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Economic Development and Food Consumption in Mediterranean Countries[1]

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Abstract. This paper investigates the relationship between food consumption and economic development in countries belonging to the Mediterranean area. Differences in food diets are analyzed using per capita calories intake data. Results provide a better knowledge of the dynamic evolution of consumption patterns and the non-existence of a convergence towards a common diet.

Keywords. Food consumption – Convergence – Economic development – Mediterranean area.

Résumé. *Cet article étudie le rapport entre la consommation alimentaire et le développement économique dans les pays méditerranéens. Les différences dans les régimes alimentaires sont analysées à partir des apports caloriques par habitant. Les résultats permettent une meilleure connaissance de l'évolution des tendances de la consommation alimentaire et montrent l'inexistence de convergence vers une alimentation commune.*

Mots clés. *Consommation alimentaire – Convergence – Développement économique – Pays méditerranéens.*

I – Introduction

Traditionally, the existence of a "Mediterranean diet" has been justified as an agglutinating factor for Mediterranean countries, and at the same time, as something that differentiates them from other geographical regions. However, as Titos (1992) states, to speak about the existence of only one diet, common to all Mediterranean countries, seems inadequate. Independently from common agro-climatic factors and similar productions, the development level reached has a remarkable influence on the diet composition.

This paper aims at analyzing the modifications that economic development brings about in the population's diet, based on the study of caloric intake per inhabitant. To this purpose, per capita data are used, covering a wide range of countries with different economic development levels, such as the Mediterranean countries. All of them show a positive relation between the increase of the real per capita income and the access to a diet richer in calories, together with an increase in the relative ratio of animal calories.

The study is organized as follows: first, the consumption evolution of total calories and animal calories is analyzed, fixing maximum thresholds for caloric intake. Secondly, an attempt is made to represent the trajectory of the diet in the different Mediterranean countries on a factor plan. Also, the behaviour of these countries is grouped according to the similarities they show in diet composition expressed in calories per capita. Then, it determines the possible convergence of diets among the different countries, according to a set of indicators. Finally, some conclusions are advanced about the results obtained.

II – Relation between Diet and Economic Growth in Mediterranean Countries

Every process of economic development is in general linked to a more satisfactory situation as for the nutritional quality of the population's diet (Reig, 1992). Nevertheless, there is clear evidence (Senauer, 1990) that improvement in nutritional terms, measured as the increasing availability of calories, is not usually proportional to the income increase. Furthermore, in every process of economic development,

food expenditure elasticity of income tends to be higher than the calory intake elasticity. It can even be easily verified, if analyzing the evolution of the calory consumption in most of the developed countries, that the total of calories consumed reaches usually a maximum limit that is not exceeded when a given per capita income level is reached.

As the average development level of the population increases, what appears is a modification of the diet composition, that is to say, of the origin of the calories consumed. The demand of starch (grains, roots and tubers) normally decreases as there is an increase of consumption of other products from plant origin, such as fats and oils, pulses, fruits, vegetables and sugar. To this follows an increase in the demand of milk, meat and eggs. Finally, in the richest societies, another important qualitative change takes place, in the sense that an increasing share of the food budget is spent in out-of-home meals and in paying for operations related to food processing and marketing.

Table 1 shows the evolution of the calories consumed in different Mediterranean countries, the proportion of animal calories, and the per capita income level. Since it was not possible to collect homogeneous information (in a common currency) on the GNP/per capita for each country along the study period, an index has been prepared that takes the value 100 for the base period. The data source for calories and GNP/per capita (in constant values for 1980) is FAO.

As it can be observed, in almost all countries there has been an increase in the amount of calory consumption together with the increase in the level of economic development. In real terms, only Lebanon, Libya, Turkey and Yugoslavia had lower income levels in the period 1988-90 than in 1968-70. Likewise, a deceleration can be noticed in the calory consumption increase, the average value being around 3,250 calories. Greece is the country with the highest caloric diet, while Algeria is placed in the opposite extreme. The main difference existing between developed and developing countries lays in the percentage of animal calories out of total calories. This fact is due to the nil consumption of pork meat in Arab countries. In France, about 40% of the calories come from animal origin. For Spain the percentage is over 32%, while in Greece, Italy and Portugal, it is around 25%. In Arab countries, this figure hardly reaches 10%.

