DIETARY EVOLUTION OVER TIME IN EUROPE, BETWEEN CYCLOPS AND PHAECIANS . AN OUTLOOK ON THE ROLE OF SUPPLY-SIDE FACTORS IN DRIVING CHANGES IN THE FOOD PATTERNS

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Abstract

The present study intends to shed light, both from a descriptive and investigative point of view on the dietary evolution taking place in Europe during last 45 years, using secondary data from FAO FBS, which can cover the entire time span considered and allow for several extrapolation and time-series analysis, differently than single survey data.. After a clustering of selected european national diets, using specific metrics with respect both to internal and external variety (as measured by appropriate indicators), we intended to check the actual distance that average, national diets have in front of the so called Food Pyramid, which consists in a balance of several food items in adequate proportions and in fact glorifies the healthy virtues of the Mediterranean Diet as a reference model among food patterns.

Furthermore, if several studies focussed strictly on the evolution of diet per-se, from a nutritional perspective- our purpose was to put it in context with economic and materialistic factors which could have a part in the explanation. In particular, our intention was to provide a focus on trade factor as explaining the changing diets.We tested with causality tests the hypotesis behind, in order to find relationship between economic factors and nutritional aspects.

Eventually, we propose a preliminar investigation about the role of GIs (Geographic Indication food products, such as PDO) in relation to globalised food patterns.

The results are interesting, and let the doors open for interpretations and further research.

Keywords: diets, evolution, clustering, food pyramid, Europe, trade, GI.

JEL codes: E37, Q18,

The increased consumption of meat, dairy products in many emerging countries is a matter of fact of recent years, as well as more in general, of animal fats and proteins (Speedy, 2003). By 2020, the share of developing countries in total world meat consumption is expected to expand from 52% currently to 63% (Delgado, 2003). A plenty of often related explanatory causes is apparent, and the principal can be conducted to income increase (Smil, 2002 Speedy, 2003 -allowing for more varied and caloric-dense diets); to the adoption of culturally driven dietary patterns (due to the sociological trickle down effects); to the deployment of long food chains and of global food players, which have an intrinsic advantage in standardising the diets worldwide and so far controlling the quantity and the price-level.

The same trend was somehow experienced before in the transition of Western countries during the passage to the mass-market society and the reconstruction after the Post II° World War (De Boer, 2005, Smil 2002). Here, wealth (Demand side) due to Policy plans (the Marshall one in Europe) and industrialization, along with the Green Revolution in agriculture (supply side), relying on an increasingly more mechanized agriculture, permitted to have a shift in the dietary patterns (Schmidhuber, 2003, Smil, 2002)

Even if the overall amount of calories available both in the USA and Europe to the final consumers slighlty decreased in last years (FAO, USDA), the burden of health illness is still increasing (overwight, obesity, diabetes, cardiovascular diseases, etc).

The frame is full of implications from a public health perspective, both for the charge of human lives losses (Schmidhuber, 2010), for increasing financial costs in charge to the tax-payers (Levy, 1995), both for the social consequences in term of discriminations and stigma of obesity (most of all when occurring during childhood). The Gordon Brown Cabinet estimated the direct and undirect costs of the malnutrition in the UK (CabinetOffice Uk, 2008[1]), while sources pretend food-illness responsible for at least a 7% of the European GDP (EC, 2006), while a systematic review stressed lesser values considering direct costs, whereas economic burdens ranged from 0.09% to 0.61% of each country's gross domestic product (GDP)(Riemenschneider et al. 2008).

Many programmes have started both at the European level and at the national levels to counteract against overwigth, obesity and linked ailments. If during last decades the focus was prevalently country-based, in more recent years the European Commission started in 2005 a more comprehensive approach based on a public-pivate partnership (the so called "European Platform for Action "Diet, Physical Activity and Health", -Robertson et al. 2007) even if it has been cricticised for the lack of real commitment or improvements along time by private actors (CityUniversity, 2005).

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1 Studies have estimated that food-related ill health cost the NHS £6 billion in 20022 (9% of its budget) and that malnutrition (mainly in the elderly) costs public services £7.3 billion. About 70.000 premature deaths could be avoided in response to simple and little changes in diets (less salt consumption, more fruit and vegetables consumption, etc).

Even if the diets respond to socio-economic gaps with pronounced differences among social classes (Deirala, 2000, Disdall, 2003), an outlook onto the more general burden in charge to national societies can be spotted by using aggregate-level data such as FAO Food Balance Sheets, which provide a basic proxy for the total caloric intake per capita, depending on the pertenence country.

We used a slightly different version of the FAO Consumption Similarity Index, in order to take into account real consumption similarity between diets of different countries.

The Consumption Similarity Index is a formula derived from the Michaely's formula (1962), at the outset used to measure trade flows, and after adapted (Schmidhuber, 2006) to be used to compare diets of one or more countries against the diet of a reference-country.

Furthermore for analytical purposes, we avoided large and comprehensive food classes (ie, vegetables, …) to prefer more detailed ones, which permit to better explain differences.

So far we included 50 items instead of the short-list of 29 suggested by FAO (*personal communication from FAO*).

Referring to 1961-2005 period, it is useful for defining tendencies of long term. Furthermore, FBS include a wide number of food categories, helpful to go in depth in countries' analysis, without simply referring to macronutrients or aggregate-level food categories. So far, it is possible to make reflection on real food choices and food patterns, outside any medicalisation of the food and technicalities of the language.

With regard to the choice of the countries, we selected south European countries which in the past proved to stay stick to the Mediterranean Diet parameters, and North European countries for the comparison sake. Along with this culturally based dietary patterns, those countries showed a resilient behaviour in front of globalization of the food supply chain, and differently from north European, continental countries, only recently evidenced a sharp increase in the retail concentration phenomenon. The analysis confronted the CSI of Italy, Portugal, Spain, Greece against the USA diet as benchmark for the "globalised", long chain derived US food supply.

