GOBIERNO DE ARAGON

Departamento de Agricultura, Ganadería y Montes.

DIFFERENCES IN FOOD DEMAND BETWEEN SPANISH AND BRITISH CONSUMERS: A DYNAMIC APPROACH

A.M. ANGULO
J.M. GIL
A. GRACIA

Documento de Trabajo 96/4

SERVICIO DE INVESTIGACION AGRARIA

UNIDAD DE ECONOMIA Y SOCIOLOGIA AGRARIAS

Apartado 727
50080 ZARAGOZA

Teléfonos (976) 57 63 11
(976) 57 63 61
Fax (976) 57 55 01

DIFFERENCES IN FOOD DEMAND BETWEEN SPANISH AND BRITISH CONSUMERS: A DYNAMIC APPROACH

A.M. Angulo
Departamento de Análisis Económico
Facultad de C.C.E.E. y Empresariales de Zaragoza
A.Gracia and J.M. Gil
Unidad de Economia Agraria
Servicio de Investigación Agraria-DGA
Apdo 727-50080 Zaragoza (Spain)

1.- Introduction

Food demand structures within the European Union (EU) countries are becoming increasingly similar. Although some differences have been found in the evolution of the dietary structure of the Mediterranean countries compared to other countries, the trend is towards the approximation of diets. Gil et al.(1995) used two measures of convergence to test whether these similarities are sustainable and showed that convergence could be observed in most products although the speed has decreased in the last decade

This convergence is the result of several forces. Firstly, the largely parallel trend in the determinants of food demand in European countries: the orthodox economic factors of household income, relative prices (as markets become more integrated), demographic changes and the newer concerns by consumers about the nutritional impacts and preventative health possibilities of dietary habits (Connor, 1994). Secondly, the increased vertical and horizontal integration in European firms: technological transfers, multinational marketing strategies (European brands, promotions, etc) and the internalization of food distribution. And thirdly, the evolving similarities in public policies.

Despite this process, there is still some consumption variation between EU countries. It is difficult to talk about an euroconsumer, but same difficulties arise when one attempt to define either the Spanish or the British consumer. In this paper, a comparison is made between Spanish and British food consumers based on prices and expenditure elasticities calculated from a estimated dynamic demand system.

Economic studies of food demand often show that consumers do not adjust instantaneously to changes in prices, income or other determinants of demand Psychological causes of consumer inertia, which include habit formation or persistance, institutional factors such as inventory adjustment and intertemporally separate budgeting contribute to observed lagged effects in consumers' decision making (Brown,1952; Houthakker and Taylor,1970; Blundell,1988; Kesavan et al, 1993). It seems that the assumption of instantaneous adjustment to change by consumers is very restrictive.

A standard procedure for incorporating dynamic processes is to assume an adjustment process, with focus only on the short-run dynamics. An alternative for identifying the appropiate model specification for demand is to develop a relatively general framework incorporating the alternative hypotheses related to dynamics and allowing for direct estimation of long run coefficients (Anderson y Blundell, 1983).

The purpose of this study is to evaluate the dynamics of food demand in Spain and United Kingdom within a general framework and to detect if there exists significant differences between Spanish and British food consumers. The study is done in aggregate terms although it is likely that there are segments with homogeneous socio-economic characteristics, cutting across both countries. Prices and food expenditure have considered the main determinants of food demand.

The paper is organised as follows. First, some descriptive statistics on the evolution of the structure of dietary intake and food expenditure in Spain and the United Kingdom are outlined. Next, a discussion of dynamic adjustment and the Theil's (1969) multinomial extension of the linear logit model, hereafter called GADS (generalised addilog demand system), which has been used in this paper. Part 4 collects the main results including the appropiate dynamic specification of models and a discussion of the estimated elasticities for both countries. Also the existence of significant differences are tested. Finally, main conclusions are outlined.

2.- Food trends in Spain and the United Kingdom.

Table 1 shows the evolution of the apparent per capita daily food consumption in the EU countries. The apparent average food comsumption in EU countries was 3,201 Kcalories/capita/day, in 1971, and increased at an average rate of 0 4 percent per year to reach 3,473 Kcal/capita/day, in 1990. Consumption in most countries has shown an upward trend except for the United Kigdom and Sweeden, where it has remained constant, and Finland where it has slightly declined. Spain, the country with the lowest apparent per capita consumption in 1971 has shown the largest increase (about 28% between 1971 and 1991).

Economic theory suggests that the main determinants of changes in total food consumption are variations in real consumer income and in the price of complementary or substitutive goods. In the case of food, few other goods can be considered close substitutes. Thus, it is likely that the principal economic determinant of long run changes in per capita food consumption is variation in real consumer income. Generally, a positive correlation between income and consumption is observed. However, with low income levels, food consumption is relatively high and, as income grows, food consumption increases at a lower rate up to a threshold which is difficult to surpuss, although, in this case, food consumption becomes more diversified.

The proportion of calories coming from animal products is lower than the proportion derived from vegetable products in each country (table 1), although there have been significant changes in many countries in recent years. In 1971, and specially in Mediterranean countries (Greece, Spain, Italy and Portugal), differences were more significant and, on average, vegetable and animal calories accounted for 80% and 20% of total food calorie intake, respectively. In the other countries, over 33% of total calories were derived from animal products.