Finally, a calculation has been made on what the maximum consumption of total and animal calories would be for each country if the economic growth rate were maintained. To that purpose, an inverse function has been estimated for each country, relating either total or animal calories with the inverse of the per capita income for that country. The results are shown in the last column of *Table 1*[2]. For Israel, Lebanon, Libya, Turkey and Yugoslavia, no values have been estimated due to the lack of complete information for the 30-year period considered in the study.

Results seem to indicate that most of the countries present threshold values close to the calory consumption reached during the 1988-90 period. These values are even closer for more developed countries which caloric consumption has barely increased in recent years.

Concerning the threshold estimated for animal calories, it is worth mentioning the differences between North and South Mediterranean countries. For the former, there is a higher than proportional increase with respect to total calories; for the latter, the increase is proportional.

III – Evolution of the Diet in Mediterranean Countries

When studying the diet in Mediterranean countries, two questions arise: "Does a common Mediterranean diet really exist?" and "will food consumption patterns in Mediterranean countries tend to become more similar over time?". In a certain way Titos (1992) answers both questions through a shift-share analysis.

Our study will analyze diet evolution in Mediterranean countries during the 1968-70, 1978-80 and 1988-90 periods by means of the STATIS method (*Structuration des Tableaux à Trois Indices de la Statistique*).

The STATIS method analyzes simultaneously the same individuals characterized by a set of quantitative indicators at different time periods.

In our case, we analyzed 15 Mediterranean countries characterized according to the calories consumed of the following products: (1) cereals, (2) tubers and pulses, (3) meat and fish, (4) vegetable oils, (5) animal fats, (6) milk, (7) eggs, (8) sugar and (9) fruits and vegetables. First, global evolution is analyzed (inter-structure), comparing the data corresponding to the periods 1968-70, 1978-80 and 1988-90 and calculating the compromise matrix. Then, the evolution of the diets is studied from the first three principal axes derived from the Principal Components Factor Analysis of the compromise matrix that explain 76% of the matrix inertia. Correlation coefficients of variables with principal axes are presented in *Table 2*.

The first axis explains 43% of variance. This axis is positively correlated to the proportion of cereal calories consumed and negatively correlated to that of meat and fish, milk and eggs. In other words, it constrasts high cereal consumption with low consumption of animal products. Besides, these correlations, except oscillations, remain constant over long periods of time, with the exception of dairy products that show a slight decrease.

The second axis accounts for 21% of variance of the compromise and presents a positive correlation with animal fat consumption and a negative one with the consumption of vegetable oils, and fruits and vegetables. This axis opposes the Mediterranean countries with heavy and low consumption of animal fats.

The third principal axis accounts for 12% of the variance and is negatively correlated to the proportion of sugar consumption and positively, but at a lower degree, with tuber and pulses consumption. In this case, it can be noticed that these correlations decrease over the period considered, which means that the differences among countries are subduing.

The next step is to study the diet similarities among Mediterranean countries through a cluster analysis of the 15 countries from the coordinates of the first 3 axes of the compromise. This analysis permits to classify Mediterranean countries into 6 homogeneous groups, as shown in *Figure 1*. As it can be observed, there are 4 countries which diets are different from the others. Then, the remaining countries are subdivided into 2 groups with similar diets among them. These are the European countries, traditionally considered as Mediterranean (Greece, Italy, Portugal and Spain), and the arab countries (Maghreb, Egypt, Turkey, Lebanon and Libya).

Finally, we analyze the evolution of the diets of Mediterranean countries from the trajectories that represent the evolution of each observation with respect to the evolution of an "average" individual. Trajectories for the different countries in the first two principal axes are shown in *Figure 2*.

The horizontal axis corresponds to the first factor that, as indicated before, constrasts countries with high cereal consumption and low animal calory consumption (meat and fish, dairy and eggs). The vertical axis corresponds to the second factor that separates countries with high consumption of animal fats and low of vegetable oils, and fruits and vegetables. No big shifts are observed along the horizontal axis. This means that the consumption of products related to this axis (cereals, meat and fish, milk and eggs) in the countries considered has evolved in a very similar way to average behaviour. On the contrary, numerous shifts along the vertical axis have occurred. The upward shifts of Algeria and Egypt and the downward shifts of Tunisia and Morocco are noteworthy. This means that the evolutions in consumption of animal fats, vegetable oils, and fruits and vegetables are quite different among countries.

