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Will European Diets be Similar? A Cointegration Approach

INTRODUCTION

The European Union (EU) is experiencing an integration process, which has accelerated in the current decade. Any integration process has several effects on the countries involved, including trade liberalization, internationalization of industries, distribution channels and markets, harmonization of economic parameters and similar harmonization of public policies. These effects are responsible for the economic convergence that is taking place, which can be seen in various indicators (GDP, productivity, unemployment and so on) and which is also affecting habits, behaviour and attitudes. As regards food consumption, Blandford (1984) for OECD countries, and Wheelock and Frank (1989), for nine developed countries, suggested that convergence is taking place in dietary patterns. Grigg (1993) related the phenomenon to economic development and to concerns about health. Herrmann and Röeder (1995) and Gil et al. (1995) used different methodologies to measure food consumption convergence, though they reached similar conclusions. This work looks at food diet convergence in more depth for EU countries, plus Norway.

The first step is to define what convergence means. In general terms, it can be said to be the tendency towards the equalization of relevant variables among individuals in the various countries and regions. In the case of food consumption, however, it is important not to be too general but to adopt a rather more specific definition. Gil et al. (1995) used the proportions of different food products within the total, expecting to find that shares tend to equalize across European countries. In the present work, we are interested in analysing whether food consumer behaviour is similar across Europe; that is, whether the allocation of total calories in the different food products (the diversification of diets) is responding in a similar way in response to changes in total calorie intake. Therefore a measure of the total calorie response (total calorie elasticities) is needed in this kind of convergence analysis.

The paper is therefore organized as follows. First, we study the two steps in the food consumer decision process: (1) the relation between food consumption and income, which gives the maximum potential consumption level and the income elasticities, (2) the relation between consumption of specific food products and total calorie intake, which gives the total calorie intake elasticities.

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Finally, a cointegration approach is used to measure the long-run convergence relationship among total calorie intake elasticities of different products across the European Union.

THE EVOLUTION OF FOOD CONSUMPTION ACROSS EU COUNTRIES

Total food consumption and income

Table 1 shows the evolution of total food consumption (daily per capita calories intake) and the real income (per capita GDP) in the EU countries and Norway from 1972 to 1992. The daily average per capita food consumption in EU countries was 3180 kilocalories in 1972, and this increased at an average annual rate of 0.5 per cent to 3475 in 1992. In the same period, average per capita GDP increased at an average rate of 2.1 per cent. Behaviour has been different across countries, depending on the initial GDP level. Food consumption in most countries has shown an upward trend, the exception being Finland, where it has declined slightly. Countries with the lowest per capita GDP and food consumption in 1972 (Spain, Greece and Portugal) have shown the largest increase. From 1982 to 1992, however, calorie intakes of animal products stabilized, or even declined, in most of the countries.

It can be seen that total calorie consumption and the relative animal calorie intake have reached a ceiling, while income is still increasing. To measure the response of total food consumption to income, as well as to calculate the maximum food consumption level, a functional form that relates total calories and per capita GDP is specified. The selected functional form has to hold two requirements: income elasticities must be decreasing (Engel's Law) and it must have an upper asymptote (maximum consumption level). The reciprocal functional form satisfies both requirements:

$$TCAL_t = \alpha + \beta \frac{1}{y_t} + U_t \quad t = 1965,......,1992 \tag{1}$$

In equation (1) *TCAL* is the total calorie intake (Kcal/per capita/day); y_t is the per capita GDP at constant 1985 prices; U_t is an error term; α is an upper asymptote (maximum potential consumption level); and β is the income parameter to calculate the elasticities. Annual material from 1965 to 1992 has been used. Total calorie intake data comes from the *Food Balance Sheets* gathered by the FAO, while GDP is taken from *Financial Statistics*, published by the IMF (International Monetary Fund). Model (1) was estimated by generalized least squares (GLS).

