Journal of Economic Psychology 5 (1984) 101-124
North-Holland

THE CONTRIBUTION OF E.C. CONSUMER SURVEYS IN FORECASTING CONSUMER EXPENDITURES: AN ECONOMETRIC ANALYSIS FOR FOUR MAJOR COUNTRIES

Peter PRAET and Jozef VUCHELEN *

University of Brussels, Belgium

Received October 5, 1983; accepted January 13, 1984

In this article we investigate the forecasting performance of alternative models of private consumption using the EEC consumer surveys. Two basic conclusions emerge from the study:
(1) in absolute as well as in comparison with a standard economic model, consumption functions incorporating opinion variables perform surprisingly well given the important measurement problems (missing data, qualitative character of the responses, strong collinearity among responses), and
(2) consumers' opinions are helpful guides only in very short-term forecasting (between 0 and 3 quarters).
The article extends previous investigations both on the basic characteristics of opinion variables and on their relation with actual economic variables.

In recent years consumption has been more difficult to predict as a result of increasing uncertainty in important economic variables such as income and inflation. Information on how consumers perceive and predict economic reality is therefore of crucial importance. In the present article we estimate and compare alternative quarterly models of private consumption expenditure incorporating consumer survey results for the main E.C. countries, i.e. France, Germany, Italy and the U.K. [1].

The rationale of incorporating survey results into forecasting equations can be questioned, since in order to forecast the dependent

* The authors wish to acknowledge helpful comments made by M. Biart, T.P. de Hora, A. Dramais (European Commission) and J. Mercenier (University of Brussels) and efficient computer assistance from Y. Dabin and B. Mariash (IBM-Diegem).

Mailing address: P. Praet, Institute of European Studies, 39 Avenue F.D. Roosevelt, 1050 Brussels, Belgium.

[1] Similar comparisons have been performed by Robinson et al. (1981) for the E.C. business survey.

variables the opinion variables will have to be generated (predicted) for the forecasting period. Predicting people's opinions to predict their actual behavior looks obviously weird. However, if the forecasting horizon is smaller than the time horizon considered by survey respondents then survey models, which are based on direct and recent information, should present a marked advantage over economic models. In the E.C. consumer surveys, questions are asked on opinions for the past, the present and the next twelve months. For a forecasting horizon of say up to one year, survey models are certainly worth testing. These predictions could then be confronted in the early periods of a forecasting exercise to the corresponding "pure economic" forecasts. Such interaction between alternative models is regularly performed when economic model predictions are revised in view of any objective or subjective additional information. The potential role of opinion models in providing early signals to policy-makers also has to be stressed.

While we believe that survey models are important in short-term forecasting it remains that their main function should be to complement rather than replace economic models. It is under this perspective that the present work has to be considered.

In the first section, we estimate standard economic models for consumption expenditures. In these models, the dependent variable is a function of economic variables only. In a subsequent section, the results of the consumer surveys and the problems related to their integration into quantitative models are analyzed. Then, the estimation of survey and mixed models follows, i.e. models in which all or part of the dependent variables are consumers' opinions. The different models are compared on their forecasting performances in the last section.

A standard economic model for private consumption

One of the main difficulties in modelling the short-run dynamic interaction between income and consumption stems from the short-term variability of the average propensity to consume: over the period 1973(4) to 1982(3) the propensity to consume has ranged between 80.7 and 86.0% in France, 83.1 and 90.7% in Germany, 78.8 and 89.6% in Italy, and 82.7 and 94.1% in the United Kingdom.

The variability of consumption growth has generally been smaller than the variability of income growth. On the whole, savings appeared

thus as a buffer which limited the effects of changes in disposable income on consumption flows. Very recent years are interesting in that they indicate a *decrease* in the variability of consumption relative to income in three countries. The coefficients of variation between consumption growth and income growth were [2]:

	1973(4) to 1982(3)	1979(2) to 1982(3)
France	0.79	0.45
Germany	0.99	2.94
Italy	0.46	0.41
UK	0.67	0.30

To falling and unstable income growth has corresponded an increasingly anticyclical role of savings in three countries. Germany is in strong contrast with the other countries in that savings have evolved pro-cyclically, consumers reacting to falling income by increasing their savings.

As a standard economic model, we chose the one extensively discussed by Davidson et al. (1978) for the UK and estimated with good results for the four main E.C. countries by Lohan (1980):

$$\Delta_4 C = \alpha \Delta_4 YD + \beta \Delta_1 \Delta_4 YD + \gamma (C/YD)_{-4} + \delta \Delta_4 P + \varepsilon \Delta_1 \Delta_4 P$$

where:
C = private consumption at constant prices;
YD = real disposable income;
P = implicit deflator of private consumption.

All variables are expressed in logarithmic terms, $\Delta_4 Z$ is the four period or annual difference of variable Z, $\Delta_1 \Delta_4 Z$ refers to the acceleration of growth rates over one quarter ($= \Delta_4 Z - \Delta_4 Z_{-1}$). All variables are expressed in percentages.

The model uses differentiated variables and also takes into account the level of variables in short-term consumption behavior (C/YD).

[2] $$\frac{SD\Delta_4 C}{\text{Mean } \Delta_4 C} \Big/ \frac{SD\Delta_4 YD}{\text{Mean } \Delta_4 YD}$$

where SD is the standard deviation and Δ_4 refers to annual growth rates calculated as logarithmic differences, C is private consumption and YD disposable income.

Since variables are expressed in annual differences, non deseasonalized data have been used [3]. This model presents the advantage of simplicity while relying on a plausible short-term consumption behavior. Accordingly, "consumers plan to spend in each quarter of a year the same as they spent in that quarter of the previous year modified by a proportion of their annual change in income, and by whether that change is itself increasing or decreasing; these together determine a "short-term" consumption decision which is altered by the feedback from the previous consumption income ratio insuring coherence with the long-run "target" outcome: $C = k \cdot YD$" [4] (Davidson et al. 1978: 684).

