_n \ln fs_n - \beta_1^2 \ln^2 fs_n \quad (13)$$

The assumptions that are needed to replace the inordinate number of reference weights in Equations (12) and (13) are basically given in Van de Stadt, Kapteyn, Van der Geer (1985). As an example of what the assumptions lead up to we notice that as a result $\bar{m}_n$ can be approximated as follow:

$$\bar{m}_n = \kappa\,.\,\eta + (1-\kappa)\overline{\ln y}_n + u_n, \quad (14)$$

where η is mean log-income in society, $\overline{\ln y}_n$ is mean log-income in the *social group* of individual n and u_n is an error term independent $\ln y_n$, and κ is an unknown parameter that is to be estimated as a set of individuals who share certain characteristics, i.e., within a social group individuals have the same education level, are of about the same age, and have a similar employment status (the exact definition of the characteristics is given below in "Data and Estimation Results").

The parameter κ measures what share of the reference group of individual n lies within his social group. If κ =0, the social group comprises the reference group; if κ =1 the social group of an individual does not yield any information about the reference group of the individual.

Approximating the other reference weighted quantities in Equations (12) and (13) in a similar way yields the following estimable model:

$$\mu_n = \gamma_0 + a \cdot \mu_n(-1) + [1-\beta_2(1-a)]\beta_1 \ln fs_n - a\beta_1 \ln fs_n(-1) + \beta_2(1-a)\ln y_n + \\ + (1-a)(1-\beta_2)(1-\kappa)\overline{\ln y_n} - (1-a)(1-\beta_2)(1-\kappa)\beta_1 \cdot \overline{\ln fs_n} + \varepsilon_n \tag{15}$$

$$\mu_n^2 + \sigma_n^2 = \delta_0 + a[(\mu_n^2 + \sigma_n^2)(-1)] + 2\beta_1\mu_n \ln fs_n + a\beta_1^2 \ln^2 fs_n(-1) - \\ 2a\beta_1\mu_n \ln fs_n(-1) + (1-a)\beta_2 \ln^2 y_n - 2\beta_1(1-a)\beta_2 \ln y_n \ln fs_n + \\ [(1-a)\beta_2 - 1]\beta_1^2 \ln^2 fs_n + (1-a)(1-\kappa)(1-\beta_2)\overline{\ln^2 y_n} - \\ 2(1-a)(1-\kappa)(1-\beta_2)\beta_1 \overline{\ln y_n \ln fs_n} + (1-a)(1-\kappa)(1-\beta_2)\beta_1^2 \ln^2 fs_n + \zeta_n \tag{16}$$

where Υ_0 and δ_0 are the constant terms in the equations and ϵ_n and ζ_n are error terms that have been added to account for specification and measurement error. The error terms are assumed to be multivariate normally distributed with mean zero and unrestricted covariance matrix. Given these assumptions, the parameters in the simultaneous system (Equations [15] and [16]) can be estimated by means of maximum likelihood. The estimation results are given in the next section. It is the first time that Equations (15) and (16) are estimated *jointly*. In previous papers only Equation (15) has been estimated. Using the additional Equation (16) improves the efficiency of the estimates.

DATA AND ESTIMATION RESULTS

The data comes from an annual household panel in The Netherlands. We have used the waves of 1981 and 1982. Household heads were interviewed in March 1981 and March 1982. The characteristics that define the social groups are education, employment status, age. Five education levels are distinguished, three states of employment (self-employed, employee, not employed), and five age brackets (less than or equal to 30, 31–39, 40–49, 50–65, over 65). This lends to a maximum of 5.3.5 = 75 social groups, 38 of which are represented in the sample. There are 629 observations. Results of the maximum likelihood estimation of Equations (15) and (16) are given in Table 1.

The coefficients of determination are quite acceptable for both equations, given that the data are household data. The various parameters have been estimated with considerable accuracy, except for κ. This parameter, which describes how informative social groups are for reference groups, does not differ significantly from one (in which case social groups are completely uninformative). This has also been a finding in previous research (e.g., Van de Stadt, Kapteyn, Van de Geer, 1985) and indicates the need to use data with specific information on reference groups. Fortunately such data will be available soon.