Table 2 presents the maximum potential food consumption levels and the food consumptions in 1992. Also it shows income elasticities at 1972, 1982, 1992 and mean values. Some significant positive relationship between total food consumption, in calorie terms, and income has been found in all countries, except for Finland. Owing to the chosen functional form, income

TABLE 1 *Evolution of average calorie intake and per capita GDP in European Union countries and Norway (Kcal/per capita/day and thousand dollars)*

	1972			1982			1992		
	Total calories	Animal calories (%)	Per capita GDP	Total calories	Animal calories (%)	Per capita GDP	Total calories	Animal calories (%)	Per capita GDP
Austria	3 253	34.8	6 363	3 410	36.8	8 128	3 497	35.6	10 023
Belg.-Lux.	3 198	36.7	6 503	3 467	36.8	7 994	3 680	35.3	9 991
Denmark	3 272	40.1	8 826	3 427	41.9	10 158	3 663	43.5	12 137
Finland	3 178	41.9	7 576	3 110	44.1	10 260	3 018	39.6	11 354
France	3 310	37.9	7 418	3 498	38.7	9 238	3 633	40.0	10 784
Germany	3 201	34.9	7 876	3 386	35.3	9 516	3 344	34.7	9 674
Greece	3 206	21.1	2 421	3 533	24.6	3 000	3 815	25.2	3 364
Ireland	3 438	37.8	3 915	3 639	37.0	5 076	3 847	33.4	7 041
Italy	3 462	19.6	5 194	3 395	24.9	7 045	3 560	25.4	8 865
Netherlands	3 063	33.3	7 288	3 059	38.2	8 184	3 222	31.7	9 815
Portugal	3 025	17.4	1 580	2 954	27.5	2 062	3 633	26.0	2 710
Spain	2 905	24.0	3 535	3 304	30.1	4 119	3 707	31.9	5 452
Sweden	2 891	34.0	9 632	3 005	39.0	11 051	2 971	37.6	12 365
Great Britain	3 204	41.2	6 510	3 159	40.0	7 470	3 317	32.4	9 001
Norway	3 099	39.8	11 691	3 134	40.0	12 139	3 219	33.4	15 594

Sources: FAO (1995) and IMF, *Financial Statistics* (several issues).

TABLE 2   *Maximum potential food consumption level and total food calories in 1992, estimated income elasticies at 1972, 1982, 1992 and mean values*

				E_{TCALY}		
	α	tc1992[a]	1972	1982	1992	Mean
Germany	2 877	2 551	0.13	0.11	0.11	0.12
France	3 127	2 978	0.13	0.10	0.08	0.12
Italy	3 341	3 075	0.19	0.13	0.10	0.16
Denmark	3 417	2 878	0.33	0.27	0.22	0.30
Spain	4 105	3 145	0.65	0.51	0.34	0.6
Portugal	3 232	2 996	0.031	0.023	0.017	0.027
Greece	3 705	3 294	0.25	0.19	0.17	0.24
Netherlands	2 384	2 374	0.007	0.006	0.005	0.006
Belg.–Lux.	3 696	2 991	0.48	0.36	0.27	0.44
Great Britain	3 075	2 621	0.28	0.24	0.19	0.25
Ireland	3 414	3 038	0.25	0.18	0.13	0.22
Austria	3 033	2 770	0.18	0.13	0.11	0.16
Sweden	2 710	2 380	0.18	0.15	0.13	0.16
Finland[b]	—	—	—	—	—	
Norway	3 117	2 662	0.21	0.20	0.15	0.19

Notes: [a]Total food calorie intake in 1992.
[b]No significant relationship between total food calorie intake and per capita GDP.

elasticities decrease over time but at a higher rate in the first period (from 1972 to 1982). Differences between food consumption in 1992 and the maximum estimated consumption level are low, therefore a saturation level has been attained. The largest differences have been found in Spain, Belgium and Luxembourg, Denmark, Greece and Norway.

The diversification of food consumption

The allocation of food calorie intake to specific products has been changing during the period of study. However, some differences between Mediterranean and northern countries are still important. Mediterranean countries have a higher consumption of cereals and of fruit and vegetables than the other countries. On the other hand, the consumption of milk and dairy products is lower. Differences in meat consumption are not very large, though there is remarkably high consumption in Spain and Denmark.

   Because of these similarities, countries are classified in homogeneous groups according to the food consumption dietary structure. A cluster analysis, where variables are the proportion of specific food products consumption in total

calorie intake, is used. From the analysis, five homogeneous groups are found: (1) Denmark, France and Great Britain; (2) Finland, Norway and Ireland; (3) Sweden, Netherlands, Belgium-Luxembourg, Austria and Germany; (4) Portugal, Greece and Italy; and (5) Spain. We used the following food products: (1) cereals, (2) meat, (3) fish, (4) milk, dairy products and cheese, (5) fruits and vegetables and (6) fats and oils. The analysis of the allocation of total food calorie intake to different food products has been conducted for the five clusters using the AIDS model. Demand functions, in budget calorie terms, have the following form:

$$w_{it} = \alpha_i + \beta_i lnTCAL_t + \varepsilon_t^i \qquad (2)$$

where w_{it} is the calorie share of the ith good ($i=1,2...,n$) in period t ($t=1...T$); $TCAL_t$ is the total calories in period t ($t = 1...T$); and ε_t is the error term. The adding-up restriction implies that $\sum_i \alpha_i = 1$ and $\sum_i \beta_i = 0$.