The inflation rate and its rate of change can be interpreted in various – and sometimes contradictory – ways, leaving the signs of the coefficients of price variables *a priori* undeterminate. Consumers can increase their savings in inflationary periods in order to keep the real value of their liquid assets constant, or because high and variable inflation rates create uncertainty about the future. Inflationary expectations can also have the effect of stimulating purchases of real assets, in particular of durables [5]. Inflationary expectations are not explicit in the model: it is assumed that actual inflation and its acceleration are proxies for expectations. The regression results are reported in table 1.

Notwithstanding the high degree of uncertainty which characterizes the sample period, the model performs reasonably well. The Durbin-Watson statistics are in the inconclusive region for three countries, there is a first order positive autocorrelation in the Italian model. We also present the regression results using the Cochrane-Orcutt correction for first-order autoregressive error processes (AUTO). This leads to a reduction in the sum of the squared residuals in the regression for Germany and Italy; all corrected R-squares are around 0.6. The condition index, which identifies the magnitude of the dependencies among the independent variables, is low [6]. The standard-errors of the coeffi-

[3] Except for Italy. Davidson et al. report that equations using seasonal adjusted data induce only negligible changes in the estimates of such models (1978: 672).

[4] Long run stability of the propensity to consume.

[5] The impact of inflation and inflationary expectations on consumption-savings flows has been the subject of a number of studies (see among others Juster and Wachtel (1972), Wachtel (1977), Howard (1978)).

[6] Weak dependencies are associated with condition indexes around 5 or 10, whereas moderate to strong relations are associated with condition indexes of 30 to 100 (see Belsley et al. (1980)).

Table 1
Regression results of standard economic models [a].

	$\Delta_4 YD$	$\Delta_1\Delta_4 YD$	$(C/YD)_{-4}$	$\Delta_4 P$	$\Delta_1\Delta_4 P$	$\bar{R}^2$	*DW*	*SSR*	*Cond.*	*Rho*
France (OLS)	0.328	−0.184	−0.310	−0.324 [b]	−0.432 [b]	0.96	1.44	16.45	12.1	–
	(4.27	(−1.65)	(−8.64)	(−5.74)	(−2.86)					
France (AUTO) [c]	0.472	−0.196	−0.380	−0.494 [b]	−1.820 [b]	0.64	2.37	13.82	6.5	0.70
	(3.99)	(−1.99)	(−6.53)	(−5.17)	(−0.11)					
Germany (OLS)	0.756	−0.481	−0.222	−0.563	−0.683	0.84	1.23	43.16	9.3	–
	(6.77)	(−3.78)	(−3.65)	(−3.74)	(−1.41)					
Germany (AUTO) [c]	0.721	−0.467	−0.176	−0.432	−0.789	0.58	1.89	36.04	6.2	0.45
	(5.34)	(−4.35)	(−2.69)	(−2.50)	(−1.72)					
Italy (OLS)	0.518	−0.116	−0.211	−0.168	0.561	0.81	1.09	75.92	9.5	–
	(7.24)	(−1.71	(−3.14)	(−2.26)	(4.06)					
Italy (AUTO) [c]	0.449	−0.089	−0.236	−0.193	0.386	0.59	2.05	55.83	5.2	0.58
	(5.89)	(−1.67)	(−3.48)	(−2.45)	(3.24)					
UK (OLS)	0.529	−0.064	−0.188	−0.151	0.153	0.77	1.77	57.53	5.4	–
	(7.27)	(−0.42)	(−3.42)	(−2.56)	(−0.70)					
UK (AUTO) [c]	0.621	−0.347	−0.168	−0.158	−0.282	0.55	1.90	53.38	3.8	0.47
	(5.69)	(−2.62)	(−2.58)	(−2.19)	(−1.24)					

[a] Sample period: 1973(4) to 1982(3) for France, Germany and Italy; 1975(3) to 1982(3) for the UK. *DW* = Durbin-Watson statistic; *SSR* = sum of the squared residuals; *Cond.* = condition index indentifying dependencies among independent variables; *Rho* is the coefficient of the correction for first-order auto-correlation; *t*-ratios are in brackets.

[b] Lagged two periods.

[c] Cochrane-Orcutt correction for first-order autocorrelation.

Source: INSEE for France, D.I.W. for Germany, I.S.C.O. for Italy and C.S.O. for the U.K.

cients are small with the exception of acceleration variables (particularly the rate of change of the inflation rate for France and for the UK). Note that, as in Lohan's earlier estimates [7], the rate of inflation exercises a negative effect on consumption; the signs of the rate of change of inflation differ from Lohan's previous estimates, except for Italy. In Italy, short-run anticipatory buying is important when the inflation rate is accelerating. Rough stability tests have been performed by estimating the equations for a number of sub-periods. The results indicated that the standard-errors of the coefficients of the acceleration variables strongly increase in some periods.

Alternative models using the nominal short-term interest rate improved the fit only for Germany. The regression was:

$$\Delta_4 C = \underset{(5.18)}{0.543}\,\Delta_4 YD - \underset{(-3.13)}{0.338}\,\Delta_1\Delta_4 YD - \underset{(-5.93)}{0.234}(C/YD)_{-4} - \underset{(-5.99)}{0.336} IR_{-1}$$

with $R^2 = 0.88$; $DW = 1.85$; $SSR = 34.61$; and where IR is the three-month inter-bank interest rate.

The measurement of opinions (survey model)

Economists have approached the question of measurement of psychological variables in two main directions: the first is indirect and consists in deriving expectation proxies out of assumptions on the formation of expectations (rationality, error-learning process) or on the role of expectations in the determination of the values taken by observed economic variables (e.g. the so-called Fisher interest-rate identity); the second is direct measurement. Direct methods consist in asking a sample of economic agents their opinion on the evolution of an economic variable. Objections made against the use of direct information are of the same type as those relating to other opinion surveys, notably the fact that the interviewees do not necessarily act as they say they would, sampling errors, nature of the questions asked and, last but not least, the cost of polling. The main advantages of surveys are that they do not rely upon simplistic and/or untestable theories, that they

[7] They covered the early sixties to the end of the seventies.