The parameter β_1 is an elasticity. It represents the percentage increase in income that is needed to keep a family at its current welfare level if family size increases by 1%. Thus the estimate for β_1 implies that an increase of family size by 1% requires an income

Table 1
Estimation Results

Parameter	*Estimate*	*Standard Error*
a	0.64	(0.02)
α_0	1.16	(0.23)
β_1	0.27	(0.01)
β_2	0.60	(0.04)
β_3	0.40	(0.04)
δ_0	11.31	(2.31)
κ	0.83	(0.52)
R^2 μ-equation	0.79	
R^2 $\mu^2 + \sigma^2$-equation	0.80	

increase by 0.27%. The parameters β_2 and β_3 represent the relative influence of own income and incomes of others on present preferences. Apparently own income (habit formation) is somewhat more important than the income of others (preference interdependence).

The estimate of a implies the following weights for periods 0, -1, -2,..., -8,... respectively: 0.36, 0.23, 0.15, 0.09, 0.06, 0.04, 0.02, 0.02, 0.01,... Thus events that took place more than eight years ago get a weight of less than 1%.

Given the model estimates one can simulate the welfare effects of various income policies. To this we turn to the next section.

PREFERENCE FORMATION, INCOMES, AND THE DISTRIBUTION OF WELFARE

Figure 2 presents the cumulative distribution of welfare levels[5] in the sample for three income groups. These groups represent the lowest one-third, the middle one-third and the highest one-third in the sample respectively. As one would expect, the welfare distribution for the highest income group is located most to the right and that for the lowest income group most to the left. In the lowest income group approximately 40% of the individuals evaluate their income by a number below 0.5. In the middle income group approximately 15% of the individuals evaluate income by a number less than one-half. In the highest income group the percentage is approximately six.

According to model (Equations [15] and [16]) the observed distribution of welfare levels depends on the distribution incomes and family sizes presently and in the past, and on individual effects represented by the error terms in the equations. In the sequel we simplify matters a bit by ignoring the error terms. Further, family sizes are assumed to be constant over time and for incomes we mostly consider steady state situations, i.e., situations in which all incomes are constant or grow at a constant rate.

As a first example, Figure 3 represents the distribution of welfare for the same three groups as distinguished above for the situation where incomes have been constant for a long time. The distances between the distributions are substantially larger than in Figure 2. This is partly due to the neglect of the error terms. The error terms tend to blur systematic differences. Also, however, keeping incomes constant takes away variation in the past which would increase σ (see Equation [10]). Larger σs simply imply flatter

