...ITY
...SITEIT
...RABANT
POSTBOX 90153
5000 LE TILBURG
THE NETHERLANDS

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DEPARTMENT OF ECONOMICS

RESEARCH MEMORANDUM

LARGE, INFREQUENT CONSUMPTION IN THE MULTI-GOOD LIFE CYCLE CONSUMPTION MODEL

Pim Adang

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Pim Adang
Department of Econometrics
Tilburg University
P.O. Box 90153
5000 LE Tilburg
The Netherlands

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Abstract

For a detailed empirical analysis of consumer behaviour, one usually uses datasets containing information on the expenditures of households disaggregated into several commodity categories. Such datasets often contain one or more commodities which are either not bought at all or, if they are bought, it is in (relatively) large quantities only. Such expenditure patterns are usually explained from the difference between (frequent) consumption and (infrequent) purchase of a commodity. But there are cases, such as the vacation of households, in which an alternative explanation is worthwhile to take into consideration. In these situations, the fluctuating expenditure pattern corresponds to fluctuations in the underlying consumption behaviour.

In this paper, it is investigated how such a consumption pattern can be explained within a life cycle framework. As the multi-good version of Hall's (1978) life cycle model under uncertainty cannot fully capture it, a modification is proposed. It amounts to a non-convex transformation of either the preferences or the budget set, which ensures that low consumption levels are never preferred by the consumers.

The relevance of the modification is assessed using a simple two good example, which is estimated using a Dutch panel containing information on the disaggregated monthly expenditures of households.

1. Introduction.

In empirical studies applying a life cycle framework for modelling the behaviour of consumers, different types of datasets are employed. Some studies are concerned with the life cycle hypothesis at the macro level. Hence, in these studies macroeconomic quantities, usually in per capita terms, are used. In order to justify the use of macroeconomic data for estimating what are essentially microeconomic models, these studies usually have to impose the well-known 'representative consumer' assumption. Examples of this approach can be found in Hall (1978, 1988), Hansen and Singleton (1982, 1983), Flavin (1981) and Bean (1986). Since the focus in this study is on the life cycle model at the micro level, data on a corresponding level are needed. Put more precisely, as the multi-good version of the life cycle model is considered, household expenditures disaggregated into several commodity categories are required. Examples of studies using such data are the contributions of Alessie, Kapteyn and Melenberg (1988), Alessie and Kapteyn (1989) and Blundell, Browning and Meghir (1988).

In this paper, a problem that may occur if one uses such a disaggregated dataset for estimating a life cycle model is studied. If the dataset is sufficiently disaggregated over goods as well as over time[1], it often will contain one or more goods which for most households display a strongly fluctuating expenditure pattern. Typically, such a commodity is either not *bought* at all in a particular period or, if it is *bought*, it is in (relatively) large quantities only. One possible explanation for this pattern can be found in the so-called 'infrequency of purchase' literature[2] (see, for instance, Deaton and Irish (1984) or Pudney (1989) chapter 4), which explains the existence of such expenditure patterns from the observation that consumption and expenditures may differ substantially, if the period over which they are measured is short. The line of reasoning followed in studies belonging to this strand of literature, can briefly be illustrated by the following example. Consider a household consuming a certain commodity every week, but buying it only once every fortnight. If the observation period is a week, the household will either be observed not to buy the good at all, or to buy twice the quantity that in reality is consumed during the observation period.

Although the distinction between consumption and expenditures that is made in these studies, in many cases can provide a satisfactory explanation for the aforementioned fluctuating expenditure patterns, in some situations it may be worthwhile to consider an alternative explanation. This is, for example, the case if the fluctuating expenditure pattern for a particular good corresponds with fluctuations in the underlying consumption behaviour. That is, such a good is either not *consumed* at all, or is *consumed* in relatively large quantities only. A typical example of such a good is the vacation of households.

To illustrate this, consider the dataset used by van Soest and Kooreman (1987) in their study on vacation behaviour. The distribution of the (positive) annual expenditures on vacations as reported in this dataset, is given in Table 1.[3] From this table it can be seen that, for example, less than five per cent of the reported vacation expenditures are below Dfl 300.- (currently about $ 150.-).

An example in a somewhat different context can be found in some studies on labour supply. In these studies, it often is observed that people either do not work at all, or work a considerable number of hours. Hausman (1980) and Cogan (1981), for example, study this phenomenon using a static framework.

Table 1: distribution of positive holiday expenditures[1)]

AMOUNT	PERCENT
0-100	1.2
100-200	2.0
200-300	1.4
300-400	3.0
400-500	3.1
500-600	4.1
600-700	3.8
700-800	4.3
800-900	4.3
900-1000	4.7
>1000	68.1
#obs	1143

1) source: 1815 household observations from the 1981 Consumer Expenditure Survey of the Netherlands Bureau of Statistics
AMOUNT = average annual expenditure on vacation (in Dutch guilders)
PERCENT = number of positive expenditures on vacations in a certain class as a percentage of the total number of positive expenditures on vacations
#obs = total number of positive vacation expenditures

The aim of this paper is to explain such fluctuating patterns in a dynamic context; the life cycle model. In order to illustrate the model which is developed to offer this explanantion,the vacation example is used. Applying the model to the labour supply case does not seem to be more difficult, but is not done here because of lacking labour supply data. The content of this paper can briefly be summerized as follows.

In section 2, it is shown that a strongly fluctuating consumption pattern cannot be fully explained within the multi-good version of Hall's (1978) life cycle model. Therefore, a modification of this model is proposed, and its consequences are examined. The essential feature of this modified model is that either the preference ordering, or the budget constraint is non-convex for small values of the good displaying the strong consumption fluctuations. In section 3, a two-good version of this modified life cycle model is estimated and tested for the aforementioned vacation example, using a panel containing, among other variables, the monthly expenditures on vacation. The estimation procedure which is used to do this, is taken from Adang and Melenberg (1991). Finally, some concluding remarks are made in section 4.

2. Modelling Infrequency of Consumption.

Consider the following two-good version of Hall's (1978) life cycle consumption model under uncertainty (for t=1,...,L):

$$\max_{x_t, y_t, \ldots x_L, y_L} E_t \sum_{\tau=t}^{L} \left(\frac{1}{1+\rho}\right)^{\tau-t} \cdot u(x_\tau, y_\tau) \tag{2.1}$$

$$\text{s.t. } \sum_{\tau=t}^{L} \left(\frac{1}{1+r}\right)^{\tau-t} \cdot [p_{\tau x} x_\tau + p_{\tau y} y_\tau] \le W_t = (1+r) A_{t-1} + \sum_{\tau=t}^{L} \left(\frac{1}{1+r}\right)^{\tau-t} \cdot i_\tau,$$

$$x_\tau,\ y_\tau \ge 0 \quad \tau = t, \ldots, L^4,$$

where

$u(\cdot)$	: within period utility function; assumed to be strictly concave, constant over time and increasing in its arguments,
$(x_\tau, y_\tau)'$	: period τ's consumption vector,
$(p_{\tau x}, p_{\tau y})'$	: period τ's price vector,
i_τ	: period τ's income,
r	: nominal interest rate; assumed to be constant over time,
ρ	: time preference parameter,
A_{t-1}	: assets available at the beginning of period t,
E_t	: expectation conditional on the information available at period t.