We arbitrary selected USA due to their geopolitical supremacy, their cultural role in leading food consumptions styles (and changes) in the world, and last but not least, because of their role in the food chain not only as a big wheat producer in the world (the third after China and Europe in 2006), but as being the first world exporter(329.46.902 ton in 2006, FAO).

Fact which gives it a sort of "arbitrage" onto the food-currency worldwide, deciding if stock the crops or the sell on the market (deciding the quantity and hence the price). This reflects in the power to establish the price on the principal international board.

In parallel, we confronted exogenous variability of diets with internal variety of a country-specific diet over time. Variety means a lot for nutritionists and a varied diet is recommended as a general measure to achieve and maintain a good health status. Gini Index and Entropy were used as reference points for that.

Several studies pointed out differences about European countries diets *versus* other diets as present worldwide (Gems FAO, De Boer 2006), with changes over time acquiring momentum due to specific factors such as increased global food trade, food processing, dismantling of the CAP in Europe, International regulatory environment getting more and more homogeneous under WTO provisions and Scientific Assessment convergence (see EFSA meeting with FDA and other world agencies, Finardi 2010, *in press*).

The purpose of our study is twofold. First, we intend to investigate over time internal variability of national diets of a bundle of EU countries, namely, those belonging to the North Europe *versus* the South European ones. The variability so obtained is therefore confronted against an international benchmark, the USA diet, to assess convergence or divergence of national diets along decades.

Eventually, we proposed to estimate a casual relationship under the Vector Autoregressive Model/ Granger causality test with variables such as:

- (increased) food trade ratio (in particular, *prepared foods,* as one of the emerging features of globalised food chains);
- (declined) global food price index of selected food commodities.
- an Index of Food Trade Specialization (not exactly the Gruber Lloyd, which can only take a positive value) in order to check if material aspects (ability of food export) determined the stability, independence and somehow “hegemony” of a country-specific national diet.

First move, we used a modified version of the Consumption Similarity Index (CSI now forth) including 49 food items, in order to gain an appropriate level of detail. The CSI consists in a comparative ratio between 2 countries of calories derived from the same sources, and converted in a single indicator which takes the expression of:

$$CSI_{j,k} = 1 - \frac{1}{2}\sum_i \left| \frac{CAL_{ij}}{CAL_j} - \frac{CAL_{ik}}{CAL_k} \right| \qquad (1)$$

The CSI can provide insights on the exogenous variability of a national diet, but does not say anything with regard the overall variety and quality of a diet in itself. Since a varied diet is a policy making goal for nutritionists and repealed in several EC Regulations (1924/2006, 1925/2006, 353/2008) we intended to use concentration indexes too in order to assess the quality of North European and South European diets over time, starting with 1961 (the first year available in FAO/FBS)..

We used the Gini Coefficient, able to estimate the concentration.

$$\frac{G}{G_{\max}} = \frac{\sum_{i=1}^{m} f_i(1-f_i)}{1-\frac{1}{m}} = \frac{1-\sum_{i=1}^{m} f_i^2}{1-\frac{1}{m}}$$

(2)

Furthermore the entropy index was added. In theory of information entropy was introduced first by Claude E. Shannon in *A Mathematical Theory of Communication* (1948).

$$H(X) = \sum_{i=1}^{n} p(x_i)\, I(x_i) = -\sum_{i=1}^{n} p(x_i) \log_b p(x_i),$$

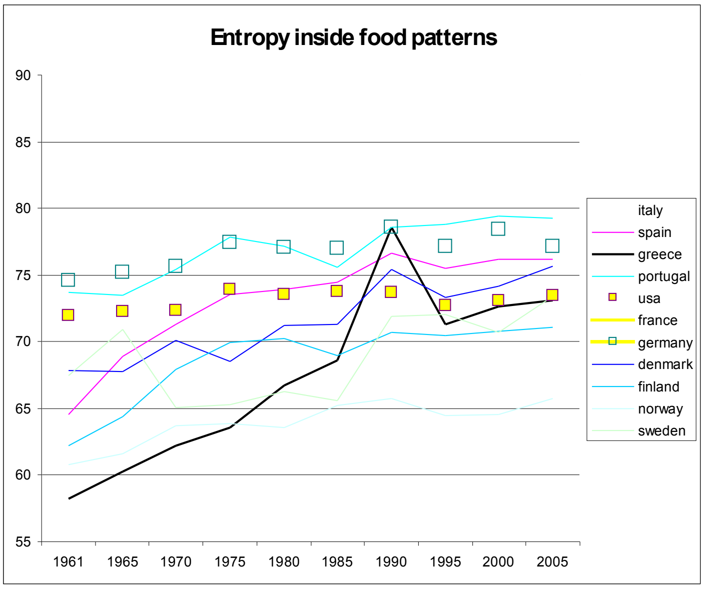
(3)

Whereas "p" is the probability mass function (pmf) which shows the expected values, and X a random variable (in our case, the calories sourced from any given food item), "I" the information content.