Economic studies of food demand often show that consumers do not adjust instantaneously to changes in prices, income or other determinants of demand (the static approach); adjustment takes place gradually. Such dynamic behaviour has been incorporated in the AIDS model (2), using Anderson and Blundell's (1983) approach. This general dynamic specification assumes that changes in endogenous variables are responses to anticipated and unanticipated changes in exogenous variables. The general model, assuming a first-order autoregressive distributed lag, can be expressed in an error-correction form (error correction model, ECM):

$$\Delta w_{it} = \varphi_i \Delta lnTCAL_t - \sum_{j=1}^{n-1} \lambda_{ij}[w_{j,t-1} - a_j - \theta_j lnTCAL_{t-1}] + \varepsilon_t \qquad (3)$$

where φ_i are short-run total calorie effects, λ_{ij} are adjustment coefficients to the long-run equilibrium and θ_j are long-run total calorie effects.

Model (3) nests other dynamic specifications, such as first-order autoregressive (AR), partial adjustment (PA) and the static models, by imposing some parameter restrictions. If $\varphi_i = \theta_i$ is imposed on equation (3), we get the autoregressive model; if the restriction $\varphi_i = \sum \lambda_{ij}\theta_j$ is imposed, we get the partial adjustment model; and, finally, if $\lambda_{ij} = 1$ (if $i = j$), $\lambda_{ij} = 0$ (if $i \neq j$) and $\varphi_i = \theta_i$ are imposed, the result is the static model.

The different dynamic specifications are estimated for the five clusters using full information maximum likelihood (FIML) and some tests are carried out to determine which specification fits the data better. Because all alternatives are nested in equation (3), a likelihood ratio test has been used. In all clusters, the first-order autoregressive specification has not been rejected at the 1 per cent level of significance, which means that relative specific food products depend not only on present total calories but also on the previous total calorie intake (results are not included owing to space limitations). Finally, total calorie elasticities are calculated using the estimated parameters (Table 3).

All total calorie elasticities except fish are positive and significantly different from zero. The negative elasticities for fish are not significant. Positive values mean that, as total food calories increase, consumed calories from

TABLE 3   *Total calorie elasticities for different food products at mean values[a]*

	Cereals	Meat	Fish	Dairy	Fruits	Fats
Denmark	0.73**	0.77**	−0.43	1.83**	1.14**	1.11**
France	0.76**	0.75*	−1.5	1.70**	1.12**	1.14**
Great Britain	0.75**	0.72*	−1.95	1.70**	1.11**	1.12**
Finland	0.06	0.47**	0.11	3.13**	0.47**	1.09**
Ireland	0.15	0.32*	−1.08	3.25**	0.54**	1.08**
Norway	0.06	0.28	0.55	3.54**	0.53**	1.07**
Sweden	0.74**	0.05	1.67**	0.63*	3.04**	0.88**
Austria	0.76**	0.26	4.18**	0.49*	2.98**	0.89**
Netherlands	0.73**	0.17	3.15**	0.59*	2.74**	0.89**
Belg.–Lux.	0.75**	0.11	2.61**	0.40*	2.77**	0.91**
Germany	0.76**	0.30	2.14**	0.40*	2.73**	0.88**
Italy	1.12**	0.77*	−0.32	0.67**	1.12**	1.01**
Greece	1.13**	0.79*	−0.26	0.71**	1.09**	1.01**
Portugal	1.12**	0.79*	0.52	0.51*	1.09**	1.01**
Spain	0.71**	2.47**	1.78**	−0.93**	0.47*	1.66**

Note: [a]Two stars indicate that elasticity is significant at 1%; one star that it is significant at 5%.

different products also increase, more or less than proportionally depending on whether elasticities are greater or less than unity. In all countries, except for Italy, Greece and Portugal, cereals are losing relative importance in total food calorie consumption. Meat consumption is also losing weight in total consumption in all countries except for Spain. On the other hand, fruit and vegetables are increasing their relative importance, except for Finland, Ireland, Norway and Spain. It seems that consumers tend to replace products with high calorie contents (cereals, meat) with those with low calorie content (fruits and vegetables).

