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Consumption and Models of the World Economy

by Ray Barrell* and Jan W. In't Veld**

Introduction

This paper compares the consumption functions for Germany, France, Italy and the UK on the world economy models NIGEM, MIMOSA, QUEST, OEF and the OECD. This paper starts with a brief discussion of theory and then goes on to investigate whether or not it is statistically ever possible to generate theoretically acceptable relationships for these economies. We then analyse the properties of the individual models and assess their statistical properties.

1. A theoretical overview

Consumption functions have been at the centre of macro-economic modelling for some decades, and at the outset there was very little discussion of the theoretical underpinnings of the relationship. The 1950s saw a number of studies that discussed the role of inter-temporal utility maximisation subject to a lifetime budget constraint. Various „permanent income" or life cycle related measures of income were produced. This approach was taken to its logical conclusion by Hall (1978). In a fully forward looking world any information a person has about the future is taken into account in making todays decision on consumption. Next period a different decision may be taken for one of two reasons. Either the initial optimal plan indicated that higher or lower consumption was needed, or new information has become available. Hall assumes that as individuals are fully forward looking the new information follows a white noise process with zero mean. These assumptions imply that we can write the aggregate consumption decision as

$$(1)\ \log(C_t) = a_t + \log(C_{t-1}) + e_t$$

where e_t is the news, C_t is consumption and a_t is a time varying intercept. Under simplifying assumptions Hall was able to say a was a growth constant and hence that aggregate consumption should follow a random walk with drift. Interestingly none of macro models considered here have attempted to use the Hall approach to consumption.

A much more common empirical and theoretical approach is to assume that wealth enters both the budget constraint and the utility function. Hey (1980) demonstrates that optimal consumption depends upon instantaneous wealth in an uncertain world, but it is common to go beyond that and follow Barro and Grossman (1971) and assume that wealth is an object of utility. If this is the case then we would expect both income and wealth to enter our consumption function, and if wealth is absent it may be that its statistical insignificance indicates a rejection of the hypothesis that wealth is a relevant variable in the utility function. However the omission of wealth may lead to a biased result if it is a potentially significant regressor.

The individual or representative consumer maximises their utility over time and chooses the optimal paths for C and W (wealth):

$$(2a)\ C(t) = f(Y(t),W(t),t)$$

$$(2b)\ \dot{W}(t) = Y(t) - C(t)$$

where a dot denotes a time derivative. We would expect that in a sustainable steady state that the personal wealth income ratio should stabilise. This can arise for a number of reasons, including a marginal rate of substitution between consumption and wealth that depends only upon the wealth consumption ratio and not upon time or the level of wealth. If we assume that our representative consumer has an homothetic utility function of this form then 2(a) will be modified so that it is homogenous of degree one in its arguments and is not dependent on time. This implies that in the long run the wealth and income elasticities sum to one, and that they are independent of time and the level of wealth. If all these features hold then we would expect the consumption income ratio and the wealth income ratio to be constant in the long run. In any application we have to decide to what extent we wish to impose long run structure, or allow our observed relationship to depart from it. Departures from the steady state may persist for very long periods of time, and the imposition of steady state properties may cause severe statistical problems.

