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EVALUATION QUESTIONS AND INCOME UTILITY

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EVALUATION QUESTIONS AND INCOME UTILITY

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Abstract

In this paper we present an operational method to define and estimate income utility functions or welfare functions of income (WFI). Moreover, we present a theory and empirical evidence on the genesis and the determinants of WFI's that are seen to vary over individuals

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EVALUATION QUESTIONS AND INCOME UTILITY

1. Introduction

One of the most intriguing issues in human sciences is the nature and measurement of well-being. Feelings of well-being or lack of well-being are determined by many factors. One of the most important determinants is individual income as an index for the availability of material resources. If we take the other factors to be constant, we may concentrate on the question how well-being changes with variations in income. To stress that we like to consider only this effect we do not speak of well-being but of income utility or alternatively of welfare derived from income. Let U stand for income utility and y for income, then we are interested in the assumed relationship $U = U(y)$. It will be called the individual welfare function of income or WFI for short.

The measurement of this relationship is conditioned by the operational definition of a procedure of welfare measurement. This is a problem that forms part of a more general problem, viz. the measurement of the intensity of feelings and perceptions.

In psychological literature such problems have been studied a.o. by Thurstone (1959), Helson (1964), Bradburne (1969), and Stevens (1975). In sociology such problems have been studied by Rainwater (1974) and Rossi (1979), while in economics the problem is considered a.o. by Van Praag (1968), (1971) and Kapteyn (1977).

Our basic instrument will be a set of attitude questions giving us information about what amount the respondent considers to be a "bad" or a "good" income for his household. These Income Evaluation Questions (IEQ) will be described in Section 2. The questioning method will be compared to an apparently similar approach, the factorial survey approach introduced by Rossi (see Rossi and Nock (1982)). Moreover, it describes our method to define a WFI on the basis of an IEQ and presents the arguments for doing so.

The WFI may be seen as a subjective reflection of the objective income

distribution in society. The basic idea is that a specific income level $y_{0.8}$ will be evaluated by 0.8 on a zero-one scale if the individual assumes that about 80% in society earns less than $y_{0.8}$. The specific process that translates the objective income distribution into a subjective WFI is called the social filter process, first introduced by Van Praag (1981). In Section 3 we describe this social filter process, while in Section 4 its parameters are empirically estimated on a dataset collected in the Boston area. Section 5 concludes.

2. Income evaluation questions

Value judgments on persons, things or situations are regularly made in daily life. A description of the judgment process and its subsequent observation and measurement is not a trivial affair. Such a process is composed of three basic ingredients. First we have to describe the evaluandum by a vector x of characteristics thought to be relevant. The total set on which x is assumed to vary is called X . Second, we have to specify a value scale V on which we evaluate x . Third, we have the mapping from X into V , say the utility function $V = v(x)$.

With respect to X we shall assume in the context of this paper that an evaluandum is totally described by a money amount y , a possible level of after-tax household income. With respect to V we may think of V as being a bounded interval, say $[0,1]$. However, in practice people do not evaluate income levels on a numerical scale but in verbal terms like "good" or "bad". So we shall specify V to be an ordered set of verbal labels, varying from "worst" to "best".

It is obvious that the mapping $V = v(x)$ differs between individuals. One individual n may think an annual income of \$20,000 to be "good" while another individual n' values it as "insufficient". Hence, we index v as v_n . Now there seem to be two approaches to get an idea about v_n from questioning an individual n . Both have in common that we have to specify for the respondent how the evaluandum is described on X and how the values are described in V . Then one approach is to offer the individual a description x and to ask him to specify the associated value $v_n(x)$. In our context it means mentioning an income level y and asking for its verbal evaluation $v(y)$ as a response. This is the vignette approach, developed by Rossi (1979). The second approach is the inverse. We offer a verbal label v and ask the respondent to describe the corresponding situation, i.e. income level, by $y = v_n^{-1}(v)$. This is the basic idea behind the IEQ-approach, developed by Van Praag (1971).

Let us consider the first approach. A situation is described by a vignette x . The advantage of this approach is that one respondent may be offered many vignettes, say a set $\{x_t\}_{t=1}^T$. Then it would be possible to estimate indifference surfaces $\{x \in X | v_n(x) = v_0\}$, sets of different situations that are

evaluated identically; if v is numerically specified, i.e. v is a cardinal utility function, it is also possible to estimate the function $v = v_n(x)$ per individual n .

