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Consumers Expectations and
Aggregate Personal Savings

Daniel Weiserbs * and Peter Simmons **

Internal Paper

The Directorate-General for Economic and Financial Affairs,
Commission of the European Communities,
200, rue de la Loi
1049 Brussels, Belgium

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* Professor at the Catholic University of Louvain

** Professor at the University of York

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1. Introduction.

The purpose of this paper is to investigate the ways in which consumer anticipations data on real income growth might have empirical significance for the aggregate saving/consumption function. Using a general error correction modelling approach, we search for an acceptable consumption function for UK quarterly data over 1974-1984. We then explore the effects of the E.E.C. consumer anticipations data on real income and compare it with the extrapolative schemes frequently used.

The conversion of qualitative responses to a quantitative form has been the subject of an increasing number of studies in the last two years. A survey of the various approaches used in the literature can be found in Praet (1983) and Pesaran (1984). It is worth noticing that, with the exception of Batchelor (1983), attention has been devoted to Business surveys. Consequently almost all the empirical work relates to surveys with three response categories while most household surveys use questions with five categories of response.

The survey data that we use is the EEC consumer survey on households income and inflation expectations. This survey has five response categories and asks households to rank their perception of changes in their past living standard and to forecast changes in their future living standard.

Now clearly in order to reduce the risk of a type I error, one should proceed by incorporating the survey responses in the model rather than following a two-step procedure consisting of, first, constructing an index of expectations and, second, incorporating the latter in the model. In other words, values of the parameters which enter the consumer's sentiment index should be jointly determined by the survey data and by data on consumption (or saving) and its determinants rather than solely by the former.

However the functional form adopted is likely to be of crucial importance. The methodology we adopt in searching for an adequate specification rests on three assumptions:

(A1) expectations ought to be related to perceptions rather than observations of the past;

(A2) the "best" functional form on perceptions is likely to be also the most appropriate in modelling expectations;

(A3) the "best" functional form on perceptions may be selected from the econometric performance of the survey data in relation to observed past events.

Notice that only (A1) is a testable hypothesis from the survey data and that it is especially justified when one suspects the presence of a systematic bias due for instance to the nature of the sample.

In section 2 we discuss some general principles which should lie behind the construction of a quantitative index of perception of past income changes. Section 3 compares the relative merits of various methods on econometric grounds: Batchelor's method; Taylor approximations and Pade approximants. Section 4 is devoted to the selection of an aggregate saving (consumption) function. Finally, section 5 shows the impact of income expectations comparing the E.E.C. survey with the more traditional scheme of rational expectations.

2. Properties of an index of perception of past events.

2.1. Consider the following question: "compared to twelve months ago, is your real income (i) a lot higher ? (ii) a little higher ? (iii) about the same ? (iv) a little smaller ? (v) a lot smaller ?

Let n_{1t}, n_{2t}, n_{3t}, n_{4t}, n_{5t} be the percentages of answers in each category at period t and denote respectively by $\hat{Y}_t$ and $\hat{Y}_t^p$ the observed and estimated perceived rate of growth of aggregate real income.

Consider next the index

$$\hat{Y}_t^p = f(n_t, t) \qquad (1)$$

which aggregates the survey data in a quantitative manner. Choice of f(.) should be guided in the first instance by whether it satisfies some desirable properties in n_t $[n_t = (n_{1t}, \ldots, n_{5t})]$.

2.2. An obvious property is weak monotonicity: whenever a household changes its beliefs by moving from a lower to a higher category (e.g. from n_5 to n_4) the index should increase. Mathematically, this says that for all t:

$$\frac{\partial f}{\partial n_i} > \frac{\partial f}{\partial n_j} \qquad i < j. \qquad (P1)$$

This also implies that the increase in the index is larger when a household moves up more than one category than when it moves up a single category:

$$\frac{\partial f}{\partial n_i} - \frac{\partial f}{\partial n_j} > \frac{\partial f}{\partial n_k} - \frac{\partial f}{\partial n_j} \qquad \text{for all } i<k<j. \qquad (P1')$$

2.3. Extending this a little, we might want the increase in the index to be an increasing function of the number of categories the household moves up. This stronger monotonicity condition amounts to:

$$\frac{\partial f}{\partial n_i} - \frac{\partial f}{\partial n_h} > \frac{\partial f}{\partial n_k} - \frac{\partial f}{\partial n_j} \quad \text{for } h-i > j-k > 0 \text{ and all } t. \qquad \text{(P2)}$$

2.4. Category 3 plays the role of a natural origin and one might require that:

$$\frac{\partial f}{\partial n_i} > 0 > \frac{\partial f}{\partial n_j} \qquad \text{for } i < 3 \text{ and } j > 3 \qquad \text{(P3)}$$

In other words, an individual moving from category 3 raises (lowers) the index when he moves to category 2 or 1 (4 or 5).

2.5. Properties P1-P3 seem unexceptionable on the assumption that the survey data is unbiased at least as far as perceptions are concerned. A more debatable property would be symmetry of the effects on either side of category 3:

$$\frac{\partial f}{\partial n_1} / \frac{\partial f}{\partial n_2} = \frac{\partial f}{\partial n_5} / \frac{\partial f}{\partial n_4} \qquad \text{(P4)}$$

In addition to (P3) and (P4), the consumers sentiment index published by the EEC imposes the cardinalization that "a lot" is twice "a little":

$$\frac{\partial f}{\partial n_1} / \frac{\partial f}{\partial n_2} = \frac{\partial f}{\partial n_5} / \frac{\partial f}{\partial n_4} = 2 \,, \qquad \text{(P5)}$$

and the condition $$\frac{\partial f}{\partial n_1} = -\frac{\partial f}{\partial n_5} \tag{P6}$$

2.6. It must be emphasized that, though reasonable at first sight, P1-P3 are actually highly restrictive. Indeed, even if there is no bias in the survey and if all individuals in the population perceive their growth rate of income perfectly, there will not exist an index such that $\hat{Y}_t^p = \hat{Y}_t$ since household's answers are not weighted according to their position in the income distribution. Nevertheless, in view of (A3), we proceed to model (1) to minimize the divergence between $\hat{Y}_t$ and $\hat{Y}_t^p$.

2.7. It is most likely that respondents views are not time independent and more precisely not independent of the previous evolution of income. Indeed a given rise may be considered as important in a period of slow growth and small or moderate in a period of sustained growth. Therefore we write (1) as:

$$\hat{Y}_t^p = \hat{Y}_t - e_t = f(n_t, \hat{Y}_{t-1}; \alpha), \tag{2}$$

assuming that all time dependence of the form of f(.) is captured in $\hat{Y}_{t-1}$. In (2) α is a vector of parameters and the error terms e_t are assumed to be distributed independently of $\hat{Y}_t^p$ with mean zero and constant variance.

2.8. Individuals form expectations by comparison with the level of the variable they actually perceive. Consequently an index of expectations should not be constructed independently of the data on perceptions. In Pesaran (1984) the expectation errors depend systematically on the gap between peceptions and reality; this comes from the assumption that the disturbances in the expectation relation follow a first-order regressive scheme. Although Pesaran found strong empirical support for this AR1 process in his study on the British manufacturing sector, we prefer the following assumption which makes the links more explicit.