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Figure 1

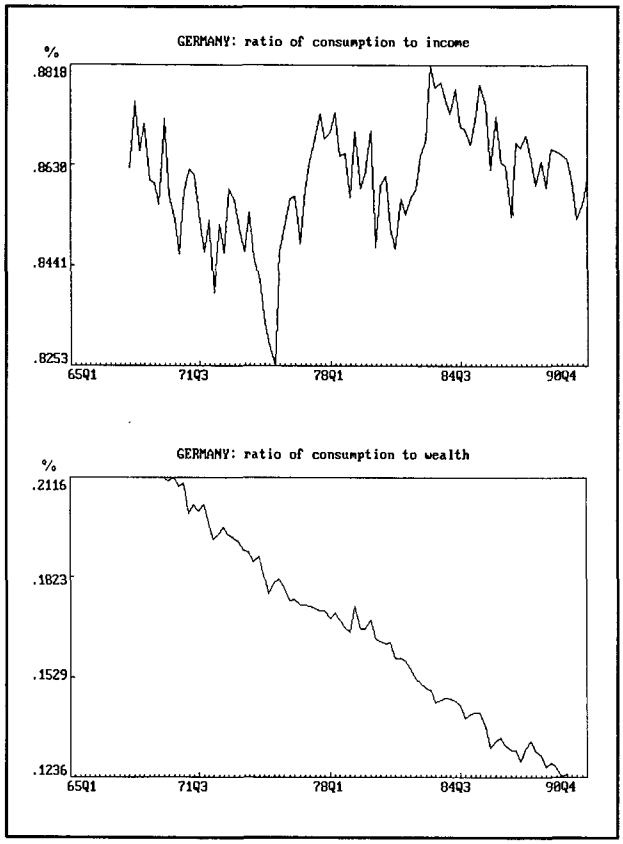


Figure 2

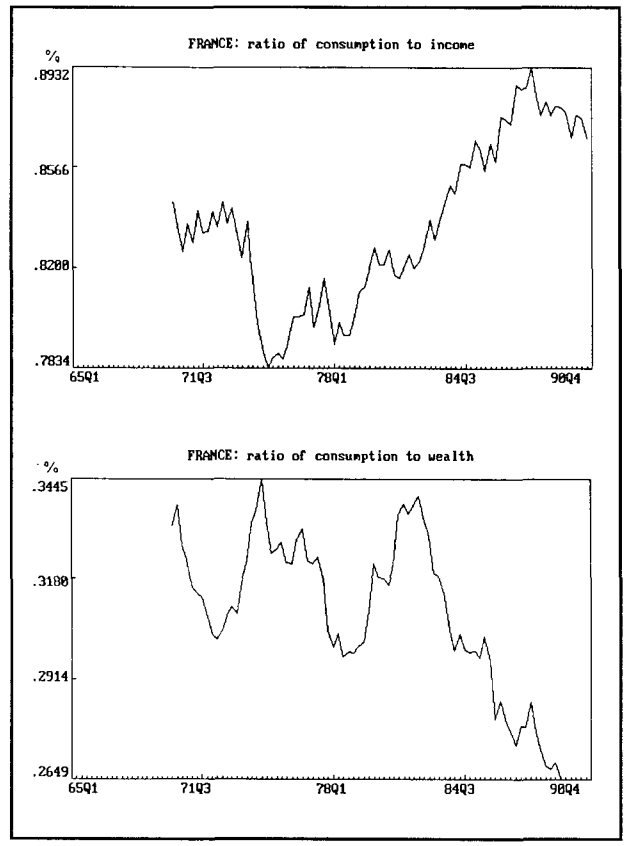


Figure 3

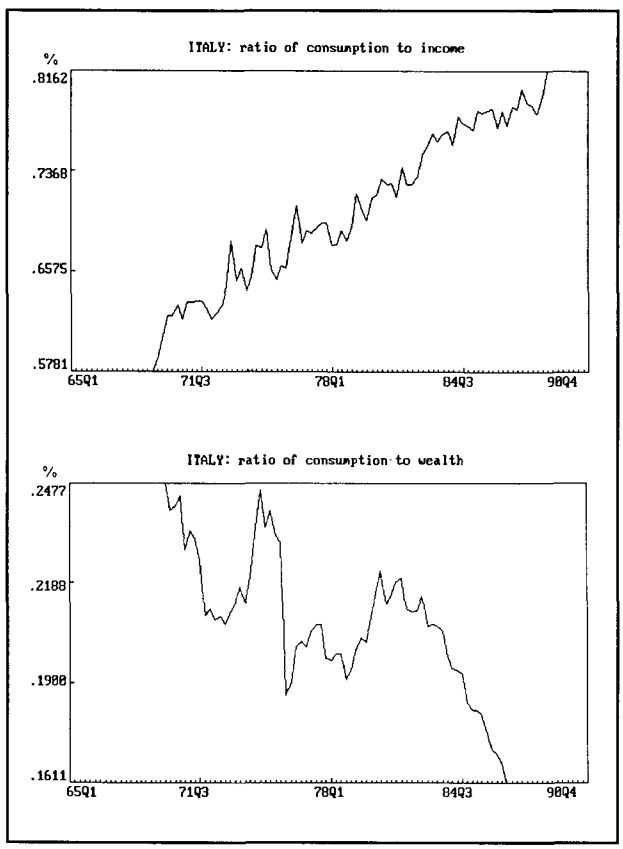
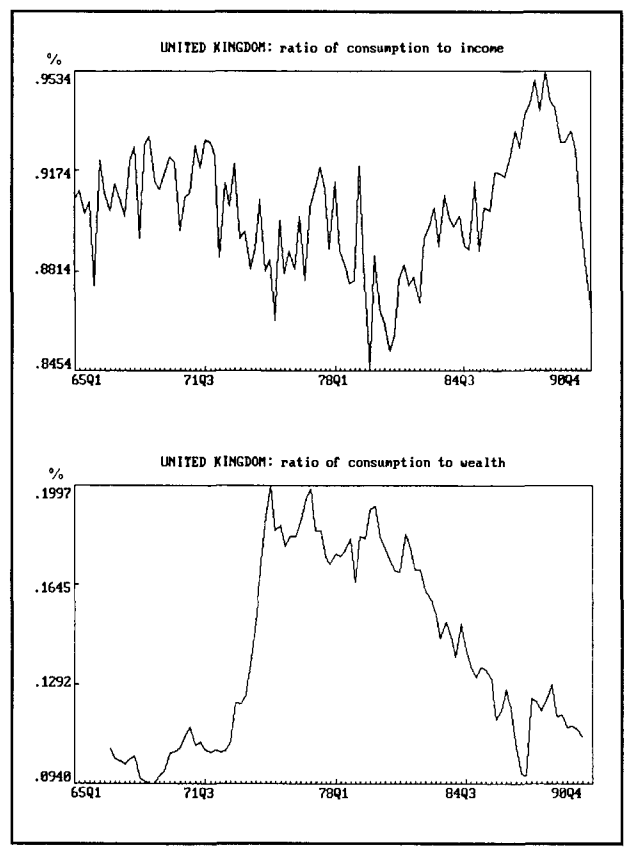