Because of the multi-good setting of this model, prices must, in contrast with Hall's model, be included. This implies that uncertainty in model (2.1) may result not only from future incomes, as in Hall's model, but also from future prices. Consider now the example on which will be the focus in the empirical part of this study: the monthly consumption of vacation. A household typically will not go on vacation every month, but will only take one or two vacations per year, during which relatively large amounts of money will be spent. Can the model given in (2.1) explain such consumer behaviour, implying either a considerable consumption level, or no consumption at all?

As the interest rate, the time preference parameter and the preference ordering over all possible commodity bundles within a period, all are assumed to be constant over time, they cannot account for the variation over time of the consumption level. Since the life cycle model was especially formulated to account for the effect that an income change in a period is smoothed over several periods, the only possible cause left for explaining the jump from a substantial consumption level in one month, to no consumption in the next (and vice versa), is a big shift in the price of vacation. However, as can be seen from Table 2, the monthly price variability during the period covered by the dataset used in this study is very limited, both in absolute and in relative terms. So, unless the own price elasticity is very large, prices cannot fully account for the large changes in the consumption level of vacation.

Moreover, in months during which many households report holiday expenditures (i.e. the holiday season from May until September)[5], the price of holidays often rises more than the price of the other commodity (compare %ΔPV with %ΔPNV in Table 2). This combined increase in the price of holidays (albeit small) and the number of households spending money on vacations, cannot be explained by the model given in (2.1), unless the own price elasticity of vacation is positive.

Given the limitations of model (2.1), these findings are not very surprising. There are several ways in which model (2.1) can be changed, so as to better explain the fluctuating consumption pattern. A straightforward generalization is to make the period utility function $u(\cdot)$ time specific (for example by including taste shifters), thus capturing the seasonal pattern in the number of households reporting holiday expenditures present in Table 2. However, although this approach is likely to generate a more fluctuating consumption pattern, it is not fully satisfactory, as it does not exclude the consumption of small quantities in general.

Table 2: price variability and purchase frequency of vacation[1)]

Period	NH	%NZ	RPV	%ΔPV	%ΔPNV	Period	NH	%NZ	RPV	%ΔPV	%ΔPNV
Apr 84	921	21.2	1.00	.	.	Jan 86	676	15.8	1.02	-0.1	-0.5
May 84	966	25.9	1.00	0.0	0.1	Feb 86	667	16.8	1.01	0.0	0.1
Jun 84	884	33.4	1.00	0.5	0.0	Mar 86	680	17.3	1.01	0.0	0.2
Jul 84	922	40.8	1.01	0.1	-0.1	Apr 86	706	21.9	1.01	0.6	0.3
Aug 84	855	31.7	1.00	0.0	0.1	May 86	676	29.0	1.01	-0.3	0.0
Sep 84	757	19.5	1.00	-0.2	0.5	Jun 86	776	30.1	1.02	0.3	-0.5
Oct 84	889	14.1	1.00	0.8	0.6	Jul 86	818	40.2	1.03	-0.1	-1.0
Nov 84	849	9.5	1.00	0.1	0.1	Aug 86	798	30.7	1.03	0.1	0.1
Dec 84	789	10.8	1.00	0.0	-0.1	Sep 86	787	19.2	1.02	0.1	0.5
Jan 85	736	14.3	1.00	0.2	-0.1	Oct 86	837	16.8	1.02	-0.1	0.7
Feb 85	693	17.9	1.00	0.0	0.5	Nov 86	858	9.8	1.01	-0.4	-0.1
Mar 85	856	17.1	0.99	-0.3	0.5	Dec 86	978	10.7	1.02	0.8	-0.1
Apr 85	816	22.4	1.00	1.7	0.4	Jan 87	956	15.9	1.04	-0.1	-1.6
May 85	751	28.3	1.01	0.7	0.1	Feb 87	1022	16.5	1.03	0.0	0.3
Jun 85	753	28.8	1.01	0.1	-0.1	Mar 87	1018	19.4	1.03	-0.2	0.0
Jul 85	757	37.0	1.02	0.2	-0.2	Apr 87	981	21.5	1.04	1.2	0.5
Aug 85	767	29.0	1.01	0.0	0.1	May 87	1024	28.5	1.04	-0.1	-0.1
Sep 85	789	20.0	1.01	-0.2	0.4	Jun 87	1052	33.5	1.03	-0.2	0.1
Oct 85	806	14.0	1.01	0.6	0.3	Jul 87	968	39.4	1.04	0.1	-0.1
Nov 85	764	8.6	1.01	-0.1	0.0	Aug 87	954	33.6	1.04	0.7	0.2
Dec 85	742	9.8	1.01	-0.1	-0.2	Sep 87	898	23.2	1.04	0.0	0.4

1) NH = number of households participating in the panel in a particular month

%NZ = percentage of these households reporting positive expenditures for vacation in that month

%ΔPV = monthly percentage change in the price index of vacation; the price of vacation in April '84 has been set equal to 100

%ΔPNV = monthly percentage change in the price index of nonvacation good; the price of non-vaction in April '84 has been set equal to 100

RPV = price of vacation relative to the price of the nonvacation good

A second way in which model (2.1) can be improved, is by no longer maintaining the assumption that the lifetime utility function is additively separable over time. With a commodity like vacation, it is possible that consumption in a particular month will influence utility in a number of preceding and subsequent months. A possible way of modelling this, is to assume that by going on vacation, one builds up a stock of 'holiday pleasure'. This stock renders utility not only during the holiday itself, but also in a number of preceding and subsequent months. As time goes by the stock decreases (for example because of the daily routine at work), until a certain minimum level is reached, at which point the household replenishes the stock by going on holiday again. A problem with this approach in empirical work, is that one has to construct the (usually unobserved) stock of 'holiday pleasure'. Moreover, this modification again does not exclude the possibility that households, when replenishing their stock, do so by consuming only a small quantity of vacation.

As both modifications of model (2.1) discussed so far do not exclude low consumption levels for vacation, a third alternative is considered. In this approach, either each period's preference ordering or cost structure is changed in such a way, that consuming small quantities in any period does not result in the maximum expected utility.[6]

There are several possible motivations for a preference ordering which would imply that the consumption of a small quantity of vacation in a certain period gives less expected utility than not going on holiday, and spending the money thus saved on other goods in that period, or use it for consumption in other periods. One such motivation could be that a holiday must span a certain minimum period, in order to enjoy it. Therefore, one prefers, for example, a fortnight's holiday to fourteen holidays of one day.