Let m_t be the survey data on the expected growth of income and denote by ${}_tY_{t+1}$ the level of income for period t+1 as expected at t. Assuming that (2) can be expressed as

$$\hat{Y}_t^P = \Delta \ln Y_t^P = f(n;\alpha) + \pi \, \Delta \ln Y_{t-1}, \tag{3}$$

we get:

$${}_t\hat{Y}_{t+1} = \ln {}_tY_{t+1} - \ln Y_t^P = f(m;\alpha') + \pi' \Delta \ln Y_t^P \tag{4}$$

and therefore

$${}_t\hat{Y}_{t+1} = f(m;\alpha') + \pi' f(n;\alpha) + \pi' \pi \, \Delta \ln Y_{t-1} \tag{5}$$

will be both a plausible and operational hypothesis.

In an empirical application where ${}_t\hat{Y}_{t+1}$ enters as an exogeneous variable, it seems preferable not to impose a priori the equality between α and α' (π and π') but rather to consider it as an hypothesis to be tested (as well as $\pi' = 0$, $\pi = 0$ and so forth).

The data we use throughout this paper is quarterly for the UK over the period 1974:2 to 1984:4 giving a total of 43 observations.

3. Modelling income growth.

3.1. Batchelor's Method

In his study of consumer's inflation expectations Batchelor (1983) proposed an extension of the Carlson and Parkin (1975) approach to the quantification of survey data. Mutatis mutandis, it can easily be applied to income.

Let $f(x_t)$ be the subjective probability density function with mean μ_t and variance $\sigma^2{}_t$ of an economic variable x. Denote by δ the "just noticeable difference" around $x = 0$, by π^+ (π^-) the subjective estimate of x such that an individual answers "a lot better (worse) instead of "a little better (worse)". Next, to be operational assume that f(x), π^+, π^- and δ are identical for all individuals and moreover that f(x) has the form of a logistic function.

It then follows that

$$\mu_t = \pi^+{}_t \frac{x_{2t} + x_{3t}}{x_{2t} + x_{3t} - 2x_{4t}} ; \tag{6.1}$$

$$\pi^-{}_t = - \pi^+{}_t \frac{2x_{1t} - x_{2t} - x_{3t}}{x_{2t}} ; \tag{6.2}$$

$$\sigma_t = - 2\mu_t \frac{1}{x_{2t} + x_{3t}} ; \tag{6.3}$$

$$\delta_t = \mu_t \frac{x_{2t} - x_{3t}}{x_{2t} + x_{3t}} , \tag{6.4}$$

where the x_{jt}'s are the abscissae of the logistic function corresponding to the probabilities n_{5t}, $n_{5t} + n_{4t}$, $n_{5t} + n_{4t} + n_{3t}$, $n_{5t} + n_{4t} + n_{3t} + n_{2t}$ respectively.

In order to estimate (8.1) we can either consider π^+ constant over time or assume some adaptative behavior mechanism using observed past values [cf.(2) supra].

Batchelor offers an elegant justification of his approach drawing on experimental psychology. Unfortunately this is not costless [cf. Pesaran (1984b)]: (i) from an empirical point of view, the assumptions required turn out to be far more restrictive than for more direct methods; (ii) Batchelor's (or Carlson and Parkin's) measure does not satisfy property (P1) (for instance if $n_1+n_2 > .5$ than an increase in pessimism given by $\Delta n_5 = -\Delta n_4 > 0$ increases the index!) and (iii) the measure breaks down whenever one n_i vanishes.

The application of Batchelor's method to perceptions of the growth rate of disposable income appears quite disappointing. Under the assumption that π^+ is constant over time, we obtain $\pi^+ = -.004$ (t-stat. = .28) while setting $\pi^+{}_t = \pi_0 + \pi_1 \Delta \ln Y_{t-1}$ yields $\pi_0 = -.008$ (.52) and $\pi_1 = -1.97$ (3.67) with an R^2 of .15 .

Notice however that in the case of inflation perception, Batchelor's approach yields more encouraging results. As households face more or less the same price movements the assumption of a given probability distribution is much more realistic.

3.2. Taylor Approximations

3.2.1. A straightforward "direct" method consists of taking a first order Taylor approximation (around an arbitrary base point n) which amounts to expressing (1) as

$$Y_t^p = \alpha_0 + \alpha_1 n_{1t} + \alpha_2 n_{2t} + \alpha_4 n_{4t} + \alpha_5 n_{5t} , \qquad (7)$$

where $\alpha_i = \partial Y(n)/\partial n_i$ and $\alpha_0 = Y(n) - \Sigma_i (\partial Y(n)/\partial n_i)\, n_i$ $(i = 1,5;\ i\neq 3)$.

Obviously (7) is simply an extension of Anderson (1952).

Whether or not one includes a constant term in (7) depends on whether one believes there is an unexpected trend in income growth.

If households correctly perceive general income growth, then all such growth will be incorporated into revisions of the n_{it}. However if the functional form is in fact nonlinear, then, even if household's perceptions are correct, changes in the frequencies are not linearly transformed into income changes. In these circumstances the constant term reflects the path of income growth not incorporated into a linear function of the frequencies. Of course households may also have imperfect perceptions in which case the constant term also reflects the growth in income which is unaccompanied by changes in the frequencies.

The estimation of (7) using the rate of growth of real disposable income $[\hat{Y}_t=(Y_t-Y_{t-4})/Y_{t-4}]$ as endogeneous variable yields:

$$\hat{Y}_t = \underset{(1.7)}{-.132} + \underset{(1.9)}{1.176}\, n_{1t} + \underset{(1.3)}{.258}\, n_{2t} + \underset{(2.1)}{.454}\, n_{4t} - \underset{(2.5)}{.374}\, n_{5t} \quad (8)$$

$R^2 = .675$; D.W. $= 1.56$; $\mathcal{L} = 108.6$.

However imposing property (P2), i.e.

$\alpha_1/\alpha_2 = \alpha_5/\alpha_4$,

yields:

$$\hat{Y}_t = \underset{(.5)}{-.027} + \underset{(2.0)}{1.271}\, n_{1t} + \underset{(.8)}{.155}\, n_{2t} - \underset{(-)}{.019}\, n_{4t} - \underset{(1.2)}{.159}\, n_{5t} \quad (9)$$

$R^2 = .646$; D.W. $= 1.52$; $\mathcal{L} = 106.8$.

Furthermore dropping the constant term gives:

$$\hat{Y}_t = \underset{(2.1)}{1.132}\, n_{1t} + \underset{(.6)}{.104}\, n_{2t} - \underset{(-)}{.021}\, n_{4t} - \underset{(4.9)}{.226}\, n_{5t} \quad (10)$$

$R^2 = .644$; D.W. $= 1.50$; $\mathcal{L} = 106.6$.