Over time, two major trends can be observed. All countries, with the exception of the United Kingdom, showed an upward trend in the share of animal calories consumed over the period 1971-1981. However, from 1981-91 decade, the share of animal calories consumed has estabilized or even declined. Only in Mediterranean countries the trend is positive, although the growth rate has declined. In 1991, on average, EU countries derived 66% and 34% of their total consumed calories from vegetable and animal products, respectively.

Figure 1 shows the evolution of dietary structure in Spain and the United Kingdom over the last 30 years. In some products, it seems to appear certain convergence (cereals, milk, dairy and eggs, and fats and oils). In Spain, total cereals consumption declined during the 1960's but since then has remained reasonably steady. In the UK, total bread consumption has declined but, in recent years, there has been a growth in the demand for high-fibre bread and high-fibre breakfast cereals. As a result, total cereals consumption in the UK has remained constant and quite similar to the Spanish consumption.

Table 1 Evolution of average food consumption and per capita GDP in EU countries (Kcal/capita/day and dollars, 1985=100).

	1971			1981			1991		
	Total Calories	Animal Calories (%)	Per Capita GDP	Total Calories	Animal Calories (%)	Per capita GDP	Total Calories	Animal Calories (%)	Per capita GDP
Austria	3288	34.1	5983	3392	37.6	8046	3547	35.8	9948
Belg-Lux	3290	35.7	6184	3339	36.6	7932	3654	36.1	9678
Denmark	3249	39.7	8413	3493	43.9	9851	3613	44.1	12279
Finland	3143	42.7	7369	3033	43.1	9963	3039	39.2	11816
France	3336	37.6	7153	3496	39.7	9043	3623	40.0	10700
Germany	3233	35.0	7711	3360	35.7	9758	3420	34.7	11814
Greece	3250	20.9	2239	3480	23.6	3007	3745	24.4	3436
Ireland	3448	37.7	3727	3607	39.6	5017	3793	35.1	6988
Italy	3413	19.5	5010	3501	23.9	7047	3546	25.4	8750
Netherlands	3020	33.2	7104	3003	36.6	8361	3171	32.8	9689
Portugal	3011	16.8	1453	2902	21.6	2021	3616	25.1	2681
Spain	2870	23.4	3304	3231	30.0	4093	3681	31.8	5417
Sweden	2935	34.5	9442	3001	39.4	10939	2939	37.4	12649
U. Kingdom	3282	40.6	6323	3143	40.3	7341	3241	34.2	9085

Source: FAO (1995) and IMF (several years).

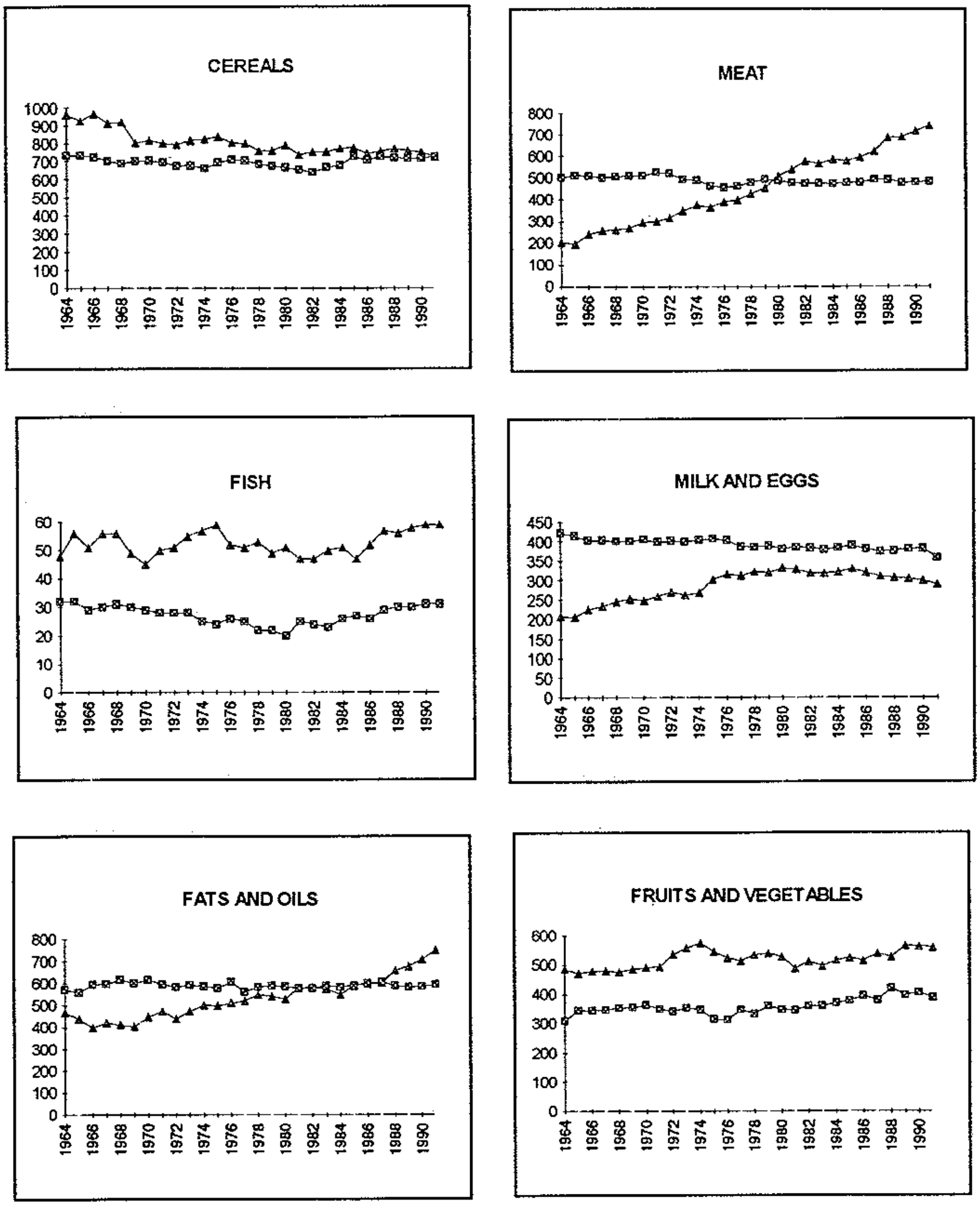
In meat, consumption trends have opposite signs. In the UK it follows a downward trend due to the decline in lamb and beef consumption while, in Spain, consumption of total meat has increased three-fold over the same period. Same opposite trends can be observed in the consumption of oils and fats. In the UK, total fat consumption has remained approximately steady, although margarine consumption has grown at the expense of butter. In Spain, there has been a big increase in the consumption of butter in the last few years.