This preference ordering will be modelled below by introducing a transformation in the utility function which results in non-convex preferences for small values of the vacation commodity. But before turning to this, consider first the two simple examples of such a preference ordering depicted in Figures 1 and 2. In Figure 1, it is assumed that the consumption levels in all periods except period t remain unchanged. The preference ordering in this figure implies that by going from a low consumption level of the vacation commodity y (point A), along the budgetline to no consumption of this good (point B), a higher utility level can be reached.

Instead of using the money that becomes available by not going on vacation in period t on the other good in the same period, it may be more plausible to assume that this money is used for consumption of good y in other periods. To illustrate this case, consider the example given in Figure 2. Assume that the consumer has perfect foresight and only varies the consumption of good y in period t and t+1. And again, as Figure 2 shows, consuming small quantities of good y in period t or t+1 (points A and C), results in a lower expected utility level, than consuming not going on vacation in either of these periods, and spending the money thus saved on good y in the other period (points B and B').

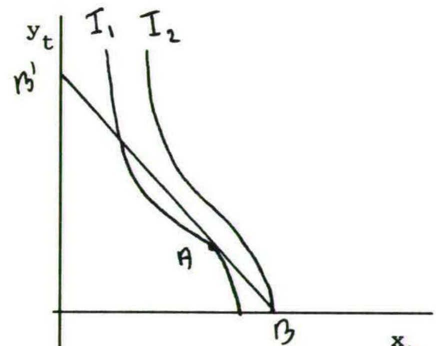

Figure 1

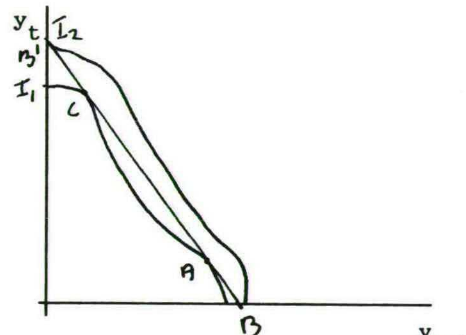

Figure 2

I_i = i-th indifference curve, i=1,2

BB' = budgetline

In both these examples only the consequences of shifts of money from one good to one other good, keeping all other consumption levels unchanged, were considered. Of course, much more complicated transfers are possible, but they cannot easily be represented in simple diagrams. More importantly, the main point of the two examples is not to demonstrate all possible ways in which the money that becomes available by not consuming good y can be redistributed, but to show that the proposed change of the preference ordering implies that a higher utility level can be reached by shifting consumption of good y towards zero in some periods.

In both examples, the crucial characteristic of the within period preference ordering is that it is no longer convex for small values of y. As convexity of the preference ordering is equivalent to quasi-concavity of the utility function (see e.g. Deaton and Muellbauer (1980) page 30), this change in the preference ordering can be incorporated in model (2.1) by changing the strict concave period utility function $u(\cdot)$ in such a way, that it is not quasi-concave for small values of y. This can be achieved by replacing y_τ in $u(\cdot)$ by a transformed value $g(y_\tau)$, with $g(\cdot)$ a strictly increasing function which is strictly convex for small values of y_τ, and concave for larger values. An example of such a transformation is the well-known logistic function.

Because of the strict concavity of $u(\cdot)$ with respect to x_τ and y_τ[7], this convexity of $g(\cdot)$ itself does not imply that $u(\cdot)$ is no longer quasi-concave for small values of y_τ. Using the necessary second order conditions for quasi-concavity of $u(\cdot)$ (see for example Takayama (1974) page 123), a sufficient condition on the transformation $g(\cdot)$ guaranteeing non-convex preferences for small values of y_τ can be derived. It states that, given a value of x_τ, the following must hold:[8]

$$g''(y) > h(x,y) \equiv \{[-u_{xx}u_g^2 - u_{gg}u_x^2 + 2\,u_x u_g u_{xg}]\cdot (g'(y))^2/[u_g u_x^2]\} > 0 \qquad \text{for } y \le \bar{y}, \tag{2.2}$$

where

u_i = partial derivative of $u(x,g)$ with respect to i; $i=x,g$,

u_{ij} = second order partial derivative of $u(x,g)$ with respect to i and j; $i,j=x,g$,

$g'(y)$ = first order derivative of $g(y)$,

$g''(y)$ = second order derivative of $g(y)$,

$\bar{y}$ = largest value of y satisfying condition (2.2).

Because $u(\cdot)$ is assumed to be strictly concave in x and g[9], and increasing in its arguments, the right hand side of (2.2) must be greater than zero. Hence condition (2.2) simply states that the convexity of the transformation $g(\cdot)$ must outweigh the concavity of the utility function

$u(\cdot)$, in order to ensure that the modified model can account for the consumption pattern of goods like vacation. To recapitulate, the transformation $g(\cdot)$ is assumed to have the following proporties, given a value of x:

$$\begin{aligned} &g'(y) > 0 \\ &g''(y) > h(x,y) \text{ if } y \le \bar{y} \\ &g''(y) \le h(x,y) \text{ if } y > \bar{y} \end{aligned} \tag{2.3}$$

An alternative way of introducing the modification in model (2.1) does not deal with the utility derived from a vacation, but with the costs associated with it. In model (2.1) it is assumed that the costs of a holiday increase proportionally to the quantity bought. However, for most holidays substantial costs must be incurred, irrespective of the quantity consumed. For example, whether one is one or two weeks on holiday has few consequences for the (often substantial) travelling expenses one has to make in order to get to one's holiday residence.

The presence of such 'initial costs', imply that if one increases the quantity consumed, the average costs will diminish, but at a decreasing rate. Eventually, this process may be stopped or even reversed as a number of restrictions (time available for holidays, duration of reservations, or package tours) become binding, implying constant or even increasing average costs from this point onwards.

This change in the cost structure can be incorporated in model (2.1), by replacing y_τ in the budget constraint by the transformed quantity $f(y_\tau)$, where $f(\cdot)$ is assumed to be strictly increasing, strictly concave for small values of y, and convex for larger values. This model can be considered as a continuous and differentiable version of the well-known fixed costs model. Static versions of this model have been used in labour supply studies see, for example, Hausman (1980) and Cogan (1981).[10]

An example of the transformation introduced above, is the inverse of the logistic function. The consequences of including such a transformation in the lifetime budget constraint, are illustrated in Figure 3. In this illustration it is assumed that the consumption of all periods except period t remains unchanged. As can be seen from this figure, setting the consumption of y in period t equal to zero, i.e. going from point A to point B, increases the expected lifetime utility.