CONVERGENCE AND COINTEGRATION

The aim of this section is to ask whether food consumption behaviour is becoming standardized; or, in other words, to see if a convergence process is taking place as far as the reactions to changes in total calorie intake (elasticities) are concerned. There are different methods to measure convergence from which, in this paper, stochastic definitions for both convergence and fluctuations in long-term elasticities are used. These definitions are based on the recent developments in unit root tests and cointegration. Following Bernard and Durlauf (1995), it is possible to define convergence in elasticities as follows: if e_{ij} denotes total calorie elasticity for product i in country j and e_{iej} the average total calorie elasticity for all countries except for the cluster to which country j

belongs and for product i, then country j and the rest of the countries converge if the long-term forecast of elasticities for both groups become equal at a fixed time t. In the equation below, I_t is the information set at time t.

$$\lim_{h \to \infty} E(e_{ij,t+h} - e_{iej,t+h} / I_t) = 0 \qquad (4)$$

Following this definition, the natural way to test for convergence is to test for cointegration with cointegrating vector $[1, -1]$. If both elasticities are cointegrated, but with cointegrating vector different from $[1, -1]$, then it is said that both groups of countries' elasticities contain a common trend but do not converge.

Then, in order to test for convergence, first we have to test if the series of elasticities have unit roots and if they are integrated of the same order. The augmented Dickey–Fuller test (ADF) is used (Said and Dickey, 1984). The test has been sequentially implemented. First, for each series the presence of two unit roots (I(2)) is tested against I(1). If rejected, the null of a unit root is tested against stationarity. Owing to space limitations, only the results from the second step are included in Table 4, as the first test was rejected in all cases. In most cases, we fail to reject the null hypothesis of one unit root, so most series have to be differentiated to achieve stationarity. Only meats and fats elasticities in Great Britain, and cereals elasticities in Portugal and in the group of countries excluded from cluster 1, are stationary at the 5 per cent significance level. In cases where e_{ij} and e_{iej} are I(1) the next step is to test for cointegration. The maximum likelihood (ML) approach of Johansen (1988) and Johansen and Juselius (1990) has been used.

Johansen (1988) showed that a vector of p economic variables X_t may be represented as a VAR model:

$$X_t = \sum_{i=1}^{k} \pi_i X_{t-i} + u_t \quad t = 1, 2 \dots, T$$

The number of cointegration vectors (r) is given by the rank of a $\prod$ matrix defined by $\prod = I - \pi_1 - \pi_2 - \dots - \pi_k$, where I is an identity matrix of order p. When the rank of matrix $\prod$ is r with $r < p$, r stationary lineal relationships among the variables of the X_t vector exist. In this case, the matrix $\prod$ can be decomposed in the product of two matrices $\prod = \alpha\beta'$, where β is a matrix of the long-run parameters and α is a matrix of coefficients which indicates the speed of adjustment after a shock in the long-run equilibrium. The Johansen (1988) procedure starts with the estimation of the following autoregressive vectors:

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_{0i} \Delta X_{t-i} + V_{0t}$$

$$\Delta X_{t-h} = \sum_{i=1}^{k-1} \Gamma_{1i} \Delta X_{t-i} + V_{1t}$$

(5)