Consumption of fish and fruits and vegetables is consistently higher in Spain. In both countries, there has been a fall in consumption of potatoes while the demand for green vegetables has grown. Fruit consumption has been increased in the last years due to the demand for fruit juice. The demand for fish has followed parallel trends although differences have slightly increased.

The demand for milk, dairy products and eggs increased, in Spain, in the 1960's and 1970's, and has remained constant since then with a slightly fall in the last years. On the other hand, consumption in the UK has declined in the last thirty years. A converge process has taken place between both countries.

Results from the analysis of the dietary structure have to be complemented with the analysis of the evolution of food expenditure structure in both countries (figure 2). In order to make data comparisons, food expenditure in both countries are expressed in percentage. In

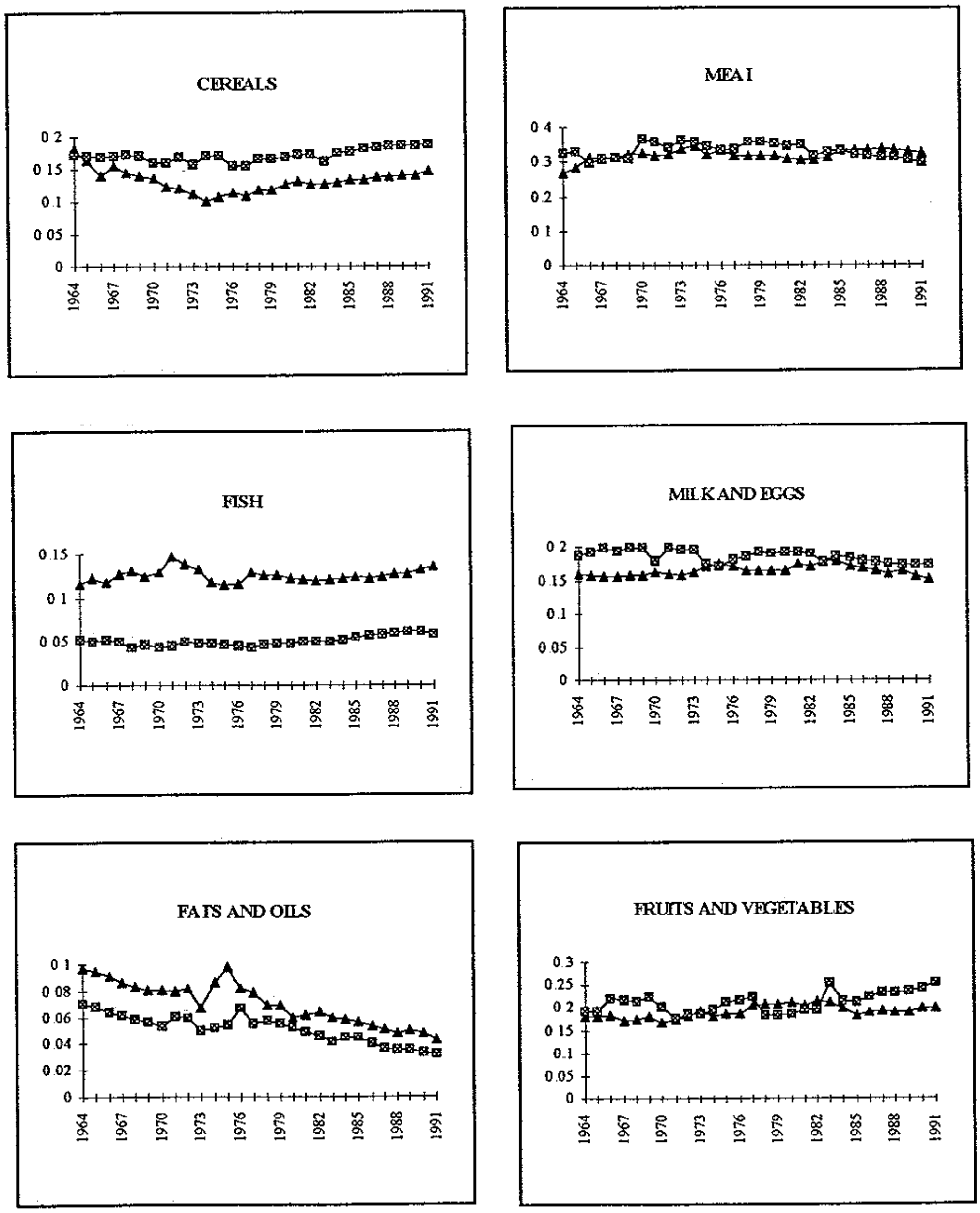
Figure 1 Evolution of dietary structure in Spain and the United Kingdom (Kcal/capita/day)