make the detection of the impact of specific events on expectations possible. Direct and indirect methods are in fact complementary and their mutual confrontation should be fruitful. The measurement of *consumers'* opinions presents specific problems: on the whole one would expect them to be less reliable than businessmen's opinions. One characteristic of consumers' opinions is that they evolve relatively smoothly compared to the evolution of corresponding observed variables. The Economic Community's survey of consumers' opinions started in 1972 on a thrice-yearly basis. Since October 1980 for the UK, June 1981 for Germany and January 1982 for Italy, monthly data are available. The survey is of a qualitative nature since questions only relate to directions of changes and not to numbers. However, contrary to the business survey where (typically) only three answers are possible (positive change, negative change, and no change), questions of the consumer survey provide a greater number of possible responses. Table 1A summarizes the twelve questions and the possible answers. Interesting characteristics of the questions are:

- three questions relate to the past 12 months, three questions to the present and six questions to the next 12 months;
- about half of the questions concern micro economic conditions, while the remaining relate to the more general economic environment;
- questions are formulated to give de-trended [8], deseasonalized [9] responses. Consumers are asked to compare evolutions of variables 12 months ago or ahead. As a consequence the yearly change in consumption is a more appropriate dependent variable than the level of consumption [10];
- the number of possible responses amounts to 6 for nine questions, 5 for two questions and 4 for one question. The response frequencies on each question are summarized by the Commission to obtain weighted average answers. The weights are fixed arbitrary, the "don't know" responses are redistributed between the other answer categories according to the latter's percentage distribution;
- for most of the period, the surveys have been conducted in the

[8] Except if there is an acceleration process.

[9] Except – in principle – for the questions related to the present.

[10] This is one reason why we chose a consumption function expressed in differences.

months of January, May and October. The number of observations available for this study is 30 for France, 32 for Germany, 31 for Italy and 27 for the UK. In most of the following regressions, the period of estimation has been reduced by one year in order to allow flexibility in the use of lagged values of opinion variables.

The European Commission computes a Consumer Confidence Index (*CCI*) as the arithmetic average of the answers to the four questions on the financial situation of households and general economic situation together with that on the advisability of making major purchases (*ACHT*). Survey results show large inter-country differences. These differences are not easily explainable. For example, the average *CCI* over the sample period has been the lowest for Italy (-23), followed by the UK (-13), Germany (-6) and France (-2). These important differences do not correspond to the observed inter-country differences in real disposabe income or consumption growth nor to differences in the decelerations of the rate of growth that occurred in the seventies. If one concentrates on particular responses, the striking features are:

- opinions on the future have generally been more optimistic (less pessimistic) than perceptions of the past. However, this was not the case for opinions on savings and purchases of durables where expectations have been considerably more pessimistic compared to the answers on present savings [11] or purchases [12];
- opinions on macroeconomic conditions were on average more pessimistic than opinions on personal situations;
- the relative variability of opinions was greater for expectations than for perceptions of the past for questions on the financial and general economic situation. By contrast, series on price and savings expectations are flat.

The integration of the E.C. consumer survey data as explanatory variables in quarterly private consumption functions poses four main problems: errors of measurement (and notably, missing data problems), transformation of qualitative data into quantitative series, linear or near-linear relationships among opinion variables (problem of collinear-

[11] Note, however, that the questions on savings, present and future, are not identical.
[12] Except in Italy.

ity), overlapping of expectation periods (autocorrelation problem). These problems have been solved in this paper in a rather pragmatic way; further research would be needed on each of these problems.

(1) By their very nature, opinion variables are subjected to *measurement errors.* In the case of the E.C. consumer surveys, special problems arise due to the fact that for most of the sample period the survey was conducted only in three non-equidistant months while the other variables are available on a quarterly basis. Two main alternatives have been explored to solve this problem:

- the first consists in performing regressions on the original sample with only three observations for each year. Since monthly data for economic variables are not available, survey responses for January, May and October are assumed to be representative of the first, second and fourth quarters respectively. The main drawback of this method is that it is not convenient in models with time lags [13];
- a second alternative consists in interpolating the data. In a first variant, the third quarter ($Q3$) is calculated as a simple arithmetic average of the second and fourth quarter ($Q3 = (Q2 + Q4)/2$), the other quarters being assimilated as above. A second variant is an interpolation for all the quarters, the weights being inversely proportional to the time-span between the end of quarter figure and the available data [14]. The drawbacks of interpolation are twofold: the error terms and the explanatory opinion variables will not be independent so that one expects the OLS estimates to be biased and inconsistent; second the successive values of the error term are interrelated and should exhibit autocorrelation patterns. These problems should, however, not be too worrisome, given the fact that the true pattern of consumers' opinions for the missing months is probably smooth in reality. Table 2 compares estimates of changes in real consumption regressed against the Consumer Confidence Index

[13] While survey questions refer to expectations for the next 12 months, at this stage, it is not clear if consumers really envisage a 12-month horizon.

[14] This gives:

$Q1_t = 0.75\ \text{Jan}_t + 0.25\ \text{May}_t$; $Q2_t = 0.08\ \text{Jan}_t + 0.85\ \text{May}_t + 0.07\ \text{Oct}_t$; $Q3_t = 0.40\ \text{May}_t + 0.60\ \text{Oct}_t$. $Q4_t = 0.67\ \text{Oct}_t + 0.33\ \text{Jan}_{t+1}$.

Table 2
Original and interpolated survey data [a]: comparison of regression results (dependent variable = yearly changes in real consumption, in %).

	N	Constant	CCI	$\bar{R}^2$	DW
France					
Original survey data	27	0.042	0.285	0.67	0.54
		(19.38)	(7.34)		
First interpolation method	36	0.042	0.272	0.66	1.32
		(23.53)	(8.38)		
Second interpolation method	36	0.043	0.276	0.62	1.22
		(21.64)	(7.59)		
Germany					
Original survey data	29	0.029	0.168	0.75	1.29
		(11.03)	(9.33)		
First interpolation method	36	0.029	0.161	0.72	1.67
		(12.62)	(9.57)		
Second interpolation method	36	0.029	0.165	0.75	1.72
		(13.49)	(10.35)		
Italy					
Original survey data	28	0.056	0.159	0.10	0.44
		(2.89)	(2.00)		
First interpolation method	36	0.054	0.148	0.09	0.62
		(3.12)	(2.12)		
Second interpolation method	36	0.052	0.138	0.06	0.56
		(2.78)	(1.83)		
United Kingdom					
Original survey data	23	0.031	0.160	0.39	0.86
		(4.64)	(3.87)		
First interpolation method	29	0.032	0.167	0.44	1.30
		(5.78)	(4.82)		
Second interpolation method	29	0.032	0.166	0.40	1.21
		(5.43)	(4.42)		

[a] In the original sample, the third quarter is missing up to a certain period; in the first interpolation, the third quarter is an interpolation of the second and fourth quarter; the second interpolation is a general interpolation of the data (see text).