The main features that can be observed are that France reaches the highest consumptions of animal products but which importance has been decreasing slightly over time. Yugoslavia has a high consumption of animal fats that increased slightly in the 70s to decrease again in the 80s. Countries in the bottom left quadrant are characterized by low consumption of animal fats and cereals and heavy consumption of animal products, vegetable oils, and fruits and vegetables. Spain and Portugal have experienced a decrease in animal fat consumption by the end of the 70s, maintained stable since then. On the contrary, in Greece and Italy, animal fat consumption increased during the 70s, reaching a stationary level for Italy and maintaining the increase for Greece during the 80s.

Lebanon has not shown variations during the 70s and its main feature was to be at an intermediate situation regarding consumption of any food product. During the 80s it registered a considerable shift and at present its position is closer to that of Portugal.

In the bottom right quadrant are placed Tunisia, Turkey and Libya that are characterized by low animal fat and animal products consumption and high consumption of all types of plant products. It is worth stressing the decreasing trend in animal fat consumption experienced by Turkey. Algeria and Egypt were positioned within this quadrant at the end of the 60s but the evolution of their diet has been shifting them progressively towards the top quadrant, due to an increase in animal fat consumption.

IV – Are Mediterranean Countries Converting towards a Common Diet?

A well established principle of the neoclassical growth theory is that economies or regions with identical basic parameters must converge in per capita income over time. To achieve that, regions that initially presented a lower per capita income should grow at a faster rate than those that at the beginning had a higher per capita income. This part of the theory is known as "Σ–convergence" according to the terminology by Barro and Sala-i-Martín (1992).

A second concept of convergence makes reference to the scattering of the per capita income at a given moment in time. From that perspective, there is convergence if the scatter decreases over time. This type of convergence is called Σ–convergence in the terminology of the authors mentioned above, and was applied, among others, by Baumol (1986).

In this section, we have used these two concepts of convergence in order to measure if it can be stated that there is one common Mediterranean diet or on the contrary, if there is divergence among diets. To this purpose, we have analyzed total caloric consumption and the percentage over total calories corresponding to cereals, meat and fish, vegetable oils, animal fats, fruits and vegetables, and dairy products.

"Σ–Convergence" is derived from the estimation of the convergence equation, where the average growth rate of the total caloric consumption per capita in the interval (t, t-T) (or the average growth rate of the percentage of calories provided by the different food groups considered) is expressed as:

$$(1/T)\log(Y_{it}/Y_{i,t-T}) = a - b\log(Y_{i,t-T}) + D_i + U_{i,t-T} \qquad (1)$$

where: $Y_{i,t}$ is total caloric consumption per capita in country i and year t.
$Y_{i,t-T}$ is total caloric consumption per capita in country i and year t-T.
T is the time period.
$b = (1-e^{-T})$, being the convergence rate.
$U_{i,t-T}$ is the random error.

Additionally, a dummy variable (D_i) has been introduced to attempt to capture the advantages of the positioning of European Community countries. So, the variable takes the value 1 for France, Greece, Italy, Portugal and Spain.

The case of presence (or absence) of Σ–convergence, understood as greater growth in the 1970-90 period of calories consumed in the Mediterranean countries that initially had a poorer diet, is presented in *Table 3*. Regarding consumption of total calories, it can be stated that in fact, the countries that in 1970 had the lowest caloric diet grew, as average for the period considered, at higher rates than the countries that had a richer caloric diet (the regression line presents a negative slope and is statistically significant). Convergence rate is estimated at 7.3% per year.

Nevertheless, this result does not permit to establish the existence of diet convergence in Mediterranean countries. From our viewpoint, what should be calculated is the presence of convergence as for consumption of given groups of foods. Table 3 presents also the results of the regressions performed for different products. For the 1970-90 period, all slopes are negative except those corresponding to dairy products. However, only that for vegetable oils is statistically significant (in this case, the convergence rate is 1,4% per year). This result indicates that we cannot strictly speak of convergence of the diets of Mediterranean countries.

Although the convergence process is a long run phenomenon, it is interesting to break up the whole period into subperiods in order to analyze whether the said process has been homogeneous over time. To do so, we have divided the period considered into two subperiods of equal length: 1970-80 and 1980-90. The results of the estimations appear in *Table 3*.