Figure 4



All models considered here start with a general error correction model:

$$(3)\ Dc = a + b_1 c_{-1} + b_2 y_{-1} + b_3 w_{-1} + \Sigma^{n}_{i=0} c_{1i} U_{-i} + \Sigma^{n}_{i=0} c_{2i} r_{-i} + \Sigma^{n}_{i=0} c_{3i} Dy_{-i} + \Sigma^{n}_{i=0} c_{4i} p_{-i} + \Sigma^{n}_{i=0} c_{5i} Dw_{-i} + \Sigma^{n}_{i=1} c_{6i} Dc_{-i}$$

where c is the log of consumption, y is the log of income, w is the log of wealth, r is the nominal interest rate, u is the level of unemployment, p is the rate of inflation and D indicates a change term. We have tried to note all the theoretical priors below. Amongst the more important are that the OECD and QUEST have a preference for using real interest rates, but sometimes also include inflation terms. We have tried in (3) to distinguish between factors affecting the long run and those influencing the dynamics of the relationship, and OEF attempt to take this distinction into account in their modelling by using the cointegration approach to ECMs.

If we wish to impose linear homogeneity in y and w on (3) then we have to ensure that the long run coefficients sum to one:

$$\text{ie } -b_2/b_1 - b_3/b_1 = 1$$
$$\text{or } b_2 + b_3 = b_1$$

and hence the first three terms on the first line of (3) can be rewritten as:

$$(3a)\ Dc = a + b^{+}_{2}(y_{-1} - c_{-1}) + b^{+}_{3}(w_{-1} - c_{-1})$$

This is of course a testable proposition. Linear homogeneity in y is imposed by NIGEM and OECD and tested and sometimes imposed by MIMOSA.

2. Time series properties

We feel that it is instructive to examine first whether consumption and disposable income (and possibly net wealth) form a cointegrating set. The series y_t and x_t are said to be cointegrated if there exists a constant a such that $z_t = y_t - ax_t$ is I(0). Cointegration implies that the equilibrium error z_t is stationary. If y_t and x_t were not cointegrated, this would imply that they would drift apart without bound, and estimating a relationship between y_t and x_t would not be sensible. If consumption C and disposable income Y are both I(1) but no constant can be found so that the equilibrium error z_t is I(0), consumption and income form no cointegrating system and no stable estimated equation exists.

In all cases we use real consumption and real disposable income (1980 prices) for C and Y and real net financial wealth for W (for data sources see annex). Financial wealth consists of liquid assets, equities and bonds held directly or indirectly by the personal sector. Figure 1 to 4 give the graphs of the ratios of consumption to real personal disposable income and to real net financial wealth for each of the four major European countries. The ratio C/Y shows some evidence of cycles, with the exception of Italy where there is a remarkable upward trend in the ratio C/Y. The ratio C/W shows a downward trend for most countries, most noticeable for Germany, but for the United Kingdom, with the longest series for wealth and arguably the most reliable, the sharp increase in the ratio C/W in 1973-1974 is notable.