Period: 1973(4) to 1982(3) for France, Germany and Italy; 1975(3) to 1982(3) for the UK.

(CCI) using different samples (original data, first and second interpolation methods). The results exhibit only small differences in the regression coefficients and statistical tests [15]. Subsequent regres-

[15] The only marked difference is the magnitude of the Durbin Watson statistic which is significantly *lower* in non-interpolated data. The DW statistic for regressions performed on the original sample is difficult to interpret since it measures correlations between the residuals of the fourth and *second* quarters, the second and the first quarter, etc... Note also that economic variables are omitted in the regressions.

sions have been performed using the second interpolation method [16]; when monthly data became available, quarterly averages have been calculated.

(2) A second problem related to the introduction of consumer survey data in regression models results from its *qualitative* character. Qualitative series can be transformed into quantitative series through statistical techniques. A simple way is to construct a weighted average of the frequencies associated to the responses to a particular question. This is how the European Commission summarizes the survey results (see table 1A) [17]. Regressions (not reported) have shown that it is generally preferable to use the whole set of information available for a particular question rather than specific answers.

A more sophisticated approach is based on the assumption that survey respondents have a common subjective probability distribution over the evolution of opinion variables. This approach also assumes that there are threshold values from which interviewees will react. In Knöbl (1974), Carlson and Parkin (1975) there is a constant arbitrary scaling factor which is assumed to be constant over time; in Papadia and Basano (1981), who measure inflationary expectations, this role is played by a perceived inflation rate. A drawback of the latter method is that no use is made of consumers' opinions on actual inflation. Another drawback is that one needs information on actual variables. This is not always possible for the E.C. consumer survey (e.g. what would be the corresponding economic variable for households' opinions over their financial situation?). After statistical transformations, the Papadia and Basano method leads to a weighted average of the frequencies associated to the responses times the perceived inflation rate. In subsequent regressions, an expected inflation *à la* Papadia-Basano using for the perceived inflation actual inflation lagged by one quarter proved satisfactory.

[16] A third alternative – not explored in this research – would be to endogenize expectations. The procedure would consist in explaining the January, May and October perceptions from the values of past observed values and other variables, then in predicting expectations for the missing months. Since for some countries one has now monthly survey data, this method could be tested.

[17] The weights have been recently changed by the Commission: for example, the former weight vector for price expectations was (3, 2, 1, 0, −1, 0) compared to the present vector (1, 0.5, 0, −0.5, −1). The major difference is that the "don't know" responses are now redistributed over the other answers. Tests have shown that this has only minor effects on regression results.

Contrary to the preceding methods, a third approach uses the relationship between actual variables and respondents perceptions of the past as a yard stick for quantification of respondents' expectations about the future (see Pesaran and Gulamani 1982). The idea of using respondents' perceptions of the past also lies behind the method developed by Dramais and Waelbroeck-Rocha (1984) for the Community Business survey. The authors use this information to correct the survey results: the rationale is that there are systematic biases in responses. For example, near turning points, businessmen's production expectations have a high probability of being false. The correction consists in weighting the survey responses by their probability to be true. These probabilities are computed from objective indicators and from information contained in the business survey itself. Lack of correspondence between actual and opinion variables did not allow us to proceed in this direction. As subsequent regression results show, the use of the Commission weighting scheme gave a relatively good fit.

(3) Ideally, the specification of consumption functions including survey responses should include as many opinion variables as possible in order to assess the impact of specific opinions on the consumption behavior (impact of inflationary expectations, unemployment expectations, savings attitudes). The problem is that there exist *linear (or near-linear) relationships* among the survey responses, a characteristic that violates a crucial condition for the application of least squares. Since collinear variables do not provide information that is very different from that already inherent in the others, it becomes difficult to infer the separate influence of such explanatory variables on the dependent variable (see Belsley et al. 1980). Matrices of correlation of survey responses indicate important correlations between consumers' opinions: among 66 correlations between pairs of opinion variables, about 50% are greater than 0.5 in France, in Italy and in the UK. This percentage amounts to 80 for Germany. Weaker correlations (< 0.2) represent 20 to 30% of the total in the three countries (only 2% in Germany). More specifically, it appears that:

- responses to micro- and macro-questions are highly correlated in particular the opinions on the financial situation, the general economic situation, inflation, important purchases and savings;
- there is a great diversity between the countries: for example, the correlation between major purchases, present and expected is negligi-

ble in France, negative in Italy (−0.79) and positive in Germany (+0.64) and in the UK (+0.82).

These results confirm earlier work undertaken by Van der Linden (1977).

The principal components technique allows one to summarize the information given by a set of variables in a smaller number of uncorrelated variables which describe the major part of the variance of the original set. When applied to the 12 opinion variables, it appears that the first two components explain as much as between 66% (in the UK) and 83% (in Germany) of the total variation in the survey data, implying that only two underlying dimensions determine to a great extent consumers' opinions. The loadings [18] of the first principal components on the personal financial and general economic variables are among the highest in all countries. It is interesting to note that, when applied to the five *CCI* variables, the loadings of the first principal component are relatively close to unity which roughly confirms the unitary weights taken by the Commission to construct its confidence index. The principal components analysis also reveals for Italy a negative sign for the loading on price expectations (contrary to the other countries). A negative sign corresponds to the variables which have a favorable effect on consumption. This confirms the economic model finding that the acceleration of inflation (which is used as proxy for inflationary expectations) has had a positive effect on private consumption in Italy.