Note: ☐ UNITED KINGDOM ; ▵ SPAIN
Source : FAO (1995)

both countries, meat expenditure is the most important product accounting for 30% of food expenditure, in the United Kingdom, and 33%, in Spain. However, trends have the opposite sign as it was observed in calorie intake data. Fruits and vegetables are becoming more important in the food expenditure structure showing an upward trend in both countries although the increase has been higher in the UK. Oils and fats expenditure has been decreasing, in relative terms, in the last years, being more significant in the UK.

Figure 2. Evolution of food expenditure structure in Spain and the United kingdom (%)



Note : □ UNITED KINGDOM ; ▵ SPAIN
Source: INE (Instituto Nacional de Estadística) (several years) and MAFF (Ministry of Agriculture, Fisheries and Food) (several years)

Main differences are found looking at fish consumption The relative importance of fish expenditure in Spain, one of the largest consumer countries, is almost three times the British expenditure. Finally, as far as cereals consumption concerns, trends have followed opposite signs in both countries. While in the UK, the relative importance of cereals expenditure has slighly increased, in Spain it has reduced by 3%. Thus, in general terms although a certain convergence process has taken place, differences still remain which implies that food elasticity differences between both countries are expected

3. Methodology

Generalised Addilog Demand System

A number of demand systems have been used to explain how food expenditures allocate among different foodstuffs. The AIDS model is the most commonly used because of the desirable features and the easiness estimation of the linearized Stone's price index version Nevertheless, it does not satisfy the nonnegativity of the estimated average budget share. A model that guarantees this non-negativity property and satisfy the aggregation restriction is the Generalised Addilog Demand System (GADS) developed from Theil (1969) Moreover, homogeneity and symmetry restrictions can be imposed by appling linear restrictions on the estimated parameters. Applications can be land in Bewley and Young (1987), for the demand for meat in Great Britain, and in Gaiha and Young (1989), for cereals and starchy products in developing countries.

The GADS model assumes that budget shares have the following structure:

$$w_i = \frac{e^{\delta_i}}{\Sigma_k e^{\delta_k}} \qquad (1)$$

where:

$$\delta_i = \alpha_i + \beta_i \ln y + \sum_{j=1}^{n} \gamma_{ij} \ln p_j$$

and: w_i: average budget share of the i-th good

y: total expenditure

p_j: price of the j-th good

Model (1) is difficult to estimate and then, some transformations are needed for estimation purposes. First, model (1) is linerarized by taking logs:

$$\ln w_{it} = \alpha_i + \beta_i \ln y_t + \Sigma_j \gamma_{ij} \ln p_{jt} - \ln \Sigma_k e^{\delta_k} \qquad (2)$$

Then, premultipling (2) by Σw_i (=1) to get:

$$\Sigma_i \overline{w_i} \ln w_{it} = \Sigma_i \overline{w_{it}}\, \alpha_i + \Sigma_i \overline{w_i}\, \beta_i \ln y_t + \Sigma_j \Sigma_i \overline{w_i}\, \gamma_{ij} \ln p_{jt} - \Sigma_i \overline{w_i} \ln \Sigma_k e^{\delta_k} \qquad (3)$$

On substracting (3) from (2) and rearranging terms the final linear version of the GADS is obtained:

$$\ln \left(\frac{w_{it}}{w^+} \right) = a_i^* + b_i \ln y_t + \Sigma_j g_{ij} \ln p_{jt} \qquad (4)$$

where:

$$\ln w^{+} = \sum_i \overline{w_i} \ln w_i$$

$$a_i^{*} = \alpha_i - \sum_j \overline{w_j}\, \alpha_j$$

$$b_i = \beta_i - \sum_j \overline{w_j}\, \beta_j$$

$$g_{ij} = \gamma_{ij} - \sum_j \overline{w_i}\, \gamma_{ij}$$

Total expenditure and price elasticities are:

$$\eta_i = 1 + \beta_i - \sum_k w_k\, \beta_k$$

$$E_{ij} = -\delta_{ij} + \gamma_{ij} - \sum_k w_k\, \gamma_{kj}$$

where δ_{ij} is the Kronecker delta.