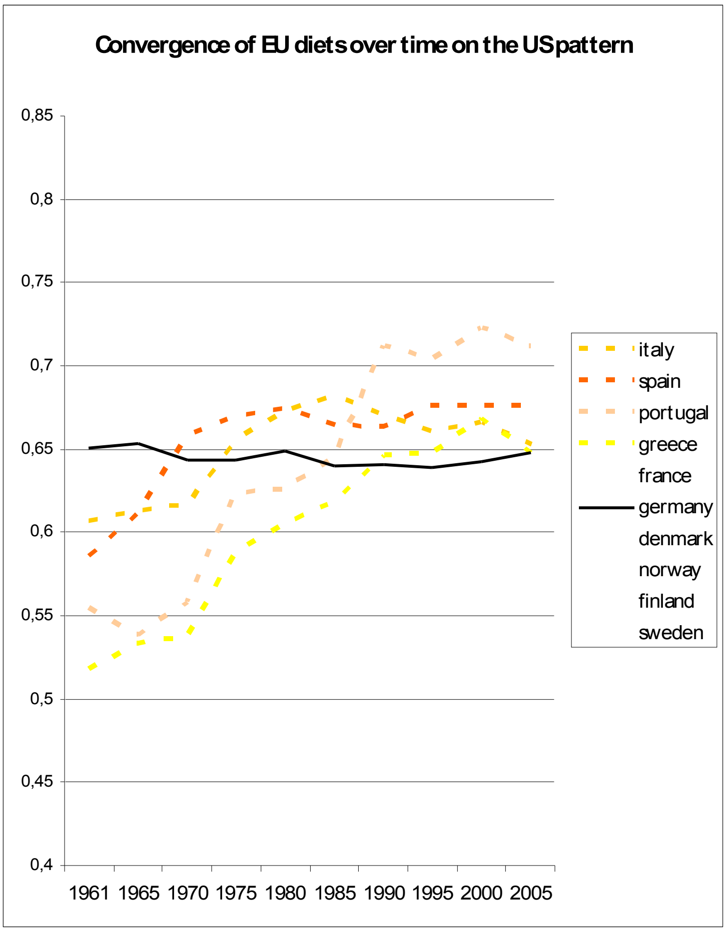
Entropy can be interpreted as follows: an increase in entropy means a loss in the information content. In our case, *if the same amount of calories could derive from each food items, the expected value for entropy would be 100*.

Even if any given situation needs specific assessment, from a general perspective we can consider the relative increase in entropy inside European diets as a measure of the overall caloric increase: food items previously less consumed augmented their caloric share (sugars, meat, fats).

-Fig. 1- Entropy of diet in selected European diets

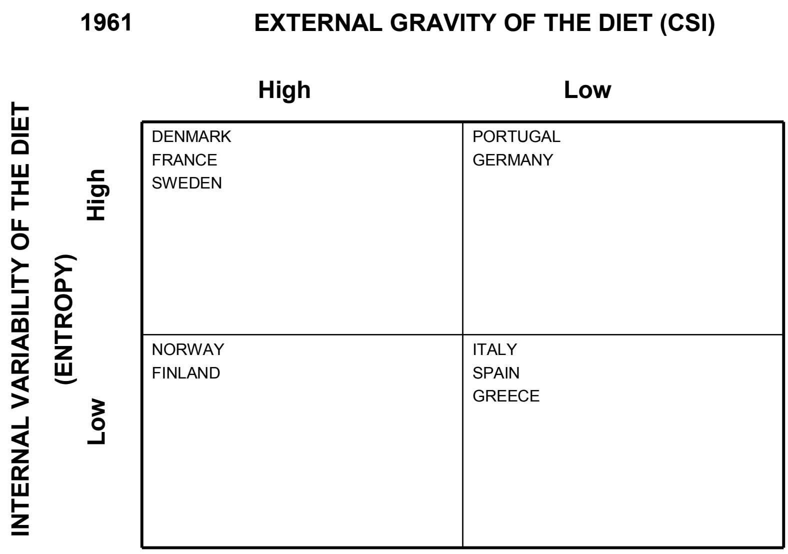


-Fig. 2- Consumption Similarity of diets in selected European countries



Eventually, and for clustering purposes, we could derive a matrix both for 1961 and 2005, showing the food trends behind and assuming 4 food models in Europe (**Fig. 3 and Fig. 4**)

-Fig. 3- 1961 Food Pattern clustering in selected European countries



-Fig. 4- 2005 Food Pattern clustering in selected European countries

2005 EXTERNAL GRAVITY OF THE DIET (CSI)

INTERNAL VARIABILITY OF THE DIET (ENTROPY)	High	Low
High	DENMMARK FRANCE	SPAIN PORTUGAL GERMANY
Low	NORWAY SWEDEN GREECE	ITALY FINLAND

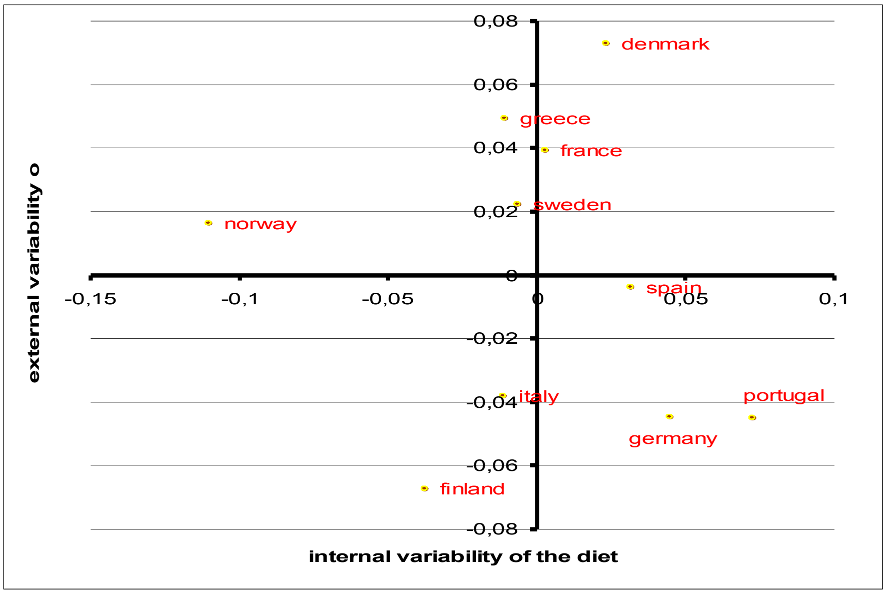
1 model: HH. **McDonald Outstations**, global trade made lost national diets, eroded by cultural and economic homogenization

2 model LL. **Resilient Food Island**. Italy is the benchmark, while Finland improved national diets due to urgent measures from the '70 based on school education and extensive use of food programmes. This is not only the best model considering the entropy value, but also the less globalised model.