In view of the strong linear relations among consumers' opinions, one alternative is to select empirically the opinion variables which will give the best statistical fits (including tests on collinearity); another alternative is to summarize all (or part) of the survey information into one or more (orthogonal) variables. The Commission confidence index belongs to the second alternative. Ward (1980) has explored a great number of alternative forms of index construction without clear-cut results [19]. It has also been proposed to take the first principal component loadings to construct a confidence index (see Moutet and Vangrevelinghe 1969; Heald 1971; and Van der Linden 1977). How-

[18] The loadings are the weights which transform the original variables into the new orthogonal variables.

[19] Ward also found that there appeared to be no advantage in using the array of data on the characteristics of respondents as a means of weighting their responses.

ever, regressions performed on such constructed indexes did not prove better than those using the Commission *CCI*.

(4) The last main problem concerns the *time horizon of opinions*. Survey questions and economic data (consumption, disposable income) cover a different time span: perceptions refer to a 12-months horizon while economic data are on a quarterly basis. The overlapping of time horizon potentially creates problems of autocorrelation of errors. In reality, the time horizon of survey respondents is probably vague and short, consumers expressing more their "short-term" views than referring to a precise horizon. To test for this changes in real consumption have been regressed against each of the twelve survey responses using increasing lags, from 0 to 4 quarters. For each survey response, an "optimum" lag was identified corresponding to the highest R-squared. The results summarized show that the highest correlations were obtained when opinion variables were lagged less than one year, notwithstanding the fact that survey questions refer to yearly periods. For France, e.g., 6 opinion variables showed the best correlation with consumption when lagged only one quarter (see table 3).

It appears that households adjust their consumption according to opinions concerning very recent periods. For the countries considered altogether, two-third of the "optimum" lags lie between zero and one quarter. As a consequence, the overlapping of time horizons should not constitute a major problem in a quarterly model.

These tests have also revealed no marked differences in optimum lags between questions regarding the future and the questions concerning the past or the present. For the four countries taken as a whole and for the relevant questions, the "optimum" lag of expectations is greater

Table 3

'Optimum' lags	Number of responses				
	France	Germany	Italy	United Kingdom	All countries
0	2	9	2	4	17
−1	6	2	1	6	15
−2	3	0	1	0	4
−3	0	1	4	0	5
−4	1	0	2	1	4
Undeterminate	0	0	2	1	3
Total responses	12	12	12	12	48

than the corresponding lags for the past or the present in only six cases (out of twenty) and identical in ten cases.

Pure survey and mixed models of consumption

Pure survey consumption models explain changes in the flow of consumption expenditure by levels or changes in opinions. The combination of levels and changes did generally not lead to satisfactory results. On the whole, only changes in inflationary expectations and in purchase intentions in Italy and changes in savings intentions in the United Kingdom were retained. Regressions using (when available) the differences between expectations and the corresponding perceptions of the past or present gave extremely poor fits [as one could expect, in view of the strong linear relationships between these variables (see above)].

Mixed consumption models basically assume that consumers modify their consumption-income ratio as a result of changes in their expectations on the general or personal economic and financial situation and inflationary expectations.

Table 4 reports selected regression results for both survey and mixed models. The *opinion* variables that are retained are those that gave the "best" statistical tests for the sample period: perception of the personal financial situation ($SFAD$) for France, a sub-CCI composed of the expected financial situation ($SFAP$), the expected general economic situation ($SEAP$), and important purchase intentions ($ACHT$) for Germany, perceptions of the general economic situation ($SEAD$) and savings intentions ($EPAR$) for Italy, and a sub-CCI composed of the expected financial situation ($SFAP$) and the perception of the general economic situation ($SEAD$) for the United Kingdom. Price expectations constitute a second group of opinion variables. The quantification method proposed by Papadia and Basano (1981) has been applied [20]. Changes in opinions for inflation expectations ($\Delta_4 PRAP$), important purchases ($\Delta_4 ACHT$) and savings expectations ($\Delta_4 EPAP$) appear in the Italian and British models.

Additional regressions using the confidence index (CCI) are also presented for comparison.

[20] Using the first weighting scheme proposed by the authors. The perceived inflation rate is the actual inflation lagged by one quarter.

Table 4
Regression results of s·vey and mixed models.

(a) France

	Constant	Opinion variables			Economic variables		Statistical tests			
		$SFAD_{-1}$	CCI_{-1}	$\Delta_4 Pe_{-4}$	$(C/YD)_{-4}$	$\Delta_4 YD$	$\bar{R}^2$	DW	SSR	$Cond.$
Eq. 1	3.770	0.736		0.325			0.74	1.97	19.91	12.9
	(6.14)	(9.43)		(3.65)						
Eq. 2	2.090		0.320	0.252			0.71	1.72	21.65	12.1
	(2.93)		(8.90)	(2.85)						
Eq. 3		0.648		0.308	−0.193		0.96	1.85	16.38	12.3
		(8.72)		(3.92)	(−7.28)					
Eq. 4			0.287	0.216	−0.127		0.96	1.69	18.83	11.2
			(7.86)	(2.80)	(−3.85)					
Eq. 5		0.608		0.273	−0.186	0.081	0.96	1.82	15.80	14.4
		(7.36)		(3.23)	(−6.81)	(1.08)				
Eq. 6			0.283	0.209	−0.127	0.015	0.96	1.67	18.81	13.4
			(6.36)	(2.38)	(−3.79)	(0.17)				

(b) Germany

	Constant	Opinion variables		Economic variables		Statistical tests			
		$(SEAP + SFAP + ACHT)$	CCI	$(C/YD)_{-4}$	$\Delta_4 YD$	$\bar{R}^2$	DW	SSR	$Cond.$
Eq. 1	2.009	0.057				0.81	2.10	34.57	1.1
	(11.92)	(12.07)							
Eq. 2	2.891		0.165			0.75	1.72	44.01	1.7
	(13.49)		(10.35)						
Eq. 3		0.056		−0.141		0.90	2.04	30.46	1.1
		(12.71)		(−12.88)					
Eq. 4			0.166	−0.203		0.88	1.84	35.31	1.6
			(11.61)	(−15.33)					
Eq. 5		0.053		−0.131	0.077	0.95	2.12	29.90	3.2
		(8.62)		(−7.73)	(0.78)				
Eq. 6			0.149	−0.179	0.138	0.89	1.99	33.39	3.5
			(7.95)	(−8.12)	(1.38)				