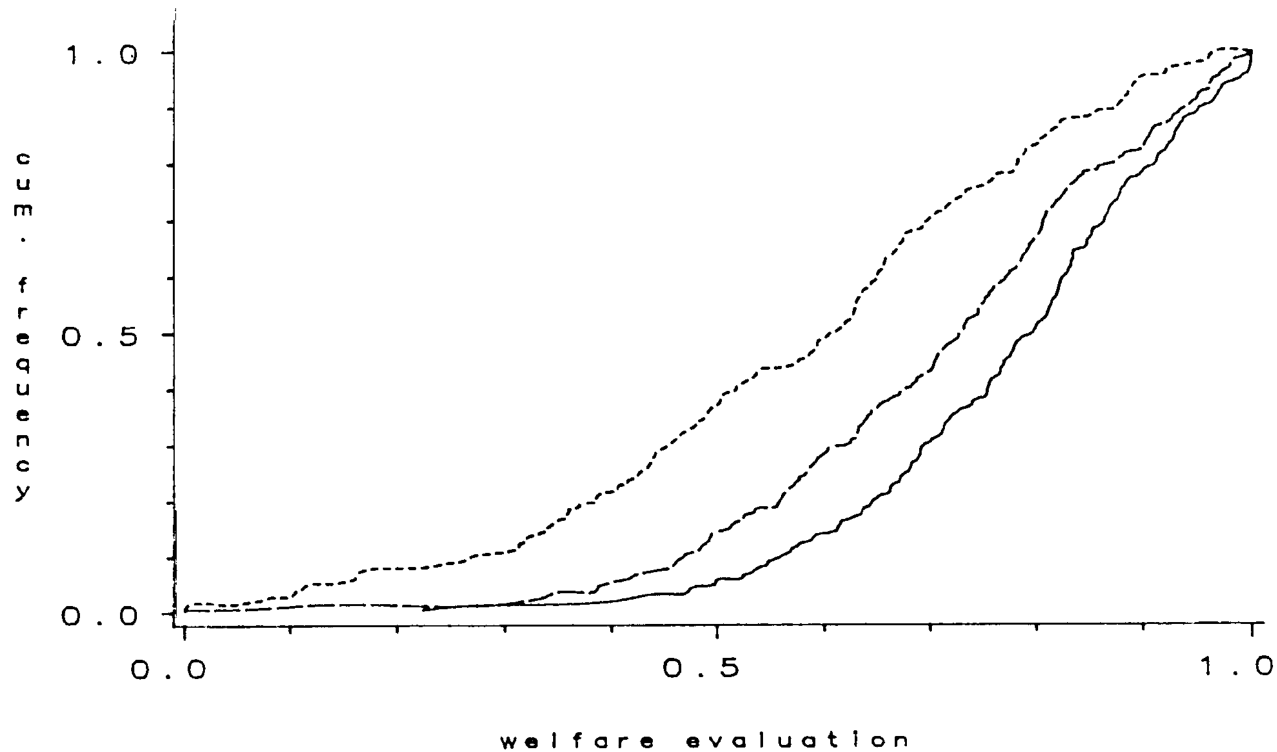


Figure 2. Distribution of Welfare Levels in the Sample for Three Income Groups.

Key: - - - - - = low income group.
— — — = median income group.
——— = high income group.