On substracting $\ln(p_i/y)$ from both sides of expression (4) a new version of the model is obtained which directly gives the estimated elasticities:

$$\ln\left(\frac{q_{it}}{w^{+}}\right) = a_i^{*} + \eta_i \ln y_t + \sum_j E_{ij} \ln p_{jt} \qquad (5)$$

where, q_i: quantity consumed of i-th good
η_i: expenditure elasticity evaluate at the mean budget share
E_{ij}: price elasticities evaluates at the mean budget share

If we want to test the general restrictions of demand theory (homogeneity and symmetry) it is necessary further transformations Multiplying equation (5) by w_i and rearranging terms:

$$\overline{w_i} \ln\left(\frac{q_{it}}{w^{+}}\right) = a_i + \theta_i \ln\left(\frac{y_t}{P^{+}}\right) + \sum_{j=1}^{n} \pi_{ij} \ln p_{jt} \qquad (6)$$

where:

$$a_i = \overline{w_i}\ a_i^*$$

$$\theta_i = \overline{w_i}\ \overline{\eta_i}$$

$$\pi_{ij} = \overline{w_i}\ E_{ij} + \overline{w_i w_j}\ \eta_i$$

$$\ln P^+ = \sum_j \overline{w_j}\ \ln p_j$$

The θ_i and π_{ij} parameters are the marginal budget share and the Slutsky parameters, respectively, calculated at the mean budget share. Adding-up restriction implies that:

$$\sum_i a_i = 0 \qquad \sum_i \theta_i = 1 \qquad \sum_i \pi_{ij} = 0$$

and homogeneity and symmetry are given by:

$$\sum_j \pi_{ij} = 0 \qquad \pi_{ij} = \pi_{ji}$$

Furthermore, average budget shares estimated are positive and sum to unity.

Dynamics and the Long-run Structure

Consumers do not adjust instantaneously to changes in prices and income. Lagged values of certain variables cause changes in consumer behaviour because of habit formation which include cultural, social and demographic factors. A common approach to deal with dynamic structures consists of assuming an adjustment process, such as partial adjustments. These models only provide information about short-run coefficients and long-run parameters are based on the ratio of short-run and adjustment coefficients. However, standard deviations of long-run parameters are difficult to calculate. An alternative to this modelling approach consists of developing a more general framework which is able to incoporate different dynamic structures and allows for direct estimation of long-run coefficients. It is assumed that changes in endogenous variables are responses to anticipated and unanticipated changes in exogenous variables to maintain a long-run relationship between them.

The general dynamic demand framework is extended to the GADS model defined above. The GADS model in standard matrix notation is:

$$Y_t = X_t \beta \qquad (7)$$

where, Y_t: is a vector of endogenous variables
X_t: is a vector of exogenous variables (income and prices)

The general dynamic model can be defined, following Anderson and Blundell (1982):

$$B(L)\ Y_t = \Gamma(L)\ X_t + \varepsilon_t \qquad (8)$$

where:

$$B(L) = I - B_1L - B_2L^2 - \ldots - B_pL^p$$

$$\Gamma(L) = \Gamma_o - \Gamma_1L - \Gamma_2L^2 - \ldots - \Gamma_qL^q$$

being L the lag operator.

The above transformation yields a general dynamic model difficult to estimate with a short time series data. Therefore, usually a first-order autoregressive distributed lag model is assumed (p=1 and q=1).

From this ADL(1,1) process and making the necessary transformations we get the following model in a error-correction form:

$$\Delta Y_t = \Delta X_t B - (Y_{t-1} - \Phi X_{t-1})\lambda + \varepsilon_t \qquad (9)$$

where: B: short-run coefficients matrix
λ: adjustment coefficients matrix
Φ: long-run coefficients matrix

Expression (9) nests other dynamic specifications such as, partial adjustment, first order autoregressive and the static model by imposing some parameter restrictions which allows us for the possibility of testing the "correct" dynamic specification, to do that, model (9) has to be reparametrized to get the following expression:

$$\Delta Y_t = \Delta X_t \Phi A - (Y_{t-1} - \Phi X_{t-1})\lambda + \varepsilon_t \qquad (10)$$

where A matrix relates short and long-run coefficients.

If A = λ is imposed, the model (10) yields the partial adjustment model:

$$\Delta Y_t = (X_t\Phi - Y_{t-1})\lambda + \varepsilon_t \qquad (11)$$

If A = I, the result is a first order autoregressive model:

$$Y_t = X_t\Phi - (Y_{t-1} - X_{t-1}\Phi)\rho + \varepsilon_t \qquad (12)$$

where: $\rho = I - \lambda$.

Finaly, if $\lambda = I$ is imposed in (12), we get the static model

$$Y_t = X_t\Phi + \varepsilon_t \qquad (13)$$

The model defined by (10) is still too general for estimation purposes. To avoid the large number of parameters to calculate with the short sample available a diagonal adjustment is assumed, that is, A and λ matrices must be scalar. In this context, all equations in the system adjust in the same way to the deviations from the long-run equilibrium. In any case, the adding-up restriction is guaranteed.