Regarding total calories, the convergence process is statistically significant in both subperiods, although the rate is greater in the second decade (8.5% in the 1980-90 period versus 7.1% in 1970-80). The results for individual products are not statistically significant. In the 1970-80 period divergences can be observed for the consumption of dairy and for meat and fish (although the latter is not significant). For 1980-90, there is some convergence in the consumption of Mediterranean products such as vegetable oils, fruits and vegetables.

The second concept (Σ–convergence), which presents convergence as reduction of scatter among countries for total calory consumption and for some food groups appears in *Figure 3*. Reduction is confirmed, for the entire period, of inequalities in caloric intake among Mediterranean countries. As for the relative importance of the different products in diet composition for the various countries, results confirm those obtained in *Table 3*.

V – Final Considerations

This study is an attempt to verify if there exist different diets in what has commonly been called "Mediterranean diet". In spite of similar natural conditions, diets in North and South countries are different. Development level, location and cultural diversity account for these variations.

It is, nevertheless, observed that as the development level of a country increases, the per capita caloric intake increases as well although, once a certain per capita income level is reached, consumption turns stable and even decreases in certain cases.

One of the outcomes of this study, that we believe of particular interest, is that not only there exist several Mediterranean diets, but that over time, and in spite that the amount of total calory consumption is similar, diets do not converge, except for some typically Mediterranean products. This result must be taken into consideration when attempting to plan food policies for Mediterranean countries or when reorienting production in these countries.

Notes

1. Results from this paper were supported by the Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA).
2. A more detailed analysis of the regressions can be requested from the authors. A problem met for certain countries was self-correlation. The solutions used to correct it distorted the results; so, taking into account that estimates were unbiased, the equations have been estimated by Ordinary Least Squares.

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Table 1. Evolution of calory consumption, of plant calory share and of per capita income in different Mediterranean countries

	1968-1970			1978-1980			1988-1990			Maximum consumption	
	Total Calories	Animal Calories (%)	Per Capita GNP	Total Calories	Animal Calories (%)	Per Capita GNP	Total Calories	Animal Calories (%)	Per Capita GNP	Total Calories	Animal Calories (%)
1. Algeria	1819	9,8	100	2531	10	118	2944	10,9	114	418	499
2. Egypt	2431	7,3	100	2990	7,3	175	3310	7,7	238	3895	329
3. France	3330	35,4	100	3424	39	134	3592	38,5	158	3709	1644
4. Greece	3123	19,1	100	3423	24,1	161	3775	25	183	4074	1152
5. Israel	2986	20,1	100	3005	21,6	122	3219	20,5	94	/	/
6. Italy	3322	18,1	100	3558	22,7	130	3498	25,7	162	3971	1248
7. Lebanon	2377	14,2	100	2609	15,8	241	3142	16	33	/	/
8. Libya	2350	14	100	3458	16,2	66	3293	14,1	39	/	/
9. Morocco	2344	8,1	100	2699	7	146	3030	6,1	163	3738	206
10. Portugal	2988	15,9	100	2915	19,4	150	3342	23,6	188	3413	837
11. Syria	2345	11,6	100	2816	14,8	143	3122	12	203	3594	495
12. Spain	2793	22,3	100	3242	27,5	135	3472	32,2	205	3882	1488
13. Tunisia	2247	7?7	100	2762	8?5	141	3122	9	174	3728	352
14. Turkey	2814	10,4	100	3067	9,7	74	3196	7,6	76	/	/
15. Ex-Yugoslavia	3318	18,4	100	3526	23,3	87	3545	23,8	93	/	/

Table 2. Correlation coefficients of the variables with the first 3 principal axes of the compromise