As all models use more or less similar data sources for consumption and income, we first discuss the sample behaviour of the series here and then test for cointegration. Table 1 reports the tests for the order of integration of each variable for the four European countries. To test for trend

Table 1

Unit root tests

Germany	levels	first differences
c	—	ADF(2): −4.95 (2.89)
y	ADF(2):−3.51 (3.46)	ADF(1): −5.60 (2.89)
w	—	ADF(10):−3.05 (2.90)
R	ADF(5):−3.33 (2.89)	DF : −4.99 (2.89)
p	—	DF :−19.01 (2.89)
France	**levels**	**first differences**
c	—	ADF(4): −4.28 (2.90)
y	—	ADF(2): −3.52 (2.90)
w	—	ADF(4): −3.37 (2.90)
R	—	DF : −5.16 (2.89)
p	—	DF :−16.79 (2.89)
Italy	**levels**	**first differences**
c	—	ADF(4): −3.88 (2.89)
y	—	ADF(4): −5.34 (2.90)
w	—	ADF(4): −3.85 (2.91)
R	—	DF : −7.05 (2.89)
p	—	DF :−14.08 (2.89)
U.K.	**levels**	**first differences**
c	—	ADF(3): −4.67 (2.89)
y	—	ADF(4): −4.18 (2.89)
w	—	ADF(4): −3.40 (2.89)
R	—	DF : −8.50 (2.89)
p	DF :−3.63 (2.89)	DF :−13.90 (2.89)

Note: First column gives significant (A)DF statistic that rejects unit root in levels of c, y and w (with trend and constant included) and shows no sign of serial correlation in residuals of the ADF-regression (— indicates no significant statistic). Similarly for R and p, except that no trend is included in regressions. Second column gives significant ADF-statistic that rejects unit root in first differences of the variables. (95% critical values in brackets)

Table 2

Cointegration regressions

Germany		
(I) $c_t = -0.23 + 1.02y_t + e_t$	DW = 0.54	DP:68q1–90q4
$De_t = -0.27e_{t-1}$ (3.80)	LM(4) = 6.61	LM(12) = 10.25 (95% critical value DF statistic: 3.40)
(II) $c_t = 0.16 + 0.79y_t + 0.11w_t + e_t$	DW = 0.72	DP:69q4–89q4
$De_t = -0.37e_{t-1}$ (4.28)	LM(4) = 4.20	LM(12) = 8.90 (95% critical value DF statistic: 3.85)
France		
(I) $c_t = -0.73 + 1.09y_t + e_t$	DW = 0.10	DP:70q1–90q3
$De_t = -0.06e_{t-1}$ (1.76)	LM(4) = 10.64	LM(12) = 18.81 (95% critical value DF statistic: 3.41)
(II) $c_t = -0.40 + 0.64y_t + 0.34w_t + e_t$	DW = 0.72	DP:70q1–89q2
$De_t = -0.17e_{t-1}$ (2.73)	LM(4) = 5.61	LM(12) = 11.23 (95% critical value DF statistic: 3.40)
(III) $c_t = -0.15 + 0.48y_t + 0.43w_t + 0.0058R_t - 0.38p_t + e_t$	DW = 0.90 DP:70q1–89q2	
$De_t = -0.45e_{t-1}$ (4.65)	LM(4) = 4.07	LM(12) = 8.77 (95% critical value DF statistic: 4.60)
Italy		
(I) $c_t = -7.86 + 1.66y_t + e_t$	DW = 0.80	DP:69q1–88q4
$De_t = -0.43e_{t-1}$ (4.81)	LM(4) = 3.32	LM(12) = 17.99 (95% critical value DF statistic: 3.41)
(II) $c_t = -4.43 + 1.10y_t + 0.24w_t + e_t$	DW = 0.78	DP:69q4–86q4
$De = -0.39e_{t-1}$ (3.95)	LM(4) = 1.99	LM(12) = 6.47 (95% critical value DF statistic: 3.87)
United Kingdom		
(I) $c_t = -0.12 + 1.00y_t + e_t$	DW = 0.61	DP:65q1–90q4
$De = -0.30e_{t-1}$ (4.14)	LM(4) = 14.61	LM(12) = 23.80 (95% critical value DF statistic: 3.40)
(II) $c_t = -0.58 + 0.96y_t + 0.07w_t + e_t$	DW = 1.22	DP:66q4–90q2
$De_t = -0.62e_{t-1}$ (6.33)	LM(4) = 6.65	LM(12) = 14.99 (95% critical value DF statistic: 3.83)