4.- Estimation and results

Data come from different sources. In Spain, information about food expenditure has been taken from the National Accounts elaborated by the Instituto Nacional de Estadistica (INE). However, data on food quantities consumption were not available so calorie intake data from FAO data base have been used. In the United Kingdom, data about food quantities and expenditure have been obtained from the National Food Expenditure Survey elaborated by the Ministry of Agriculture, Food and Fisheries. In order to get per capita data, population figures from both countries were collected from the International Monetary Fund.

Food products have been aggregated into six broad categories: 1)bread and cereals; 2)meat; 3)fish; 4)milk, dairy products and eggs; 5)fruit, vegetables and potatoes; 6)oils and fats. Sample period covers yearly data from 1964 to 1991.

Since the GADS system adds up, the sum of the residuals across equations is equal to zero ($\sum U_i=0$), and the variance and covariance matrix of residuals is singular. To overcome this problem, one equation has to be arbitrarily deleted and a systems estimator applied to the remainder of the system. Oils and fats equation has been deleted and the systems have been estimated using the Full Information Maximum Likelihood (FIML) procedure. Weak separability has been also imposed.

Once model (10) has been estimated, several tests have been performed in order to get the "correct" dynamic specification. As all the alternatives are nested in the ECM a Likelihood Ratio test has been used. Table 2 shows the log likelihood ratio test performed to discriminate among the alternative models (partial adjustment, first order autoregressive and static) for Spain and the United Kingdom. Results indicate that the hypotheses of partial adjustment or static forms seem to be too restrictive for the data. In both countries, the first order autoregressive form seems to be the correct dynamic specification at 1% level of significance.

Table 2: Testing for alternative dynamic specifications

SPAIN				
	Log L	LR	D.F.	Critical Value (1%)
MCE	590.91			
Autoregressive	589.78	2.26	1	6.63
Partial Adjustment	586.23	9.36	1	6.63
Static	585.15	11.53	2	9.21

UNITED KINGDOM				
	Log L	LR	D.F.	Critical Value (1%)
MCE	694.54			
Autoregressive	694.53	0.02	1	6.63
Partial Adjustment	680.82	27.44	1	6.63
Static	680.12	28.83	2	9.21

Log L: Log of likelihood Functions
LR: Likelihood Ratio
DF: Degrees of Freedom

The autoregressive specification implies that actual food demand not only depends on actual income and prices but also on previous experience. Also, from table 2 and from this point of view it is possible to conclude that the behavior of Spanish and British consumers is similar.

The rejection of the partial adjustment implies that habit formation does not play an important role in explaining food consumer behavior in both countries. Finally, the rejection of the ECM form means that actual consumption do not need to be short-run adjusted towards a long run equilibrum as it does not appear strong deviations between short-run and long-run consumer behavior; that is, food consumers do not present a high sensibility to anticipated income and prices changes as it can be expected in developed countries.

Restrictions imposed by economic theory (homogeneity and symmetry) have been also tested in autorregresive models. A second step procedure has been followed. First, homogeneity against the unrestricted model is tested. If accepted, homogeneity and symmetry against homogeneity is tested. Likelihood Ratio tests statistics have been used. Results are shown in table 3. Both restrictions are accepted at the 1% level of significance for both, the Spanish and the British models.

Table 3. Testing theoretical restrictions

SPAIN				
AR	Log L	LR	D.F.	Critical Value (1%)
Unrestricted	589.78			
Homogeneity	587.42	4.73	5	15.08
Homogeneity Symmetry	579.69	15.46	10	23.21
UNITED KINGDOM				
AR	Log L	LR	D.F	Critical Value (1%)
Unrestricted	694.53			
Homogeneity	691.20	6.66	5	15.08
Homogeneity Symmetry	679.65	23.10	10	23.21

Log L: Log of likelihood Functions
LR: Likelihood Ratio
DF: Degrees of Freedom

The estimated coefficients with homogeneity and symmetry imposed for both countries are presented in table 4. All income and own price parameters are statistically significant at the 1% level of significance. The λ parameter, which introduces previous experience in the models, is highly significant, indicating that it is an important determinant in food consumer demand. Finally, cross-price parameters are mostly significant.

A system-wide measure of goodness of fit has been used which has a similar interpretation to the single-equation measure. The system R^2 compares the current model with a benchmark, which in this case is a model with intercepts only. It has the following expression:

Table 4 Maximum Likelihood parameters of the autoregressive model (AR) with homogeneity and symmetry restrictions imposed