(c) Italy

	Constant	Opinion variables					Economic variables		Statistical tests			
		$SFAD_{-3}$	$EPAR_{-4}$	CCI_{-3}	$\Delta_4 PRAP$	$\Delta_4 ACHT$	$(C/YD)_{-4}$	$\Delta_4 YD$	$\bar{R}^2$	DW	SSR	$Cond.$
Eq. 1	3.511	0.100	0.232						0.60	0.95	120.95	7.7
	(2.81)	(1.44)	(5.96)									
Eq. 2	3.889	0.131	0.144		0.074	0.069			0.75	1.25	71.41	8.8
	(3.69)	(2.23)	(3.99)		(1.90)	(2.13)						
Eq. 3	1.610		0.176		0.096	0.044			0.72	1.12	82.87	2.7
	(5.94)		(4.97)		(2.41)	(1.36)						
Eq. 4	5.440	0.222			0.112	0.095			0.63	0.91	108.12	7.9
	(4.59)	(3.39)			(2.46)	(2.49)						
Eq. 5	5.343			0.157	0.173				0.60	0.92	122.90	8.1
	(4.04)			(2.93)	(4.84)							
Eq. 6		0.036	0.236				−0.126		0.68	0.95	136.16	7.4
		(0.50)	(5.39)				(−1.82)					
Eq. 7		0.080	0.143		0.068	0.075	−0.160		0.78	1.26	86.09	9.3
		(1.20)	(3.38)		(1.51)	(1.96)	(−2.45)					
Eq. 8				0.209			−0.366		0.48	0.95	228.57	6.3
				(3.66)			(−4.84)					
Eq. 9				0.100	0.177		−0.213		0.66	0.99	143.31	7.3
				(1.92)	(4.43)		(−3.05)					
Eq. 10		0.160	0.054		0.066	0.061	−0.222	0.303	0.90	1.41	39.96	10.4
		(3.31)	(1.65)		(2.13)	(2.30)	(−4.80)	(5.88)				
Eq. 11			0.115		0.105	0.022	−0.073	0.255	0.86	1.05	54.59	3.1
			(3.66)		(3.17)	(0.79)	(−5.91)	(4.49)				
Eq. 12		0.204			0.071	0.071	−0.262	0.341	0.90	1.46	43.57	8.5
		(4.96)			(2.24)	(2.69)	(−6.50)	(7.27)				
Eq. 13				0.152	0.065	0.062	−0.266	0.337	0.89	1.40	45.93	8.5
				(4.66)	(1.93)	(2.32)	(−6.11)	(7.00)				
With correction for autocorrelation												
Eq. 10 bis		0.128	0.067		0.077	0.051	−0.192	0.275	0.79	2.06	35.93	7.7
		(2.40)	(1.89)		(2.34)	(1.67)	(−3.80)	(5.54)				
Eq. 12 bis		0.185			0.080	0.066	−0.245	0.317	0.78	2.03	40.15	6.4
		(4.02)			(2.38)	(2.20)	(−5.52)	(6.76)				

(d) United Kingdom

	Constant	Opinion variables				Economic variables		Statistical tests			
		$(SFAP + SEAD)_{-2}$	CCI_{-2}	$\Delta_4 Pe_{-2}$	$\Delta_4 EPAP$	$(C/YD)_{-4}$	$\Delta_4 YD$	R^2	DW	SSR	$Cond.$
Eq. 1	7.282	0.060		−0.220				0.82	2.66	39.11	7.9
	(10.92)	(6.30)		(−3.22)							
Eq. 2	6.782	0.054		−0.193	0.057			0.83	2.90	35.19	8.4
	(9.54)	(5.57)		(−2.85)	(1.67)						
Eq. 3	5.966		0.153	−0.227				0.80	2.40	44.29	8.0
	(8.00)		(5.65)	(−3.10)							
Eq. 4	5.416		0.138	−0.182	0.077			0.82	2.82	36.76	8.7
	(7.37)		(5.36)	(−2.58)	(2.26)						
Eq. 5		0.087		0.044		−0.385		0.71	1.92	76.60	6.3
		(6.27)		(0.58)		(−6.94)					
Eq. 6		0.073		0.053	0.112	−0.344		0.76	2.32	60.23	6.6
		(5.41)		(0.076)	(2.61)	(−6.54)					
Eq. 7			0.221	−0.009		−0.289		0.75	1.96	66.48	5.9
			(7.02)	(−0.13)		(−5.82)					
Eq. 8			0.190	−0.015	0.116	−0.262		0.81	2.58	48.33	6.2
			(6.53)	(0.25)	(3.06)	(−5.95)					
Eq. 9		0.034			0.105	−0.216	0.282	0.83	2.25	43.86	7.8
		(2.33)			(2.81)	(−3.57)	(3.18)				
Eq. 10			0.114		0.109	−0.193	0.217	0.84	2.44	40.05	6.0
			(2.88)		(3.20)	(−4.55)	(2.29)				

The *economic* explanatory variables are the four-quarter lagged propensity to consume and the annual change in real disposable income.

Considering the multiple measurement problems discussed above, the general impression is positive: the regression results look satisfactory for three countries (in particular, see eq. 3 for France and Germany and eq. 2 for the United Kingdom). For these countries, the introduction of real disposable income as an explanatory variable does not improve the fit. For Italy, while the independent variables are more numerous, the Durbin-Watson statistic indicates positive first-order autocorrelation. A correction for autocorrelation of the Italian models leads most of the time to insignificant explanatory variables. Only two satisfactory regressions can be reported. They incorporate real income growth (see eqs. 10 bis and 12 bis for Italy).

More specifically, the results show first that using selected opinion variables rather than the *CCI* has generally permitted an improvement of the fit, second that mixed models perform significantly better than survey models for three countries (France, Germany, and Italy). Mixed models tend to correct one of the weaknesses of opinion variables, namely their relative low variability: coefficients of variation of predicted values of the survey models presented in table 4 are smaller than those of mixed models. This is strongly the case for the German models.