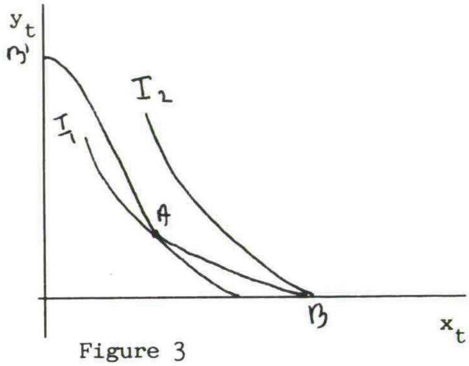

Figure 3

I_i = i-th indifference curve; i=1,2

BB' = budgetline

It can easily be demonstrated that, although the two proposed modifications (changing the preference ordering, and the cost structure respectively) result from two different lines of reasoning, the resulting models are equivalent in the sense that given a function $f(\cdot)$, one can always find a corresponding function $g(\cdot)$. In order to demonstrate this, consider the life cycle model in which the first modification is incorporated:

$$\max_{x_t, y_t, \ldots x_L, y_L} \quad E_t \sum_{\tau=t}^{L} \left(\frac{1}{1+\rho}\right)^{\tau-t} \cdot u(x_\tau, g(y_\tau))$$

$$\text{s.t.} \sum_{\tau=t}^{L} \left(\frac{1}{1+r}\right)^{\tau-t} \cdot [p_{\tau x} x_\tau + p_{\tau y} y_\tau] \leq W_t, \tag{2.4}$$

$$x_\tau,\ y_\tau \geq 0 \quad \tau = t, \ldots, L.$$

Next define y^*_τ to be equal to $g(y_\tau)$, and substitute this in model (2.4):

$$\max_{x_t,y^*_t,..x_L,y^*_L} E_t \ \sum_{\tau=t}^{L}(\frac{1}{1+\rho})^{\tau-t}\cdot u(x_\tau,y^*_\tau)$$

$$\text{s.t. } \sum_{\tau=t}^{L}(\frac{1}{1+r})^{\tau-t}\cdot[p_{\tau x}x_\tau+p_{\tau y}g^{-1}(y^*_\tau)] \le W_t, \qquad (2.5)$$

$$x_\tau,\ g^{-1}(y^*_\tau) \ge 0 \quad \tau = t,\ldots.,L.$$

Because of the assumed shape of the function $g(\cdot)$, its inverse, say $f(\cdot)$, is a function that is concave for small values of y^*_τ, and convex for larger values. So, as was claimed, model (2.5) is just the life cycle model incorporating the second modification.

Because of this equivalence, the strict concavity of $u(\cdot)$ again makes the imposition of an additional condition on $f(\cdot)$ necessary, to ensure that small quantities of y will not be chosen. This condition can be derived either from model (2.5) directly, or, because of the aforementioned equivalence, from the condition on $g(\cdot)$ given in (2.2). Following this second approach, it is straightforward to show that condition (2.2), given the properties (2.6)-(2.8), is equivalent to condition (2.9) given below.

$$\frac{\partial u(x_\tau,y^*_\tau)}{\partial y^*_\tau} = \frac{\partial u(x_\tau,g(y_\tau))}{\partial g} \qquad (2.6)$$

$$g'(y_\tau) = [f'(y^*_\tau)]^{-1} \qquad (2.7)$$

$$g''(y_\tau) = -[g'(y_\tau)]^2\cdot f''(y^*_\tau)/f'(y^*_\tau) \qquad (2.8)$$

$$f''(y^*_\tau) < [u_{xx}u^2_{y*}+ u_{y*y*}u^2_x - 2u_xu_{y*}u_{xy*}]\cdot$$
$$f'(y^*_\tau)/\ [u^2_xu_{y*}] < 0 \qquad \text{if } y^*_\tau \le g(\bar{y}_\tau) \qquad (2.9)$$

Condition (2.9) simply states that, in order to guarantee that no small quantities of good y^*_τ are chosen, the concavity of $f(\cdot)$ must outweigh the concavity of $u(\cdot)$ for these values of y^*_τ. As each of the models (2.4) and (2.5) can be written in terms of the other one, it suffices to study either one of them. In the remainder of this paper the modified model given in (2.4) is considered.

The usual conditions which guarantee the existence (and uniqueness) of a solution which, moreover, is fully characterized by the first order conditions, are not satisfied for model (2.4), since by incorporating the transformation $g(\cdot)$ the lifetime utility function is no longer strictly concave. In appendix A, conditions ensuring the existence of a solution which is characterized by the first order conditions are given. The only problem remaining is that the solution need not be the only commodity bundle satisfying the first order conditions, as is illustrated, for example, in Figure 1. The assumptions made in this example imply that point B results in the highest expected lifetime utility. Hence, if a consumer behaves rationally, which is an assumption underlying the life cycle model, he or she will choose point B. Thus, only point B is observed by the researcher.

There is, however, one situation in which the possibility of multiple solutions might cause a problem, namely if there is a future period in which two different commodity bundles, adding up to the same period consumption, result in the same maximum (expected) period utility. In this case, one might be confronted with a so-called time consistency problem, as a consumer can *plan* in period t to consume one commodity bundle in this future period, but can actually *realize* the other bundle without changing the expected lifetime utility. As a result, the modified life cycle model (2.4) is still valid in planned quantities, but may no longer be valid in the corresponding realizations (see Melenberg and Alessie (1989) for a more general discussion on time consistency problems).

Figure 4 shows for a certain realization of the variables influencing period τ's ($\tau > t$) consumption, i.e., period τ's input variables, that such a situation can occur in model (2.4), since points B and C result in the same maximum utility in this period. As most datasets do not contain information on the consumption plans of households, this could seriously restrict the empirical usefulness of model (2.4). However, it is not very likely that a situation as depicted in Figure 4 will often occur. For example, any change in the price of y_τ relative to the price of x_τ changes the slope of the budgetline, resulting in different utility levels for the interior and the corner solution. So, for exactly one ratio of period τ's prices, given the values of the other variables influencing period τ's consumption, this time consistency problem can occur.

In order to exclude this unlikely event, not only the usual time consistency conditions (cf. Melenberg and Alessie (1989)) must hold, but an additional condition is needed. The additional time consistency condition imposed here, is that if the above described situation occurs, a household does not deviate from its original consumption plan when arriving in period τ. Given that deviating from the plan does not yield extra utility for the consumer, and the fact that the time consistency problem occurs only for particular values of the input variables, this additional assumption seems not to be to restrictive.

