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The Introduction of Sociological Variables in Engel Curve Analysis

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I. INTRODUCTION

It is well known that traditional Engel curves explain only a small part of the variation in *individual* consumption patterns. This should not come as a surprise, as it is clear that individual households differ on more dimensions than their income level alone. Indeed, at least one non-economic variable, i.e. household size, had to be introduced from the early beginning of the analysis in order to make any progress. Most economists would agree that other psychological and social variables also are important determinants of the consumption pattern. Many studies therefore try to incorporate such variables in Engel curve analysis. Only a few, however, approach the problem in a theoretically consistent way.

If we want to keep to the basic economic idea of optimisation under constraints, we can introduce other variables in two ways. A first possibility is the refinement of the constraints side. An alternative approach is the relaxation of the constant preferences assumption. In this paper we explore some possibilities of this latter approach[1] and try to introduce social influences on preferences. We therefore propose a simple, but theoretically acceptable, specification and show that it allows us to introduce sociological variables in a flexible way.

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After a presentation of our data in section II, we discuss some general features of social interdependencies in section III. In section IV we spend some attention on the specification of the functional form. We there propose a simplification of the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980b) and show how it can be accomodated for the introduction of preference variables in cross-section consumption analysis by the introduction of multiplicative shift parameters. In the following three sections we discuss our empirical results from three different points of view, which correspond to three important advantages of introducing preference variation: improving the explanation of the variance in individual consumption patterns (section V), constructing a richer interpretational framework (section VI), and obtaining better estimates of the traditional income coefficients (section VII). Finally, we draw some conclusions. For our empirical exercices we used the data from a budget survey, organised by the Center for Population Studies (Ministry of Health). We would like to thank them for the permission to use this material.

II. THE DATA

As noted, the budget study from which we use the data was conducted by the Center for Population Studies of the belgian Ministry of Health. A detailed description can be found in Pauwels (1973) and Renard (1976). We will only sketch the main features here. The sample was drawn from the population of belgian families in Liège, in which both partners were married for the first time. A total of 523 families were subjected to the complete, rather extensive survey. This sample was stratified according to the number of children (with a maximum of four) and the duration of the marriage (with a maximum of sixteen years). The husband had to be a blue- or white collar dependent worker and none of the children was professionally active. The method of investigation was a combination of questionnaire and interview. Besides the budget data, the survey contained a detailed sociological analysis, which makes it particularly attractive for our purposes. All interviews were taken in the period from 15/11/1970 to 15/1/1971.

To allow the estimation of a theoretically consistent system of demand equations, we had to aggregate the rather detailed budget data into a tractable number of consumption categories. If we have too many of these categories, the interpretation becomes cumbersome and

statistical tests over the whole system difficult to compute. On the other hand, it is obvious that the introduction of preference variables can only lead to interesting results, if the consumption categories are not defined too broadly. For our purposes, we had to find a compromise between these two sets of considerations. We summarised the budget data in 18 categories, described in table 1, where we also give the average budget shares. Note the comparatively large share of food: with the available data, it was not possible to distinguish different food categories in an economically meaningful way.

TABLE 1

Expenditure categories with average budget shares

A.	Food	.2931
B.	Clothing	.0870
C.	Rent	.0982
D.	Durables	.0535
E.	Light and heating	.0487
F.	Maintenance and reparation house	.0340
G.	Diverse housing costs (mostly with a luxury character, e.g. garage, second residence)	.0096
H.	Public transportation	.0104
I.	Private transportation	.0877
J.	Telephone and postal services	.0075
K.	Hospital costs	.0052
L.	Physician's services	.0097
M.	Medicines	.0087
N.	Medical insurance	.0029
O.	Leisure expenditure	.0895
P.	Tobacco	.0174
Q.	Insurance (other than medical)	.0142
R.	Other goods and services	.1227

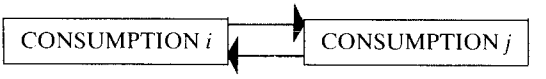
III. MODELLING SOCIAL INTERDEPENDENCIES: SOME GENERAL IDEAS

Everyone will agree that man is a social animal, whose behaviour is largely influenced by his socii, both directly and indirectly through the social structure. As consumption is part of behaviour, one could expect such influences on consumption behaviour also. The formal economic

literature on social influences is very sparse, however. Therefore, in the present state of the art there is no consensus about the exact way of modelling them.

A direct way of describing consumption interdependencies is present in some early papers (Johnson (1952), Prais and Houthakker (1955))[2]. A schematic representation can be found in figure 1.

FIGURE 1



In this simple structure we do not relate the interindividual influences on consumption to meaningful intervening variables. This model therefore can be criticised as relying "on social telepathy as an intervening mechanism"[3]. The economic framework, however, suggests immediately an interesting intervening link: the preference structure. To see what can be done within this framework, it is useful to introduce the sociological concept of a "reference group".

In general one can say that the concept of reference group designates "the type of group that an individual uses as a point of reference in determining his own judgments, preferences, beliefs and behaviour"[4]. This definition of course is very vague and the problem is that this vagueness often characterises the scientific use of the concept: the individual may or may not be member of a particular reference group, he may use it as a positive or negative reference point. One way to structure these ideas is to start from the existence of two seemingly contradictory psychological pressures, both active in actual behaviour: the tendency of social conformity and the desire for distinction.

The former tendency leads to the formation of groups, defined as "(1) persons who are interdependent upon each other such that each member's behaviour potentially influences the behaviour of each of the others, and (2) the sharing of an ideology – a set of beliefs, values and norms, which regulates their mutual conduct"[5]. Such a group is a first clear interpretation of "reference group": a group, of which the consumer is a member, and with which he tries to assimilate. This of course will have consequences for consumption also. In fact, we could reformulate the two parts of the definition as (1) persons who share the same material life style in which each member's consumption potentially influences the behaviour of the others and (2) the sharing of a preference structure.

Although this kind of group influence is pervasive, it is of course more important for some market goods than for others. Indeed, for some consumption categories the preference structure of different groups is very similar. It is exactly this similarity which identifies these different groups as belonging to the same culture. An obvious example for our society could be bread. In this context one should be careful not to confuse differences due to the budget constraint with differences in preferences. It is e.g. possible that the ownership of a car has the same desirability for all groups, differences in actual ownership being explained by income differences.