SPAIN

Estimated Parameters	Cereals	Meat	Fish	Milk and Eggs	Fruits and Vegetables	Fats and Oils
α_i	0.256 (1.40)	-1.268 (-3.04)	0.052 (0.18)	0.434 (1.87)	0.161 (0.61)	0.365
β_i	0.102 (4.30)	0.49 (9.11)	0.102 (2.71)	0.106 (3.55)	0.17 (5.01)	0.03
γ_{i1}	-0.041 (-7.51)					
γ_{i2}	0.017 (2.17)	-0.098 (-4.42)				
γ_{i3}	0.011 (2.10)	0.044 (3.51)	-0.076 (-6.96)			
γ_{i4}	0.010 (1.76)	0.015 (1.20)	0.012 (1.69)	-0.075 (-5.79)		
γ_{i5}	-0.005 (-0.70)	0.034 (2.82)	0.008 (1.00)	0.016 (1.84)	-0.056 (-4.05)	
γ_{i6}	0.008	-0.012	0.001	0.022	0.003	-0.022
λ	0.181 (5.41)	0.181 (5.41)	0.181 (5.41)	0.181 (5.41)	0.181 (5.41)	0.181 (5.41)

t-ratios are in parentheses

UNITED KINGDOM

Estimated Parameters	Cereals	Meat	Fish	Milk and Eggs	Fruits and Vegetables	Fats and Oils
α_i	0.47 (4.15)	-0.44 (-1.97)	-0.005 (-0.05)	-0.078 (-0.43)	0.175 (0.73)	-0.122
β_i	0.092 (4.12)	0.43 (9.79)	0.034 (1.60)	0.162 (4.57)	0.22 (4.72)	0.062
γ_{i1}	-0.019 (-2.90)					
γ_{i2}	0.016 (3.65)	-0.022 (-2.62)				
γ_{i3}	0.005 (1.03)	-0.003 (-0.71)	-0.018 (-3.20)			
γ_{i4}	-0.008 (-1.54)	0.005 (0.85)	0.010 (2.08)	-0.013 (-1.68)		
γ_{i5}	-0.005 (1.92)	0.0009 (0.20)	0.005 (1.85)	0.007 (1.65)	-0.016 (-2.91)	
γ_{i6}	0.001	0.0031	0.001	-0.001	-0.0019	-0.0022
λ	0.084 (3.01)	0.084 (3.01)	0.084 (3.01)	0.084 (3.01)	0.084 (3.01)	0.084 (3.01)

t-ratios are in parentheses

$$R^2 = 1 - \frac{1}{1 + 2 * [\,L L_u - L L_b\,] * \frac{1}{T*(N - 1)}} \tag{14}$$

where LL_u = Log likelihood of unrestricted model
LL_b = Log likelihood of base model
T = Number of observations
N = Number of equations in the system

The R^2 values for both the Spanish and the British models were 0.63 and 0.61, respectively, indicating that models perform relatively well in term of explanatory power.

Estimated Elasticities

The most interesting economic parameters for policy analysis are elasticities. No distintion can be made between long and short run in the AR/GADS model. Table 5 presents the estimated own-price and expenditure elasticities for Spain and United Kimgdom calculated at mean values.

Table 5. Expenditure and price elasticities calculated at mean values

	SPAIN		UNITED KINGDOM	
	Expenditure	Price	Expenditure	Price
Cereals	0.77	-0.42	0.53	-0.21
Meat	1.54	-0.80	1.28	-0.49
Fish	0.81	-0.71	0.68	-0.41
Milk - Eggs	0.64	-0.56	0.87	-0.23
Fruit- veget.	0.90	-0.46	1.05	-0.30
Fats- Oils	0.35	-0.23	1.20	-0.14

In Spain, all food products have food expenditure elasticities less than unity. On the other hand, meat has a estimated elasticity greater than unity implying that this product is highest ranking by household food expenditure responses. Due to the weak separability assumption, results must be regarded with respect to total food expenditure in the six food products considered. In the United Kingdom, meat, fruits and vegetables and oils and fats have elasticities greater than unity while fish, milk and eggs and cereals are food expenditure inelastic. Results are as expected, as fruits and vegetables are more expensive in the United Kingdom than in Spain, in which fruits and vegetables production is important. On the other hand, fish consumption is higher in Spain so it becomes more elastic than in the United Kingdom.

Price elasticities are quite similar between Spain and the UK. All the uncompenseted own prices elasticities are negative, that is, changes in own prices have inverse impact on quantities demanded. Also, for both countries and for all the food groups, the estimated elasticities are less than unity; however, Spanish elasticities are consistently higher than in the UK. In absolute terms, price elasticities are ranked in the same way in both countries being meat and fish products the more elastic. In the UK fruits and vegetables are more price elastic than milk products whereas in Spain the opposite ocurrs.

Finally, in order to analyse the complementary or substitute relationships among food products in each country, compensated price elasticities, adjusted for change in total food expenditure, have been calculated (table 6). The estimated compensated elasticities suggest that, in Spain, meat and fish are net substitutes (0.35). Likewise, oils and fats and milk and eggs are net substitutes (0.28). The rest of the relationships are mostly of substitution although the small values indicate that demands are independent. In the United Kingdom, only a high substitute relationship exits between fish and milk and dairy products (0.20) while the rest can be characterized as independent.