3 model. HL **Phaeacians** Here the suggestion comes from the Odyssey, where the Phaeacians were an advanced and cosmopolite population met during Ulysses journey; they were provided with the state-of-the-art shipping technologies for that time. Phaeacians are optimistic heralds of the globalization. Out of metaphor, we can assume that in this case, increased global trade was put at the service of country-specific, local food pattern. Even if a fair interpretation requires case-by case analysis, we could expect that convergence on global diet allowed to benefit from increased trade. Entropy stays relatively low, assuming a varied diet.

4 model. LH **Cyclops** Spain, while seems to maintain its autonomous food pattern, experimented a loss in variety, as Portugal while Germany, maintaining its independence, reproduces a relatively poor diet. *Conservation here is not desirable as a proxy for "good diet"*:

-Fig. 5- z-scores for 2005 data on internal and external dietary variability



Discussion

The Gini Index shows a generalised loss of internal variety of the diets examined. The same results are derivable with the Entropy index (standardised).

However, if a "Varied Diet" is assumed to be a good , necessary starting point when making right food choices, we consider that a*n healthy diet needs a certain degree of concentration on a limited number of food categories;* differently put, *entropy is somehow needed (some food categories are more important than others)*.

In effects, focussing on the traditional Mediterranean diet (reflected in the Food Pyramid model[2]), a balanced diet for the human body need some 45-55% of calories stemming from cereals and complex carbohydrates; a 20%-30% from fats; and a15-20% from proteins.

So far, " *a varied diet*" is a lexical approximation, not truly reflected in the highest variety possible as measured by a simple statistical index.

Hence we modelled entropy accordingly in order to make it having sense.

In particular, we introduced the baseline entropy of reference considering the Pyramid Food model, and then we measured the deviaton from it along years.

2 http://www.health.gov/dietaryguidelines/dga2005/document/default.htm
http://www.piramideitaliana.it/files_allegati/gruppodilavoro.pdf

Differently than measuring entropy in itself, we built around a meaningful framework, considering the appreciable level of *entropy needed by a varied yet healthy diet.*

We considered the proportion between meat and legumes and dairy products as offered by the ***Piramide Italiana*** project in order to stay inside the 20% protein meals per day.

Even if the Model is not restrictive, we can say it is fairly inside the fair Dietary model for a varied diet. The entropy derived is as follows **(Table 1)**:

-Tab. 1- the desirable Food Pattern

The desirable Food Pattern		
	Food Piramid	
cereals	925	46 %
fruit and veg.(5 a day)	175	9%
veg. oils	440	22%
animal fats	100	5%
meat	79	4%
pulses	79	4%
dairy prod.	203	10%
TOT	2000	
Entropy	**0.791357**	
Gini	**0.480188**	

In literature there are other recents contributions about the compliance to nutrition guidelines (Schmidhuber J, Traill WB, 2006, Mazzocchi, 2007), very useful instead. Since the Food Pyramid has been reformulated and made publicly available, our attempt is to consider it on the 3 European food producers, Italy, France and Germany. We selected the 3 countries for practical purposes, since are geographically near, culturally different, and with a traditional divergent focus on food and diets in general. Furthermore, France shares dietary aspects with both the other 2 countries in terms of Continental versus Mediterranean dietary style.

We made some assumptions in order to proceed with quantitative estimations. For instance, to have a 5-a-day intake of fruit and vegetables, fixing a caloric amount as reference value for 100 gr. Furthermore, we estimated a proteic intake as shared among pulses, meat and dairy product in the proportion offered by the *Piramide Italiana* project. Then, we considered caloric values for 100 gr of each food items starting arbitrarily from the German diet.

If in the 1961 Italy had an entropy of 70,3 on a 0-100 scale (from now on, the reference level of entropy), in 2005 the average Italian diet scored a value of 84,6 for entropy (in a 0-100 scale), signing an increase of almost 7 points with respect to the baseline, desirable model. The German diet in the same year was 8,3 points away (85,7/% value for entropy), and the French one 9,6 (86,7 entropy)

Giving a look, we can appreciate effectively a deterioration of the diet; for cereals, meat, pulses

-Tab. 2- The Italian diet versus the desirable model of Food Pyramid-

Italy				
2005	calories	%	desirable model %	
cereals	1145	38	46%	
veg and fruit	293	10	9%	
veg. Oils	658	22	22%	
an. Fats	158	5	5%	
meat	393	13	4%	
pulses	51	2	4%	
dairy	296	10	10%	
	2994		Distance= **18%**	Distance entropy = **5,5**

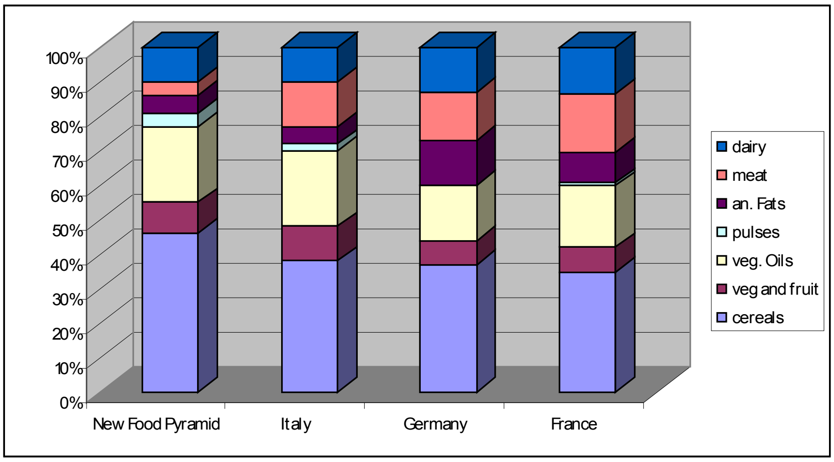
-Tab. 3- The German diet versus the desirable model of Food Pyramid-

Germany				
2005	calories	%	desirable model	
cereals	894	37	46%	
veg and fruit	178	7	9%	
veg. Oils	400	16	22%	
an. Fats	308	13	5%	
meat	344	14	4%	
pulses	5	0	4%	
dairy	312	13	10%	
	2441			
			Distance= **34%**	Distance entropy = **8,3**