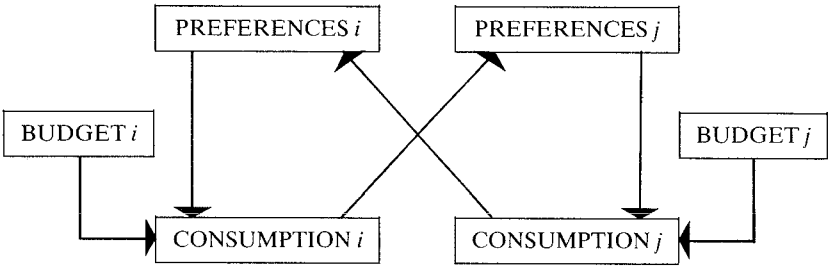
There is a further complication: each individual belongs to many groups and different parts of consumption can be influenced by different groups. It is e.g. reasonable to assume that clothing style will be influenced heavily by one's age group, while professional status codetermines the leisure expenses.

Conformity being one pole of our psychological dimension we have at the other extreme the desire for distinction. Here also, the group structure may be important, at least in a stratified society, where higher social status is linked to material consumption. Indeed, people from "lower" status-groups can try to get social distinction by imitating the consumption pattern of higher placed groups. These groups of course want to keep their place in the social hierarchy and therefore try to differentiate their consumption pattern from that of their followers. We thus have here another clear interpretation of reference group: a group of which the consumer is not a member, and which he tries to imitate (positive influence) if it has a higher social rank and from which he wants to differentiate himself (negative influence) in the opposite case. Here it is still more obvious that this influence cannot cover the whole range of market goods. Indeed, because of the budget constraint, it simply is impossible for lower status-groups to imitate completely the consumption pattern of the more wealthy[6].

Let us now return to the economic model of consumption behaviour. Since Duesenberry (1949) the most popular mechanism studied by economists (see Gaertner (1974), Pollak (1976)) has been the immediate extension of figure 1, given in figure 2.

Three points can be noted with respect to this representation. First, it does not take into account any interpersonal communication except via consumption. This of course cannot be realistic in general and reflects a typical economic bias. One can say that, while conspicuous consumption may be the principal way of transmitting information about status

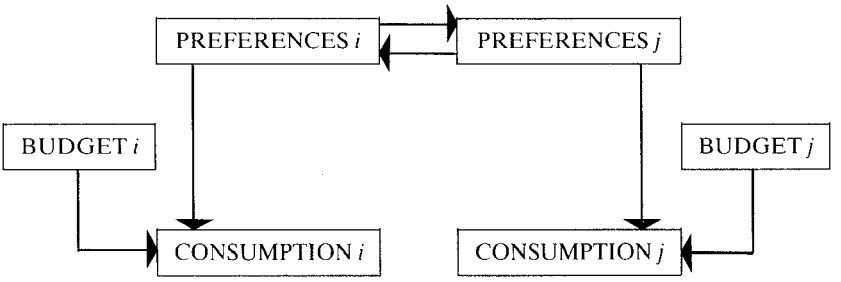
FIGURE 2



between groups, other forms of communication will dominate within life style groups with their common values and norms. This suggests that the model is better suited for the analysis of emulation than for that of the formation of life style groups. This impression is enhanced by the second important feature of the model: since the influence of person *i* on person *j* goes through consumption, it is necessarily mediated by the budget constraint. In our society the expenditure distribution is related to status and therefore to the emulation structure of society. Its relationship with the life style groups is less straighforward. Finally we can remark that the model is not a very stable one: a change in *i*'s consumption, e.g. due to a price or income change, will be reflected in *j*'s preferences and vice versa. Certainly we feel that the values and norms of life style groups do not change so easily.

The preceding discussion leads us to the conclusion that the figure 2 – model can be useful to describe emulation but that another representation should be found for the analysis of life styles. It is striking however, that the economic tradition almost completely neglects the conformity-effect. One exception is the paper by Hayakawa and Venieris (1977), who start from the (obvious) sociological fact that "wants are not distributed randomly throughout society but rather in clusters associated with social groups. In turn, social groups have their life styles, and wants of their members are clustered to define these styles of life. Heuristically, there are islands of clustered wants for different social groups. Social interaction with significant others provides an opportunity for learning about these clusters"[7]. To model this effect, Krelle (1968, 1973) proposes the structure, given in figure 3.

FIGURE 3



There is a direct mutual influence of the preferences of i and j, exerted by all kinds of communication, other than the demonstration effect via consumption. This has the important consequence that this influence does not involve the budget constraint. If there is a similarity between the consumption patterns of i and j (there can be large differences due to the budget constraint), this similarity can be explained by the resemblance between the preference structures, without invoking any direct mutual influence of these consumption patterns.

Let us formalise this idea by starting from a utility function for individual i

$$u(q; \theta^i) \tag{1}$$

where q is a vector of market goods and services and θ^i a vector of preference variables for individual i. We then can write the following general representation of the process of social interaction:

$$\dot{\theta}^i = f^i(\theta^1, \ldots, \theta^N) \qquad i = 1, \ldots, N \tag{2}$$

where N is the number of consumers. It is shown by Krelle (1968) and Schokkaert (1982a) that for simple specifications of (2), social interaction leads to an equilibrium solution, characterised both by a clustering of wants (represented by equilibrium values of θ) and yet remaining interindividual differences. The final values of the psychological parameters θ depend on the pattern of social communication. The influencing social variables can be different for different market goods. This solution is an attractive formalisation of the idea of life style groups.

IV. SPECIFICATION OF THE FUNCTIONAL FORM

Although one can start from the general formulation (1) for theoretical purposes[8], only simple formulations are useful for empirical work. Indeed, starting from a complicated specification for $u(q;\theta)$ we generally end up with a system of nonlinear demand equations. The simultaneous estimation of such a system still is a far from trivial task. For our system of 17 categories ($n-1$, because of the adding-up condition) and 523 observations, the computer costs would be prohibitive.

A particularly simple and interesting approach was proposed by Barten (1964) for the treatment of household composition. This specification amounts to

$$u(\theta_1(x)q_1, \ldots, \theta_n(x)q_n) \tag{3}$$

where the vector θ for our purposes can be interpreted as a vector of differential weights, attached to the different goods, and determined by the vector x of psychological and social characteristics. Recent research has shown that this multiplicative specification works very well, both for the treatment of family composition (Pollak and Wales (1981)) and for the analysis of habit formation (Pollak and Wales (1982))[9].

It is well known in the literature[10] that (3) implies that the Marshallian demand functions must be in the form

$$q_i = \frac{1}{\theta_i} D_i \left(\frac{m\theta_1}{p_1}, \ldots, \frac{m\theta_n}{p_n} \right) \quad i = 1, \ldots, n \tag{4}$$

where m is total expenditure. This formulation is interesting because it shows immediately how changes in θ (and thus in x) can be introduced into a demand system. We will now first present an interesting specification for such a demand system, and then discuss the relevant variables x.