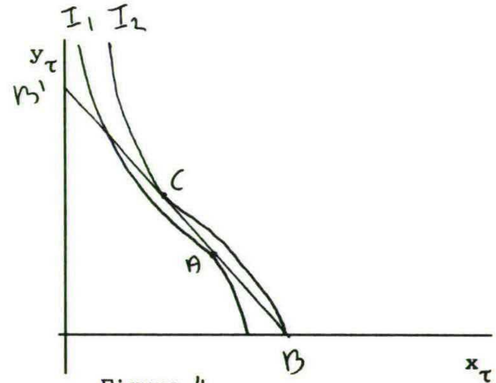

Figure 4

I_i = i-th indifference curve; i=1,2

BB' = budgetline

3. Empirical Application.

3.1 Specification and data.

In the empirical application considered in this section, the model given in (2.4) will be estimated using as commodities vacation and non-vacation. As further specification of this model, necessary to enable estimation, $u(\cdot)$ is assumed to be quadratic with respect to $x_{h,\tau}$ and $g(\cdot)$, and is made household specific by reparameterizing the parameters corresponding with the linear part of the utility function. The transformation $g(\cdot)$ is specified in such a way that the standard model, i.e., the model in which the preferences are globally convex, is a special case. Hence, the specification used in this paper can be summerized as follows (where the normalization $a\cdot c-b^2= 1$ is imposed to ensure identifiecation):

$$u(x_{h,\tau},g(y_{h,\tau})) = \frac{1}{2}\{a\cdot x_{h,\tau}^2+2\cdot b\cdot x_{h,\tau}\cdot g(y_{h,\tau})+$$

$$c\cdot g(y_{h,\tau})^2\} + d\cdot x_{h,\tau}+e\cdot g(y_{h,\tau}), \tag{3.1.1}$$

$$d = d_0+d_1\cdot \log(fs_h), \tag{3.1.2}$$

$$e = e_0+e_1\cdot \log(fs_h), \tag{3.1.3}$$

$$g(y_{h,\tau}) = y_{h,\tau}/(1+\beta\cdot \exp(-y_{h,\tau})). \tag{3.1.4}$$

where a $(=(1+b^2)/c)$, b, c, d_0, d_1, e_0, e_1 and β are parameters to be estimated, and fs_h is the household size of household h.

The estimation procedure employed in this study is taken from Adang and Melenberg (1991), who incorporate so-called 'intratemporal uncertainty' in the multi-good version of Hall's (1978) model. This is done in order to correct for the deterministic nature of the intratemporal relations which are implied by the first order conditions corresponding with this model. For a motivation of this approach, as well as for a discussion of alternative ways of dealing with the deterministic nature of the intratemporal relations, the reader is referred to Adang and Melenberg (1991). For the study at hand, it suffices to note that under the assumption of intratemporal uncertainty, the first order conditions corresponding with model (2.4) can be combined in a system of inter- and intratemporal moment restrictions which can be used in estimation. Let $z_{h,\tau}$ denote the vector of instruments described in appendix C. The system of unconditional moment restrictions for the model under consideration here, can then be written as follows:

$$E\ [\{[(1+b^2)/c]\cdot[\frac{x_{h,t}}{p_{t,x}} - (\frac{1+r}{1+\rho})\cdot\frac{x_{h,t+1}}{p_{t+1,x}}] +$$

$$b\cdot[\frac{g(y_{h,t})}{p_{t,x}} - (\frac{1+r}{1+\rho})\cdot\frac{g(y_{h,t+1})}{p_{t+1,x}}] +$$

$$d\cdot[\frac{1}{p_{t,x}} - (\frac{1+r}{1+\rho})\cdot\frac{1}{p_{t+1,x}}]\} \; z_{h,t}] = 0, \qquad (3.1.5)$$

$$E\ [\{[(1+b^2)/c]\cdot x_{h,t} + b\cdot g(y_{h,t}) + d -$$

$$g'(y_{h,t})\cdot(b\cdot x_{h,t} + c\cdot g(y_{h,t}) + e)\cdot I_{(0,\infty)}(y_{h,t}) -$$

$$(\frac{1+r}{1+\rho})\cdot([(1+b^2)/c]\cdot x_{h,t+1} + b\cdot g(y_{h,t+1}) + d)\cdot$$

$$(\frac{p_{t,x} - p_{t,y}\cdot I_{(0,\infty)}(y_{h,t})}{p_{t+1,x}})]\} \; z_{h,t}] = 0, \qquad (3.1.6)$$

for $t=1,\ldots,41$.

The data used to construct the sample analogue of this system come from the so-called 'Intomart consumer expenditure panel'. This panel contains information on monthly expenditures of households on several commodity categories, and a number of demographic characteristics of these households (including social class and household composition) which are registered on an annual basis. As prices were added the national price indices corresponding to the commodity classes as reported by the Netherlands Central Bureau of Statistics. The panel covers the forty-two months from April 1984 through September 1987.

There are some characteristics of the dataset that need to be reported. Firstly, almost no household participates in the panel for the complete spell April 1984-September 1987. Only 91 of the 2,897 households participate in all 42 periods.[11] Secondly, when constructing sample analogues of the moments that are used in estimation, different moments correspond with different data requirements. For the moments which have a demographic variable as instrument, only those households participating at least two consecutive periods are used.[12] This requirement is met by 29,732 observations reported by 2,566 households. For the restrictions which have the one period lagged expenditures as instrument, only those households are used which participate at least three consecutive periods.

This requirement reduces the number of observations that can be used to 27,334, which are reported by 2,382 households. It is assumed that both types of selection (attrition in the original panel and selection resulting from creating sample analogues of the different moment restrictions) are random.

Furthermore, as Tables 2 (on page 6) and 3 show, positive vacation expenditures are reported infrequently by households in all months. Table 4 indicates that a relatively large proportion of the reported vacation expenditures concerns small amounts. This last finding would, at first glance, suggest that consumption levels of vacation can be low, thus contradicting earlier statements regarding the consumption pattern of vacation and, moreover, making the proposed transformation superfluous.

However, it is important to note that, due to the way in which they are collected, the data in the panel refer to the *expenditures* on vacation, whereas the model discussed thusfar is concerned with the *consumption* of vacation. Expenditures on and consumption of holidays are likely to differ substantially, if measured on a monthly basis. For example, one often has to pay a part of the expenses in advance (a ticket, a hotel reservation or a part of one's holiday equipment). Or a vacation can cover (a part of) two consecutive months, which might be interpreted as two separate holidays.

Moreover, the definition of the vacation good which was used when constructing this dataset introduces an additional difficulty, as it includes day trips and school outings. This complicates matters, since a consumer when deciding on taking a day trip or going on a school outing is likely to take different aspects into consideration, than when deciding on taking a vacation which spans a longer period. Hence, if one wants to adequately describe the decision process regarding these longer holidays, as is the case in this study, it should be clearly separated from other choices. The data used for estimating such a model should reflect this distinction. An example of a dataset meeting this requirement is the one employed by van Soest and Kooreman (1987). The definition of the vacation good used there requires that one stays away from home for recreational purposes for at least four succesive nights.

Unfortunately, the dataset used in this study is a cross section, making it unsuited for estimating the complete dynamic model considered here. The way in which it could be used to estimate a part of the model, as well as the problems associated with it, are discussed briefly in appendix B. Because the 'Intomart consumer expenditure panel' does allow for the estimation of the full dynamic model, it will be used in the empirical application. In order to take account of the possibility that the difference between consumption and expenditures could influence the estimation results, three possible links between consumption and expenditures are considered.[13]

The first one corresponds to the assumption that is usually made, explicitly or implicitly, i.e., that the expenditures are a close enough approximation of the corresponding consumption to allow model (2.4) to be formulated in expenditure terms.