The reported equations have been tested for stability by regressing the models over a number of sub-periods. Except for the German survey models (but not the mixed models), the equations proved to be stable.

Forecasting performance

The economic, survey and mixed models were reestimated for the periods ending 1980(3) in order to allow us to assess their forecasting performances over the period 1980(4) to 1982(3).

Table 5 compares the average squared residuals (normalized and not normalized [21]), over the estimation period up to 1980(3) and over 1980(4) to 1982(3). For the past, only in Germany is the economic model superior. In the other countries, mixed models perform best.

[21] Normalized average squared residuals (Theil's inequality coefficient) are obtained by dividing the average squared residuals by the average of the squared observed values.

Table 5
Prediction performances of alternative models.

	$\frac{1}{N_J}\sum_J (P_i - A_i)^2$ [a]			$\sum_J (P_i - A_i)^2 / \Sigma A_i^2$ [a]	
	Sample [b] (1)	Forecast [c] (2)	(2)/(1) = (3)	Sample [b] (4)	Forecast [c] (5)
France					
Standard eco. model	0.417	0.921	2.21	0.027	0.133
Survey model (eq. 1)	0.536	0.697	1.30	0.035	0.101
Survey model with *CCI* (eq. 2)	0.656	0.426	0.65	0.043	0.062
Mixed model (eq. 3)	0.356	1.693	4.76	0.023	0.244
Mixed model with *CCI* (eq. 4)	0.553	0.575	1.04	0.036	0.083
Germany					
Standard eco. model	0.790	4.588	5.81	0.078	1.600
Alternative eco. model	0.736	2.778	3.77	0.073	0.969
Survey model (eq. 1)	1.036	0.698	0.67	0.102	0.243
Survey model with *CCI* (eq. 2)	1.360	1.239	0.91	0.134	0.432
Mixed model (eq. 3)	0.907	0.664	0.73	0.089	0.232
Mixed model with *CCI* (eq. 4)	1.090	0.705	0.65	0.108	0.246
Italy					
Standard eco. model	2.402	1.392	0.58	0.176	0.832
Survey model (eq. 2)	1.753	8.404	4.79	0.111	9.945
Survey model with *CCI* (eq. 5)	3.611	3.534	0.98	0.228	4.182
Mixed model (eq. 7)	2.574	2.119	0.82	0.163	2.508
Mixed model with *CCI* (eq. 8)	4.687	1.543	0.33	0.296	1.827
Alternative mixed model (eq. 10)	1.141	1.516	1.33	0.072	1.794
Alternative mixed model with *CCI* (eq. 13)	1.381	0.944	0.68	0.087	1.117
United Kingdom					
Standard eco. model	1.972	2.076	1.05	0.148	2.487
Survey model (eq. 2)	1.595	0.421	0.26	0.120	0.504
Survey model with *CCI* (eq. 4)	1.655	0.416	0.25	0.125	0.499
Mixed model (eq. 6)	2.569	0.824	0.32	0.193	0.988
Mixed model with *CCI* (eq. 8)	1.660	0.901	0.54	0.156	0.865
Alternative mixed model (eq. 9)	1.656	1.412	0.85	0.125	1.691
Alternative mixed model with *CCI* (eq. 10)	1.532	1.347	0.88	0.115	1.613

[a] Pi = predicted values; Ai = actual values; $J = 1, \ldots n_1$ for periods of sample; $J = n_1, \ldots N$ for forecast period.
[b] 1973(4) to 1980(3) for France, Germany and Italy; 1975(3) to 1980(3) for the UK.
[c] 1980(4) to 1982(3). [d] With correction for autocorrelation.

Concerning the forecasts, two survey models (France and the UK), one mixed model (Germany) and one economic model (Italy) give the best results. The sum of the squared residuals (not normalized) is smaller in the forecasting period, due to the decline in the growth of consumption.

When normalized however, it appears that predictions have been much poorer for the forecasts. The French and German models perform the best. For Italy, out-of-sample predictions are very unsatisfactory: the Theil's inequality coefficient is greater than unity for all models except for the economic model [22]. However, the decomposition of the inequality coefficient for Italy shows that the main source of error is an average bias, meaning that the models reproduce relatively well the general evolution of the observed variable but that there exist problems of systematic over- or underestimation.

Turning point errors can be detected by plotting the *changes* of observed real consumption growth (vertical axis) against the predicted *changes* in real consumption growth (horizontal axis). Points falling in quadrants II and IV show turning point errors. On the whole, turning point errors represent for the four countries about one third of total observations [23]. These proportions are in general of the same magnitude for the various models. If one excludes the points lying in the $-0.5\%-+0.5\%$ band around the line of perfect forecast, i.e. small turning point errors, the average falls to less than 30% of total observations. Important turning point errors (defined as errors outside the -1% $+1\%$ band around the line of perfect forecast) represent 20% of total observations. Except in France, pure survey models have the lowest number of important turning point errors.

Concluding remarks

A comparison of forecasting performances of alternative models is a difficult task because there exists no single statistical criterion that gives clear-cut responses. Personal judgement is necessary in such an exercise.

This research shows that in absolute as well as in relative terms (i.e. in comparison with a standard economic model) consumption functions incorporating opinion variables perform surprisingly well if one considers the important measurement problems: missing data, qualitative character of the responses, strong collinearity among responses, ... It is important to recall that no sophisticated statistical technique has been

[22] Note that when the average of the squared observed values of a variable is close to zero (which was the case for Italy) Theil's coefficient is very sensitive to forecasting errors.

[23] This may appear important, but recall that second differences of consumption flows are here examined.

applied to the original survey data. The models are thus simple not only in their algebraic form, but also in their easiness of updating. On the whole, the mixed models for France and Germany (eq. 3), the survey model for the United Kingdom (eq. 2) should be helpful guides in very short-term consumption forecasting. For Italy, a pure survey model (eq. 2) could be retained, considering the average systematic bias of forecasts.