A. *A consistent demand model for cross-section analysis*

As equation (4) implies that the effects of social and psychological variables in the Barten-model are equivalent to those of price changes, almost any existing demand system could be a starting point for our exercise. For our purposes, however, two important requirements should be put on the functional form. In the first place the specification

should have attractive Engel curve properties. All cross section studies indicate in this respect that the income elasticity of demand varies with income and that the relationship between income and consumption is non-linear. This implies that the functional form for estimation of Engel curves should be rather flexible. Demand systems, derived from a homothetic utility function, or linear in income (e.g. the linear expenditure system) are to be avoided. The most popular Engel curves on the other hand often lack theoretical consistency because they do not even satisfy the adding-up condition. In the second place we have to keep in mind that, except for household size and composition, there is only little experience with the introduction of socio-psychological variables in demand analysis. Moreover, we will be working with probably poorly measured variables. We can therefore expect that some experimentation will be necessary. In this respect, it is to be noted that our data base with individual data contains many more observations than a usual time series. All these considerations lead to the conclusion that the preferred specification should be as simple as possible.

Simplicity, flexibility and theoretical consistency are not easily reconciled of course. Their combination is the dream of every applied econometrician. For our purposes, we get an interesting compromise by combining (3) with the Piglog-class of preferences[11] (see Deaton and Muellbauer (1980a)).

In the appendix we derive the following specification, which is a simplification of the "Almost Ideal Demand System" of Deaton and Muellbauer (1980b):

$$w_i = c_{0i} + \beta_i \log m + \sum_j \delta_{ij} x_j \qquad i = 1, \ldots, n \tag{5}$$

where w_i is the share of good i in the total budget and c_{0i}, β_i and δ_{ij}, $j = 1, \ldots, K$, are parameters to be estimated. It is obvious that (5) is a very convenient specification, in which the preference variables x enter linearly. But, apart from its convenience, it has other important properties:

1. It implies the Engel-curves

$$w_i = c_{0i} + \beta_i \log m \tag{6}$$

This functional form was already proposed by Working (1943) and strongly defended by Leser (1963). It is a flexible way of describing the consumption-income relationship which normally fits the data very well (see also Deaton (1980)). The Working-Leser specification has re-

mained relatively unknown for a long time, but has become popular in recent years[12]. It is obvious that the expenditure elasticity in (6) is not constant, but given by

$$\varepsilon_m = 1 + \frac{\beta_i}{w_i} \tag{7}$$

The sign of β_i then immediately shows whether the good is a necessity or a luxury: it is a necessity if $\beta_i < 0$ and a luxury if $\beta_i > 0$.

2. A second important characteristic of (5) (and of the Working-Leser-Engel-curves) is the easiness with which the adding-up condition can be satisfied. The theoretical restrictions (see appendix) indeed imply that

$$\sum_i c_{0i} = 1 \qquad \sum_i \beta_i = 0 \qquad \sum_i \delta_{ij} = 0 \qquad \forall j \tag{8}$$

Also in this respect the convenience of (5) immediately stands out: if we estimate it equation by equation by OLS, the parameter estimates will satisfy (8) automatically. The adding-up condition makes it possible to interpret the effect of the preference variables in an attractive way: holding total expenditure constant, a rise in the share of one good necessarily has to be compensated by the decline in other shares. This overall view is the basic idea of the economic paradigm: only the estimation of a complete demand system allows the researcher to "hold expenditure constant" and to impose adding-up. Both these conditions have to be satisfied to avoid biased interpretations of the preference parameters. Therefore it is a pity that most actual cross-section consumption research follows the (in this respect) bad example of Prais and Houthakker (1955) and neglects the adding-up condition[13]. However, while adding-up can be imposed easily in (5), this is not the case for the other neo-classical conditions on demand systems: they are not useful here, because our sample does not allow us to identify the price coefficients.

Of course, no functional form is adequate in all respects. For our purpose, however, which is the experimentation with preference variables in a theoretically consistent way and on a large data set, specification (5) is indeed almost ideal.

B. *Defining the preference variables*

Until now, we left the vector x of preference variables unspecified. The content of this vector of course depends on the nature of the data analysed. As we work with a pure cross-section it is logical to concentrate on social influences, leading to interindividual differences. We will treat household composition, the formation of life style groups and emulation successively.

1. The most obvious variable to be introduced is *household composition*. The multiplicative transformation was first proposed by Barten (1964) in this context, and it is about the only sociological variable which has been integrated regularly by economists. The minimum information we need for this purpose is the number of persons in the household: denote it by $\bar{N}$. Our survey, however, gives more detailed information and allows us to introduce

N_{-2} the number of children between 0 and 2 years old
N_{36} the number of children between 3 and 6 years old
N_{711} the number of children between 7 and 11 years old
N_{12+} the number of children, at least 12 years old

Given the composition of the sample, we know that

$$\bar{N} = N_{-2} + N_{36} + N_{711} + N_{12+} + 2$$

2. We argued in section III that the principal social influence is the *formation of life style groups*. These groups are identified by the equilibrium values for the vector of psychological parameters θ, following from the social interaction process. The group structure of these equilibrium values reflects the patterns of social communication. If physical distance does not matter, i.e. for a circumscribed geographical region, the communication pattern will be determined in the first place by social distance. Human beings indeed tend to affiliate with socii who are similar. It is quite generally accepted that in our society the most important stratifying factors are economic status and age. We therefore assume that the value of θ depends on the status and the age of the subject. Of course, the relationship may be different for different consumption categories.

Although it does not confront us with difficult theoretical problems, the empirical operationalisation of the idea is not easy. Its implementa-

tion indeed requires the measurement of a *social class-dummy*. This is not a trivial problem, since there are a priori many candidates, none of which is theoretically unambiguously superior. The most obvious possibility is the variable socio-professional status, with the following categories[14]:

SPS = 1 (5,4%) highest occupations, for which a university degree is necessary;
SPS = 2 (13,6%) superior positions, but university degree not necessarily required;
SPS = 3 (33,5%) lower intellectual occupations, white collar-workers;
SPS = 4 (33,5%) qualified manual labour and some non-manual activities (e.g. policeman, telephonist);
SPS = 5 (11,4%) specialised manual labour, requiring a certain experience;
SPS = 6 (2,6%) unqualified manual labour.