It is intuitively obvious that the choice of the vignettes may cover situations with which the respondent is unacquainted in real life. Intuition tells us as well that the set of T stimuli is most informative if $x \in X$ is chosen at random and such that the components of x are mutually independent. The philosophy behind it is that we then have many different situations to be judged. This approach is the factorial survey approach. The disadvantage of the approach is that people are conditioned by their own vignette x_0 , describing their own situation. If the distance between their own situation x_0 and the vignette x is large, the respondent will have only a vague idea about y and its evaluation may be distorted by lack of knowledge. A second disadvantage is that the set of vignettes $\{x_t\}_{t=1}^T$ to be offered may vary a lot for the average respondent but not for all. Assume, we specify 10 income levels between \$10,000 and \$100,000, then the differences will still be slight for someone earning \$1,000,000. It follows that the set $\{x_t\}_{t=1}^T$ should ideally be adapted to the real vignette x_0 of the respondent. This can be done only on the basis of prior knowledge on $v_n(\cdot)$.

The second (IEQ) approach may be described in the same terms. The respondent's own vignette is described by $x_0 = (y_0, \tilde{x}_0)$. The individual is supplied with a specific value v and he is asked to complete the corresponding vignette $x = (y, \tilde{x}_0)$ where x is equal to his own situation except for income. The advantage of this approach is a gain in realism, as each respondent uses his own situation as a yardstick. By supplying a set of values $\{v_t\}_{t=1}^T$ we get a set of corresponding incomes $\{y_t\}_{t=1}^T$. The second advantage is that the variation in emotional connotation, i.e. values is approximately normalized between individuals, while in the vignette method objectively varying vignettes may have roughly identical values to some respondents and greatly differing values for others. Especially, if vignettes do not necessarily differ in value, respondents may feel urged to differentiate vignettes, where they do not see much difference.

The IEQ runs as follows:

"Considering our present needs and circumstances I would consider our household to be

- poor at an after-tax household income below
- nearly poor at an after-tax household income of about
- just getting along at an after-tax household income of about
- living reasonably comfortable at an after-tax household income of about
- living very comfortable at an after-tax household income of about
- prosperous at an after-tax household income above

This question battery has been asked to about 500 respondents in the Boston area in 1983. The survey financed by a grant from the National Science Foundation to Steven Dubnoff was not intended to be representative for some population but was carried out for methodological purposes only. In this study we consider only the 448 respondents who gave a complete answer to the IEQ. Given the methodological accent of this paper we shall not bother about representativity problems.

By the IEQ we offer the respondent a set of six values $\{v_t\}_{t=1}^6$ and get six corresponding responses say $y_{1n}, \dots, y_{6n}$ in money amounts. Theoretically it might have been possible to make the response 2- or more-dimensional by asking indifference surfaces on X . In practice this is difficult.

Let us denote the results for individual n by the vector y_n . It is obvious that the answers vary over respondents. This variation may be due to two factors. The first one is the difference in the frame of reference between individuals. One respondent may have many children and a low income, another respondent may have a large income and no children. The second cause of difference may be that the verbal labels are ambiguous and represent different emotional connotations for different respondents. The second factor would be a spurious one. Our hypothesis is that the verbal labels represent the same welfare degrees to different respondents. The first reason for assuming that is evidently that it is the basic principle underlying a common language. If words would not convey approximately the same concepts between people, then people would not understand each other. Although it cannot be denied that understanding by means of language is not perfect, the degree of confusion is relatively minor, which makes the idea acceptable that words, especially

common language, represent the same concepts to different people in a language community. More scientific experiments have been performed by Van Doorn and Van Praag (1984) where respondents have been asked to translate verbal labels into figures at a (0,1)-scale and in terms of line segments of different length, with affirmative results.