Despite the insignificant n_2 this is certainly an improvment. However if in the spirit of the EEC. method ($\alpha_1 = 2\alpha_2 = -2\alpha_4 = -\alpha_5$) we furthermore impose $\alpha_1 = 2\alpha_2$ and $\alpha_5 = 2\alpha_4$, then

$$Y_t = \underset{(8.9)}{.605}\,(n_{1t} + .5\,n_{2t}) - \underset{(7.2)}{.168}\,(.5\,n_{4t} + n_{5t}) \qquad (11)$$

$R^2 = .632$; D.W. $= 1.52$; $\mathcal{L} = 105.9$.

where, clearly, the equality (in absolute value) of the two coefficients is rejected. Nevertheless this gives some support for the EEC method. The relative weightings of α_1 and α_2 and of α_4 and α_5 used in the EEC method are appropriate. But the results indicate that positive responses should probably receive a larger weight than negative responses. The rationale for doing so may be an asymmetric perception of changes in income.

That is if there is a natural degree of pessimism in the population they will tend to overstate bad times or even think of constant real income as a deterioration of their living standard. Consequently their perceptions are biased downwards. On the other hand they may well think that things will improve.

The overall outcome in this case is then that we would accept (11) against (9), the drop in likelihood being within the χ^2 critical value of 7.81.

3.2.2. On the other hand approximating (2) instead of (1) gives an estimating equation

$$\hat{Y}_t = \alpha_0 + \alpha_1 n_{1t} + \alpha_2 n_{2t} + \alpha_3 n_{3t} + \alpha_4 n_{4t} + \alpha_5 n_{5t} + \pi \hat{Y}_{t-1} \qquad (12)$$

yielding

$$\hat{Y}_t = \underset{(1.3)}{-.103} + \underset{(1.3)}{.847}\, n_{1t} + \underset{(1.1)}{.230}\, n_{2t} + \underset{(1.5)}{.385}\, n_{4t} - \underset{(2.0)}{.339}\, n_{5t} + \underset{(1.6)}{.195}\, \hat{Y}_{t-1} \qquad (13)$$

$R^2 = .694$ D.W. $= 1.95$ $\mathcal{L} = 109.9$.

The survey data are in themselves significantly related to $\hat{Y}_t$: the hypothesis $\alpha_i = 0$ for all i is rejected:

$$\hat{Y}_t = \underset{(1.0)}{.004} + \underset{(5.7)}{.669}\ \hat{Y}_{t-1} \qquad (14)$$

$$R^2 = .443; \quad D.W. = 2.01; \quad \mathcal{L} = 97.0 \ .$$

which shows that the survey data does at least better than a AR1 process. However on a t-test the frequency n_{5t} is the most significant expectation variable whilst n_{4t} has the wrong sign.

Dropping the constant in (13) hardly affects the results. However imposing as before $\alpha_2 = .5\,\alpha_1$ and $\alpha_4 = .5\,\alpha_5$ gives:

$$\hat{Y}_t = \underset{(5.3)}{.478}\ (n_{1t} + .5\ n_{2t}) - \underset{(4.8)}{.134}\ (.5\ n_{4t} + n_{5t}) + \underset{(2.1)}{.251}\ \hat{Y}_{t-1} \qquad (15)$$

$$R^2 = .667; \quad D.W = 2.04; \quad \mathcal{L} = 108.1 \ .$$

which appears as the best equation in this class of models. On a t-test with this restricted form of equation, one would accept (15) against (9) so that the way in which households perceive changes in growth depends on the prevailing rate of growth. But then also one would accept (15) against (13) on a likelihood ratio test.

3.2.3. Taking a "translog" approximation of (2) yields

$$\hat{Y}^p_t = a_0 + \Sigma_i\ a_i\ \ln n_{it} + \pi\ \hat{Y}_{t-1} \qquad i = 1,5\ ;\ i \neq 3. \qquad (16)$$

Still, despite its attractions, (16) also has some shortcomings. In particular, properties (P1) and (P2) can only be verified locally since $\partial \hat{Y}^p_t / \partial n_i = \alpha_i / n_i$. However the a priori sign conditions remain unchanged.

Regressing (16) with $\Delta_4 Y_t / Y_{t-4}$ as dependent variable yields

$$\hat{Y}_t = \underset{(1.4)}{.197} + \underset{(1.3)}{.038} \ln n_{1t} + \underset{(.73)}{.023} \ln n_{2t} + \underset{(1.4)}{.112} \ln n_{4t} - \underset{(2.1)}{.072} \ln n_{5t} + \underset{(1.5)}{.196} \hat{Y}_{t-1} \tag{17}$$

R^2 = .686; L = 109.3; D.W = 1.90 .

In terms of empirical performance this is pretty much identical to (13), perhaps marginally worse. Though, judged from the sample means of the frequencies, the distribution of expectations in the survey is positively skewed. So to give due weight to the lower end of the distribution, a suitable transformation of frequencies may be the log. Setting $\alpha_1 = 2\alpha_2$ and $\alpha_5 = 2\alpha_4$ does not make too much sense in this context although it allows us to conceal the incorrect sign of n_{4t}:

$$\hat{Y}_t = \underset{(.4)}{.044} + \underset{(1.9)}{.034}(\ln n_{1t} + .5 \ln n_{2t}) - \underset{(1.4)}{.029}(.5 \ln n_{4t} + \ln n_{5t}) + \underset{(2.2)}{.244} \hat{Y}_{t-1} \tag{18}$$

R^2 = .664; L = 107.8; D.W = 1.96

and without a constant term:

$$\hat{Y}_t = \underset{(4.9)}{.021} (\ln n_{1t} + .5 \ln n_{2t}) - \underset{(5.1)}{.043} (\ln n_{4t} + .5 \ln n_{5t}) + \underset{(2.1)}{.264} \hat{Y}_{t-1} \tag{18}$$

R^2 = .659; L = 107.6; D.W = 1.98

Once could also argue that the $\Sigma_i \ln n_{it} \neq 1$ and therefore that n_3 should not have been deleted. Technically speaking, this is correct but still yields α_4 positive when unrestricted.

3.3. Pade approximants

Other approximation methods could have been applied to (1) or (2). For instance the Pade approximants, which proved to be useful in the context of complete demand systems[1], yield [approximating (1)]:

$$\hat{Y}_t^p = \frac{\alpha_0 + \Sigma_i \ \alpha_i \ n_{it}}{1 + \Sigma_i \ \lambda_i \ n_{it}} \qquad i = 1,5 \ (i \neq 3). \qquad (19)$$

The interesting feature of (24) is that the $\partial \hat{Y}_t^p / \partial n_i$ now depends on the actual $\hat{Y}_t^p$. Indeed

$$\frac{\partial \hat{Y}_t^p}{\partial n_i} = [1 + \Sigma_i \ \lambda_i \ n_{it}]^{-1} \ (\alpha_i - \lambda_i \ \hat{Y}_t^p)$$

so that there is no longer any a priori reason to approximate (2) instead of (1). Moreover in the three category survey (19) reduces to

$$Y_t^p = \frac{\alpha_0 + \alpha^+ \ n^+_t + \alpha^- \ n^-_t}{1 + \lambda^+ \ n^+_t + \lambda^- \ n^-_t}$$

This is a generalised form of Pesaran's (1984) method which results when α_0 and λ^- are set equal to zero.