An interesting finding of this research is that consumers' opinions predict changes in consumption only for the very short-term (between 0 and 3 quarters) notwithstanding the fact that survey questions refer to yearly periods. The absence of marked differences between opinions on the past and for the next twelve months confirms the "very recent past" or "very near future" character of consumers' opinions. It implies that if performances of economic and opinion models are not very different, the benefit of using opinion models in a forecasting exercise is reduced. However, data on disposable income and other economic variables are available with long delays, so that opinion models retain their usefulness in short-term consumption forecasting.

References

Adams, F.G. and L. Klein, 1972. 'Anticipation variables in macro-econometric models'. In: B. Strümpel, J. Morgan and E. Zahn (eds.), Human behavior in economic affairs. Amsterdam: Elsevier.

Belsley, D.A., E. Kuh and R.E. Welsch, 1980. Regression diagnostics: indentifying influential data and sources of collinearity. New York: Wiley.

Carlson, J.A., M. Parkin, 1975. Inflation expectations. Economica 42, 123–138.

Commission of the European Communities, n.d. Consumer survey results. European Economy, Supplement C.

Davidson, J.E.H., D.F. Hendry, F. Srba and S. Yeo, 1978. Econometric modelling of the aggregate time-series relationship between consumers' expenditure and income in the United Kingdom. The Economic Journal 88, 661–692.

Dramais, A., 1982. Formal structure of the business survey model. Report to the Commission, Jan. (internal).

Dramais, A. and E. Waelbroeck-Rocha, 1984. A probabilistic approach to the quantification of business survey data. Journal of the American Statistical Association (forthcoming).

Heald, G., 1971. Intentions and attitude data in short-term forecasting of consumer durable expenditures. A report of British experiences. 10th CIRET-Conference, Brussels.

Howard, D.H., 1978. Personal saving behavior and the rate of inflation. The Review of Economics and Statistics 60(4), 547–554.

Juster, F.T. and P. Wachtel, 1972. A note on inflation and the savings rate. Brookings Papers on Economic Activity 3, 765–778.

Knöbl, A., 1974. Price expectations and the actual price behavior in Germany. International Monetary Fund Staff Papers 21, 83–100.

Lohan, H., 1980. The effect of inflation on household consumption. European Economy, no. 5. Commission of the European Communities, March.

Moutet, G. and G. Vangrevelinghe, 1969. Attitudes and buying intentions of private households. 9th CIRET-Conference, Madrid.

Nerb, G., 1976. Zur Aussagefähigheit von Indikatoren aus den harmonisierten Konjunkturumfragen bei den Konsumenten in den Ländern der Europäischen Gemeinschaft. Report to the Commission of the European Communities, Dec. (internal).

Papadia, F. and V. Basano, 1981. Survey based inflationary expectations for the EEC countries. Economic Papers. Commission of the European Communities, May.

Pesaran, M.H. and R. Gulamani, 1982. Expectations formations and macroeconometric modelling. Colloque International sur les Développements Récents de la Modélisation Macroéconomique. Paris, 13–15 septembre.

Robinson, P.W., D.B. Smith and P.J. Warburton, 1981. The use of european community business survey data for forecasting. An econometric analysis of the four major countries. Report to the Commission of the European Communities, Nov. (internal).

Shapiro, H.T., 1972. 'The index of consumer sentiment and economic forecasting: a reappraisal'. In: B. Strümpel, J. Morgan and E. Zahn (eds.), Human behavior and economic affairs. Amsterdam: Elsevier, pp. 373–396.

Strümpel, B., A. Kuss and R. Curtin, 1979. The use of consumer anticipations data in the member countries of the European Community. Report to the Commission of the European Communities, Nov. (internal).

Theil, H., 1966. Applied economic forecasting. Amsterdam: North-Holland.

Van der Linden, E.G., 1977. Principal component analysis with data from the EEC-entrepreneurial and consumer surveys. 13th CIRET-Conference, Munich.

Wachtel, P., 1977. 'Survey measures of expected inflation and their potential usefulness'. In: J. Popkin (ed.), Analysis of inflation 1965–74. Studies in income and wealth, no. 42. New York: National Bureau of Economic Research, pp. 361–402.

Ward, A.V., 1980. The forecasting performance of indices of consumer attitudes: some results from the EEC consumer attitudes survey. Report to the Commission of the European Communities, Sept. (internal).

Appendix

Table 1A
List of questions and possible responses to the Community consumer survey.

Questions	Name of variable	Possible responses [a]
Financial situation of your household now compared to 12 months ago	*SFAD*	A lot better (+1), a little better (+1/2)
Financial situations of your household, prospects over the next 12 months	*SFAP*	The same (0), a little worse (−1/2)
General economic situation in the country now compared to 12 months ago	*SEAD*	A lot worse (−1), don't know
General economic situation in the country, prospects over the next 12 months	*SEAP*	
Price levels now compared to 12 months ago	*PRAD*	Much higher (+1), moderately higher (+1/2), a little higher (0), about the same (−1/2), lower (−1), don't know
Price trends over the next 12 months	*PRAP*	More rapid increase (+1), same increase (+1/2), slower increase (0), stability (−1/2), fall slightly (−1), don't know
Unemployment level in the country over the next 12 months	*CHOM*	Increase sharply (+1), increase slightly (+1/2), remain the same (0), fall slightly (−1/2), fall sharply (−1), don't know
Major purchases (furniture, washing machine, TV, ...) at present	*ACHT*	Yes, right time (+1), neither right nor wrong time (0), wrong time, should postpone (−1), don't know
Major purchases next 12 months compared to last 12 months	*AEQD*	Much more (+1), a little more (+1/2), the same (0), a little less (−1/2), much less (−1), don't know
Savings at present, a reasonable time to save	*EPAR*	Yes, certainly (+1), yes, perhaps (+1/2), probably not (−1/2), certainly not (−1), don't know
Savings by you or your household over the next 12 months	*EPAP*	
Financial situation of households at present – financial asset accumulation	*SFAC*	Borrowing (−1), drawing on savings (−1/2), just making ends meet (0), saving a little (+1/2), saving a substantial amount (+1), don't know

[a] The numbers in parentheses are the weights given by the Commission to each percentage response to obtain the average answer to each question. The "don't know" responses are redistributed between the other answer categories according to the latter's percentage distribution.