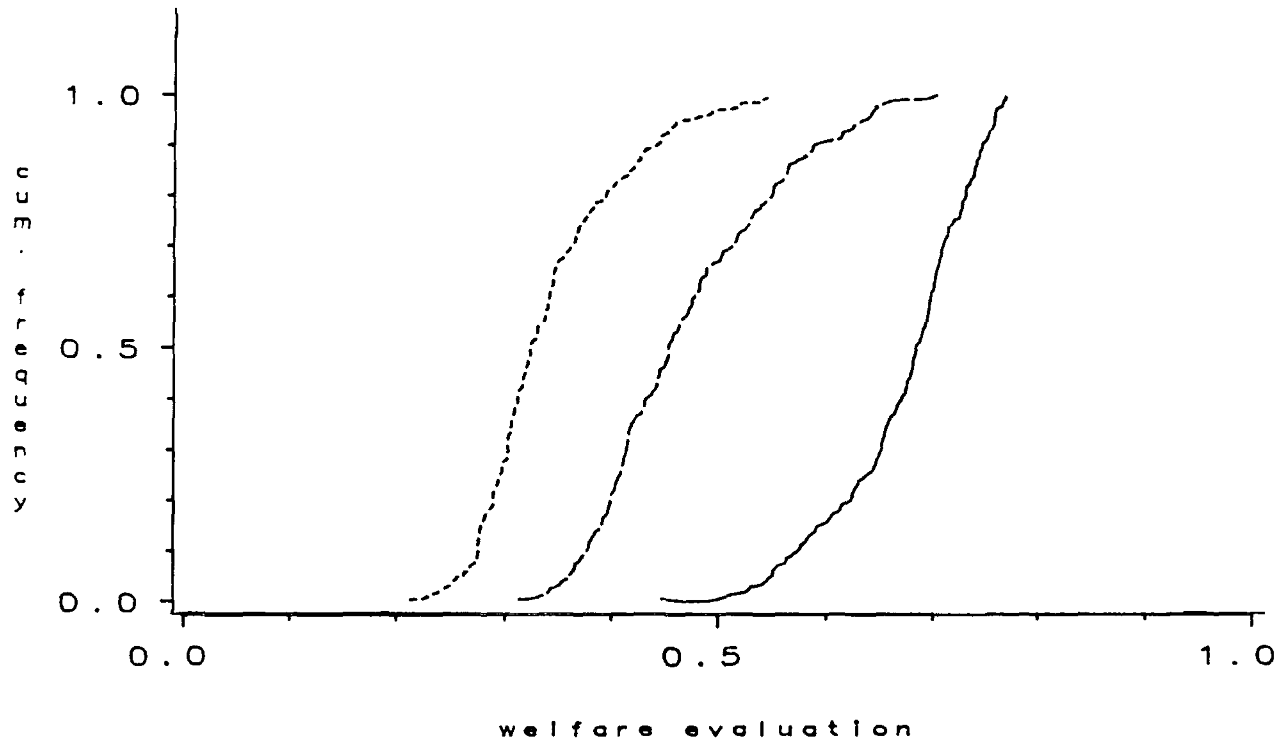


Figure 3. Distribution of Welfare for Three Income Groups if all Incomes are Constant Over Time.

Key: - - - - - = low income group.
— — — = median income group.
——— = *high income group.*

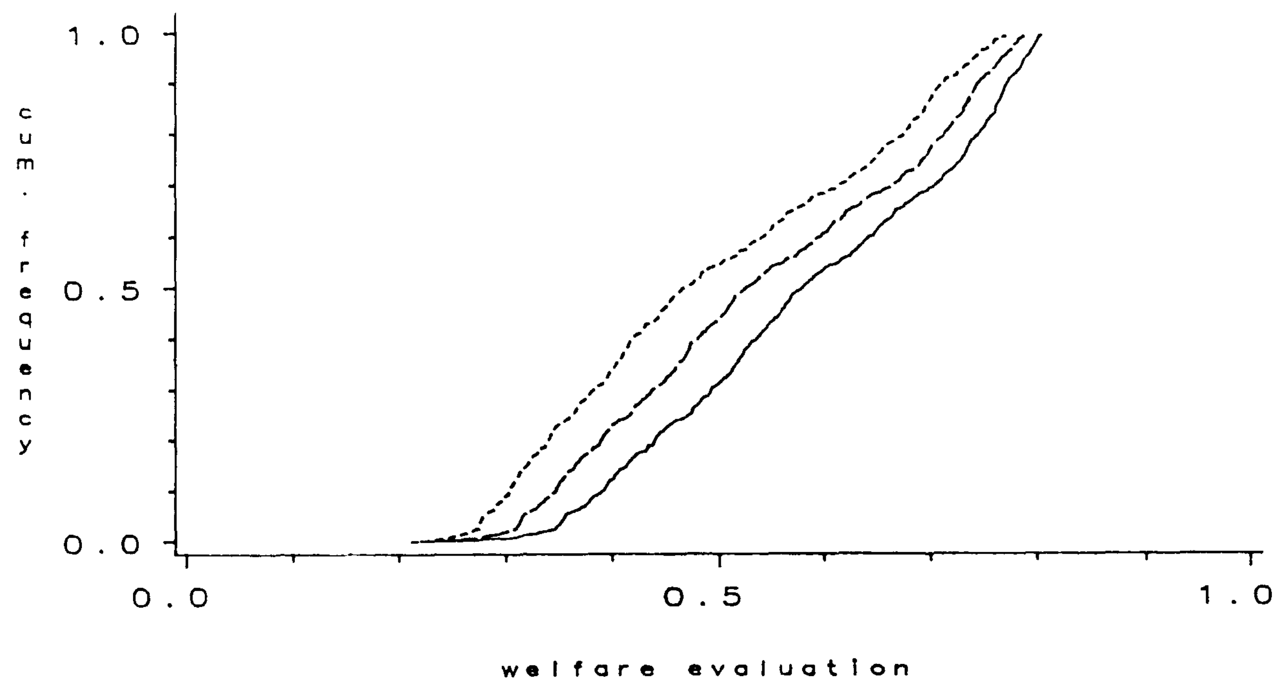


Figure 4. Distribution of Welfare Levels Corresponding to Three Income Growth Rates.

Key: - - - - - = growth rate at 0%.
— — — = growth rate at 2%.
——— = growth rate at 4%.