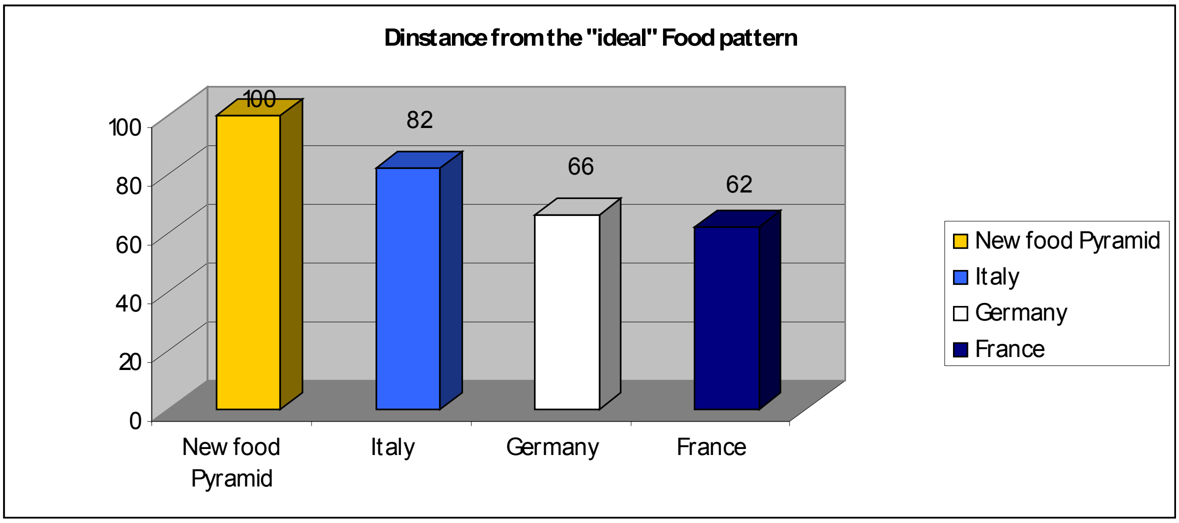
-Tab. 4- The French diet versus the desirable model of Food Pyramid-

France				
2005	calories	%	desirable model	
cereals	940	39	46%	
veg and fruit	197	8	9%	
veg. Oils	481	20	22%	
an. Fats	254	10	5%	
meat	452	19	4%	
pulses	18	1	4%	
dairy	377	15	10%	
	2719			
			Distance = **38%**	Distance Entropy = **9,6**

-Fig. 6- The Food Pyramid pattern and the average diets of Italy, Germany and France-



-Fig.7- The distance of selected Eu diets from the ideal model, on a 100-points scale



Then for Italy we confronted the entropy in itself and the entropy corrected for the "Varied Diet" model, deriving reflections.

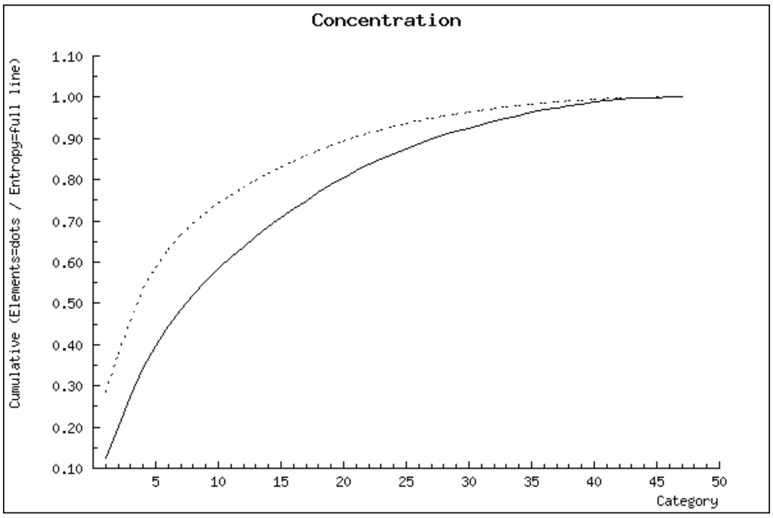
Obviously, aggregated statistical indexes provide only an insight on the truly surface, while means of dispersions are not enough and require a case by case analysis.

With regard to Italy, the diet concentration relative 2005 and 1961 as reference dates[3] (% of

3 It is coherent with the Lorenz Curve, the perfect reverse.

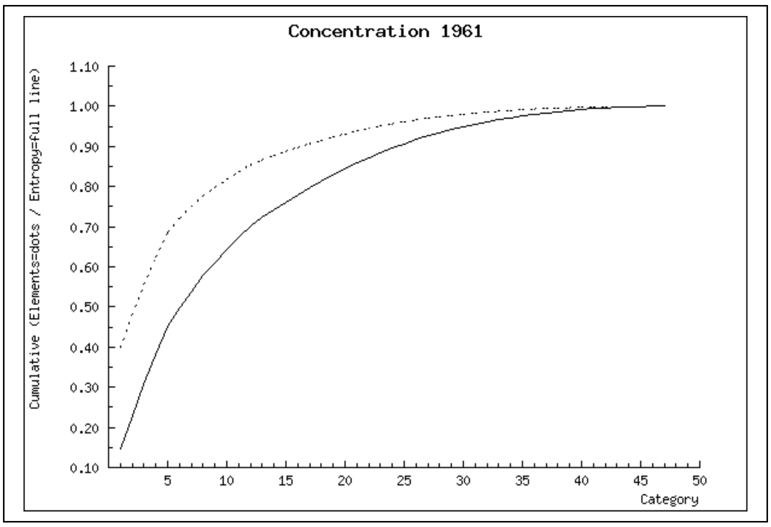
single food items on total caloric amount) is as below:

-Fig. 8- Cumulative distribution of food items in 2005



(30% of calories derived from the first source -cereals)

-Fig. 9- Cumulative distribution of food items in 1961



(more or less 40% of the calories derived from the first source -cereals)

The curve makes previsions based on homogeneous, not grouped distribution of the data. So far we can compare the expected values (diagonal, hypothetical line) with the observed ones (real curve in dots).