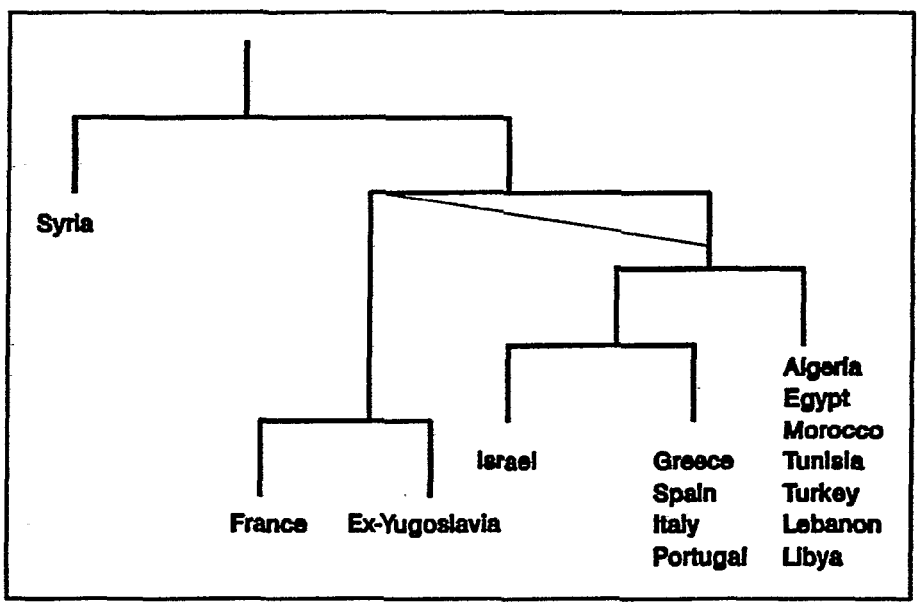
	Cereals	Tubers & Pulses	Meat & Fish	Vegetable Oils	Animal Fats	Milk	Eggs	Sugar	Fruits & vegetables
AXIS 1									
1970	0,97	-0,62	-0,88	-0,52	0,06	-0,87	-0,78	-0,11	-0,34
1980	0,97	-0,52	-0,91	-0,55	-0,04	-0,88	-0,83	0,25	-0,16
1990	0,98	-0,25	-0,89	-0,58	-0,17	-0,83	-0,79	0,45	-0,34
AXIS 2									
1970	-0,09	0,13	0,31	-0,72	0,92	0,22	-0,02	0,17	-0,6
1980	-0,09	-0,06	0,27	-0,74	0,9	0,21	0,01	0,11	-0,62
1990	-0,03	-0,18	0,18	-0,68	0,9	0,28	-0,00	0,13	-0,62
AXIS 3									
1970	0,00	0,63	0,00	0,02	0,04	-0,0	-0,4	-0,79	-0,14
1980	-0,02	0,54	0,1	0,02	-0,14	-0,17	-0,38	-0,72	-0,17
1990	-0,05	0,43	0,24	0,01	0,02	-0,14	-0,44	-0,69	-0,29

Table 3. Diet convergence for Mediterranean countries (1970-1990)

	a	b	1970-1990 β	Y	R^2
Total Calories	**0,3***	**-0,037***	**0,073***	**0,0025***	**0,94**
Cereals	-0,0078*	-0,0042	0,0044	-0,0069**	0,26
Meat & fish	-0,0097	-0,0031	0,0032	0,019*	0,35
Vegetable oils	-0,016*	-0,012*	0,014*	0,001	0,51
Animal fats	-0,016	-0,0035	0,0037	0,013	0,1
Fruits & vegetables	-0,016	-0,0057	0,0061	0,0005	0,08
Dairy	0,022	0,0076	-0,007	0,0044	0,22
	a	b	1970-1980 β	Y	R^2
Total Calories	**0,41***	**-0,051***	**0,075***	**0,00012**	**0,69**
Cereals	-0,012*	-0,009	0,0096	-0,008**	0,18
Meat & fish	0,026	0,0065	-0,006	0,01	0,33
Vegetable oils	-0,027	-0,016**	0,017**	0,048	0,2
Animal fats	0,0096	-0,002	0,0021	-0,015	0,06
Fruits & vegetables	-0,0094	-0,0029	0,003	-0,012	0,16
Dairy	0,037*	0,0099*	-0,009*	0,0009	0,33
	a	b	1980-1990 β	Y	R^2
Total Calories	**0,45***	**-0,055***	**0,085***	**0,0056***	**0,83**
Cereals	-0,003	-0,0004	0,0004	-0,008	0,12
Meat & fish	-0,035	-0,0098	0,01	0,026	0,21
Vegetable oils	-0,03	-0,02*	0,022**	0,001	0,25
Animal fats	-0,026	-0,00088	0,00088	0,04*	0,52
Fruits & vegetables	-0,061**	-0,022**	0,025**	0,011	0,28
Dairy	-0,0007	0,003	-0,0029	0,008	0,07

* significant parameters at 5%.
** significant parameters at 10%.