TABLE 4   *Augmented Dickey–Fuller test on elasticities*

	CEREALS	MEAT	FISH	DAIRY	FRUITS	FATS
Excl. clus. 1	$\tau_\tau = -3.82\ (2)*$	$\tau_\mu = -1.31\ (0)$	$\tau_\mu = -1.25\ (1)$	$\tau_\mu = -1.27\ (2)$	$\tau = -0.45\ (1)$	$\tau = -1.57\ (0)$
Denmark	$\tau = -0.11\ (0)$	$\tau_\mu = -0.48\ (0)$	$\tau = -0.62\ (1)$	$\tau_\mu = -0.77\ (0)$	$\tau_\mu = -2.9\ (0)$	$\tau_\tau = -2.61\ (1)$
France	$\tau = -1.71\ (0)$	$\tau_\mu = -1.47\ (1)$	$\tau = -1.08\ (3)$	$\tau = -0.77\ (0)$	$\tau_\mu = -1.21\ (2)$	$\tau_\mu = -1.02\ (1)$
G. Britain	$\tau_\mu = -2.69\ (0)$	$\tau_\tau = -4.1\ (3)*$	$\tau = -0.40\ (0)$	$\tau_\mu = -0.3\ (0)$	$\tau = -0.71\ (1)$	$\tau_\mu = -3.5\ (0)*$
Excl. clus. 2	$\tau_\mu = -1.87\ (0)$	$\tau_\mu = -1.81\ (0)$	$\tau_\mu = -1.18\ (0)$	$\tau_\mu = 1.74\ (0)$	$\tau = -0.42\ (1)$	$\tau = -1.59\ (0)$
Finland	$\tau_\mu = -2.35\ (0)$	$\tau_\tau = -3.07\ (2)$	$\tau_\mu = -2.23\ (2)$	$\tau_\mu = -1.12\ (3)$	$\tau_\mu = -0.78\ (0)$	$\tau_\mu = -0.66\ (0)$
Ireland	$\tau = -1.06\ (0)$	$\tau_\mu = -1.51\ (0)$	$\tau_\tau = -1.82\ (2)$	$\tau_\mu = -1.36\ (0)$	$\tau = 0.11\ (0)$	$\tau = -1.27\ (0)$
Norway	$\tau = -0.21\ (1)$	$\tau_\mu = -2.86\ (3)$	$\tau_\mu = -1.2\ (1)$	$\tau_\tau = -0.57\ (3)$	$\tau = -0.36\ (0)$	$\tau_\mu = -1.01\ (2)$
Excl. clus. 3	$\tau_\mu = -2.68\ (1)$	$\tau_\mu = -1.93\ (0)$	$\tau_\mu = -0.85\ (0)$	$\tau_\mu = -1.15\ (2)$	$\tau = -0.26\ (0)$	$\tau = -1.59\ (0)$
Sweden	$\tau = 0.03\ (0)$	$\tau = -0.84\ (0)$	$\tau = -0.09\ (2)$	$\tau = -0.06\ (3)$	$\tau = -0.02\ (0)$	$\tau = -1.11\ (0)$
Austria	$\tau_\mu = -1.71\ (0)$	$\tau_\mu = -2.85\ (0)$	$\tau_\mu = -0.04\ (2)$	$\tau = -0.14\ (0)$	$\tau = -0.22\ (1)$	$\tau_\mu = -2.55\ (1)$
Netherlands	$\tau_\mu = -1.33\ (0)$	$\tau_\mu = -2.13\ (1)$	$\tau = 0.11\ (0)$	$\tau = -0.07\ (0)$	$\tau = -0.91\ (1)$	$\tau = -0.59\ (0)$
Belg.–Lux.	$\tau = -1.65\ (2)$	$\tau_\tau = -2.87\ (3)$	$\tau = -0.85\ (1)$	$\tau = -0.41\ (2)$	$\tau = -0.34\ (0)$	$\tau_\mu = -1.19\ (0)$
Germany	$\tau = -1.05\ (2)$	$\tau_\tau = -2.67\ (1)$	$\tau_\mu = -1.29\ (0)$	$\tau_\tau = -1.32\ (0)$	$\tau_\mu = -1.95\ (1)$	$\tau = -1.01\ (2)$
Excl. clus. 4	$\tau_\mu = -2.51\ (1)$	$\tau_\mu = -1.44\ (0)$	$\tau_\mu = -0.29\ (1)$	$\tau_\mu = -1.12\ (2)$	$\tau = -0.35\ (1)$	$\tau = -1.57\ (0)$
Italy	$\tau_\mu = -0.46\ (0)$	$\tau_\mu = -1.71\ (1)$	$\tau = -0.84\ (0)$	$\tau_\mu = -1.91\ (0)$	$\tau_\mu = -2.05\ (0)$	$\tau_\mu = -1.43\ (1)$
Greece	$\tau_\mu = -1.47\ (1)$	$\tau_\tau = -1.78\ (5)$	$\tau = -0.63\ (0)$	$\tau_\mu = -2.24\ (0)$	$\tau = -0.23\ (0)$	$\tau = -1.19\ (0)$
Portugal	$\tau_\tau = -3.61\ (3)*$	$\tau_\mu = -2.06\ (0)$	$\tau = -0.77\ (0)$	$\tau_\mu = -0.31\ (3)$	$\tau_\mu = -1.71\ (1)$	$\tau = -0.467\ (0)$
Excl. clus. 5	$\tau_\tau = -3.51\ (2)$	$\tau_\tau = -2.45\ (0)$	$\tau_\mu = -0.79\ (0)$	$\tau_\tau = -0.46\ (3)$	$\tau = -0.18\ (1)$	$\tau = -0.09\ (0)$
Spain	$\tau_\mu = -0.52\ (1)$	$\tau_\mu = -2.75\ (1)$	$\tau_\mu = -0.86\ (0)$	$\tau = 0.02\ (0)$	$\tau = -0.90\ (1)$	$\tau = -1.59\ (0)$