Let us consider here a less direct way of testing the assumption. Let us assume that verbal labels v_i are translated on some internal continuum by n into scalars $u_{in} = \phi_n(v_i)$ and that the translation into money amounts works like $y_{in} = \psi(u_{in}; \theta_n) = \psi(\phi_n(v_i), \theta_n)$, where θ_n stands for a vector of individual parameters. If $\phi_n(v_i)$ is constant over n , it implies that each respondent interprets v_i in the same way. In that case it must be possible to explain y_{in} by a separable function in i and n , that is $y_{in} = \psi(u_i, \theta_n)$. An easy specification is

$$(2.1) \quad \ln y_{in} = \sigma_n u_{in} + \mu_n \quad i = 1, \dots, 6$$

where we choose logarithms to get rid of the money unit. It is always possible to specify the u_i 's such that $1/6 \sum u_i = 0$ and $1/5 \sum u_i^2 = 1$. Doing so, we have

$$(2.2) \quad \mu_n = 1/6 \left\{ \sum \ln y_{in} - \sigma_n \sum u_{in} \right\} = 1/6 \sum_{i=1}^6 \ln y_{in}$$

$$(2.3) \quad \sigma_n = \sqrt{1/5 \sum_i (\ln y_{in} - \mu_n)^2}$$

It follows that (μ_n, σ_n) may be estimated per individual and consequently the sequence $u_{1n}, \dots, u_{6n}$ may be estimated per individual as well. If u_{in} is constant over n , say u_i , we may conclude that verbal labels are equally interpreted by different individuals. In practice we cannot expect constancy as there will be a random response error involved. A measure for it is the standard deviation. We found the following results for the average of u_{in} and its sample standard deviation.

Table 1. Average and sample s.d. of u_i and $N(u_i)$

Label	u_i	$\sigma(u_i)$	$N(u_i)$	$\sigma(N(u_i))$	Equal interval
1	-1.291	0.236	0.104	0.041	0.083
2	-0.778	0.190	0.222	0.059	0.250
3	-0.260	0.241	0.400	0.091	0.417
4	0.259	0.239	0.600	0.091	0.583
5	0.760	0.190	0.773	0.061	0.750
6	1.311	0.229	0.899	0.040	0.917

From Table 1 we see that although u_{in} is not constant, its s.d. about the mean is fairly constant about 0.21. This suggests that the response error is of the same size at each level. We could not find any dependency of u_{in} on n , which suggests that the error is independent from n . The second even more intriguing feature is that u_i is almost symmetric about zero which suggests a specific response pattern. Instead of u_i we may also consider any monotonous transform of u_i . We choose the standard-normal transform $N(u_i; 0, 1)$ yielding the third column with corresponding sample-standard-deviations. This normal transformation has the advantage that labels are translated on a $[0, 1]$ -scale such that "poor" may be identified with a figure of $10.4\% = \pi_1$ and "prosperous" with $89.9\% = \pi_6$. In general we denote $N(u_i) = \pi_i$. If such a translation is reasonably constant over individuals as Table 1 suggests, we have a numerical translation of verbal labels which seems intuitively reasonable. We thus have that y_{1n} is evaluated by individual n on the average by 10.4% and y_{6n} by 89.9%. It follows then that we may consider

$$(2.4) \quad U_n(y) = N(\ln y; \mu_n, \sigma_n)$$

as an income utility function or an individual welfare function of income (WFI). The question remains why we choose the normal transform. First, the choice of a distribution function maps income amounts to a value scale that is bounded from below and above. In practice evaluations are always done on a finite value scale. Such a transform should involve only two parameters, as μ_n and σ_n give a rather complete description of y_n . Thirdly, it should be symmetric about μ_n as the u_i 's are clearly symmetric about zero. Finally, it should be defined on $(-\infty, +\infty)$ and be tractable.

It is this normal or rather lognormal WFI that has been introduced by Van Praag (1968, 1971) and studied and tested by Van Praag, Kapteyn (1973), Van Praag et al. (1978), Buyze (1982). A recent survey is given by Kapteyn, Wansbeek (1985a, 1985b) and a critical rejoinder on measurement problems by Ratchford (1985).

In those references it is frequently argued that the π_i 's should equal $(i-\frac{1}{2})/6$ ($i = 1, \dots, 6$). The idea behind it is that the labels are interpreted in such a way that the respondent gives as much information as possible on his $U(y)$. This is the "equal interval" hypothesis. From the last column in Table 1 we see that it is an acceptable hypothesis. Formal testing seems to be too dependent on the statistical model and the confidence limits accepted to be of much practical use. Here we take the equal interval hypothesis for granted. Without giving all pros and contras, our position in this paper will be that we cannot prove or disprove mathematically the validity of any relation between verbal labels and values on a numerical scale. We stress, however, that by means of a standardization device we get a meaningful mapping of labels on u-values in $(-\infty, +\infty)$ and that a normal transform of u makes sense for a number of reasons. The proof of the pudding is what results can be extracted from a specific cardinalization. This will be the subject of the following sections. The "equal interval" hypothesis is non-essential for the following sections but it is assumed for convenience*.