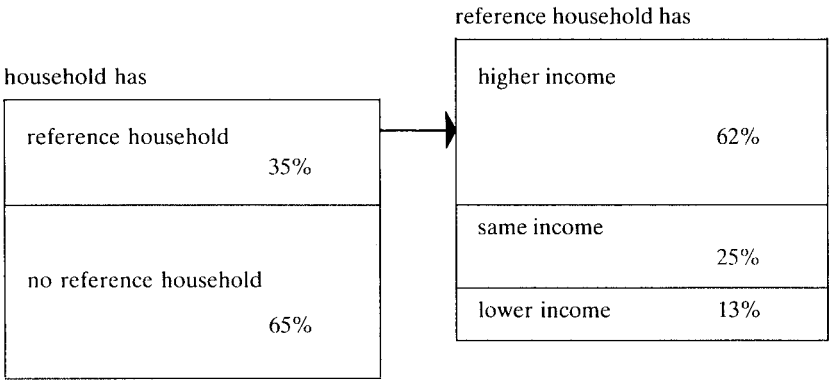
It could be argued, however, that this variable is too differentiated and that the only relevant distinction is the one between white collar- and blue collar-workers. This definition would be more closely related to the original content of social class, i.e. the worker-capitalist distinction. Many budget studies start from this simpler social structure and it was also the main focus of Renard (1976)'s analysis of the Liège-data. Although there was a separate variable available, we did not use it, but defined instead SKB = 1, if SPS = 4,5 or 6. This procedure was followed to obtain nested models.

There is not much of a problem, of course, with the *age*-variable. We therefore used the age of the household head. Our data set allowed us to distinguish the following categories:

AGE = 1 if the household head is less than 21 years old
AGE = 2 if the household head is between 21 and 24 years old
AGE = 3 if the household head is between 25 and 29 years old
AGE = 4 if the household head is between 30 and 34 years old
AGE = 5 if the household head is between 35 and 39 years old
AGE = 6 if the household head is between 40 and 44 years old
AGE = 7 if the household head is between 45 and 49 years old
AGE = 8 if the household head is more than 50 years old

3. A last, possibly important social influence is *emulation*. Indeed, one of the interesting features of the survey is its information on the "reference households" of the subjects and therefore on the emulation structure of society. We summarise part of this information in figure 4. This figure suggests that emulation may be a codeterminant of consumption for some households. Indeed, using the same data, Carlier (1979) has already shown that emulation with a reference household with a higher income level considerably increases the probability that the wife joins the labour force. However, our consumption categories probably are too broadly defined to detect any significant social emulation effect. A more important problem is obvious if we return to figure 2, which suggests that adequate modelling of emulation requires at least some knowledge about the consumption pattern of the reference households. This information is missing. We only have general information on some broadly defined sociological characteristics. As we moreover feel that the importance of the phenomenon is overemphasised, we will not discuss it further in this paper.

FIGURE 4
Emulation structure of society



A more concrete formulation of the models estimated and of their statistical significance will be given in the following section. The interpretation of the estimation results for the complete model follows in section VI.

V. STATISTICAL SIGNIFICANCE OF THE PREFERENCE VARIABLES

To illustrate the relevancy of the preference variables, it seems interesting to start from a traditional system and use it as a reference point. Such a system in our context consists of the Working-Leser-Engel-curves (6) with as explanatory variable total expenditure per capita

$$w_i = c_{0i} + \beta_i \log (m/\bar{N}) \tag{9}$$

Simple *OLS*-estimation of this system of linear equations with the same independent variables yields maximum-likelihood estimates. However, we want to test the statistical significance of introducing the preference variables. Because of the adding-up condition, the whole system is affected by such an introduction and testing procedures, confined to one equation, are theoretically not optimal. Therefore, we calculated the likelihood value for the whole system: to avoid the singularity of the covariance matrix of residuals, we omitted the last equation, i.e. the equation for "other goods and services".

The estimation results for (9) are given in table 2. It is obvious that only a small part of the variance in the budget shares can be explained by total expenditure per capita. There seems to be plenty of room for the introduction of preference variables. One can interpret the results as a sort of check on the data. This test seems to be positive, as our findings are in the line of most previously published results. Food, clothing, light and heating, medical care and tobacco are necessities: rent, durables, diverse housing costs, private transportation, leisure expenditures and other goods and services are luxuries. Total expenditure per capita seems to have no effect on the shares of house maintenance, public transportation, telephone and postal services and insurances. For the last category, this seems somewhat surprising.

While much empirical research in economics ends here, for our purpose it is only a starting point. Our main interest is the introduction of the preference variables. A summary of the different models estimated and of the statistical test results is given in figure 5. For each model we give the names of the independent variables (where *CON* indicates the constant), the total number of coefficients estimated, and the maximum value of the loglikelihood function. The value of the likelihood ratios and the number of degrees of freedom are given in the diamond-like boxes, connecting the rectangles. *All likelihood ratio tests indicate*