stationarity, augmented Dickey Fuller statistics were computed up to the 12th order for the level of the logarithms of each variable. Allowing for trends, unit root tests could not be rejected for consumption, disposable income and net wealth, with the possible exception of German real disposable income, which could be trend stationary. First differences of these series were tested for the presence of a unit root by augmented Dickey Fuller regressions with as many lagged second differences included as were required to achieve white noise errors, which is a precondition for a valid ADF-test. The ADF-statistics reported in table 1 are based on regressions which residuals showed no signs of serial correlation. Consumption, income and net wealth are first difference stationary and therefore I(1). Two other variables often included in model equations for consumption are interest rates and inflation. Intuitively we would expect these variables to be I(0), but tests are often not able to reject the presence of a unit root, although the evidence is not clear-cut. The fact that interest rates and inflation are commonly found to be I(1) over typical sample periods in empirical studies can simply be attributed to a combination of long cycles in the economy and samples that are too short to find stationarity. In longer samples interest rates and inflation must be stationary and if consumption, income and wealth cointegrate, including I(0) variables will not affect the cointegrability results.

We can now turn to tests for cointegration between consumption and income and between consumption, income and net wealth. Table 2 reports the cointegration regressions for each country. The residuals of these regressions were tested for unit roots with again as many lagged first differences of the residuals included in the augmented Dickey Fuller regressions as was necessary to ensure that the errors on these auxiliary regressions were not serially correlated. For Germany the estimates of the static regression suggest that a unit income elasticity can not be rejected, but this can not be tested as the t-statistics of these static regressions do not have the standard distribution. The DF statistic of 3.80 is significant and valid as the auxiliary regression does not show any sign of serial correlation. Similarly, when net wealth is included the DF statistic is clearly significant, suggesting that C, Y and W cointegrate over the sample period. For France the DF statistic from the residuals of a static regression of C on Y is not significant, nor was any higher order ADF statistic, suggesting that C

and Y do not cointegrate over the sample. A similar conclusion is reached when wealth is included in the regression. This seems to suggest that there exists no stable relationship between C, Y and W, at least over our sample period. When the interest rate and inflation term are included in the regression the DF-statistic rejects the presence of a unit root in the residuals, but unfortunately the interest rate does not have the anticipated sign in this cointegrating regression. The cointegrating regression for Italy shows a much higher coefficient for income than in other countries, reflecting in part a difference in data used (see annex). The null hypothesis of no-cointegration can in both cases be rejected. For the United Kingdom, the DF-statistics of a static regression of C on Y suggests that the residuals are stationary, but this auxiliary regression shows signs of serial correlation and is not a valid test of stationarity of the residual e . When W is included in the cointegration regression, the DF statistic can reject the null hypothesis of no-cointegration and the auxiliary regression shows no sign of serial correlation. It seems that C and Y do not cointegrate and W must be included in the regressions to achieve stationary residuals. With the exception of the United Kingdom, and possibly France, this analysis suggests that a stable relationship between C and Y can be found. For the United Kingdom the data seem to suggest that wealth should not be omitted from the consumption equation.

So far we have tested for cointegration without imposing a restriction of linear homogeneity on the coefficients. For theoretical and policy analysis purposes it may be desirable to impose a unit long run income elasticity on the equations and indeed this is what most models discussed here do. Homogeneity implies that the ratio of consumption to income must be stationary. Table 3 reports unit root tests for the ratio C/Y. Only for Germany can the null hypothesis of a unit root in C/Y be rejected. For the other three countries no significant (A)DF-statistic could be found without serial correlation in the residuals of the auxiliary regression. Only for Germany can we therefore accept the conclusion that C/Y is I(0) and that consumption and income cointegrate with linear homogeneity imposed. To see how this conclusion is affected when wealth is included we test for cointegration with the restriction imposed that the long run elasticities of income and wealth sum up to unity. Table 4 reports the cointegration regressions. For Germany the imposition of homogeneity does not affect the conclusion of table 2 that consumption and income and wealth cointegrate. For France, we can again reject cointegration.

Table 3

Ratios of consumption to income, C/Y

levels		first differences
Germany	DF: −3.63 (2.89)	DF :−13.60 (2.89)
France	—	DF :−10.73 (2.89)
Italy	—	ADF(3): −8.09 (2.90)
U.K.	—	DF :−15.77 (2.89)
Notes: see table 1.		