* In the empirical calculations in Section 4 we will assume the "equal interval" hypothesis. However, in the final version of this paper we shall deny the equal interval assumption and base ourselves on the values, that are empirically found and presented in Table 1.

3. The social filter process

It is a well-known idea that the evaluation of income, like of many other things, is a fairly relative affair. An income level y is evaluated good if we perceive it to be in the upper tail of the income distribution, and as poor if we assume that only a few people earn less (cf. Duesenberry (1949), Easterlin (1974), Rainwater (1974), Kapteyn et al. (1980), Layard (1980) for similar ideas). This idea may be stated more precisely as follows. People perceive an income distribution in society, described by a distribution function $F_n(y)$. Verbal descriptions v_i are translated in numerical values π_i , such that an income y is evaluated by v_i , if $\pi_i\%$ is perceived to earn less than y ; it follows that the income amount y evaluated by v_i is found by solving

$$F_n(y) = \pi_i$$

Setting $\pi_i = N(u_i; 0, 1)$ as defined in the previous section at $(i-\frac{1}{2})/6$ according to the equal interval hypothesis we find that the response behavior conform to this assumption is

$$F_n(y) = N(\ln y; \mu_n, \sigma_n)$$

It then follows that $U_n(y) (= F_n(y))$ is just a perceived income distribution. As any income distribution is approximately lognormal, it is not strange to assume that $U_n(\cdot)$ is a lognormal distribution function as well. The fact that people associate different income levels with the same π -values is then evidence for the hypothesis that people have different perceptions of the income distribution $F(y)$ in society.

Our problem now is how $F(y)$ is transformed by an individually determined process such that its output is the lognormal distribution F_n . Let us consider the density function (with respect to log-income) of both distributions, say f and f_n respectively, then we may define the social filter function $\phi_n(y)$ by

$$(3.1) \quad f_n(y) = \phi_n(y) \cdot f(y)$$

To understand $\phi_n(y)$ let us consider the frequency-interpretation of this equation. Let $f(y)\Delta y$ stand for the percentage of people with income in an

income range of $\frac{1}{2}\Delta y$ about its midpoint y , then $f_n(y)\Delta y$ stands for the perceived percentage. If $f_n(y)\Delta y/f(y)\Delta y \approx \phi_n(y) = 2$, it implies that individual n counts every person in that interval twice as heavy as pure counting would yield. If $\phi_n(y) = \frac{1}{2}$ each person counts for only half its weight. We notice that $\phi_n(y)$ is not a density function itself, although it describes the varying importance that individual n assigns to people in varying income classes.

Actually $\phi_n(y)$ is just what is called an importance function in simulation and Monte Carlo literature (see e.g. Hammersley and Handscomb (1964)). Table 2 summarizes the interpretation of ϕ .

Tabel 2. Interpretation of the social filter function with respect to income

$\phi_n(y)$	Weight assigned by individuals to income y
$= 0$	no value assigned
< 1	some weight given but less than the actual circumstances would imply
$= 1$	weight given just in proportion to reality
> 1	more value given than dictated by objectiveness

Actually the social filter function describes how an individual filters reality and derives his own perception of it. The respondent shows us his frame of reference with respect to income by giving weights to all members of society in conformity with his view of the income distribution. The social filter function with respect to income may be interpreted as an operational definition of the concept of social reference groups with respect to income. To gain insight into the notion of the social filter process with respect to income we sketch three different types of filter functions in Figure 1.

Figure 1.a.
Perfect transparency

Figure 1.b.
Short-sightedness

Figure 1.c.
Far-sightedness

The individual whose filter function is depicted in Figure 1.a. perceives the income distribution as it actually is; there is no social filter but we have a case of perfect transparency. The situation of Figure 1.b. is characteristic for short-sightedness; the respondent's attention is concentrated on people in his own income range. Figure 1.c. shows us a person who puts his mind to high classes, far away from his own; hence we speak of far-sightedness. One may say that the social reference group with respect to income of the individual of Figure 1.a. consists of all members of society while in Figure 1.b. it consists mainly of people being in the same income class while the individual in Figure 1.c. engages in a "struggle for high life".

There are two striking analogies. The first one is the Bayesian sampling model in statistics. There we have an input f , the a priori density and an output, the posteriori density f_n . The transform is described by just the same equation. A second analogy is the optical process of looking through a lens. The objective income distribution is perceived through a visual filter.