TABLE 2

Traditional Engel-curve – ln L = – 2645

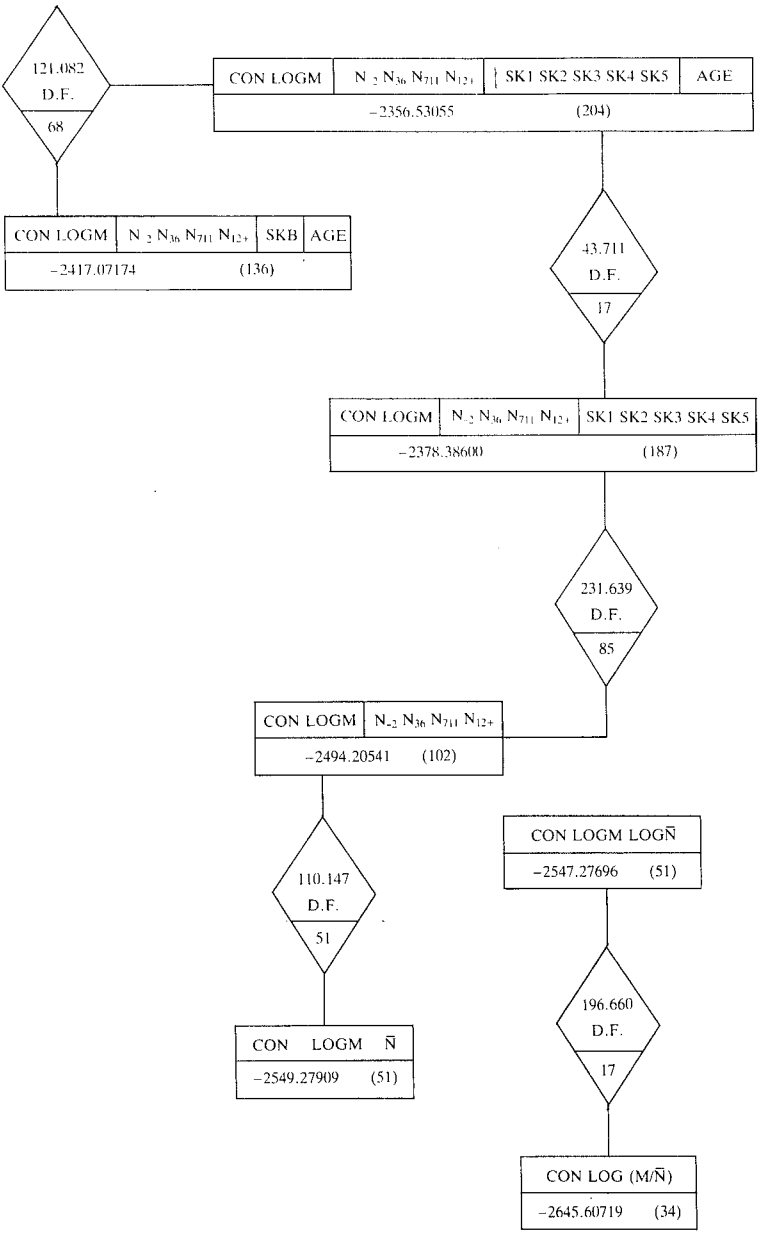
	c_{0i}	β_i	R^2 s
A. Food	1.681**** (.081)	–.123**** (.007)	.359 .081
B. Clothing	.196**** (.041)	–.010**** (.004)	.013 .041
C. Rent	.006 (.064)	.008** (.006)	.004 .064
D. Durables	–.066* (.052)	. .011*** (.005)	.010 .052
E. Light and heating	.292**** (.021)	–.022**** (.002)	.211 .021
F. Maintenance house	.024 (.040)	.001 (.003)	.000 .039
G. Diverse housing costs	–.056**** (.013)	.006**** (.001)	.045 .013
H. Public transportation	.009 (.015)	.000 (.001)	.000 .015
I. Private transportation	–.243**** (.082)	.029**** (.007)	.030 .082
J. Telephone and postal services	.003 (.008)	.000 (.007)	.000 .007
K. Hospital costs	.062**** (.023)	–.005**** (.002)	.011 .023
L. Physician's services	.037**** (.011)	–.002**** (.001)	.012 .011
M. Medicines	.046**** (.010)	–.003**** (.001)	.025 .010
N. Medical insurance	.015**** (.002)	–.001**** (.000)	.045 .002
O. Leisure expenditure	–.177**** (.054)	.024**** (.005)	.044 .054
P. Tobacco	.089**** (.017)	–.006**** (.001)	.034 .017
Q. Insurance	.022* (.018)	–.001 (.002)	.000 .018
R. Other goods	–.939**** (.101)	.094**** (.009)	.174 .101

*, **, *** and **** imply that the coefficient is significantly different from zero at the .20, .10, .05 and .01 level respectively.

strong rejection of the simplified model, i.e. all preference variables enter in a highly significant way.

FIGURE 5

Statistical significance of the preference variables



Together, all models presented in figure 5 produce an impressive amount of coefficients and it is not very meaningful to present them all. Since the likelihood ratio tests show that all simplified models are significantly rejected we will give and interpret in the following section only the results for the complete model:

$$w_i = c_{0i} + \beta_i \log m + \delta_{i1} N_{-2} + \delta_{i2} N_{36} + \delta_{i3} N_{711} + \delta_{i4} N_{12+} \quad (10)$$
$$+ \gamma_{i1} SK_1 + \gamma_{i2} SK_2 + \gamma_{i3} SK_3 + \gamma_{i4} SK_4 + \gamma_{i5} SK_5 + \xi_i \text{ AGE}$$

where SK_1 to SK_5 are zero-one dummy-variables, corresponding to $SPS = 1, \ldots, 5$ respectively.

These results are given in table 3. It is interesting, however, to investigate more closely the idea that only the distinction between white collar- and blue collar-workers is relevant. We therefore replaced the five social-class-dummies by the dummy *SKB*, described in the previous section:

$$w_i = c_{0i} + \beta_i \log m + \delta_{i1} N_{-2} + \delta_{i2} N_{36} + \delta_{i3} N_{711} + \delta_{i4} N_{12+} \quad (11)$$
$$+ \bar{\gamma}_i SKB + \xi_i \text{ AGE}$$

The results in figure 5 show that this simplified specification also yields a significantly lower value of the likelihood function.

The conclusion from the statistical analysis is obvious: for the analysis of our individual survey data *preference variables statistically do matter.* A final illustration of this conclusion is given by a comparison of the standard errors of regression, resulting from the estimation of the traditional Engel-curves (9) (table 2) with the standard errors for the complete model (10) (table 3). This suggests that the predictive power of the model also rises through the introduction of preference variables.

VI. RESULTS FOR THE COMPLETE MODEL

Statistical significance without theoretical interpretability is quite meaningless. In fact, the construction of a richer interpretational framework is one of the primary purposes of introducing preference variation. In this section we try to validate this claim by considering the estimation results for the complete model (10).

These results are given in tables 3.a and 3.b. The complete model contains 216 coefficients; it would be possible but dangerous to build