Table 6. Compensated price elasticities for the AR models

SPAIN						
	Cereals	Meat	Fish	Milk-Egg	Fruit-vegetables	Fats-oils
Cereals	-0.31	0.13	0.08	0.08	-0.03	0.05
Meat	0.05	-0.31	0.14	0.05	0.11	-0.04
Fish	0.09	0.35	-0.61	0.10	0.07	-0.002
Milk-Eggs	0.06	0.09	0.07	-0.46	0.10	0.12
Fruit-veget	-0.02	0.18	0.04	0.09	-0.29	0.001
Fats-oils	0.10	-0.18	-0.004	0.28	0.004	-0.20

UNITED KINGDOM						
	Cereals	Meat	Fish	Milk-Egg	Fruit-vegetables	Fats-oils
Cereals	-0.11	0.09	0.03	-0.05	0.03	0.008
Meat	0.05	-0.06	-0.009	0.01	0.003	0.008
Fish	0.10	-0.06	-0.37	0.20	0.10	0.04
Milk-Eggs	-0.04	0.03	0.05	-0.07	0.04	-0.002
Fruit-veget	0.02	0.004	0.02	0.03	-0.07	-0.008
Fats-oils	0.03	0.05	0.04	-0.007	-0.034	-0.07

Differences in demand elasticities between both countries have been tested. In this analysis, expression (5) of the GADS model has been used as it directly provides the elasticities. Data from Spain and the United Kingdom have been pooled and appropiate dummy variables have been defined. A ordered sequence of tests have been carried out. Results are shown in table 7.

First, differences in all model parameters (intercept and demand elasticities) are tested. Results indicate that we fail to accept the null hypothesis of no differences. Therefore, both countries show different food patterns although the dynamic structure of food consumer behavior is similar as the AR model has been chosen for both countries.

Next, only differences on the intercepts has been tested by introducing dummy variables affecting prices and expenditure. We fail to reject the null hypothesis of no differences, that is, average budget shares are similar between both countries. Next, differences in food expenditure parameters have been tested by introducing dummy variables only afecting to price slopes. The null of no differences are rejected. Then, Spanish and British consumers ranked food products in a different way from the total food expenditure point of view.

Finally, differences in price elasticities have been tested by defining dummy variables which only affect to food expenditure parameter. Again, in this case, the null of no price differences is rejected as price elasticities are higher in Spain than in the UK although both sets are inelastic

Table 7. Testing significant differences in food demand elasticities between Spain and the United Kingdom

	Log	LR	Critical Value (1%)
General	720.13		
All coefficients	661.94	116.39	63.69
Intercepts	718.53	3.204	15.08
Expenditure parameters	704.69	27.68	15.08
Prices parameters	663.08	110.89	50,9

Log : Log of Likelihood function.
LR: Likelihood Ratio.

5.- Conclusions

In this paper a dynamic approach is used to test for food demand differences between Spanish and British consumers. Results suggest several points. First, as income increased, food calorie intake reaches a maximum which is difficult to surpass. Also, the relative importance of food groups remains quite steady although some diversification within the group exits. Second, comparing the evolution of the structure food calorie intake and food expenditure in Spain and in the UK, a convergence process is observed. Third, consumers from both countries follow a similar dynamic behavior as among the different dynamic specification alternatives, the autoregressive form fits better the data. Although average shares are similar, income and price elasticities are still significantly different because of different production patterns, cultural aspects, etc.

Results only apply to the food groups considered which are quite aggregate. Further research is needed in two directions: first, to analyse food demand behavior within food groups; and second, to try to detect segments cutting across countries which have similar behavior. However, this study has also shown that that considerable efforts have to be made in order to get homogeneous information for european countries to incentive european food demand analyses.

6.- References

Anderson G. J. and Blundell R.W. (1983). Testing restriccion in a flexible dynamic demand system: An applications to consumers' expenditure data in Canada. Review of Economic studies 50: 397-410.

Bewley R. A. and Young T. (1987). Applying Theil's multinomial extension of the linear logit model to meat expenditure data. American Agricultural Economics. 151-157

Blundell, R. (1988). Consumer Behavior: Theory and empirical evidence. A survey. The economic journal 98: 16-65.

Brown, T.M. (1952). Habit, persistence and lags in consumer behavior. Econometrica 20: 355-71.

Connor, J.M. (1994). Northern America as a precursor of changes in western European food-purchasing patterns. European Review of Agricultural Economics 21(2): 155-173

FAO (1995). Computerized information series Faostat PC. N°6: Food Balance sheets. Food and Agriculture Organization of the United Nations. Rome.

Gaiha R. and Young T. (1989). On the relationship between share of starchy staples, calories consumed and income in selected development countries. Journal of International Development, 1(3). 373-386.

Gil J.M., Gracia A. and Pérez y Pérez L. (1995). Food Consumption and Economic Development in the European Union. European Review of Agricultural Economics, impress.

IMF (several years) Finantial Statistics. Washington

INE (several years). National Account of Spain. Madrid.

Houthakler, H.S. and Taylor L.D. (1970). Consumer Demand in the United States 1929-1990. 2ª edición. Cambridge, Mass.: Harvard University Press.

Kesavan T. Zuhair A. Hassan, Helen H. Jensen and Stanley R. Johnson. (1993). Dynamics and Long-run structure in U.S. Meat demand. Canadian Journal of Agricultural Economics 41. 139-153.

MAFF (several years). Annual Reports of the National Food Survey Committee. HMSO. London

Theil H. (1969). A multinomial extension of the linear logit model. International Economic Review 10: 251-59.