Figure 1. Dendrogram of Mediterranean countries



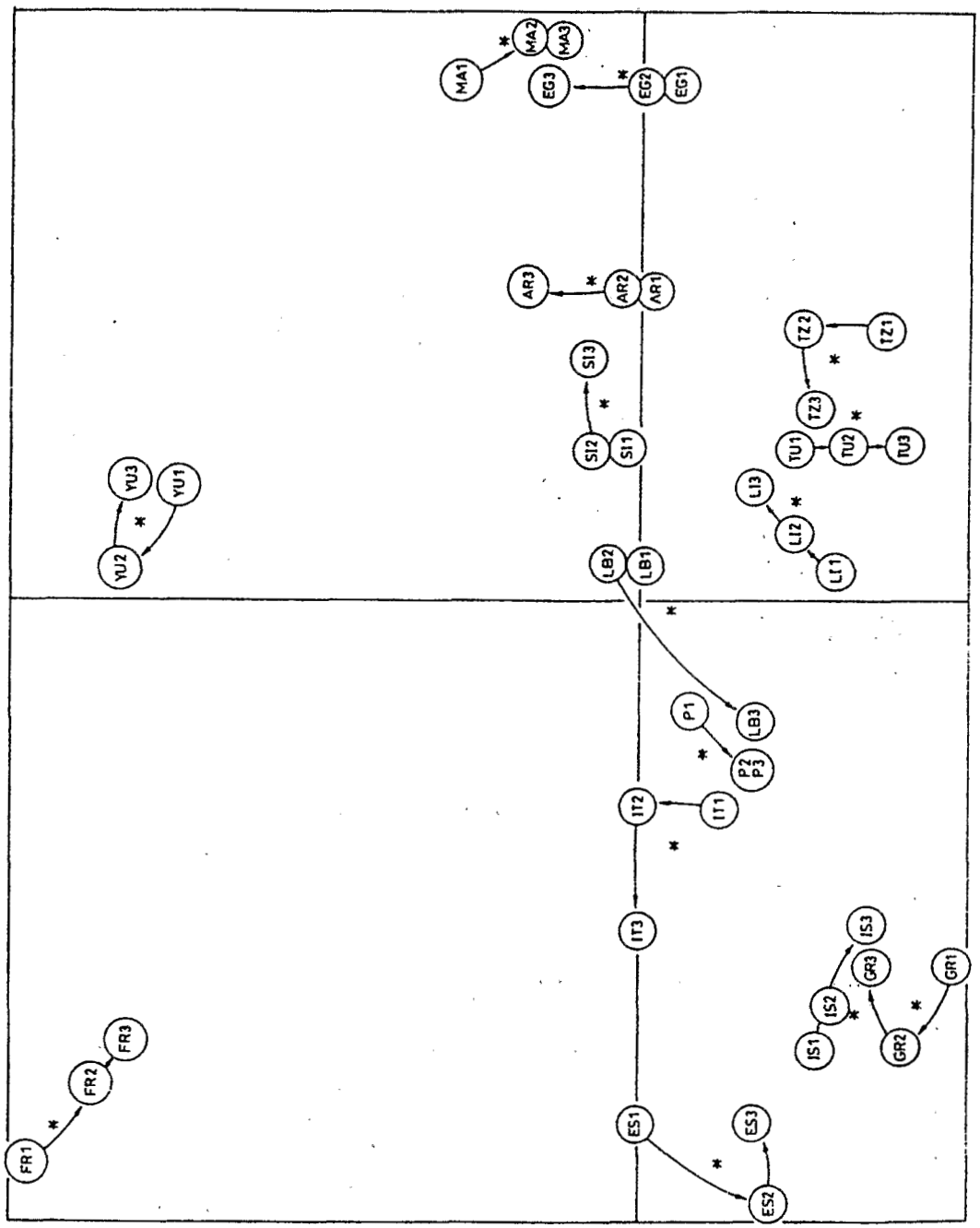


Figure 2. Representation of the trajectories of Mediterranean countries

Figure 3. Sigma-convergence of the diet structure across Mediterranean countries (1970–1990)