If in 1961 in Italy 82% of overall caloric intake came from the top 10 food items, in 2005 the value was of 72%. It is consistent with the slight change in the Lorenz Curve.

A simple measure of correlation shows that increased trade in prepared/transformed food items goes in the same direction of the convergence of the Italian diet towards the USA diet[4].

and in the meantime the Italian diet is loosing variety (Pearson Bravais 0,78 considering Trade Food Nes e Gini Index Italy). There is also some evidence that the increased trade in prepared foods is going along with higher caloric intake in Southern Europe. (0,68 Pearson Bravais). Starting from 1961 (including: 1965, 1970, 1975. 1980, 1985, 1990, 1995, 2000, 2005), we are now able to outline the **Table 5.**

-Tab.5- The trade in Prepared-foods versus the Gini concentration Index and the South Europe as a whole CSI on the USA diet

TRADE PREP FOOD	GINI ITALY	SOUTH EU CSI (average)
196147	0,81441	0,566055923
351403	0,827851	0,573864861
778256	0,843705	0,592494411
1137343	0,846323	0,634212131
1957067	0,857787	0,643845835
2607829	0,876959	0,652348309
2770013	0,883581	0,672490092
4831486	0,883947	0,671630904
6606017	0,889018	0,683073167
10589203	0,888767	0,671651051

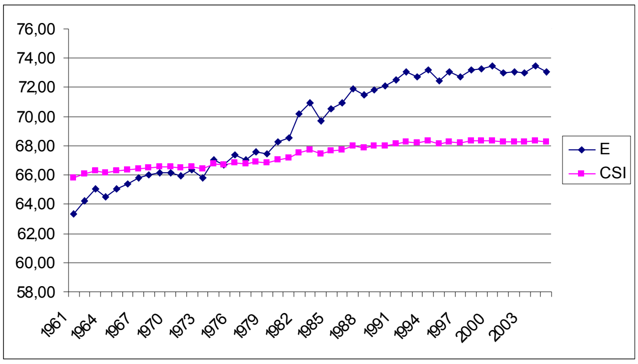
The Granger causality test[5] even if needs to be used with caution, since it is somehow mechanical and based only on temporal precedence of the “x” term on “y” (Lucchetti 2004), help us in giving a different angle on the topic, exploring *causality relationships and not merely correlation.*

Testing hypotesis if the increase in prepared-food trade(X) caused an increase in calories consumed (Y) for Italy, we obtain not useful results. The experiment with lags more than 1 (2,3,4) provided even worst results. We can assume that actually there is little evidence that increased commerce in (processed) foods is directly and mechanically related to increased caloric intake. Other variables underlining may better explain the relationship. Differently, we discovered interesting links between the Italy-Germany diets convergence and Italian diet entropy. It seems (**Fig. 10**) that increasing the value of Consumption Similarity Index among the 2 countries, the Italian diet entropy increases in a perfect co-graduation.

4 Table 1, Appendix for the row data. Pearson Bravais = 0,73 (trade food nes e CSI Southern Europe on the USA Diet)

5 As available inside the R statistical Package

-Fig. 10- Entropy and Consumption Similarity between Italian and German diets-



(Entropy of Italian diet apparently increases with the convergence of Italian and German diets)

The results are impressive because of a 0,99 correlation coefficient. Trying with an explicative regression in which the explanatory variable is the CSI and the dependent variable is the Italian Entropy, we find a 0.94 R-squared value. When the reverse is true, the R- squared is 1 (it means that the increase in Italian entropy apparently explains perfectly the convergence of Italian and German diets): assuming a convergence between German and Italian Diet, it should be expressed as the result of an augmented entropy in the Italian diet. We can derive that it is possible that there is some underlying, unobserved variable. Taking now into account Italy and France, and assuming CSI of Italy versus France and the level of entropy, we find again good results of correlation (0,81) and somehow lesser in coefficient of determination (0,65). The granger-causality is possible even if slightly off the confidence level of 5% (7%, with F statistics of 3,45 on 41 degrees of freedom). But in this case, differently from Germany, growing entropy forecasts similarity in dietary patterns between Italy and France. Sign that there are probably external drivers (cultural and material factors pushing for food homogenization (a possible explanation is that when Italy goes worse, it follows France on the same ground, since France is the leading European food producer). Eventually we used trade index (Gruber Lloyd[6] and Trade Specialization Index[7]) in order to check out if trade flows determine the diets or viceversa. The Trade Specialization Index may be defined as a Normalised Balassa Index (4).

(4)

$$NB_{ji} = \left(\frac{x_{ji} - m_{ji}}{x_{ji} + m_{ji}} \right)$$

6 The Index is a measure to show the balance in trade between 2 countries http://www2.lse.ac.uk/researchAndExpertise/Experts/l.gruber@lse.ac.uk . We used the Total Merchandise Trade from FAO. For a critical review of Trade indexes, see: http://www.entrepreneur.com/tradejournals/article/75531660_2.html

7 Table 2 in the Appendix.

whereas values appear in the range between -1 and +1. More positive the value, more specialised country A is; more negative, lesser specialised.
In contrast, the Gruber-Lloyd Index goes from zero to one. A value of zero indicates that gross flows are in one directional; a value of one indicates that inflows exactly match outflows (5).

(5)

$$\mathbf{GL} = 1 - \frac{\sum_{i=1}^{N} \left| x_{ij} - m_{ij} \right|}{\sum_{i=1}^{N} \left(x_{ij} + m_{ij} \right)}$$

From the analysis, it seems furthermore than a change in the dietary pattern revealing convergence between Germany and Italy can be *useful to predict* moves in the Italian Index of Trade Specialization in food. The explanation so far could be that other factors driving the demand, and with real consumptions making the demand (diet) and driving the offer (specialisation in food trade). The Granger-causality this time has a p-value of 0.05 (for an F statistic of 3,95 for 42 degrees of freedom).