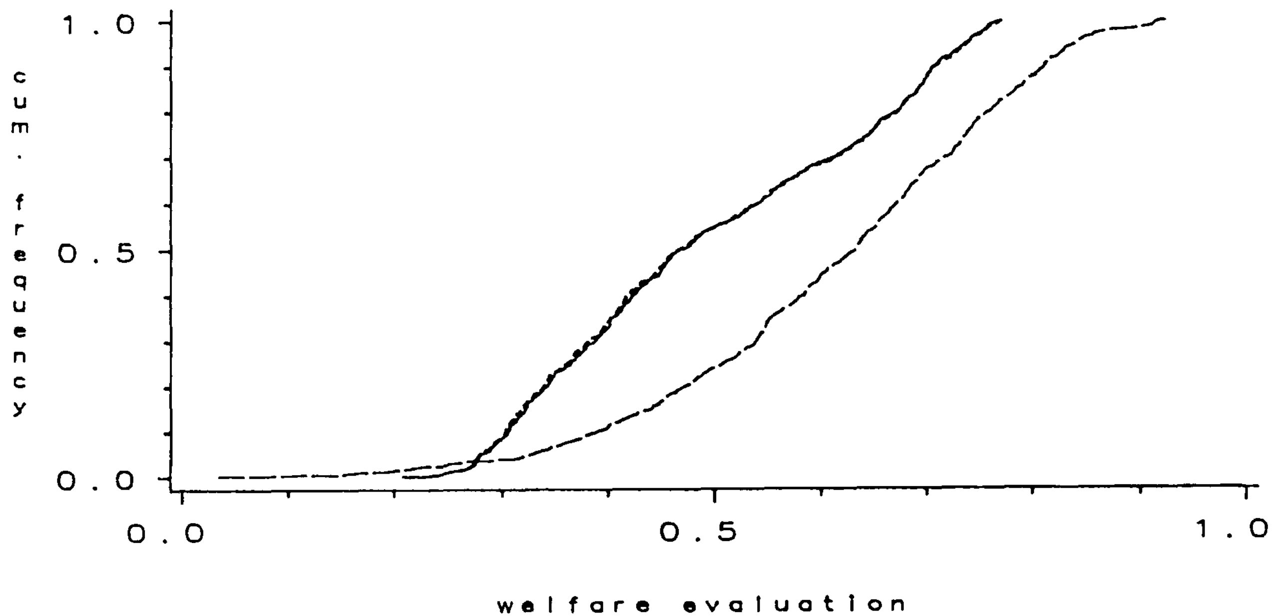


Figure 5. Distribution of Welfare Levels After 1 Period, 10 Periods, 100 Periods (Steady State).

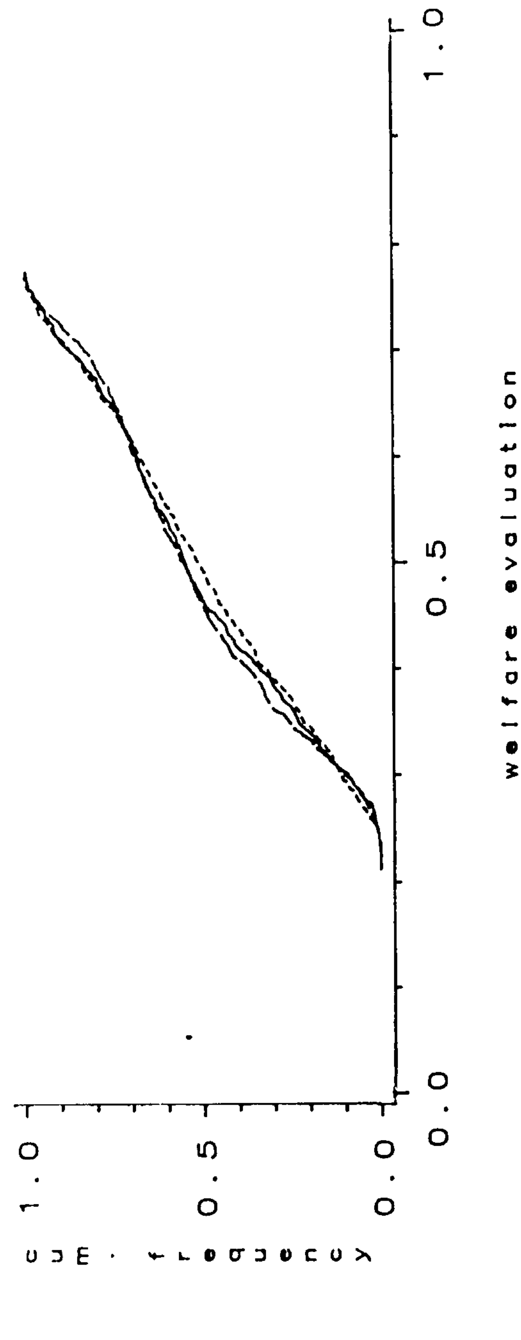
Note: n income growth rate of zero percent has been assumed.