Note: Critical values are shown in Fuller (1976) and for 5% level are: $\tau_\tau = -3,60$, $\tau_\mu = -3.00$ and $\tau = -1.95$; one star means the null hypothesis is rejected at 5%; the number of lags of the endogenous variable are in parentheses.

The R_{0t} and R_{1t} vectors of residuals from the above-estimated models are used to perform a likelihood ratio test (the trace test) to calculate the number of cointegration vectors in X_t. The null hypothesis is that at least r cointegration vectors exist and it is defined as:

$$T_r = -T \sum_{i=r+1}^{p} ln(1 - \lambda_i)$$

where λ_{r+1}, ... , λ_p are $p - r$ canonical correlations of R_{0t} with respect to R_{1t}. The distribution of this statistic is a multivariate version of the Dickey–Fuller distribution and depends on the number of $(p - r)$ non-stationary components under the null hypothesis. Critical values are provided in Johansen and Juselius (1990) and in Osterwald-Lenum (1992).

We apply this test to determine the number of cointegration relationships between the elasticity for each country and the average elasticity for the heterogeneous countries. Therefore the number of variables in our case is two. Then both variables will be cointegrated if we can accept that one cointegration vector ($r = 1$) exists. The number of lags included in equation (5) has been determined using the likelihood ratio test suggested by Tiao and Box (1981). The trace test results are shown in Table 5, where the values in parentheses are the number of lags. In most cases, the null hypothesis has not been rejected, which means that no cointegration relationship, and therefore no long-run equilibrium, exists. Only in the case of the meat elasticity can a cointegration relationship be accepted in all countries. However, the existence of a long-run equilibrium relationship is a necessary condition but not sufficient for convergence. As mentioned before, the cointegrating vector must be [1,–1].

Johansen and Juselius (1990) developed several methods to make specific hypothesis tests concerning the size and relative characteristics of the β and α coefficients. The hypothesis on the β takes the form: $\beta = H\phi$, where H is a design matrix with dimension $p \times s$ ($r \le s \le p$) and s is the number of β coefficients that are not restricted. The statistic test is $-2\ ln\ (Q) = T \sum ln\ [(1 - \lambda_i^*)/(1 - \lambda_i)]$, where $i = 1, 2, ... , 5$, and λ_i^* and λ_i are eigenvalues generated by the model with and without restrictions, respectively. The test is distributed as $\chi^2_{r(p-s)}$.

Cereal elasticities for Austria and Spain have a long-run relationship with the rest of the countries. However, the null hypothesis that the cointegrating vector is [1,–1] is rejected, so both countries show a common trend but do not converge in elasticities. More cointegration relationships have been found among meat elasticities. However, only in the case of Denmark and Greece can we fail to reject the null of convergence at the 5 per cent level of significance. If the significance level was 1 per cent, Norway and Austria would also show a trend to convergence in meat elasticities with the rest of countries. It is important to mention again that convergence in this case means that meat consumers in all European countries will react in the same way to changes in total calorie intake. That does not mean that meat calorie shares will equalize across countries.