Again properties like (P1) and (P2) cannot be imposed globally but only at a given values of Y_t^p.

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[1] Cf. Simmons and Weiserbs (1979).

The estimation of (19) gives

$$Y_t^p = \frac{\underset{(.56)}{-.033} + \underset{(.69)}{1.02}\, n_{1t} - \underset{(.71)}{.143}\, n_{2t} + \underset{(.67)}{.170}\, n_{4t} - \underset{(.73)}{.169}\, n_{5t}}{1 + \underset{(.67)}{18.5}\, n_{1t} - \underset{(.85)}{7.30}\, n_{2t} - \underset{(.27)}{97}\, n_{4t} + \underset{(.13)}{-.32}\, n_{5t}} \qquad (20)$$

$R^2 = .747$; $\mathcal{L} = 113\ 9$; D.W. $= 1.94$.

As a consequence of the clear overparametrization implied by (19) several simplifications are equally accepted. Among those, constraining α_0, λ_4 and λ_5 to zero yields:

$$Y_t^p = \frac{\underset{(2.2)}{1.50}\, n_{1t} - \underset{(2.0)}{.278}\, n_{2t} + \underset{(1.4)}{.133}\, n_{4t} - \underset{(2.4)}{.273}\, n_{5t}}{1 + \underset{(1.6)}{29.9}\, n_{1t} - \underset{(2.5)}{11.1}\, n_{2t}} \qquad (21)$$

$R^2 = .732$; $\mathcal{L} = 112\ 7$; D.W. $= 1.80$.

On the statistical likelihood basis, (21) outperforms the linear approximation[2]. However the interpretation of the parameters is not easy especially in a period where the rate of growth of income has more or less oscillated around zero. Moreover its integration in an econometric model is likely to be computationaly heavy. We will therefore keep (15) as the most appropriate functional form to incorporate households income expectations in a saving/consumption model.

[2] To estimate (25) it is recommended to first estimate (12) and fix the α_i's in order to obtain suitable initial conditions for the λ_i's.

4. An Aggregate Consumption-Savings Model

The purpose of this section is to search for an appropriate savings/consumption function in which we can evaluate the merits of households' income expectations provided by the EEC survey. We shall first outline our econometric methodology, then choose a functional form and finally test various hypotheses within the retained framework.

4.1. Methodology

4.1.1. A general dynamic process for determining changes in economic behaviour would relate such changes to past values of the variable itself and of exogenous variables and to changes in the values of exogenous variables. This approach could be applied to consumption or savings behaviour (or their logs) or to the ratio of either to income. For the sake of simplicity, we shall limit the presentation of the dynamics to the case of a one period lag. In the empirical application using quaterly data, we shall consider four lags as well.

Denoting by V the endogenous variable and by X the vector of exogenous variables (or their logs), let us assume that the long-run equilibrium value of V, V^*, is determined by

$$V^*_t = \beta_0 + \Sigma_i \beta_i X_{it} \tag{23}$$

which can be interpreted as a linear approximation to the sort of consumption equation that would result from the life cycle hypothesis.

If consumption behaviour really is a dynamic adjustment process around an optimal consumption level of a life cycle model, then the vector X should, at least, include disposable income, Y, financial assets, A (A is defined at the end of the previous quarter), and the interest rate, R, all in real terms. Futhermore, in a related paper[3],

[3] Simmons-Weiserbs (1986)

where we develop a model which recognises the existence of durable goods, we have found empirical support for the inclusion of the relative price of durables to non durables, W, in the determination of the saving ratio. Lastly, we do not want to exclude a priori the assumption that the inflation rate, I, affects the consumption ratio as in Davidson, Hendry, Srba and Yeo (in short DHSY) (1978). Thus we specify the vector X as:

$$X_{1t} = Y_t;\ X_{2t} = A_{t-1};\ X_{3t} = W_t;\ X_{4t} = R_t;\ X_{5t} = I_t.$$

4.1.2. We then postulate that the (short-run) change in economic behaviour can be decomposed into four components and a white noise error term u_t:

$$\Delta V_t = \mu_1\ (V^*_{t-1} - V_{t-1}) + \mu_2\ (V^*_t - V^*_{t-1}) + \mu_3\ ({}_tV^*_{t+1} - V^*_t) + \Sigma_j\ \lambda_j\ \Delta Z_{jt} + u_t \qquad (24)$$

where μ_1 denotes the proportion of past disequilibrium "corrected" at period t; μ_2 and μ_3 respectively the proportions of current and expected future changes in equilibrium which are taken into account at period t while ΔZ_j represents variables which affect the adjustment process but have no influence on the long run (equilibrium) solution.

Given the theoretical arguments and empirical results available, [see in particular Deaton (1977)], unanticipated inflation is a likely candidate for such a variable. If inflation expectations are generated by

$$I^e_t = (1 - \lambda)\ I_t + \lambda\ I_{t-1} + e_t$$

where $I_t = \Delta P_t/P_{t-1}$ and P is the consumer implicit deflator, e_t being a white noise component, then unexpected inflation is defined by:

$$\lambda_5\ \Delta Z_{5t} = I_t - I^e_t = \lambda\ (I_t - I_{t-1}) - e_t. \qquad (25)$$

Therefore we add the variation of the inflation rate (hereafter denoted ΔZ_5) as a variable which only affects short-run behavior.

Obviously, the same specification is obtained when household expect the inflation rate to remain the same as the one prevailing during the previous quarter.

4.1.3. Since the role of income expectations is the purpose of the next section, we provisionally set $\mu_3 = 0$, so that (24) can be written

$$\Delta V_t = \mu_1 (\beta_0 + \Sigma_i \beta_i X_{it-1} - V_{t-1}) + \mu_2 \Sigma_i \beta_i \Delta X_{it} + \Sigma_j \lambda_j \Delta Z_{jt} + u_t \quad (i=1,5;\ j=5) \qquad (26)$$

Several remarks have to be made at this stage.

(i) The error correction model [DHSY (1978)] can been seen as a particular specification of (26) (cf.infra).

(ii) If $Z_i = X_i$ (for i = 2 to 5), then (26) is simply a reparametrization of the "unconstrained" dynamic specification

$$V_t = b + \Sigma\, b_{0i} X_{it} + \Sigma\, b_{1i} X_{it-1} + \beta_2 V_{t-1} + u_t \qquad (27)$$

(iii) Indeed, with respect to (27), equation (26) imposes k-1 restrictions (k being the rank of X), namely that the ratio between the short and the long run effect of X_i on V is the same for all i. This arises from the fact that in a model compatible with a dynamic optimization the adjustment process depends on the size of previous disequilibrium independently of its cause.