Let us take the logarithm of (3.1). Except for a proportionality constant we have

$$(3.2) \quad \left[-\frac{1}{2} \left(\frac{\ln y - \mu_n}{\sigma_n} \right) \right]^2 \propto \ln \phi_n(y) - \frac{1}{2} \left[\left(\frac{\ln y - \mu_0}{\sigma_0} \right) \right]^2$$

where we assume the objective income distribution to be lognormal with median μ_0 and log-variance σ_0^2 . The identity implies that $\ln \phi_n(y)$ is log-quadratic. We write

$$(3.3) \quad \frac{1/q_n^2}{\sigma_0^2} (\ln y - \mu_n)^2 \propto \left(\frac{1/q_n^2 - 1}{\sigma_0^2} \right) (\ln y - \tilde{\mu}_n)^2 + \frac{1}{\sigma_0^2} (\ln y - \mu_0)^2$$

where $q_n^2 = \sigma_n^2 / \sigma_0^2$ and where $\tilde{\mu}_n$ is implicitly defined. Setting coefficient equal we find

$$(3.4) \quad \mu_n = (1 - q_n^2) \tilde{\mu}_n + q_n^2 \mu_0.$$

We notice that $\mu_n = \mu_0$ if $\tilde{\mu}_n = \mu_0$. As $\tilde{\mu}_n$ is the point which gets most importance in the filter-process (if $1/q_n^2 > 1$) we call $\tilde{\mu}_n$ the focal point of the filter. Borrowing the optical analogy we call q_n^2 the myopia factor.

If q_n^2 tends to zero, social myopia increases and social importance tends to be assigned to an ever-narrowing interval about $\tilde{\mu}_n$ only. We notice that $\ln \phi_n(y)$ may be interpreted as a social distance concept, if $\ln \phi_n > 0$. Notice that not necessarily the log-income of n , say $\ln(y_n)$ coincides with his social focal point $\tilde{\mu}_n$. In that case the individual may feel a non-zero social distance with his own income class as he tries to identify with his social focal point $\tilde{\mu}_n$.

As we may estimate (μ_n, σ_n) per individual it is empirically possible to estimate the parameters $\tilde{\mu}_n$ and q_n^2 or rather to explain them by objective characteristics. This empirical investigation will be the subject of the next section.

4. Empirical estimation

Assuming that the social focal point heavily depends on the respondent's own net family income y_n and family size fs_n we hypothesize

$$(4.1) \quad \tilde{\mu}_n = \beta_0 + \beta_1 \ln y_n + \beta_2 \ln fs_n$$

Considering (3.4) we obtain

$$(4.2) \quad \mu_n = (1-q_n^2)\beta_0 + (1-q_n^2)\beta_1 \ln y_n + (1-q_n^2)\beta_2 \ln fs_n + q_n^2\mu_0.$$

The myopia factor with respect to income q_n^2 is linked up with the individual's scope of fantasy: the larger q_n^2 the broader the range of incomes that are weighted substantially different from zero indicating a greater sensitivity with respect to income differences. We assume

$$(4.3) \quad q_n^2 = \exp(\gamma_0) \cdot sc_n^{\gamma_1} \cdot pex_n^{\gamma_2}$$

where sc_n stands for the respondent's years of schooling and pex_n ($age_n - sc_n - 6$) for potential years of labor market experience. Now we connect the model outlined in this section with the previous results. From Section 3 we saw that $\ln c_{in} = \mu_n + u_i \sigma_n$ with $u_i = N^{-1}(\frac{i-1}{6})$, $i = 1, \dots, 6$ holds approximately. Introducing the error term ϵ_{it} , we write

$$(4.4) \quad \ln c_{in} = \mu_n + u_i \sigma_n + \epsilon_{in} \quad i = 1, \dots, 6; n = 1, \dots, T.$$

On the disturbance term we assume that $\{\epsilon_{it}\}_{i=1, \dots, 6}^{t=1, \dots, T}$ are independent

identically distributed and have a normal distribution with mean 0 and variance σ_ϵ^2 . Combining (4.1), (4.2), (4.3) and (4.4) we minimize $\sum_{i,n} \epsilon_{in}^2$ with respect to $\beta_0, \beta_1, \beta_2, \gamma_0, \gamma_1$ and γ_2 . This non-linear estimation

problem has been tackled with the algorithm of Marquardt (1963). The resulting estimates and corresponding standard deviations are given in Table 3.