In the case of fruits and vegetables and fats, no long-run relationships have been found; that is, elasticities move independently. Finally, only Austria, in

TABLE 5 *Cointegration (trace statistic) and convergence test on food elasticities*

H_0:	Cereals $r=0$[a]	$r\le1$	$[1,-1]$[b]	Meat $r=0$	$r\le1$	$[1,-1]$	Fish $r=0$	$r\le1$	$[1,-1]$	Dairy $r=0$	$r\le1$	$[1,-1]$	Fruits $r=0$	$r\le1$	$[1,-1]$	Fats $r=0$	$r\le1$	$[1,-1]$
Denmark	—	—	—	27.4(2)*	5.42	3.49	14.81(2)	5.26	—	15.66(2)	2.63	—	12.2(2)	1.29	—	12.2(2)	4.32	—
France	—	—	—	19.0(2)	7.20	—	37.10(4)*	3.58	28.67**	22.60(2)*	9.15	11.15**	14.63(2)	5.62	—	18.0(2)	5.82	—
G. Britain	—	—	—	—	—	—	15.76(2)	4.23	—	15.39(2)	2.7	—	9.35(2)	1.20	—	—	—	—
Ireland	15.4(2)	4.74	—	19.0(2)	3.45	—	9.51(2)	3.07	—	7.58(2)	1.09	—	18 (2)	0.42	—	11.5(2)	4.11	—
Finland	16.9(2)	4.29	—	25.3(2)*	4.81	6.07**	31.6(2)*	3.35	19.42**	13.08(2)	2.79	—	17.34(2)	2.73	—	12.7(2)	4.3	—
Norway	10.8(2)	2.98	—	28.0(2)*	8.72	5.13*	7.13(2)	2.01	—	12.36(4)	3.01	—	7.14(2)	0.58	—	12.9(2)	3.72	—
Sweden	15.0(2)	4.97	—	21.2(2)*	4.11	9.12**	10.72(2)	1.67	—	20.30(2)*	3.3	15.86**	8.88(2)	2.44	—	14.8(2)	4.11	—
Netherlands	12.3(2)	1.73	—	24.8(2)	5.59	8.27**	9.78(2)	2.71	—	19.00(2)	5.36	—	7.71(2)	1.15	—	9.6(2)	3.72	—
Belg.-Lux.	12.0(2)	1.02	—	30.1(2)	8.87	12.28**	11.99(2)	1.19	—	6.61(3)	2.39	—	9.49(2)	2.18	—	11.6(2)	3.34	—
Austria	31.8(2)	7.41	10.13*	22.7(2)	4.68	5.98*	21.9(3)	9.14	1.40	17.25(2)	3.13	—	7.91(2)	1.04	—	17.5(2)	4.23	—
Germany	17.1(2)	6.25	—	25.8(2)	7.16	8.66**	9.62(2)	1.36	—	19.00(2)	3.89	—	14.44(2)	5.95	—	14.9(2)	6.93	—
Greece	17.5(2)	3.81	—	20.0(2)	5.90	0.22	12.29(2)	5.42	—	23.80(2)	7.19	14.87**	11.3(2)	0.51	—	19.0(2)	7.02	—
Portugal	—	—	—	19.0(2)	4.40	—	8.49(2)	2.71	—	24.70(4)	3.62	1.40	12.79(2)	2.18	—	13.2(2)	5.22	—
Italy	19.0(2)	4.97	—	19.0(2)	8.10	—	10.32(2)	2.82	—	26.20(2)	6.34	18.57**	8.03(2)	0.75	—	16.5(2)	5.17	—
Spain	23.7(2)	7.64	11.24*	27.8(2)	5.38	10.43**	12.01(2)	2.55	—	17.43(2)	5.89	—	11.31(2)	3.44	—	10.4(2)	2.53	—

Notes: [a]Critical values for the trace test are on Osterwald-Lenum (1992); one star means that a hypothesis is rejected at 5%.

[b]The null hypothesis is that the cointegrating vector is $[1,-1]$. Critical value at the 5% is: $\chi^2 (2)=5.99$. One star means that restrictions are rejected at 5% and two stars means rejection at 1% level of significance.

the case of fish, and Portugal, in the case of milk and dairy products, show a convergence process in elasticities with respect to the rest of the countries and, in a few cases, the existence of a common trend (but not convergence) is not rejected.

CONCLUSIONS

Total food consumption, and its distribution among different food products, have been changing in the last few years. Some authors suggest that this evolution is leading to a standardization of food diets across European Union countries. Nevertheless, after testing whether the allocation of total food calorie intake among different products will converge in the long run, the conclusion is that, in general terms, this is not the case. In most cases, total calorie elasticities between specific products and the average do not show a long-run relationship.

We can conclude that, at this aggregate level covering broad food categories and countries taken as whole rather than being regionally differentiated, there are few convergence relationships. Those which have been detected are for animal products (meat, fish and dairy products). The same method should be applied at a more disaggregated level to discover whether results which challenge this broad conclusion could be obtained.

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