Key: - - - - - = 1 Period.

— — — = 10 Periods.

______ = 100 Periods.

A.



B.

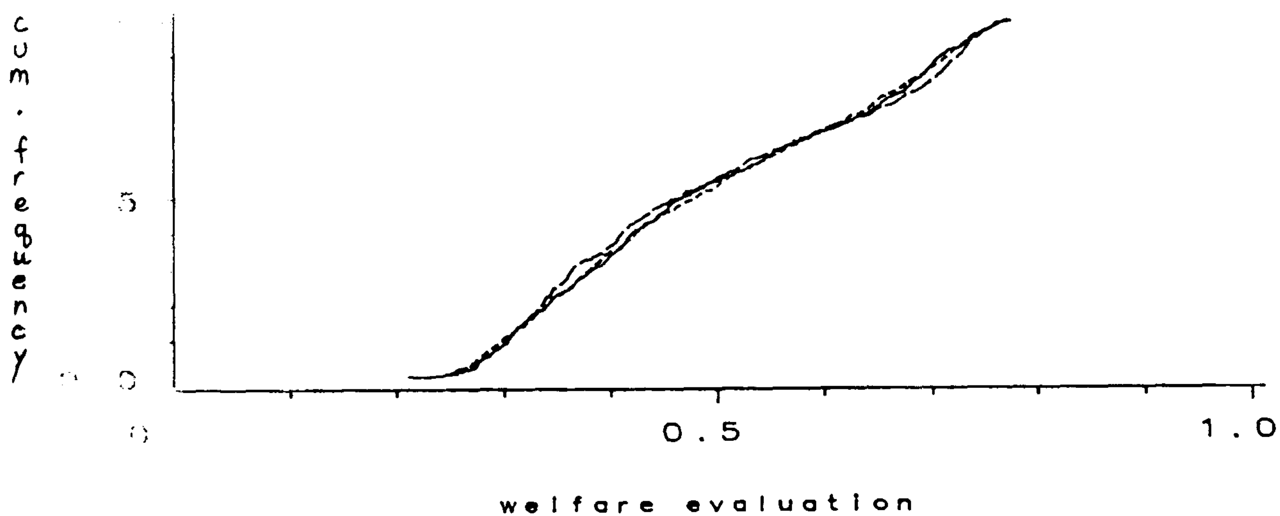


Figure 6. Distribution of Welfare Levels Corresponding to Three Income Policies.

Key: - - - - - = egalitarian income policy.
— — — = inequality increasing income policy.
——— = no changes in actual income distribution.

slopes of the WFI and therefore the evaluation of income varies less with income. This can also be seen directly from Equation (6). Altogether, the differences between the three income groups are quite dramatic now. In the lowest income group almost no one reaches a welfare level above one-half whereas in net highest income group almost no one has a welfare level below 0.5.

In Figure 4 we drop the distinction between the three income groups, but concentrate instead on the effect of economic growth. Obviously, and not surprisingly, the highest growth rate generates the highest welfare levels, although in all cases the variation in welfare levels remains substantial.

Although in theory a steady state is defined as a situation in which all incomes grow at the same rate (possibly zero) for an infinitely long time, in practice a steady state will exist for a limited period of time. To see how long a steady state has to last in order for the welfare distribution to attain its steady state form, we illustrate the speed of convergence empirically in Figure 5. As one can see, after ten years the steady state distribution has practically been attained. Figure 5 also shows that the steady state with zero growth generates lower welfare than the initial situation in the sample. The explanation is that the individuals in the sample have experienced a long spell of income growth (it is only after '82 that incomes in The Netherlands started falling), which increases their welfare (recall Figure 4).