TABLE 3a

Results for the complete model

	CON	*LOGM*	*AGE*	N_{-2}	N_{36}	N_{711}	N_{12+}
A. Food	2.1678****	−.1515****	.0013	.0141****	.0179****	.0208****	.0313****
	(.1245)	(.0103)	(.0029)	(.0058)	(.0045)	(.0042)	(.0062)
B. Clothing	.1751****	−.0083**	−.0029***	−.0011	.0045***	.0043***	.0068***
	(.0673)	(.0056)	(.0015)	(.0031)	(.0024)	(.0023)	(.0034)
C. Rent	.2931****	−.0141**	.0018	−.0018	−.0083***	−.0047**	−.0111***
	(.1051)	(.0087)	(.0024)	(.0049)	(.0038)	(.0035)	(.0053)
D. Durables	−.1479***	.0157***	−.0000	.0004	−.0042**	−.0006	−.0083***
	(.0862)	(.0071)	(.0020)	(.0040)	(.0031)	(.0029)	(.0043)
E. Light and heating	.4304****	−.0302****	.0007*	.0058****	.0028****	.0055****	.0024**
	(.0327)	(.0027)	(.0008)	(.0015)	(.0012)	(.0011)	(.0016)
F. Maintenance house	−.0396	.0057*	.0012	−.0032*	.0020*	.0019*	−.0034*
	(.0648)	(.0054)	(.0015)	(.0030)	(.0023)	(.0022)	(.0032)
G. Diverse housing costs	−.0474***	.0039***	.0019****	−.0014**	−.0016***	−.0011**	−.0017**
	(.0215)	(.0018)	(.0005)	(.0010)	(.0008)	(.0007)	(.0011)
H. Public transportation	.0685****	−.0055****	.0010***	−.0023***	−.0013**	−.0010*	.0027***
	(.0241)	(.0020)	(.0006)	(.0011)	(.0009)	(.0008)	(.0012)
I. Private transportation	−.5334****	.0536****	−.0076****	−.0024	−.0079**	−.0035	−.0057
	(.1355)	(.0112)	(.0031)	(.0063)	(.0049)	(.0045)	(.0068)
J. Telephone and postal services	.0202***	−.0014**	.0003*	.0009**	.0004*	.0003	0.007*
	(.0117)	(.0010)	(.0003)	(.0005)	(.0004)	(.0004)	(.0006)
K. Hospital costs	.0417*	−.0034*	−.0004	.0072****	.0008	.0009	.0021*
	(.0383)	(.0032)	(.0009)	(.0018)	(.0014)	(.0013)	(.0019)
L. Physician's services	.0347***	−.0027***	.0003	.0010*	.0015****	.0018****	.0017***
	(.0180)	(.0015)	(.0004)	(.0008)	(.0007)	(.0006)	(.0009)
M. Medicines	.0406****	−0.032***	.0009****	.0007*	.0025****	.0003	.0009*
	(.0167)	(.0014)	(.0004)	(.0008)	(.0006)	(.0006)	(.0008)
N. Medical insurance	.0229****	−.0016****	−.0000	−.0002*	.0002**	−.0003***	.0003**
	(.0038)	(.0003)	(.0001)	(.0002)	(.0001)	(.0001)	(.0002)
O. Leisure expenditure	−.0226	.0096**	−.0049****	−.0192****	−.0047**	−.0035*	.0091***
	(.0883)	(.0073)	(.0020)	(.0041)	(.0032)	(.0030)	(.0044)
P. Tobacco	.1561****	−.0096****	−.0005*	−.0004	−.0001	−.0016***	−.0016*
	(.0260)	(.0022)	(.0006)	(.0012)	(.0009)	(.0009)	(.0013)
Q. Insurance	.0421**	−.0029*	.0003	−.0005	.0020***	.0007	.0014*
	(.0288)	(.0024)	(.0007)	(.0013)	(.0010)	(.0010)	(.0014)
R. Other goods	1.7025****	.1459****	.0065***	.0026	−.0064*	−.0204****	−.0278****
	(.1636)	(.0135)	(.0038)	(.0076)	(.0059)	(.0055)	(.0082)

*, **, *** and **** imply that the coefficient is significantly different from zero at the .20, .10, .05 and .01 level respectively.

up a magnificent ex post interpretation of the results or to tell a story about every single coefficient. Nevertheless, it is interesting to sketch some broad lines in order to get more insight in the otherwise rather impressive tables. In fact, there are two ways to read the tables: row by row they give the explanation for the consumption of the different

TABLE 3b

Results for the complete model

	$SK1$	$SK2$	$SK3$	$SK4$	$SK5$	R^2
A. Food	−.0480***	−.0401***	−.0212*	−.0002	.0016	.4620
	(.0246)	(.0212)	(.0195)	(.0189)	(.0207)	.0747
B. Clothing	.0226***	.0275***	.0219***	.0190***	.0314****	.0382
	(.0133)	(.0115)	(.0106)	(.0102)	(.0112)	.0404
C. Rent	.0248*	−.0031	−.0089	−.0237**	−.0284**	.0494
	(.0208)	(.0179)	(.0165)	(.0159)	(.0174)	.0631
D. Durables	.0015	.0148*	.0057	.0108	.0108	.0262
	(.0171)	(.0147)	(.0135)	(.0131)	(.0143)	.0518
E. Light and heating	−.0163****	−.0113***	−.0096***	−.0163****	−.0227****	.2925
	(.0065)	(.0056)	(.0051)	(.0050)	(.0054)	.0196
F. Maintenance house	.0083	−.0102*	−.0050	−.0033	−.0015	.0226
	(.0128)	(.0110)	(.0102)	(.0098)	(.0108)	.0389
G. Diverse housing costs	.0056**	.0070***	.0024	.0024	−.0010	.1073
	(.0043)	(.0037)	(.0034)	(.0033)	(.0036)	.0129
H. Public transportation	.0129****	.0101***	.0092****	.0084***	.0078***	.0681
	(.0048)	(.0041)	(.0038)	(.0037)	(.0040)	.0144
I. Private transportation	−.0315*	−.0166	−.0107	−.0013	−.0100	.0580
	(.0268)	(.0213)	(.0213)	(.0206)	(.0225)	.0814
J. Telephone and postal services	.0056****	.0056****	.0043****	−.0004	−.0013	.1344
	(.0023)	(.0020)	(.0018)	(.0018)	(.0019)	.0070
K. Hospital costs	.0014	.0054	.0027	.0024	.0074*	.0449
	(.0076)	(.0065)	(.0060)	(.0058)	(.0064)	.0230
L. Physician's services	.0073***	.0060***	.0057***	.0033*	.0024	.0578
	(.0036)	(.0031)	(.0028)	(.0027)	(.0030)	.0108
M. Medicines	−.0001	.0012	.0012	.0015	.0026*	.0551
	(.0033)	(.0028)	(.0026)	(.0025)	(.0028)	.0100
N. Medical insurance	−.0006*	−.0007*	−.0005*	.0001	−.0001	.1400
	(.008)	(.0006)	(.0006)	(.0006)	(.0006)	.0023
O. Leisure expenditure	.0365****	.0406****	.0294***	.0145*	.0092	.1084
	(.0175)	(.0105)	(.0139)	(.0134)	(.0147)	.0530
P. Tobacco	−.0161***	−.0166***	−.0157***	−.0138***	−.0057	.1793
	(.0052)	(.0044)	(.0041)	(.0040)	(.0043)	.0156
Q. Insurance	.0231***	.0070*	.0061**	.0018	.0014	.0782
	(.0057)	(.0049)	(.0045)	(.0044)	(.0048)	.0173
R. Other goods	−.0369*	−.0266	−.0172	−.0052	−.0039	.2307
	(.0324)	(.0279)	(.0257)	(.0248)	(.0272)	.0983

*, **, *** and **** imply that the coefficient is significantly different from zero at the .20, .10, .05 and .01 level respectively.

market goods; column by column they show the overall picture of the preference effects. The second procedure is especially interesting here and it leads to *attractive results because we did impose the adding-up condition:* some hardly explainable negative signs can now be seen immediately as compensations for positive signs elsewhere.

1. Let us first concentrate on the coefficients of the *household composition* variables. For most categories, there is a clear tendency for older children to have a larger impact on the budget shares: food and clothing here are the typical examples. Interesting patterns are found for public transportation and leisure expenditure. The birth of a child leads to a decline in their shares (probably due to a decline in mobility) and the effect remains negative (but declining in absolute value) until the children become more than twelve years old: then the effect becomes positive, probably because the children themselves then get their own part in these kinds of expenditures. Note two other effects of the birth of a child: the maternity hospital's effect and the rise in the share of telephone and postal services. The (expected) overall positive effect is found for light and heating, but with a strange rise for N_{711}: do children get their own room at this age? Remarkable also are the strong positive effects of N_{36} for medicine and insurances. Totally unexpected is the negative effect on rent.