(iv) Thus from a theoretical point of view (27) is overparametrized but it might not be a good practice to immediately proceed by testing (26) (i.e. $\lambda_2=\lambda_3=\lambda_4=0$) against (27). Indeed this could lead us to drop a variable from the model on the basis of an insignificant β_i although the change of this variable affects short run behaviour. We will therefore examine the alternatives $\beta_i = 0$; $\lambda_i = 0$ and $\beta_i = \lambda_i = 0$ for each exogenous variable. In other words, to the extent that V^*_t incorporates the complete effects of life cycle variables, a given exogenous variable should only affect either V^*_t or the adjustment process. That is, in these circumstances, $\lambda_1 \beta_1 = 0$.

(v) Equation (26) also makes clear that $0 < \mu_1 < 2$ is necessary for behaviour to actually converge to its long run equilibrium value.

4.1.4. With the exception of income the signs of the effects of the exogenous variables are not determined a priori. The indeterminacy of the interest rate effect which combines an income and a substitution effect is well known while the influence of assets on the saving ratio may be multiple. In a pure life-cycle model, or in a stock ajustment model it should be negative. This is also the case in a model which postulates that the proportionality between C and Y depends on the ratio A/Y. On the other hand, everything else being constant (income, interest rate and inflation), an increase in non-human wealth corresponds to a decrease of the labour share in income and this distribution effect normally influences the saving ratio. positively. Also, the change of assets may have liquidity effects, which implies a short-run increase of the saving-ratio. Lastly, the effect of the relative price of durables to non durables is likely to be positive but not necessarily so (for instance if the price elasticity of durables is less than $|1|$).

4.2. The choice of the functional form.

4.2.1. Our first task is to choose the functional form for the dependent variable and the length of the lags. The possibilities considered are

(i) $St = f(Xt)$

(ii) $\ln St = f(\ln Xt)$

(iii $\ln Ct = f(\ln Xt)$

(iv) $\sigma t = f(Xt)$

(v) $\sigma t = f(\ln Xt)$

where S is aggregate savings, C aggregate consumption and $\sigma = S/Y$ and the possible length of lag is either one or four quarters. We also include additive seasonal dummies. Typically these were significant with pronounced fourth quarter peaks.

We choose between the different models on the basis of transformed log likelihoods of the unrestricted models Following Sargan'(1964) rule[4], and taking $L(\sigma)$ as the basis for comparison, one can easily show that:

$$L(\sigma) = L(S) + T\,\underline{\ln Y}\ ;$$
$$L(\sigma) = L(\ln S) + T\,(\underline{\ln Y} - \underline{\ln S})\ ;$$
$$L(\sigma) = L(\ln C) + T\,(\underline{\ln Y} - \underline{\ln C})\ ,$$

where L is the logarithm of the likelihood function at its estimated maximum; T is the number of observations and $\underline{x}$ the mean of x.

We also use some additional diagnostic information on the models: tests of first to fourth order autocorrelation of the residuals and a Ramsey reset test.

The results are shown in Table 1; the log forms of consumption and of the saving ratio dominate their linear counterparts as well as the log of saving alone. First to fourth order autocorrelation of residuals were tested and rejected except for the fourth order which systematically appears as significant when fourth order lags of the variables were present. However none of the models estimated display any heteroscedasticity and the "reset" test was never significant.

The combined model includes the first and the fourth order lag of the dependent variable, current as well as the first and fourth order lags of real income, real financial assets, the relative price of durables to nondurables, the real interest rate and the rate of inflation together with three seasonal dummies. Table I presents the log-likelihood for this model as well as for one where all fourth order lags are supressed (lag 1) and one where all first order lags are suppressed (lag 4).

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[4] see also Pesaran and Evans (1984).

Table I: Adjusted Log likelihoods

	Lag 1	Lag 4	lag 1 & 4
S_t	144.925	142.895(*)	150.384(*)
ln S_t	143.900	139.599	150.057(*)
ln C_t	149.716	142.443(*)	152.571(*)
σ_t (levels)	143.754	142.239(*)	149.750(*)
σ_t (logs)	149.642	142.600(*)	152.685(*)
Number of coefficients	15	15	21

(*) significant fourth order autocorrelation

Table I indicates that the first order lag dominates the fourth order lag. The general model has 21 parameters; with 6 restrictions the 5% chi-square value is 12.6 so that it is evident that we can accept the hypothesis of there being a single lag of one quarter length in the consumption function or the saving ratio in logs. But we cannot accept the hypothesis of a single lag of four quarters length.

Moreover, given the fourth order autocorrelation present in the fourth order lag models, we decided to work with a first order lag exclusively. In the context of an error correction model in many ways the first quarter lag makes more sense than a four quarter lag given that a quarter is the period of observation. Why should adjustments in consumption respond to experience of a year ago instead of yesterday?

Among the models with first order lags, the two contenders for functional form are either ln C_t or σ_t which fairly clearly dominate the others. A variety of factors - not least of which is the desire to compare our results with the literature - led us to choose ln C_t as dependent variable. As a matter of fact, the two models have to be very close: $\ln(1-\sigma_t) \approx \ln C_t$ so that when σ_t is sufficiently close to zero, the two functional forms become almost identical[5].

4.2.2. Given the functional form, log linear with $\Delta\ln C_t$ as dependent variable, and a lag length of one, we search for a more parsimonious representation of the consumption/savings function trying to avoid the problems which arise from the nonuniqueness of sequential testing.

At each stage following imposition of a restriction, which are tested either by likelihood ratio or t tests, we run a Ramsey reset test and an autocorrelation test [regressing residuals on four lagged values and the exogeneous variables as suggested by Durbin (1970)].

First, imposing the irrelevance of the real interest rate to the entire model ($\beta_4 = \lambda_4 = 0$) yields a loglikelihood of 143.316 against 143.911 for the unrestricted model so that this is clearly accepted.

However the results are not satisfactory in many respects

$$\underset{}{\ln C^*_t} = \underset{(.37)}{.117} + \underset{(30.9)}{1.06}\ln Y_t - \underset{(2.61)}{.065}\ln A_t + \underset{(.32)}{.006}\ln W_t - \underset{(8.10)}{4.18}\, I_t \qquad \text{(eq. C1)}$$

$$\Delta\ln C_t = \underset{(3.86)}{2.24}(\ln C^* - \ln C)_{t-1} + \underset{(2.32)}{.334}\,\Delta\ln C^* - \underset{(2.59)}{8.93}\,\Delta\ln A_t + \underset{(1.41)}{.145}\,\Delta\ln W_t - \underset{(2.37)}{7.64}\,\Delta I_t$$

$$+\ \text{seas.} \quad R^2 = .970 \quad s = .0103 \quad DW = 1.94 \quad \mathcal{L} = 143.316$$

Indeed, the value of μ_1 violates the stability condition and the size of the coefficients of assets and inflation are not very plausible. Dropping the inflation rate from the equilibrium relation ($\beta_5 = 0$) helps but this amounts to imposing an unacceptable restriction and also to losing the unitary income elasticity:

[5] cf. Pesaran and Evans (1984), Notice however that income elasticity (when not imposed to be one) is constant in the log-linear form of consumption but depends on the current value of σ_t in saving ratio function and also that the sample mean of σ_t is .126 ...

$$\ln C^*_t = .329 + .806 \ln Y_t + .136 \ln A_t - .002 \ln W_t \qquad \text{(eq. C2)}$$
$$\quad (.28) \quad (10.9) \qquad (1.75) \qquad (.30)$$

$$\Delta \ln C_t = .650\,(\ln C^* - \ln C)_{t-1} + .428\,\Delta \ln C^*_t + .806\,\Delta \ln A_t + .301\,\Delta \ln W_t - .331\,\Delta I_t$$
$$(3.75) \qquad (2.14) \qquad (3.76) \qquad (2.17) \qquad (1.81)$$

$+$ seas. $R^2 = .962$ $s = .0115$ $DW = 2.06$ $\mathcal{L} = 138.131$

As can been seen from the correlation matrix of the coefficients there is strong interdependence of the income, assets and inflation coefficients. We might reduce multicollinearity by incorporating some non sample information. Firstly, it is possible that the erosion of assets was overestimated as a substantial part of wealth is held in real assets. But this is certainly not the case in our sample: replacing lnA by lnÅ-klnP yields a negative estimated value for k of -.1. A much more plausible hypothesis is the one suggested by H-US namely that due to inflation there exists a non negligable difference between perceived and measured income. Following these authors we proceed by "correcting" income:

$$y_t = Y_t - \beta_6\, I_t\, A_t \qquad (28)$$

Substituting lnY by lny in (eq. C1) produces a substantial reduction in the apparent multicollinearity with $\beta_6 = .102$ (1.02) but hardly modifies the values of the coefficients. This implies a correction of only 1.6% (on average) of quarterly income with however an important change in its dynamic evolution. Incidentally, imposing the statistically rejected restriction $\beta_5 = 0$ shifts β_6 to .384. Also notice that (dropping β_3 λ_3 and λ_5) the model can be reparametrized in a form very similar to the H-US function i. e.

$$\Delta \ln C_t = b_0 + b_1 \Delta \ln y_t + b_2 (\ln y - \ln C)_{t-1} + b_3 (\ln y - \ln A)_{t-1} + b_4 \Delta \ln A_t$$

An alternative hypothesis is that assets is a proxy for some sort of liquidity constraint. Assuming that this effect plays only a short run role and is better measured in nominal terms, we replace $\Delta \ln A_t$ by $\Delta \ln \mathring{A}_t$ ($\mathring{A} = P.A$) imposing first separately and then jointly

$\beta_2 = \beta_5 = 0$. In terms of likelihood ratio tests this also should be rejected.

However combining this hypothesis with the correction of income seems much more promising as shown in table II (eq (g)).

In all the variants, the assumption of a unitary income elasticity ($\beta_1 = 0$) is easily accepted. On the other hand the maximum likelihood estimate of β_6 oscillated between .097 and .104. To render the model linear we eventually fixed it at .10.

Next we imposed the restriction that the relative price of durables to nondurables is important only in the short run and does not affect the life cycle level of consumption ($\beta_3 = 0$). This is easily accepted. However allowing β_3 to be nonzero but imposing $\lambda_3 = 0$ is rejected. So as a result the relative price appears to influence the short run adjustment process, perhaps through a form of relative price expectations (to justify its positive sign), but does not to affect the long run equilibrium.

TABLE II. Log Likelihoods for Parameter Restrictions

	model	L	β_6	(t stat.)
(a)	eq. C1	143.316	0.	
(b)	as (a) & $\beta_6 \neq 0$	144.130	.102	(1.02)
(c)	as (b) & $\beta_5 = 0$	140.217	.384	(3.04)
(d)	as (b) & $\beta_1 = 1$	144.088	.097	(1.00)
(e)	as (a) & $\beta_2 = 0$; $A \rightarrow \hat{A}$	141.802	0.	
(f)	as (e) & $\beta_5 = 0$	129.838	0.	
(g)	as (b) & $\beta_2 = \beta_5 = 0$; $A \rightarrow \hat{A}$	143.670	.103	(6.12)
(h)	as (g) & $\beta_1 = 1$	143.581	.104	(6.19)
(i)	as (h) & $\beta_3 = 0$	143.039	.1	(—)

The regression corresponding to (i) is

$$\ln C^*_t = -.019 + \ln y_t \qquad \text{(eq. C3)}$$
$$\quad (3.02)$$

$$\Delta \ln C_t = \underset{(8.46)}{1.602} (\ln C^* - \ln C)_{t-1} + \underset{(3.29)}{.325}\, \Delta \ln C^*_t - \underset{(6.19)}{4.867}\, \Delta \ln \dot{A}_t + \underset{(1.96)}{.214}\, \Delta \ln W_t - \underset{(2.03)}{.353}\, \Delta I_t$$

$$- \underset{(12.1)}{.081}\, T_1 - \underset{(8.50)}{.038}\, T_2 - \underset{(4.90)}{.025}\, T_3$$

$R^2 = .970 \quad s = .0098 \quad DW = 1.87 \quad \mathcal{L} = 143.039$

The t-statistic in a regression of the residuals on the square of the predicted value is 6 and all t-statistics of residuals regressed on the first four lags of residuals are below unity except for u_{t-3} which is 1.2 With respect to (eq.C1), (eq.C3) has the same explanatory power with 8 parameters instead of 13. Still the size of μ_1 and λ_2 is troublesome and we can certainly not rule out the possibility of some misspecification.

5. The Effects of Income Expectations

5.1. We now turn to the incorporation of income expectations in our consumption/saving model. The argument is that the long run equilibrium relationship between consumption and income holds if income is expected to remain constant through time. If the consumer expects a rise (fall) in real income his consumption (saving) path should immediately move upwards (downwards). In other words the linear relationship between $\ln C^*$ and $\ln Y$ (or $\ln y$) can only represent a partial approximation to a life cycle model since future real income growth is excluded; a better approximation would take the lifetime pattern of income into account. From these arguments one can rationalise either the expected change in the level of real income or the growth rate of income as variables affecting $\Delta \ln C$. We shall try both.

CASE I

Let us suppose first that the expected level of real income is the important variable. Then we can write (24) as

$$\Delta V_t = \mu_1 (V^*_{t-1} - V_{t-1}) + \mu_2 (V^*_t - V^*_{t-1}) + \mu_3 ({}_t\ln Y_{t+1} - \ln Y^P_t) + \Sigma_j \lambda_j \Delta Z_{jt} + u_t \qquad (29)$$

But from (15)

$$\ln Y^P_t - \ln Y^P_{t-1} = \alpha_1 n_{12t} + \alpha_5 n_{54t} + \pi \Delta \ln Y_{t-1} \qquad (30)$$

and

$${}_t\ln Y_{t+1} - \ln Y^P_t = \alpha'_1 m_{12t} + \alpha'_5 m_{54t} + \pi' \Delta \ln Y^P_t \qquad (31)$$

where $n_{12} = n_1 + .5\, n_2$ and $n_{54} = n_5 + .5\, n_4$ and similarly for the m's. The term $\mu_3(.)$ in (29) then becomes:

$$\mu_3 ({}_t\ln Y_{t+1} - \ln Y^P_t) = \delta_1 m_{12t} + \delta_2 m_{54t} + \delta_3 n_{12t} + \delta_4 n_{54t} + \delta_5 \Delta \ln Y_{t-1} \qquad (32)$$

with $\delta_1 = \mu_3\alpha'_1$; $\delta_2 = \mu_3\alpha'_5$; $\delta_3 = \mu_3\pi'\alpha_1$; $\delta_4 = \mu_3\pi'\alpha_5$; $\delta_5 = \mu_3\pi'\pi$.