Table 4

Cointegration regressions with homogeneity imposed

Germany		
$(c-y)_t = -0.22 + 0.05(w-y)_t + e_t$	DW = 0.65	DP:69q4−89q4
$De_t = -0.36e_{t-1}$	LM(4) = 4.37	LM(12) = 7.87
(4.38)		(95% critical value DF statistic: 3.41)
France		
$(c-y)_t = -0.50 + 0.32(w-y)_t + e_t$	DW = 0.29	DP:70q1−89q2
$De_t = -0.17e_{t-1}$	LM(4) = 5.84	LM(12) = 11.48
(2.85)		(95% critical value DF statistic: 3.41)
$(c-y)_t = -0.51 + 0.32(w-y)_t + 0.0032R_t - 0.72pt + e_t$	DW = 0.74	DP:70q1−89q2
$De_t = -0.40e_{t-1}$	LM(4) = 11.62	LM(12) = 17.40
(4.65)		(95% critical value DF statistic: 4.60)
Italy		
$(c-y)_t = -0.88 + 0.43(w-y)_t + e_t$	DW = 0.38	DP:69q4−86q4
$De_t = -0.18e_{t-1}$	LM(4) = 2.39	LM(12) = 16.38
(2.47)		(95% critical value DF statistic: 3.43)
United Kingdom		
$(c-y)_t = -0.23 + 0.07(w-y)_t + e_t$	DW = 1.06	DP:66q4−90q2
$De_t = -0.17e_{t-1} - 0.26De_{t-1}$	LM(4) = 5.99	LM(12) = 11.67
(3.82)		(95% critical value ADF statistic: 3.40)

Even when interest rates and inflation are included the DF regresssion shows signs of serial correlation and is therefore not valid. For Italy the null hypothesis of no-cointegration cannot be rejected when homogeneity is imposed in contrast to the freely estimated regression in table 2. For the United Kingdom, the ADF-statistic can reject the null hypothesis of no-cointegration.

These statistical tests suggest that only for Germany and the United Kingdom can the null hypothesis of no-cointegration unequivocably be rejected. For the United Kingdom the inclusion of wealth seems to be crucial to reach this conclusion. For Italy the data seem to suggest that cointegration cannot be rejected as long as linear homogeneity is not imposed on the coefficients. When homogeneity is imposed, no-cointegration cannot be rejected even when wealth is included. For France the results are more discouraging, as no cointegrating regression can be found with the data used here. This puts doubt on the statistical validity of the consumption equations discussed in the following section. This lack of cointegration may be due to either the short time period used, or the omission of relevant variables, or a combination of the two. In particular we would expect financial deregulation to play an important role over the 1980s, and the omission of demographic variables may also explain our statistical problems.

3. The model team equations

The individual teams all prepared extensive notes on their equations. We have attempted to extract the long run properties for the five most common explanatory variables and they are reported in table 5. Both GEM and Interlink impose linear homogeneity in income or income and wealth in all cases. Mimosa test for homogeneity and impose it in 3 cases, whilst it is imposed in one case in OEF. Our cointegration results above suggest that the imposition of linear homogeneity using only income is invalid for France and for Italy, and its imposition in for instance GEM produces implausibly long mean lags. All mean lags are summarised in table 6. All teams attempt to use data for personal disposable income where it is available.

Wealth effects are rather sparse in this set of equations, and they are only reported for the UK in GEM and in OEF, and for France and Germany by OEF. The definitions of wealth differ. GEM uses net financial assets of the personal sector whereas OEF use a variety of measures. (We have not reported on the OEF durables equation for the UK as none of the other teams disaggregate this far). They include the stock of housing wealth in the UK equation, and they also include a mortgage market disequilibrium term as an indicator of credit rationing in the 1970s. They experimented with wealth effects in Germany and found them to be generally insignificant. However a revaluation of wealth term is included to pick up the effects of windfall gains. For France OEF also include gross financial wealth held in the personal sector, although this is exogenous in simulations.

Tables 5 and 6 also report interest rate effects. They are present in all models, but only GEM and Interlink have them in all equations. Definitions vary considerably, with Interlink and Quest using real long rates and OEF and GEM using nominal short rates (except for the UK where OEF use mortgage rates). Sizes of coefficients vary with the most remarkable being that for Italy in GEM. As all teams also include inflation terms it is possible to compare the long run coefficients as if they were all nominal. We have attempted to scale for differences in definition, and if our adjustments are correct then we can say that GEM generally has the highest interest rate effects (in 3 out of 4 cases) and that the UK is generally more interest sensitive than other countries.