Italian diet converging on the German one?

For the period: 1961-2005, we considered an Arima model, including a forecasting exercise for the next 5 years : Consumption Similarity Index of Italy and Germany was performed with an Arima (1, 0, 1), able to minimize the diagnostic values[8]. With the classic approach, a polynomial of order 2 allows a R .squared of 0.93 (y=0,4992x^2+5,7729x+5620,7).
The exercise is useful since FAO data generally do not cover the strictly most recent years and may be useful to compare the most recent values with expectations for the nearest future.
The Arima models do not include any hypotesis about patterns behind, neither cycle (Shumway, 2006). Arima models, made popular by Box-Jenkins, are aimed at discovering the Auto-regressive (AR) and Moving Average (MA) processes inside the time series and showed good results in predicting short-term values (Frascarelli et al, 2009, Shumway, 2006).

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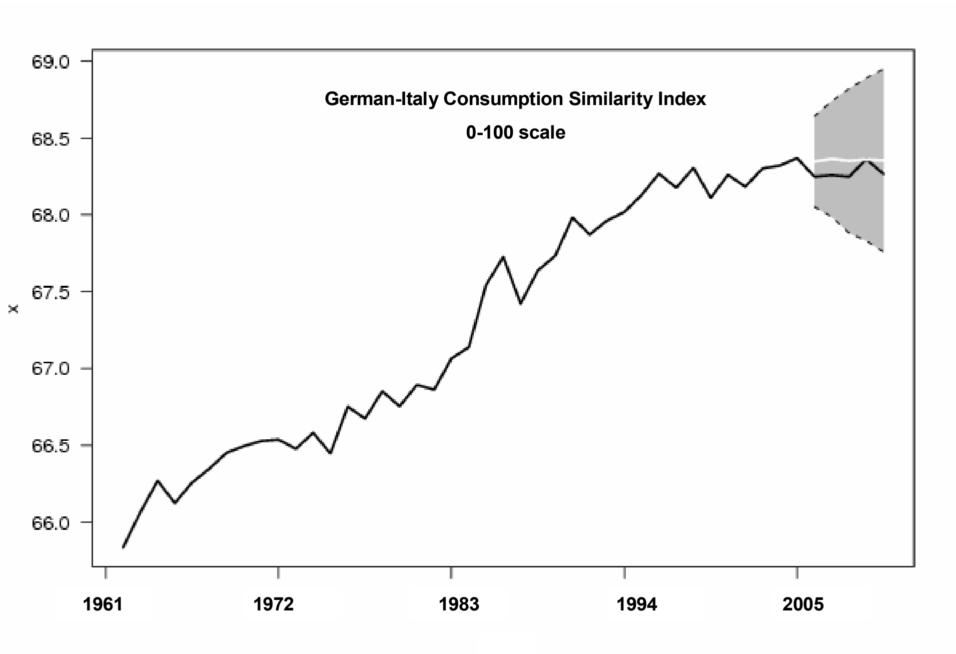
8 Coefficients:

	ar1	ma1
	0.9835	0.5399
s.e.	0.0123	0.0645

sigma^2 estimated as 1.163: log likelihood = -153.27, aic = 312.54

-Fig. 11- Dietary co-evolution between German and Italy (uncertainty factors of forecasting from 2005 to 2010)



Prices and consumption

The overall Food Price Index (which are international index prices, not farm gate prices[9]) seems not cause changes in caloric consumption at the aggregated level in Southern as well as in Norther Europe. The basic expression, mediatically abused, than an increase in food prices can cause a diminished purchase of calories it is not true at all, at least for European countries (correlation, regression and causality tests were performed). *Probably even the level of measure is not adequate, since the index is an average value of 6 commodities of different caloric density.*

At a more detailed level, the cereals price index seems to play, with the assumption of 1 year lag, an inconclusive role for both the Southern Europe as well as for Northern Europe.

It's probable than for such a commodity, increase or decrease in prices do not imply elasticity at the consumers' level for a series of factors (delay in price discharging from firms and hence, from retail, for instance) intervening, at least in last 15 years.

The dairy price index is not predictive of changes in consumptions, as the vegetable oils price.

Differently, the sugar price index seems to play a role in increasing calories consumption in northern Europe (with the Granger test, 0.02 p value, with 1 lag, and 0.01 with 2 lags; with the

9 Personall communication from Hansdeep Khaira, FAO.

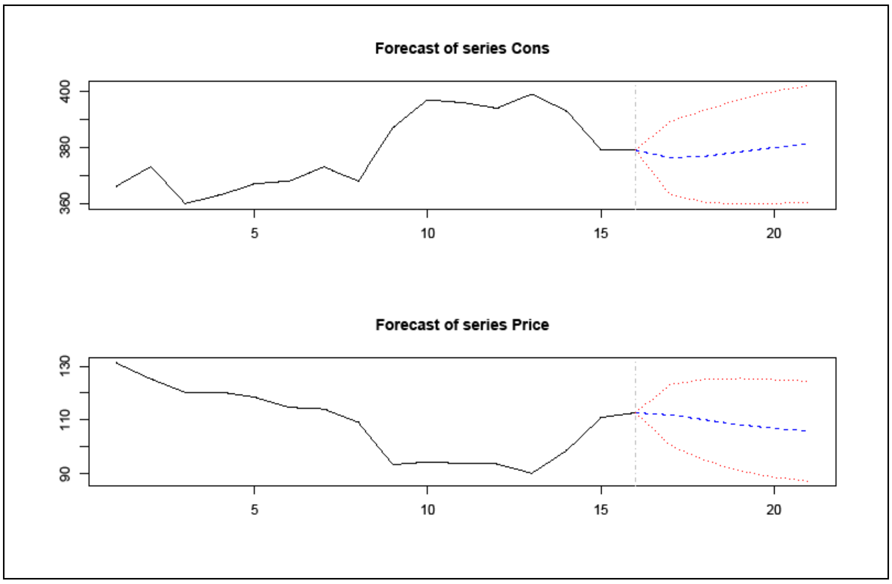
Wald-type test we cannot discard the hypotesis of causation, since there is a high p-value of 0.2[10]), (Pearson Bravais correlation cf -0.7376367).