A special case is $\pi' = 0$ (i.e. $\delta_3=\delta_4=\delta_5=0$) which would imply that only the frequencies relating to expectations are relevant, while other restrictions worth testing are $\pi = 0$ ($\delta_5=0$) and, especially, $\delta_4=\delta_2\delta_3/\delta_1$ which corresponds ($\alpha_1/\alpha_5=\alpha'_1/\alpha'_5$ with $\pi=\pi'$) to the case where expectations and perceptions may be represented by the same function.

CASE II

The second case occurs when it is expectations of the growth rate in real income that affects $\Delta\ln C$ so that (24) is specified as:

$$\Delta V_t = \mu_1 (V^*_{t-1} - V_{t-1}) + \mu_2 (V^*_t - V^*_{t-1}) + \mu_3 ({}_t\Delta\ln Y_{t+1} - \Delta\ln Y^p_t) + \Sigma_j \lambda_j \Delta Z_{jt} + u_t \quad (33)$$

Using previous results, we have

$${}_t\Delta\ln Y_{t+1} = {}_t\ln Y_{t+1} - \ln Y^p_t = \alpha' m_t + \pi' \Delta\ln Y^p_t$$

and

$$\Delta\ln Y^p_t = \alpha n_t + \pi \Delta\ln Y_{t-1}$$

so that

$$\mu_3 ({}_t\ln Y_{t+1} - \ln Y^p_t) = \alpha' m_t - \alpha n_t + \pi'\Delta\ln Y_t - \pi \Delta\ln Y_{t-1} \quad (34)$$

if consumers perceived the recent change in income correctly, and

$$\mu_3 ({}_t\ln Y_{t+1} - \ln Y^p_t) = \alpha' m_t - \alpha(1 - \pi')n_t - \pi(1 - \pi')\Delta\ln Y_{t-1}. \quad (35)$$

otherwise. But since $\Delta\ln Y_t$ already enters as a regressor in the consumption function it is unlikely that (34) and (35) could be distinguished empirically. Thus we may set π' equal to zero without lost of generality. If in addition $\alpha = \alpha'$ then (34) and (35) become

$$\mu_3 ({}_t\ln Y_{t+1} - \ln Y^p_t) = \delta_1(m_{12t} - n_{12t}) + \delta_2(m_{54t} - n_{54t}) - \pi \Delta\ln Y_{t-1} \quad (34)$$

so that, in contrast with case I, frequencies are subtracted rather than added.

CASE III

It is worth noting that these specifications permit one to test the use of the survey data to measure expectations against the use of a rational expectations income forecasting scheme. If $\alpha = \alpha' = 0$ with $\pi \neq 0$, then , after re-arrangement, the consumption function yields

$$\Delta \ln C_t = b_0 + b_1 \ln C_{t-1} + b_2 \ln Y_t + b_3 \ln Y_{t-1} + b_4 \ln Y_{t-2} + \text{other exog.} + u_t \tag{36}$$

This is identical to the permanent income hypothesis with rational expectations and adjustment costs so long as permanent income is generated either by the autoregressive scheme

$$\ln Y_t = c_0 \ln Y_t + c_1 \ln Y_{t-1} + c_2 \ln Y_{t-2} + e_t$$

or by the "rational expectations" formulation[6]

$$\ln Y_t = c_0 \ln Y_t + c_1 \ln Y_{t-1} + c_2 \ln Y_{t-2} + c_3 \ln C_{t-1} + e_t \tag{37}$$

and so long as e_t is uncorrelated with u_t

5.2. Starting with the estimation with the general form (27) together with (32), we found again that the real interest rate appears as an irrelevant regressor. With the exception of δ_1, the coefficients of the survey are clearly insignificant so that $\pi' = 0$ ($\delta_3 = \delta_4 = \delta_5 = 0$) was imposed. It might well be that the rejection of $\pi' \neq 0$ is due to the fact that the perception of past change is already captured by the dynamics of the consumption function. Conditionally on $\pi' = 0$, δ_2 is positive but however not significant. There is clearly a strong collinearity between δ_2 and the constant term. Indeed imposing $\beta_0 = 0$ yields a negative (and significant) value for δ_2 but at the cost of a dramatic drop in the value of the

[6] cf. Muellbauer (1981)

estimated maximum for the log likelihood function so that we proceed by constraining δ_2 to be zero. The interpretation of (24) now becomes that the current growth rate of consumption increases whenever m_{12t} (the weighted number of people expecting an increase in their income) exceeds some constant threshold. In any case, the hypothesis of the statistical irrelevance of the survey data is strongly rejected.

Next, taking previous results into account, we impose a unitary income elasticity and replace A_t by $\hat{A}_t$ together with the constraints $\beta_2 = \beta_5 = 0$. We note that this implies an even lower value of β_6 and therefore a minor - but empirically important - correction of income (slightly more then 1% per quarter on average). Also the relative price effect now has the correct sign and plays a role in the long run equilibrium rather than only in the short-run as before. The insignificant value of μ_2 suggests that the incorporation of expectations renders the current change in equilibrium superfluous. This amounts to dropping the term μ_2 ($\Delta \ln y_t$ - β_2 $\Delta \ln W_t$) simplifying the model to

$$\Delta \ln C_t = \mu_1(\beta_0 + \beta_2 \ln W_{t-1} + \ln y_{t-1} - \ln C_{t-1}) + \lambda_2 \Delta \ln \hat{A}_t + \lambda_3 \Delta \ln W_t + \delta_1 m_{12t}$$
$$+ \text{ seasonal dummies}$$

This is our final equation [equation (p) in tables III and IV] which can be estimated by ordinary least-squares for a fixed value of β_6. For instance with β_6 = .075 one gets:

$$\Delta \ln C_t = -.073 + 1.527\,(\ln y - \ln C)_{t-1} - .034\,\ln W_{t-1} - 4.582\,\Delta \ln \mathring{A}_t$$
$$(6.14)\quad (9.57)\qquad\qquad (2.07)\qquad (7.25)$$

$$-.659\,\Delta I_t + .295\,m_{12t} - .085\,T_{1t} - .044\,T_{2t} - .025\,T_{3t}$$
$$(6.13)\qquad (6.87)\qquad (16.7)\qquad (11.9)\qquad (6.84)$$