Inflation effects in consumption can be motivated in two ways. First, it is often seen as approximately the derivative equivalent of the integral controller that would be produced by a wealth effect. The problem with this argument is that inflation is a derivative variable. After an inflationary shock, inflation may gradually return back to base and this inflation effect will ultimately fade out, but the price level is permanently above base. The wealth effect has not worked out as long as the price level has not returned to base. Inflation terms are therefore inperfect proxies of wealth effects. A second argument for including inflation is an adjustment of mismeasurement. As Hendry and von Ungern Sternberg (1981) stress, the personal income measures we use are biased estimates of real income because they include nominal interest receipts, part of which should not be treated as income. We report only the direct effects of inflation. If we include the effect in the real interest rate definitions for Quest and Interlink we would have to add the absolute values of the interest rate coefficient to the inflation coefficient. The diversity in the size of effects is considerable, and as far as we can judge the effects are most pervasive in Interlink. Two teams also include terms in unemployment. These can be seen as representing the degree of uncertainty facing consumers.

4. Results and statistical properties

The statistical adequacy of an econometric relationship cannot be judged solely by the standard error on the regression. We use our models for forecasting and for policy analysis, and we have to be able to judge whether or not our models are adequate for their purposes. We may forecast with an equation (or model) if it is well estimated and if the endogenous variables do not Granger cause the driving variables. We may use a model for policy analysis if it contains structurally stable structural equations where the driving variables are all either weakly exogenous or have been instrumented in estimation. A reduced form system is liable to display structural changes when policy regimes change.

Table 5

Long run elasticities of consumption

			income		
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	1.00	1.00	0.95	0.98	0.98
France	1.00	1.00	1.00	0.98	0.96
Italy	1.00	1.00	1.00	1.00	—
U.K.	0.81	1.00	1.00	0.71	0.91
			Wealth		
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	—	—	—	0.0012	—
France	—	—	—	0.17	—
Italy	—	—	—	—	—
U.K.	0.19	—	—	0.16	—
			Interest rate (x100)		
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	−0.39	−0.58	−0.87	−0.13	−0.55
France	−0.63	−0.02	—	—	—
Italy	−2.64	−0.10	—	−0.24	—
U.K.	−0.94	−0.71	—	−0.33	−0.01
			Inflation (x100)		
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	—	−3.51	—	−0.0045	−2.732
France	−4.377	−0.359	−0.725	−1.390	—
Italy	−3.017	−0.749	−0.649	—	—
U.K.	—	−2.36	−0.457	—	−1.00
			Unemployment		
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	—	—	—	—	−0.015
France	—	—	—	−0.032	−0.039
Italy	—	—	—	—	—
U.K.	—	—	—	—	−0.029

(a) Included in differences, not levels.

These simple propositions suggest that all econometric relationships on our models should be well specified and structurally stable so that it is possible that they can be deemed usable. Equations that display serial correlation, heteroskedasticity or non-normality may well omit significant variables or events. The omission of relevant variables (an incorrect functional form) is a common source of diagnostic failure, and such omissions make it difficult to use the relationships for forecasting, and probably imply they are restricted in their use for policy analysis purposes. The existence of serial correlation (and in some packages heteroskedasticity) leads to biased standard errors and hence invalid inference. It is also difficult to test a badly specified equation for structural stability. An equation that

Table 6

Mean lags of variables in quarters

	GEM	INTERLINK	Income MIMOSA	OEF	QUEST
Germany	1.53	2.14	3.28	1.33	1.44
France	1.6	5.38	7.56	7.73	2.85
Italy	18.5	2.90	3.80	1.31	—
U.K.	6.81	2.50	3.80	1.63	1.94
	GEM	INTERLINK	Wealth MIMOSA	OEF	QUEST
Germany	—	—	—	3.33	—
France	—	—	—	9.68	—
Italy	—	—	—	—	—
U.K.	6.81	—	—	0.90	—
	GEM	INTERLINK	Interest rate MIMOSA	OEF	QUEST
Germany	5.66	3.36	3.28	1.33	1.44
France	15.4	4.90	—	—	—
Italy	18.5	1.62	—	2.40	—
U.K.	6.81	3.54	—	—0.1	1.94
	GEM	INTERLINK	Inflation MIMOSA	OEF	QUEST
Germany	—	5.36	—	3.33	1.44
France	15.4	4.90	7.56	5.33	—
Italy	17.5	3.62	3.80	—	—
U.K.	—	5.54	7.44	—	1.94
	GEM	INTERLINK	Unemployment MIMOSA	OEF	QUEST
Germany	—	—	—	—	1.44
France	—	—	—	6.68	2.85
Italy	—	—	—	—	—
U.K.	—	—	—	—	1.94

fails a stability test should not be used in a macro-model designed for policy analysis. There are numerous stability tests available to us, but some such as the Chow and Hendry forecasting tests (and the rather heuristic concept of a dynamic track) are joint tests of stability and homoskedacity. Failure of either can lead to failure of a forecasting test. It is generally agreed that the most powerful test available is the Chow test of parameter stability using a split sample, especially if this is undertaken in its Wald variable deletion form. Equations that fail this test should not be used on our models.