The remarks made earlier, indicate that this assumption might not be appropriate in the case considered here. Therefore, a second link is considered which differs from the first one in that only outlays exceeding Dfl. 100.- are considered to represent vacation consumption. Expenditures below this amount are assumed to be the result of day trips or school outings. Since these activities are assumed not to come under the definition of the vacation good, the corresponding expenditures are removed from the dataset by setting them equal to zero.

In the third alternative it is assumed that the vacation expenditures made over a period of three months all correspond to one and the same vacation. This case is considered in order to take account of the aforementioned difference in timing of the consumption of and the payment for a vacation. This is done by replacing the monthly vacation expenditures by a three monthly sum. Put more precisely, if during three consecutive months a particular household reports positive holiday expenditures for at least two months, they are summed and attributed to the month in which the largest expenditures were reported. The holiday expenditures of the other month(s) are set equal to zero. From Table 5 it can be seen what effect this operation has on the data. Comparing this table with Table 4, it is clear that the share of small expenditures decreases, although it remains considerable, whereas the share of large expenditures increases. In section 3.2, the sensitivity of the estimation results with respect to the different assumptions is investigated. In

Adang (1991), the consequences of incorporating a link between consumption and expenditures in a life cycle model are studied in greater detail.

Table 3: vacation expenditure frequency[1)]

NMONTHS

PERCENT	1-6	7-12	13-18	19-24	25-30	31-36	37-42
0-10	680	224	92	39	36	25	70
10-20	34	158	70	30	25	27	40
20-30	110	136	61	23	19	13	43
30-40	81	88	58	16	15	12	18
40-50	48	68	38	13	7	8	22
50-60	100	58	21	4	6	3	19
60-70	47	30	9	1	5	1	2
70-80	26	17	1	3	1	0	3
80-90	12	7	2	1	1	0	1
90-100	0	0	0	0	0	0	0
100	70	1	0	0	0	0	0

1) PERCENT = number of months a household spends money on vacation as a percentage of the total number of months a household participates in the panel.
NMONTHS = number of months a household participates in the panel.

Table 4: distribution of positive vacation expenditures[1)]

AMOUNT	PERCENT	AMOUNT	PERCENT
0-50	18.0	550-600	2.6
50-100	10.9	600-650	2.0
100-150	7.6	650-700	1.9
150-200	6.5	700-750	1.4
200-250	5.9	750-800	1.7
250-300	4.9	800-850	1.3
300-350	3.3	850-900	1.1
350-400	3.4	800-950	1.0
400-450	3.0	950-1000	1.3
450-500	3.0	>1000	17.2
500-550	2.0	#obs	7762

1) AMOUNT = monthly expenditures on vacation (in Dutch guilders)
PERCENT = number of reported positive vacation expenditures in a certain class as a percentage of the total number of positive vacation expenditures
#obs = total number of positive vacation expenditures

Table 5: positive three monthly sum of vacation expenditures[1)]

AMOUNT	PERCENT	AMOUNT	PERCENT
0-50	10.9	550-600	2.4
50-100	8.2	600-650	2.0
100-150	6.2	650-700	2.1
150-200	5.0	700-750	1.6
200-250	4.9	750-800	1.9
250-300	4.2	800-850	1.5
300-350	3.2	850-900	1.7
350-400	3.6	800-950	1.7
400-450	3.0	950-1000	1.6
450-500	3.1	>1000	28.9
500-550	2.4	#obs	5050

1) AMOUNT = three monthly sum of expenditures on vacation (in Dutch guilders)
PERCENT = number of reported positive vacation expenditures in a certain class as a percentage of the total number of positive vacation expenditures
#obs = total number of positive three monthly sums of vacation expenditures

3.2 Estimation results.

In Tables 6 and 7 the estimation results and test outcomes for the three datasets corresponding with different assumptions regarding the link between consumption and expenditures are presented for the basic and the household specific version, respectively.

The first aspect worth considering refers to the differences between the first two columns of each table. The first column of each table represents the results of the life cycle model without a transformation, which will be called the standard model. The second colummn of each table consists of the outcomes of the model with transformation (3.1.4), which are obtained using the original 'Intomart consumer expenditure panel'.

The comparison of the two columns of each table makes clear that the estimates of the parameters of the standard model, i.e., all parameters except β, are not changed dramatically by the introduction of the transformation: the estimate of c increases somewhat (in absolute value), the estimate of $(1+r)/(1+\rho)$ remains practically the same, and the estimates of the other parameters become smaller. Furthermore, sign and significance of the estimates are (essentially) unchanged. The main consequence of the changes in the estimates is that the number of non-vacation expenditures which are correctly located vis-à-vis the corresponding bliss point[14] decreases considerably. This is especially true for the household specific version.

Apart from the changes in the value of the parameter estimates, the introduction of the transformation also influences the test outcomes. For the basic version, the test statistic of Hansen and Singleton's (1982) misspecification test indicates that the model including the transformation is accepted, in contrast with the standard model. The test results for the household specific version show that including the transformation improves the performance of the model, as one should expect, although the model without the transformation is accepted as well.

Turning next to the estimate of the parameter of the transformation, Tables 6 and 7 show that in both versions it is positive, as required in order to meet the conditions formulated in (2.3), and large, but insignificant. A possible explanation for the insignificance of the estimate of the parameter β could be the difference between consumption and expenditures, touched upon in the previous subsection. In order to determine whether this is the case, compare, for both verions, the results reported in column I with those reported in columns II and III. These two columns correspond with the two alternative assumptions regarding the link between consumption and expenditures introduced in the previous subsection.

Before turning to the estimate of β itself, notice that for the basic version of the model the other results reported in these columns are rather unaffected by the choice of the link between consumption and expenditures. For the household specific version the differences are somewhat larger. In household specific version II the estimate of e_1 is negative (but insignificant), implying a bliss point for the vacation good which (slightly) decreases with family size. This counter-intuitive result is present for both goods in version III, since both d_1 and e_1 are negative. The changes in the dataset resulting from imposing the third assumption regarding the link between consumption and expenditures have another consequence, namely the rejection of the household specific version of the model by Hansen and Singleton's (1982) misspecification test.

Returning to the estimate of the parameter β, Tables 6 and 7 show that it is insignificant in all cases. So, it must be concluded that the transformation put forward in this paper does not constitute an important element of the explanation of the pattern present in the original dataset. Nor is this the case for the two datasets which result after imposing two, rather simple, alternative assumptions regarding the link between consumption and expenditures.

This finding is supported by another implication of the estimation results reported in Tables 6 and 7. Given the estimates of the model incorporating the transformation $g(\cdot)$, it is possible to determine whether an observation is located on the non-convex part of an indifference curve. Such an observation would in the transformed model imply non-optimizing behaviour on the part of the particular consumer, and hence indicate that the proposed modification offers no adequate solution.[15] In order to determine whether this occurs frequently, condition (2.2) can be used to calculate for each observation with positive vacation expenditures the inadmissable interval of vacation expenditures (given the reported non-vacation expenditures).