$R^2 = .980 \qquad s = .0080 \qquad DW = 2.22 \qquad \mathcal{L} = 151.681$

TABLE III. Log Likelihoods for Parameter Restrictions

	model	$\mathcal{L}$	$\mathcal{L}$rt.	
(j)	unrestricted	159.458		
(k)	$\beta_4 = \lambda_4 = 0$	159.332	.252	(2)
(l)	as (k) & $\pi' = 0$	156.061	6.542	(3)
(m)	as (l) & $\delta_2 = 0$	154.441	3.240	(1)
(n)	as (m) & $\beta_2=\beta_5=0; \beta_1=1; +\beta_6; A \to \mathring{A}$	152.773	3.336	(2)
(o)	as (n) & $\lambda_3 = 0$	152.316	.914	(1)
(p)	as (o) & $\mu_2 = 0$	151.717	1.145	(1)
(q)	as (p) & $\beta_0 = 0;\ \delta_2 = 0$	145.061		
(r)	as (k) with case II	152.316	14.032	(2)
(s)	as (k) with case III $(\alpha=\alpha'=0)$	144.287	30.090	(4)

notes :
$\mathcal{L}$rt = twice the difference of the log likelihoods which is distributed as χ^2 with the degrees of freedom between brackets; critical values of χ^2 at 5% (1%) for 1, 2 and 3 d. of. f.: 3.84 (6.63), 5.99 (9.21), 7.81 (11.34). Also note that (n) is nested with respect to (m) as $\Delta \ln \mathring{A}_t = \Delta \ln A_t + I_t$.

Final Remarks.

One of the major conclusions of this research is that there seems to exist a natural degree of pessimism in the survey sample. Empirically those reporting a perceived increased in their financial situation receive a higher weight in the forecast of aggregate income from the survey data.

The survey data also appears as an important determinant in the modelling of aggregate household behaviour, the short-run rate of growth of total consumption being significantly influenced by the proportion of people expecting an increase in their income. This latter variable turns out to be empirically superior to alternative expectations schemes.

However our results are not satisfactory in several aspects. We originally started this research using the sample 74:2 - 83:IV. Four additional observations and, especially, the successive revisions in the official statistics have considerably changed the values of the coefficients (i.e. increased their size) and altered the results of some of our tests ($\mu_1 = 0$ and $\delta_2 = 0$ instead of $\delta_1 = 0$ with $\delta_2 < 0$)[7]. Quite clearly, these revisions provoked an increase in the collinearity between the variables and modified their temporal profile, the latter especially for personal savings.

For these reasons we wonder by how much our results are sample specific and by how much they suffer from misspecification problems. In particular, the evolution of assets may have been badly measured and also dropping simultaneously all fourth order lags of the

[7] As a (weak) test of stability, we have reestimated equation (p) using the last two years for prediction. The ratio of the sum of squares of the residuals for those eight observations to the variance of the variance of the regression is 9. which should be compared with the $\chi^2_{(8)}$ value : 15.5 (5%).

variables may have been too restrictive. Nevertheless at least one result appears robust, namely, the statistical importance of the survey data when households' income expectations are incorporated in the aggregate savings/consumption function and, after all, the analysis of its possible influence was our main purpose

Apart from the result that the survey data appears to be informative in explaining aggregate personal consumption data, one interesting findings is that in the short run consumers overcorrect their behaviour in response to changes in the exogenous variables. This result is contrary to that found by most other researchers who work with data in annual changes (with 4th order lags). However it is not logically (nor empirically[8]) inconsistent with those studies. Indeed individual's may well adjust to a new equilibrium within a year but with an adjustment path involving initial overreaction. There appear to be quite well founded arguments supporting this hypothesis. Firstly many policies or changes in the environment seems to have an announcement effect. For example during the oil price hikes of 1973-4 and 1978, "common observation" was that the immediate response of domestic motorists was to radically reduce or eliminate pleasure motoring completely. Indeed some European countries for a short period banned Sunday motoring by domestic cars. Similarly excise duty increases in alcohol and tobacco often generate immediate sharp falls in consumption. But then over the next few months consumption increases again as individuals achieve a "general equilibrium adjustment" to the new set of relative prices. Several rationalizations of this announcement effect are possible. Firstly, if individual's have highly regressive expectations believing that changes in exogenous variables are likely to be reversed then it pays to alter quantities bought or sold dramatically to take advantage of current favourable market conditions or to avoid the effects of current adverse conditions. Secondly it may well be that in the short

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[8] One can easily construct a numerical example where the data in quarterly changes is characterized by a short run overreaction (with, let say, $\mu_1 = 1.5$) but yielding the traditional adjustment scheme $\mu_1 < 1$) when estimated with a fourth order lags specification.

term a form of liquidity constraint operates; if some demands or supplies are for fixed nominal quantities in the short run, then all adjustments to nominal income changes is pushed into a small number of commodities. In the short term aggregate personal saving may well be largely fixed in nominal terms; in a period of inflation and falling real incomes, the budget constraint can force apparent overreaction of real consumption to real income changes. It seems to us that short run overreaction is an interesting phenomenon with an empirical foundation and that it justifies further research.

References

ANDERSON O., (1952), "The Business Test of the IFO-Institute for Economic Research, Munich, and its Theoretical Model", Revue de l'Institut International de Statistiques, 20, pp. 1-17.

BATCHELOR, R.A., (1983), "Expectations, Inflation and Growth; The European Experience", mimeo.

CARLSON, J. AND PARKIN, N., (1975), "Inflation Expectations", Economica, 42 123-138.

DAVIDSON, J.E., HENDRY, D.F., SRBA, F. AND YEO, S., (1978), "Econometric Modelling of the Aggregate Time Series Relationship between Consumer's. Expenditure and Income in the United Kingdom", *Economic Journal*, 88, pp. 661-692.

DEATON, A. (1977), "Involuntary Saving through Unanticipated Inflation", *American Economic Review*, vol. 67, pp. 899-910.

HENDRY, D.F, AND VON UNGERN-STERNBERG, T., (1981), "Liquidity and Inflation Effects on Consumer expenditure", in *Theory and Measurement of Consumer's Behaviour*, ed. by A.S. Deaton, Cambridge University Press.

MUELLBAUER, J., (1983), "Surprises in the Consumption Function", *Economic Journal*, Supplement, pp. 34-50.

PESARAN, M.H., (1984), "Expectations Formations and Macroeconomic Modelling" in P. Malgrange and P.A. Muet (eds), *Contemporary Macroeconomic Modelling*, Blackwell.

PESARAN, M.H. AND EVANS, R.A., (1984), "Inflation Capital Gains and U.K. Personal Savings", 1953-1981", The Economic Journal, 94, pp.237-257.

PRAET, P., (1983), "The Integration of EEC Qualitative Consumer Survey Results in Econometric Modelling: an Application to the Consumption Function", mimeo.

SIMMONS, P. AND WEISERBS, D., (1979), "Translog Flexible Functional Forms and Associated Demand Systems", *American Economic Review*, 69, pp. 892-902.

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