Table 3. Estimation results for N = 448 persons, with standard deviations between brackets.

$\beta_0 = -5.393 (0.649)$	$\gamma_0 = -1.005 (0.156)$
$\beta_1 = 1.520 (0.065)$	$\gamma_1 = 0.223 (0.051)$
$\beta_2 = 0.260 (0.031)$	$\gamma_2 = -0.053 (0.012)$
$\bar{R}^2 = 0.774$	

Let us now make some remarks on the empirical results:

1. the myopia factor

- q_n^2 varies positively with sc_n which reflects the fact that better educated people have more fantasy concerning income than the less educated;
- q_n^2 varies negatively with pex_n which may have to do with the fact that "much experienced" people are more or less set in their income habits, left with only a small income sensitivity;
- in general $q_n^2 < 1$, i.e. individual n is short-sighted;

2. the social focal point

- since on average $q_n^2 < 1$ the social filter function generally peaks and has a maximum at $\tilde{\mu}_n$;
- $\tilde{\mu}_n$ varies positively with own income which reflects the fact that the mode of the social filter function shifts with shifting income;
- $\tilde{\mu}_n$ is positively correlated with family size indicating that the larger fs_n the higher the income level needed;
- generally $\tilde{\mu}_n > \ln y_t$ which shows people's tendency to focus their attention especially on people earning more than themselves; it may be explained by the fact that people are trying "to keep up with the Jones's". Their mind is put on people being somewhat more fortunate. This view stresses the relative aspect;

3. the parameter μ_n

the larger one's μ_n , the larger the income one needs in order to reach a specific income evaluation; μ_n may be interpreted as an individual want parameter; assuming that $q_n^2 < 1$ we have

- the elasticity coefficient $(1-q_n^2)\beta_1$, which reflects the well-known tendency of people to adapt their (income) judgments to their own

- (income) circumstances. The so-called preference drift effect (see Van Praag (1971)), is about 0.66; as distinct from earlier research results it varies among individuals: the higher q_n^2 , the smaller the preference drift rate which may be explained by a broader view on incomes;
- the family size elasticity $(1-q_n^2)\beta_2$ is about 0.11; it varies among individuals with q_n^2 in the same way as the preference drift rate;
 - if society's income and thus μ_0 rises, then because of interdependency one's needs also rise; the effect depends on the value of q_n^2 : the larger q_n^2 , the broader one's income horizon and the bigger the effect of a rise of μ_0 on μ_n ; there is, however, no reason that the effect should be proportional ($q_n^2 = 1$).

Considering the individual's social filter function with respect to income we derive the following propositions on the individual's social reference group loosely defined as the income class to which the social filter function assigns considerable importance

- I. it especially contains those people with an income being (somewhat) bigger than one's own,
- II. the width of the group is positively correlated with one's years of schooling and negatively with one's potential labor market experience; the effect of the latter being smallest in absolute terms.

5. Discussion and conclusions

In this paper we tried to show that our empirical knowledge about WFI's or income utility functions can be based on rather simple attitude questions, that may be included in practically any survey questionnaire.

It is seen that responses strongly depend on objectively measurable individual characteristics like current income and family size.

It is obvious that our way of modelling the individual perception of the income distribution by the social filter model may not only be seen as a contribution to the understanding of the utility concept, basic to decision models, but also as a contribution to sociology and psychology.

However, it is just a first step. First we have value judgments about other things than income as well, say schooling, age etc. (see Van Praag et al. (1985)). This implies that the concept of evaluation functions and social filter functions should be generalized to more dimensions. Second, it is also evident that present norms are not only generated by comparison with the present environment but also by comparing with past environments. This calls for a dynamic social filter process theory.

With a view to applications the WFI is useful for explaining varying choices in a fixed decision situation where people may decide differently on the basis of differences in their WFI. The evaluation of income inequality by people belonging to different social classes is also such a problem.

The theory outlined in this paper may also be seen as a quantitative specification of the sociological theories of relative deprivation (see Stouffer et al. (1949), Runciman (1966), Merton and Rossi (1968) and adaptation level theory (Helson (1964)) as formulated in psychology. All theories stress the relativity of evaluations, judgments and perceptions. A number of assumptions made in this paper is purely technical and can be replaced or removed altogether. This is especially so for the normal specification and the assumption of equal intervals.

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