To the extent that there exists limits to growth one may wonder whether a more equitable distribution of welfare is obtainable through a redistribution of incomes. The effect of such a policy is illustrated in Figure 6 (A and B). In both cases the effects are studied of a more egalitarian and less egalitarian distribution of incomes on the distribution of welfare. In Figure 6 (A) the distribution takes place while keeping the mean of all incomes constant. In Figure 6 (B) the redistribution takes place while keeping the median of all incomes constant (actually, the geometric mean of incomes has been kept constant, but this amounts practically to the same thing).

The way the redistribution has been implemented can be described as follows. Let the incomes before redistribution be $y_1, y_2, \ldots, y_n, \ldots, y_N$ and after redistribution $z_1, z_2, \ldots, z_n$, z_N. As a measure for the dispersion of incomes we take the log-variance of incomes. Imagine we want to increase the log variance by a factor β^2 (β may be smaller than one). Then the following relation should hold between the incomes before and after redistribution:

$$\sum_{n=1}^{N} (\ln z_n - \overline{\ln z})^2 = \beta^2 \sum_{n=1}^{N} (\ln y_n - \overline{\ln y})^2, \tag{17}$$

with ln z and ln y means of log-incomes in the sample after and before redistribution respectively. Of course, Equation (17) does not fully determine the incomes z_n. There are various redistribution schemes that all satisfy Equation (17). We have chosen the following scheme. The incomes of families are adjusted according to

$$\ln z_n - \overline{\ln z} = \gamma_n (\ln y_y - \overline{\ln y}), \tag{18}$$

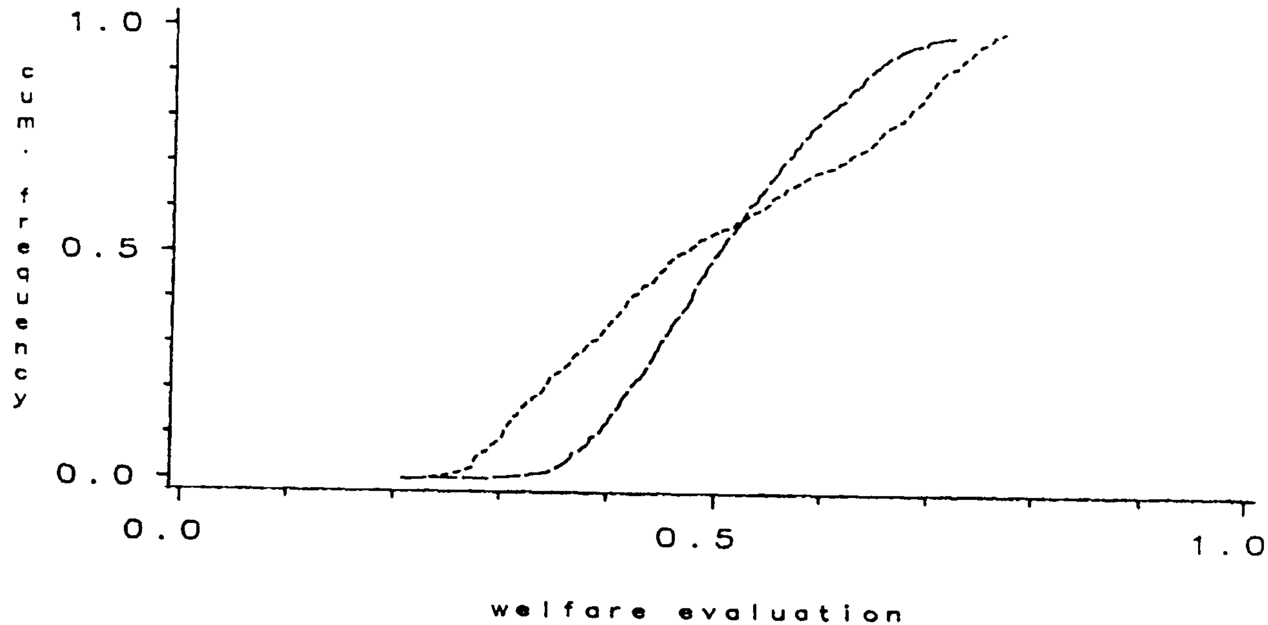


Figure 7. Distribution of Welfare Levels Corresponding to Two Income Policies for Having Children.