The statistical properties of the equations are summarised in table 7. In general it appears that standard errors are lower in France and Germany across all models. The high standard errors for the UK and Italy suggest some form of structural instability. However both GEM and OEF have stable equations for the UK. All GEM equations reported here pass the internal Chow parameter stability test, and as OEF use cointegration techniques we can say that a cointegrating regression implies parameter stability. Unfortunately, other models do not report stability tests. Remarkably, only three models, GEM, OEF and Mimosa,

Table 7

Statistical properties

	(1) Serial Correlation (Significant value*)				
	GEM[a]	INTERLINK[b]	MIMOSA	OEF[a]	QUEST[c]
Germany	3.1	−0.1	—	0.69	2.28
France	5.21	1.5	—	0.30	2.04
Italy	4.1	1.7	—	—	—
U.K.	8.4	−2.2*	—	0.31	2.25
[a] Lagrange Multiplier (4th order) — [b] Durbins h (1st order) — [c] Durbin Watson (1st order)					
	(2) Standard Error %				
	GEM	INTERLINK	MIMOSA	OEF	QUEST
Germany	0.76	0.50	0.56	0.73	0.75
France	0.60	0.50	0.61	0.54	0.76
Italy	—	1.11	1.19	—	—
U.K.	0.96	1.10	1.12	0.61	1.09

estimate consumption equations over periods beyond the mid 1980s. Our experience suggests that equations without wealth variables exhibit severe structural instabilities in the mid 1980s. Relationships estimated over earlier periods may break down when the process of financial liberalisation proceeds. The diversity of data periods makes it difficult for us to undertake a relative evaluation of these equations. As far as other statistical properties are concerned, the only commonly reported statistical test is for serial correlation, and tests are diverse. Both Durbin's h (Interlink) and the LM test (either as chi squared (GEM) or as an F test (OEF)) are valid in equations with lagged dependent variables, and these tests are generally passed. The absence of normality, heteroskedasticity and stability tests make further comparisons difficult.

5. Conclusion

The modelling of consumption in Europeanbased multi-country macro models does not appear to have advanced much in the last decade. There is a general lack of wealth effects, and the role of demographic developments is not addressed. The paucity of theoretically acceptable relationships must make the use of these models in policy analysis at least questionable.

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Interlink: „Consumption, Employment and Investment the OECD Interlinkmodel". *Peter Richardson*, January 1991.

Mimosa: „Household Consumption in Mimosa model". H. Sterdyniak, December 1990

OEF: „European Consumption Functions in the OEF World Model": *G. Meen*, December 1990.

QUEST: „Consumption, Investment and Employment, in the Quest Model" *G. Horn*, December 1990.

ANNEX I DATA SOURCES

Germany

C Consumption, 1980 prices, Table 2, Statistische Beihefte Monatsberichten der Deutschen Bundesbank Reihe 4.

Y real personal disposable income, Table 5, Statistische Beihefte Monatsberichten der Deutschen Bundesbank Reihe 4.

W real net financial wealth personal sector, Zahlenübersichten zur gesamtwirtschaftlichen Finanzierungsrechnung 1960-1989, Sonderdrucke der Deutschen Bundesbank Nr. 4.

R short interest rate, interbank deposit rate, IFS, IMF.

P consumer expenditure deflator, Table 2, Statistische Beihefte Monatsberichten der Deutschen Bundesbank Reihe 4.

France

C Consumption, 1980 prices, National Account, OECD.

Y real personal disposable income, INSEE, Information Rapides Series F.

W real net financial wealth personal sector, Tableau d'Equilibre des Relations Financieres, Banque de France.

R short interest rate, interbank deposit rate, IFS, IMF.

P consumer expenditure deflator, National Account, OECD.

Italy

C Consumption, 1980 prices, National Account, OECD.

Y real personal disposable income, estimates based on OECD Economic Outlook (household appropriation accounts) and Bank of Italy estimates.

W real net financial wealth personal sector (excluding shares and participations). Source: Bank of Italy.

R short interest rate, interbank deposit rate, IFS, IMF.

P consumer expenditure deflator, National Account, OECD.

United Kingdom

C Consumption, 1980 prices, Economic Trends, CSO.

Y real personal disposable income, Economic Trends, CSO.

W real net financial wealth personal sector, Table 14.5, Financial Statistics, CSO.

R short interest rate, interbank deposit rate, IFS, IMF.

P consumer expenditure deflator, Economic Trends, CSO.