2. *Age* as a life-style variable globally has the expected effects: negative for clothing and leisure expenditure, positive for diverse housing costs and medicines. Unexpected is the positive effect on public and the negative effect on private transportation, although it could be argued that the ownership of a car is more important in the consumption style of younger consumers. This explanation is interesting, because it suggests that here social influences tend to dominate objective needs. Let us remark finally that age of the household head of course is correlated with the age of the children: the introduction of our age variable improved the interpretability of some household composition coefficients. This finding is not unimportant for the interpretation of traditional family equivalence scales, which seem to take up partly a life-style effect.

3. More important than age, however, at least for our sample, is the influence of *social status*. While table 3 contains the results for all five dummies, it is interesting to have the coefficients of *SKB* (the "blue collar"-dummy) in (11) as a reference. They can be found in table 4 and indicate that blue collar-workers relatively spend more on food and tobacco and less on rent, light and heating, telephone and postal services, physician's services, leisure expenditure and insurances. The more detailed results in table 3 suggest that the mere distinction blue collar-white collar is satisfactory only for food, telephone and postal services

and insurances. The effect is striking for these last two categories and conforms very well to our intuitive ideas about a "white collar"-lifestyle. The effect of social class is constantly moving along one dimension for public transportation (probably because higher social classes attach more importance to mobility), physician's services (probably reflecting the well-known fact that there is a tendency among higher social classes to go immediately to a specialist, while lower social classes first consult the general practitioner) and other goods and services (hardly interpretable). For some other categories there is almost a one-dimensional relationship, with the exception that the maximum is reached for group 2 and not for group 1: diverse housing costs (having a luxury character), leisure expenditure and tobacco (for this last category, a minimum is reached for $SK2$). It is tempting (but admittedly dangerous) to link this result to the phenomena of emulation and the importance of social prestige: people just beneath the top of the social hierarchy try to raise their social prestige through their consumption (e.g. a second residence or travelling abroad) while the top-class on the contrary does not need such expenditures (or even deliberately refrains from them, to differentiate itself). For clothing and light and heating the pattern of coefficients is mixed and not easy to interpret. Nevertheless, we can conclude that the results generally suggest that the consumption pattern of higher socio-economic strata is more directed towards conspicuous consumption goods. Given this conclusion it is interesting to note that we do not really detect a social-class effect on the shares of durables and private transportation. There is, however, a significant

TABLE 4

"Blue collar-effect" in (11)

A	B	C	D	E	F
.0270****	−.0022	−.0181****	.0029	−.0068****	.0026
(.0076)	(.0041)	(.0064)	(.0052)	(.0020)	(.0039)
G	H	I	J	K	L
−.0020	−.0017*	.0099	−.0053****	.0002	−.0029****
(.0013)	(.0015)	(.0082)	(.0007)	(.0023)	(.0011)
M	N	O	P	Q	R
.0006	.0006****	−.0195****	.0045****	−.0056****	.0157**
(.0010)	(.0002)	(.0054)	(.0016)	(.0018)	(.0099)

effect of total expenditure. This possibility was already mentioned in section III: it makes sense to hypothesise that both the possession of durables and of an own car are so deeply rooted in our general cultural background that all social classes try to acquire it, as soon as they can afford it.

4. In this section we have concentrated almost exclusively on the overall picture of variation of preferences. We noted already that a row-by-row interpretation of table 3 shows the explanation for the shares of the different consumption categories. These results speak for themselves. Note the interesting and rather detailed cross-section demand model for medical care categories.

VII. INTERPRETATION OF THE INCOME COEFFICIENTS

Traditionally, the main interest of economists has been the estimation of price and income effects. Even if we accept this to be the sole purpo-

TABLE 5

Expenditure elasticities for the complete and the simple model

	expenditure elasticity in (9)	expenditure elasticity in (10)
A. Food	.5793	.4831
B. Clothing	.8885	.9046
C. Rent	1.0835	.8564
D. Durables	1.1981	1.2935
E. Light and heating	.5565	.3799
F. Maintenance and reparation house	1.0265	1.1676
G. Diverse housing costs	1.6042	1.4063
H. Public transportation	1.0096	.4712
I. Private transportation	1.3352	1.6112
J. Telephone and postal services	1.0533	.8133
K. Hospital costs	.0385	.3462
L. Physician's services	.7526	.7216
M. Medicines	.6207	.6322
N. Medical insurance	.6207	.4483
O. Leisure expenditure	1.2648	1.1073
P. Tobacco	.6322	.4483
Q. Insurance	.9507	.7958
R. Other goods and services	1.7685	2.1891

se of empirical demand analysis, there is some reason to introduce preference variables in order to avoid biased estimates. In our case there will be a positive bias for the goods, favoured by higher social classes and a negative bias for goods, which are more important for lower social classes. To illustrate this argument, we give in table 5 the expenditure elasticities, as they can be derived from the simple Working-Leser-curves (9) and from the complete model (10) and evaluated at the average budget share. We showed in section V that, at least from a statistical point of view, (10) seems to be a better model. Table 5 then suggests that the biases, caused by omitting the preference variables may be considerable.

Note that the results for the complete model suggest that rent and (especially) public transportation are necessities, while they had an expenditure elasticity of about 1 in the simple case. This result obviously stands to reason. Note also that, contrary to popular assumptions, total expenditure has only a small (and even negative) effect on the shares of insurances and telephone and postal services: these shares are better explained by the social class-variable, and more concretely, the white collar-effect.

The analysis in this section which leads to a better interpretation of the traditional income effect is not only important from a theoretical point of view. It may also have some policy implications. An example is the design of the optimal tax policy, where the distinction between luxuries and necessities often enters the discussions. Another example is the interpretation of the "true cost-of-living index": our results indicate that the "representative consumer" differs between social classes. This finding can illuminate the position of different social groups in the actual index debates and towards price increases in general.

VIII. CONCLUSION

In this paper we started from the simple multiplicative transformation to introduce individual differences in preferences into empirical demand analysis. These differences were related to social influences, leading to the formation of life style groups, to the age of the household head and to household composition. An easy and flexible Engel curve-specification has been derived, which makes it possible to estimate the effect of the sociological variables in a theoretically consistent way.