Key: - - - - - = present family allowance scheme in The Netherlands.
— — — = "optimal" family allowance scheme.

where y is chosen in such a way that either the mean or the median of incomes is the same before and after redistribution. To obtain a more egalitarian distribution we have set $\beta = 1/4$ and for a more unequal distribution β has been set equal to four.

Figure 6 (A and B) show that income redistribution hardly leads to a redistribution of welfare. Given that the evaluation of one's own income is fundamentally a function of the ranking of this income in a perceived income distribution this need not surprise us too much.

It is possible, however, to devise a more intelligent redistribution policy. This policy is presented in Figure 7. On the basis of the estimated model one can redistribute incomes in such a way that differences in family composition are fully compensated for. This has been done by "abolishing" the existing family allowance system. That is, for each family the family allowance is deducted from its after tax income (in The Netherlands family allowance benefits are not taxable). In this way a fund is created that is available for a new family allowance system. To compute the new family allowance for each family we note that two families of sizes fs_1, and fs_2 evaluate their incomes y_1 and y_2 by the same number if there holds

$$\frac{y_2}{y_1} = \left(\frac{fs_2}{fs_1}\right)^{\beta_1} \tag{19}$$

In this case the ratio of the number of equivalent adults in both families equals the ratio of incomes of both families.

Let us take a family without children ($fs = 2$) as our *standard family*. Let z_n be the income of family n after deduction of the old family allowance. Then this family receives a new allowance such that its new income w_n satisfies

$$w_n = z_n \left(\frac{fs_n}{2}\right)^{\beta_1} \tag{20}$$

Unfortunately, the fund is not big enough to cover all outlays for the new system. Hence a proportional tax is levied on z_n such that outlays for the system can be covered exactly. The results of this operation are shown in Figure 7.

Obviously, the proposed redistribution substantially reduces the observed inequality in welfare levels. Thus this form of income policy, which is directly based on differences in need across families, is considerably more powerful than policies which aim at a reduction of inequality without specific consideration of individual wants.

Looking at the various examples considered, a couple of observations can be made. First, the relative nature of the preference formation theory implies that income redistribution is basically a zero sum game. For a given size of national income, the distribution of income appears to have little effect on the distribution of welfare. There is an exception, however, income distribution policy can affect the distribution of welfare substantially if it uses specific information on the relative needs of households.

A second observation is that economic growth is an important contributor to the welfare of individuals in society. The level of national income is relevant to the distribution of welfare, but the faster national income grows the higher the welfare level in society will be.[6] Even with a stagnating economy a policy maker can improve welfare in society by creating steep age income profiles. One then pays little to young people and increases payments with increasing age. Of course a policy like this has to rest on a consensus that lets young people abstain from payment according to their marginal product in exchange for a continually rising income when they get older.

CONCLUSIONS

This article has reviewed a theory of preference formation and has considered its bearing on income policy. The policy measures we looked at were only arbitrary selections from a wide gamut. Given the tool of the WFI and the model that operationalizes the theory of preference formation, one can compute the welfare distribution resulting from just about any policy.

Altogether, both the theory of preference formation and the WFI appear to be reasonably well established. Yet, regarding the WFI more attention should be paid to methods that improve its reliability and validity (see Ratchford, 1985; Kapteyn and Wansbeek, 1985b).

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NOTES

1. Whenever we speak of "income" we mean after-tax family income. "Family" and "household" are used synononomously.
2. When we speak of "individuals" or "respondents" these are usually family heads. The words "he" and "she" are used indiscriminantly.
3. Recall that an individual is by definition head of a household. Hence we can equivalently speak of "the income of family k" and "the income of individual k."
4. Whenever $t = 0$ we omit the argument t. So, for example $f_n + f_n(0)$, $\mu_n = \mu_n(0)$, etc.
5. The term "welfare level" is used here solely to denote an individual's evaluation of his income according to his WFI.
6. Up to a limit, see Kapteyn, van der Geer, and van deStadt (1985, Appendix A).

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