The percentage of observations with positive vacation expenditures which are correctly situated according to this criterion, i.e., which have vacation expenditures larger than the corresponding $\bar{y}_{h,\tau}$, are reported in Tables 6 and 7. Furthermore, the average minimum vacation expenditures required in order to be located on the convex part of the indifference curve, i.e., $\bar{y}_{h,\tau}$ averaged over months as well as over households, are also reported. From the tables it can be seen that both the percentage and the average minimum vacation expenditures are fairly insensitive to the chosen assumption regarding the link between consumption and expenditures. This is especially true for the household specific version. More importantly, the percentages reported are rather small.

Given the framework employed here, one could argue that the presence of intratemporal uncertainty causes a number of observations to be situated on the non-optimal part of the indifference curve. However, it seems unlikely that the presence of intratemporal uncertainty fully accounts for this outcome. It seems more probable that these small percentages are another indication for the fact that the proposed modification is not suited for explaining the data used in this section.

Table 6. Estimation results basic versions[1)]

	standard	I	II	III
b	-0.771 (0.163)	-0.497 (0.164)	-0.443 (0.163)	-0.528 (0.289)
c	-1.856 (0.102)	-3.326 (0.250)	-2.446 (0.381)	-2.129 (0.385)
d_0	87.04 (24.30)	19.09 (3.965)	26.58 (4.589)	38.22 (6.831)
e_0	93.59 (24.42)	54.25 (6.014)	46.67 (4.979)	72.30 (9.815)
β	.	252.0 (232.6)	245.1 (215.8)	2481 (1702)
$\frac{1+r}{1+\rho}$	0.999 (0.009)	1.000 (0.004)	0.999 (0.026)	1.000 (0.005)
T1	31.5	23.1	15.8	20.9
df1	17	16	16	16
p1	0.017	0.111	0.467	0.182
blx	97.9	82.0	89.0	88.3
bly	97.3	96.5	96.5	98.6
%	.	33.6	45.6	37.5
$\bar{y}$	.	5.15	5.40	7.72

1) consumption measured in hundreds of guilders
standard error in parentheses
standard = model without transformation
I = model with transformation (3.1.4)
II = I, but with vacation expenditures smaller than Dfl. 100.- set equal to zero
III = I, but with three monthly sum of vacation expenditures
T1 = chi-square value for Hansen and Singleton's misspecification test
df1 = degrees of freedom of misspecification test
p1 = significance level of misspecification test

blx = percentage of non-vacation expenditures satisfying the bliss point condition
bly = percentage of vacation expenditures satisfying the bliss point condition
% = percentage of observations (with positive vacation expenditures) situated on the convex part of an indifference curve
$\bar{y}$ = average vacation expenditures at which the point of inflexion of the indifference curves is located (in hundreds of guilders)

Table 7. Estimation results household specific versions

	standard	I	II	III
b	-0.523 (0.182)	-0.732 (0.290)	-0.451 (0.204)	-0.132 (0.310)
c	-1.660 (0.069)	-3.022 (0.323)	-2.271 (0.262)	-2.420 (0.412)
d_0	88.61 (28.11)	18.27 (4.272)	23.85 (5.168)	16.74 (3.135)
d_1	31.32 (13.57)	2.562 (1.353)	1.019 (0.986)	-3.149 (0.554)
e_0	94.41 (28.61)	52.39 (9.125)	42.25 (5.667)	48.01 (6.074)
e_1	27.62 (14.04)	1.779 (3.047)	-1.137 (2.072)	-15.80 (4.445)
β	.	234.1 (247.7)	162.2 (143.9)	703.0 (2273)
$\frac{1+r}{1+\rho}$	1.000 (0.003)	0.999 (0.028)	0.999 (0.026)	0.990 (0.211)
T1	18.8	14.5	16.5	37.4
df1	15	14	14	14
p1	0.222	0.413	0.284	0.001
blx	99.1	53.3	83.9	67.9
bly	99.6	97.0	96.4	96.8
%	.	35.2	35.1	34.4
$\bar{y}$	.	4.91	4.90	5.15

4. Summary and conclusions.

In this paper it was investigated whether a consumption pattern in which no low consumption levels are present, can be explained within a life cycle context. Since neither the standard life cycle model, nor some straightforward extensions turned out to be fully suited for explaining such a consumption pattern, an alternative was proposed. It consisted of introducing a transformation in either the utility function or the budget constraint, which was chosen such that either the preference ordering or the budget constraint was not convex for small values of the good displaying the aforementioned consumption pattern.

An example of such a modified life cycle model was estimated, using a panel containing, among other variables, the monthly expenditures on vacation and non-vacation. Under different assumptions regarding the link between consumption and expenditures, a quadratic utility function in which the vacation good was replaced by a tranformation was estimated. The estimation results indicated that under none of the assumptions regarding the link between consumption and expenditures did the proposed transformation contribute significantly to the explanation of the data.

In order to determine whether transforming the life cycle model in the way put forward in this paper is in general unwarranted, further research is needed. Apart from the usual directions this research could take, like trying an alternative specification of the transformation, or a more general specification of the life cycle model (for example, including a seasonal effect, interdependent preferences, or institutional constraints to explain why most people go on vacation when it is most expensive, as noted in section 2), there are some interesting alternatives.

One could, for example, apply the modified life cycle model introduced in this paper in labour supply studies. This might be interesting, since the observation problems in case of labour supply are likely to be smaller than in case of disaggregated consumption considered here. Alternatively, one could investigate the link between consumption and expenditures more thoroughly than the rather ad hoc set up employed in this paper. This latter topic is taken up by, for instance, Adang (1991).

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APPENDIX A.

In this appendix, the conditions under which the modified life cycle model has a solution which can be characterized by the first order conditions are determined. That is, the conditions under which the usual estimation approach, in which the first order conditions are used, can be applied.

The existence of a solution is ensured since the conditions imposed by Melenberg and Alessie (1989) guaranteeing this, i.e., the continuity of the objective function and the compactness of the choice set, also hold here.

Turning to the second aspect, model (2.4) and its solution satisfy the conditions under which the generalized Lagrange multiplier rule as given by Melenberg and Alessie (1989) can be applied. However, since they formulate the multiplier rule in quite general terms, two additional assumptions are imposed by them which are suficient to make it suited for empirical applications.

The first one is that the solution must be an internal point of the domain of the consumption functions. Since at the optimum the nonnegativity constraints can be binding in model (2.4), the domain must be chosen in a way that ensures that consumption paths with zero consumption of a commodity in one or more periods are internal points. Such a domain is defined in Adang and Melenberg (1989).

The second condition is a normalization condition. However, as it assumes a concave lifetime utility function, it cannot be used for model (2.4). Instead, a condition given by Luenberger (1969, pp. 248-249) is imposed, namely that the solution is a regular point. This condition essentially requires that the choice set has at least one internal point. The choice set of model (2.4) is larger than the one corresponding to the standard model, as it includes zero consumption of the different commodities. Since the choice set of the standard model has a nonempty interior (cf. Melenberg and Alessie (1989)), the requirement for model (2.4) is met.