The model was estimated, using the individual budget data from a sample of 523 households. The empirical results convincingly show that the preference variables indeed do matter. This is not surprising for household composition although our analysis suggests that it is advisable to use more detailed information than is common in current econometric practice. The importance of age and especially social status for the determination of consumption style is very striking, however. It is important to notice that this conclusion follows from a regression study, i.e. keeping total expenditure constant.

The importance of the preference variables has been illustrated from three points of view. From the statistical point of view, the simplified model without preference variation is rejected very significantly. Therefore, even from a traditional point of view their insertion is necessary to get unbiased estimates of the expenditure elasticities. Finally, from a general theoretical point of view it is obvious that introducing preference variation leads to a much richer interpretational framework, offering a more appealing description of economic reality.

However, it could be argued that an alternative (and better) explanation of the significant social class-effect is the poor modelling of the constraints side in traditional analysis. This means, as Prais and Houthakker (1955) write that "the concept of social class is regarded as being largely a shorthand expression for a particular combination of economic factors"[16]. Elsewhere, we have tried to demonstrate that it is difficult to accept this interpretation for our sample[17].

Many questions remain unanswered, of course. Not the least important of these is the problem which basic social processes are underlying the effect of social status on consumption. The only purpose of this paper, however, was to give a simple illustration of the relevancy of preference variation and, more especially, social influences for empirical demand analysis. It is often argued that taking into account preferences is too difficult to become common practice among demand analysts. Our results show that it can be very simple and that it yields interesting possibilities even for such simple models.

APPENDIX: DERIVATION OF THE SPECIFICATION

We start from the PIGLOG-class of preferences, which is defined via the cost function

$$\log c(u,p) = (1-u)\log a(p) + u \log b(p) \tag{12}$$

where $a(p)$ and $b(p)$ are positive linearly homogeneous functions. The most popular specification for $a(p)$ and $b(p)$ has been proposed by Deaton and Muellbauer (1980b); they choose

$$\log a(p) = \alpha_0 + \sum_k \alpha_k \log p_k + \tfrac{1}{2} \sum_k \sum_j \gamma^*_{kj} \log p_k \log p_j \tag{13}$$

$$\log b(p) = \log a(p) + \beta_0 \prod_k p_k^{\beta_k} \tag{14}$$

Since we know that

$$\frac{\partial \log c(u,p)}{\partial \log p_i} = w_i ,$$

where w_i is the budget share of good i, we can derive immediately, using (12), (13) and (14), and defining $\gamma_{ij} = \frac{1}{2}(\gamma^*_{ij} + \gamma^*_{ji})$:

$$w_i = \alpha_i + \sum \gamma_{ij} \log p_j + \beta_i \log \{m/P\} \tag{15}$$

where P is a price-index, defined as

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \tfrac{1}{2} \sum_j \sum_k \gamma_{kj} \log p_k \log p_j \tag{16}$$

Deaton and Muellbauer (1980b) have called system (15) the "Almost Ideal Demand System" (AIDS). For our purposes, however, it has the decisive disadvantage that prices via the index (16) enter in a highly non-linear way. Given our acceptance of a multiplicative transformation (see (3) and (4)), the same would hold then for our preference variables[18].

We therefore start from a simplification of (13) and (14), in which we put $\gamma^*_{kj} = 0 \; \forall \; k, j$. This has of course the undesirable consequence that the cost function cannot be treated as a flexible functional form anymore[19]. The functions $a(p)$ and $b(p)$ then are linearly homogeneous if

$$\sum_i \alpha_i = 1 \qquad \sum_i \beta_i = 0 \tag{17}$$

and we find the following specification:

$$w_i = w_{0i} + \beta_i \log m - \sum_j c_{ij} \log p_j \tag{18}$$

where $w_{0i} = \alpha_i - \beta_i \alpha_0$

$c_{ij} = \beta_i \alpha_j$

Redefining prices and goods as in (4), we can write (18) as

$$w_i = w_{0i} + \beta_i \log m - \sum_j c_{ij} \log \left(\frac{p_j}{\theta_j} \right) \tag{19}$$

For our cross-section study, where there is no variation in prices, we then get

$$w_i = c_{0i} + \beta_i \log m + \sum_j c_{ij} \log \theta_j \tag{20}$$

where $c_{0i} = w_{0i} - \sum_j c_{ij} \log p_j$. If we accept, moreover, that $\log \theta_j$ is a linear function of the preference variables $\log \theta_j = \sum_k d_{jk} x_k$[20], we find the following easily estimable specification

$$w_i = c_{0i} + \beta_i \log m + \sum_j \delta_{ij} x_j \tag{21}$$

where $\delta_{ij} = \sum_k c_{ik} d_{kj}$. Equation (21) is reproduced in equation (5) in the text.

NOTES

1. For a general discussion of these approaches, see Schokkaert (1982a).
2. But *not* Duesenberry (1949)!
3. Erbring and Young (1980), p. 30.
4. Bennett and Kassarjian (1972), p. 103.
5. Bennett and Kassarjian (1972), p. 97.
6. Of course they can try to work harder or to borrow money, to relax this constraint.
7. Hayakawa and Venieris (1977), p. 602.
8. See Schokkaert (1982a, 1982b).
9. Even if it is statistically rejected against a more general linear model, it has considerable interpretational advantages.
10. See Barten (1964), Muellbauer (1974), Gorman (1976).
11. This class permits exact aggregation over consumers, but this is of course not relevant for our purposes.
12. Izan and Clements (1979) propose a form analogous to (5) without any theoretical rationalisation. In a recent cross-country analysis, Theil and Suhm (1981) also accept the Working-Leser-curve as the core of their specification, but they add price variables in a rather complicated way.
13. See e.g. Andersson (1979). A notable exception is the work of Merz (1980).
14. This stratification scheme is taken from a study by Versichelen (1959).
15. In their study, Izan and Clements (1979) also estimate (21). They cannot reject the hypothesis $\beta_i = -\bar{\delta}_i$.

16. Prais and Houthakker (1955), p. 157.
17. Schokkaert (1982a), pp. 251-256.
18. The approximation, proposed by Deaton and Muellbauer (1980b) for a timeseries analysis, is only acceptable in the case of closely collinear prices. In our context, this would require closely collinear preference variables, which is of course an unacceptable assumption.
19. In this respect it is interesting to note that Deaton and Muellbauer (1980b), p. 313, argue that: "The choice of the functions $a(p)$ and $b(p)$ is governed partly by the need for a flexible functional form. However, the *main justification* is that this particular choice leads to a system of demand functions with (the) *desirable properties*...". We have the same ranking of objectives. Note also that the Piglog-specification proposed by Muellbauer (1977) is still simpler than ours, while leading to more complicated demand functions.
20. This specification is more general than may seem at first sight, since the vector x can contain (e.g. logarithmic) transformations of the preference variables.

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