Appendix B.

Under the assumption that consumers decide on vacation before deciding on the non-vacation good, the cross section used by van Soest and Kooreman (1987) allows for the estimation of the parameters of interest on the basis of the following intratemporal moment restriction:

$$E_t[(\frac{\partial u(x_t,g(y_t))}{\partial x_t} \cdot \frac{p_{t,y}}{p_{t,x}} - \frac{\partial u(x_t,g(y_t))}{\partial y_t}) \cdot I_{(0,\infty)}(y_t)] = 0 \quad (B.1)$$

where the indicator function is needed to eliminate the Lagrange multiplier corresponding with the nonnegativity constraint for the vacation good (see Adang and Melenberg (1989) for details). The presence of the indicator function implies that all households reporting zero expenditures on vacation are not taken into account when estimating this system. By multiplying this conditional moment restriction by a vector of (properly chosen) instruments, a system of unconditional moment restrictions can be obtained. Using the specification given in section 3.1, this system can be used in estimation.

It turns out that the estimate of the parameter β of the transformation given in (3.1.4) is close to zero (0.0004), and insignificant (the corresponding standard error is 0.08). This outcome implies that the proposed transformation does not have a significant impact. This result can be seen as supporting the view that the transformation is superfluous, or that the assumption regarding the ordering of the consumption decisions is inappropriate.

However, the following explanation might also be valid. The transformation was introduced to explain that for a given household the consumption of a certain good fluctuated strongly over time. The dataset used, however, covers just a single period, implying that the jump in consumption levels the transformation was intended to explain, is not present in the data. So, the insignificance of the transformation can also be interpreted as an indication that data on more than one period is required to enable an assessment of the role of the proposed modification.

Appendix C.

The following variables were included as instrument:

- constant term;
- one period lagged expenditures on holiday;
- degree of urbanisation;
- region;
- province;
- social class;
- number of household members older than 11;
- number of children between 0 and 6;
- number of children between 7 and 11;
- number of children between 12 and 17;
- number of children older than 18.

Because the demographic variables are reported only once a year, and since the changes of these variables over time is limited, it was decided to keep them constant over the complete survey period. That is, the instruments were given the value reported by the household in the first month it participated in the panel.

The following values are possible for the variables degree of urbanization, region, province and social class:

- degree of urbanisation:
  1 = villages with more than 50 % agrarians;
  2 = villages whith between 40 and 50 % agrarians;
  3 = villages with between 30 and 40 % agrarians;
  4 = villages with between 20 and 30 % agrarians;
  5 = industrialized rural villages with less than 5,000 inhabitants;
  6 = industrialized rural villages with between 5,000 and 20,000 inhabitants;
  7 = commuter suburbs;
  8 = small cities, with between 2,000 and 10,000 inhabitants;
  9 = small cities, with between 10,000 and 30,000 inhabitants;
  10= medium cities, with between 30,000 and 50,000 inhabitants;
  11= medium cities, with between 50,000 and 100,000 inhabitants;

12= large cities, with more than 100,000 inhabitants;
13= Amsterdam, Rotterdam, The Hague;

- region:
  1 = the 4 major cities (Amsterdam, Rotterdam, The Hague and Utrecht);
  2 = remainder of western part of the Netherlands (except 1 and 6);
  3 = northern part of the Netherlands;
  4 = eastern part of the Netherlands;
  5 = southern part of the Netherlands;
  6 = suburbs of the 4 major cities;

- province:
  1 = Groningen;
  2 = Friesland;
  3 = Drenthe;
  4 = Overijssel;
  5 = Gelderland;
  6 = Utrecht;
  7 = Noord Holland (except 12);
  8 = Zuid Holland (except 12);
  9 = Zeeland;
  10= Noord Brabant;
  11= Limburg;
  12= Amsterdam, Rotterdam, The Hague;
  13= Flevoland;

- social class:
  5 = upper class;
  4 = upper middle class;
  3 = middle class;
  2 = lower middle class;
  1 = lower class.

Endnotes

1 By this is meant that the observation period is relatively short, e.g. a month for the dataset used in this paper.

2 Note that studies in this field usually do not work within a life cycle framework.

3 For those households reporting more than one vacation, only the corresponding average vacation expenditures can be determined. This is the case for about thirty per cent of the vacation expenditures. Excluding these observations from the dataset leaves the distribution as reported in Table 1 essentially unchanged.

4 It will be assumed throughout this study, that good x is consumed in each period.

5 In contrast with the number of households reporting vacation expenditures, the average monthly vacation expenditures (which are obtained by averaging over the positive vacation expenditures in a month), although varying over months, do not exhibit a clear seasonal pattern.

6 This framework also allows for the incorporation of the aforementioned seasonal and intertemporal aspects, as well as other elements (like interdependent preferences). However, as this study wants to focus on the jump in the consumption level, these aspects are not considered here.

7 The utility function $u(x_\tau, g(y_\tau))$ is still strictly concave with respect to x_t and $g(.)$.

8 For notational convenience, the period index is suppressed.

9 Strict concavity implies that the matrix of second order derivatives of $u(\cdot)$ is negative definite. This in turn implies that the matrix in

which the diagonal elements are multiplied by minus one is positive definite. Hence the first term between square brackets in equation (2.2) is positive.

10 For the following two reasons, introducing fixed costs in model (2.1) will not be considered. Firstly, because the presence of fixed costs implies non-differentialbility at zero, the generalized Lagrange multiplier rule used in this study for deriving the first order conditions can not be applied (see, for example, Melenberg and Alessie (1989) for conditions under which this rule can be applied). Secondly, the usual way of solving a fixed costs model, i.e. comparing the utility levels of all commodity bundles satisfying the first order conditions, is less suited in a life cycle setting. This because it involves comparing the expected utility of all lifetime consumption paths satisfying the first order conditions. In order to be able to do this, information on matters like the lifetime and the distribution of the uncertainty inducing variables is needed. Since this information is not available, and this study wants to do without assumptions regarding these matters, the above described procedure can not be used (see Rust (1987) for an example, albeit in a somewhat different context, of this approach, if one is willing to make such assumptions).

11 Some households enter the panel in the first month but leave before September 1987, whereas other households enter the panel in later months.

12 Generally, the first order conditions can also be combined into restrictions linking non-consecutive periods. Such restrictions are neglected in this study.

13 The assumption that the consumption of the non-vacation good is approximately equal to the reported expenditures is maintained.

14 The bliss points are $b \cdot e - c \cdot d$ for the first good, and $b \cdot d - e \cdot (1+b^2)/c$ for the transformation of the second one. The location of

each observation vis-à-vis these bliss points determines whether it corresponds with rational consumer behaviour. If an observation is not located on the part of the utility function which is increasing in its arguments (which is determined by the bliss point values) it is not optimal, as the same utility level can be obtained from a lower consumption level.

15 Notice that this implication does not hold in the standard life cycle model, since small values can be optimal in this model.

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