It appears more probable than other factors related to food availability play a major role.

Meat prices in Northern Europe appear to play a role in signalling an increase in world price index of the meat (Granger = p-value 0.04). By contrast, in Southern Europe, at any increase in the meat price index the meat consumption decrease proportionally. That's to say that the model encompasses some sort of elasticity, with inverse co-gradutation between prices and consumptions.

(F=7,71 p-value=0.01, Granger[11]), while Food Price Index transmits on meat consumption change with a lag 2 (F=6.07 p-value 0.02).

-Fig.12- Consumptions forecasting of meat considering the evolution of recent prices.



(timeline: 1990-2010, Fao data)

This last fact is consistent with the consideration that the Food Price Index is the results of several food categories, among which cereals, which are the first input for feed materials necessary to produce meat. The lag 2 so far seems to have a meaning.

Coming back to the elasticity of the demand versus the price for meat in Southern Europe, it is well depicted by the angular coefficient, with -0,88 calories of meat consumed for each point

10 Chi-squared = 1.431, df = 1, p-value = 0.2316

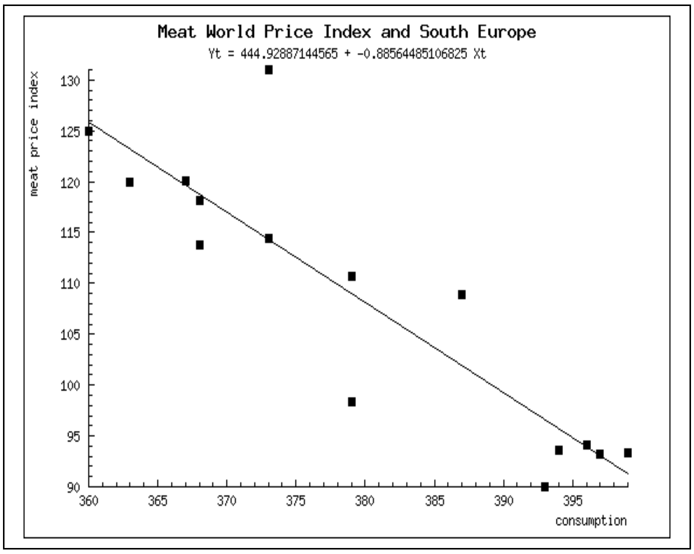
11 **Granger causality** H0: Price do not Granger-cause Cons
data: VAR object Var1
F-Test = 7.71, df1 = 1, df2 = 24, p-value = 0.01048
Wald –type instant
H0: No instantaneous causality between: Price and Cons
data: VAR object Var1
Chi-squared = 4.4128, df = 1, p-value = 0.03567

increasing in the meat price index. Such results may confirm a different approach to the animal proteins due to cultural factors, as already shown by the literature (De Boer J, 2006).

The same correlation, when transposed of 1 lag, is strongly negative (-0,89), and forecasts an elasticity of the demand on the price.

A regression analysis performed on price and meat consumption in South Europe[12]is able to detect a form of relative elasticity of substitution in response to price increases.

-Fig. 13- Regression analysis with Meat World Price and meat consumption in South Europe



It seems coherent with the historical minor consumption of meat in Southern Europe countries, what consequently can mean a higher attention paid to the price factor.

A residue analysis by normality plot leave room to other causes, but residues are not correlated (homoschedasticy maintained, test Durbin Watson).

12 Residuals:

```
    Min      1Q  Median      3Q     Max
-9.1379 -2.6260 -0.3908  2.1454 11.3128

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 438.5553    42.4893  10.322 6.30e-08 ***
y            -0.8702     0.1121  -7.764 1.94e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5.869 on 14 degrees of freedom
Multiple R-squared: 0.8115,     Adjusted R-squared: 0.7981
F-statistic: 60.28 on 1 and 14 DF,  p-value: 1.938e-06
```

The Mediterranean Paradox: high GIs number, worse diets?

Another purpose of our research was to further investigate about a possible role of the national food cultures, expressed as proxy by the interest in the registration of GI (PDO and GPI). Hence we intended to stress a possible role of *cultural drivers* in explaining food habits**.**

It was challenging to consider the Geographic Indications (GI) in Europe as a possible predictor of the resilience of the food patterns versus the globalised diet.

We so far estimated a correlation among GI[13] and Consumption Similarity Index based on the USA diet for each of the European countries considered.

Since the GI go in the direction of "*food biodiversity*", we made also the assumption that countries with a higher number of GIs may present a lower Gini concentration index (caloric intake is derived from more differenced sources when the Index is low).

– Tab. 6- Diet biodiversity and number of country-based GI –

	gini			*number of GI*	
	2005	*GI*	*pop (000)*	***standardised for the population (*000)***	***Pearson-Bravais Correlation***
italy	0,698	300	60304	0,004974794	-0,608609744
spain	0,695	185	45989	0,004022701	
greece	0,702	98	11257	0,008705694	
portugal	0,641	119	10618	0,011207384	
france	0,709	233	65447	0,003560133	
germany	0,673	94	82438	0,001140251	
denmark	0,690	6	5476	0,00109569	
finland	0,742	8	5336	0,00149925	
norway	0,775	0	4623	0	
sweden	0,708	7	9083	0,00077067	

In effect is possible to spot a negative correlation between the GIs number and diet concentration.

It is apparent that traditional food variety played its role in maintaining a more varied diet. It is also interesting because it allows to reconsider GIs not only as *private. isolated initiatives* due mainly to consortia interest in promoting and marketing products, but as widely spread indicator of the variety of the food demand behind (taste for variety and for typical products).

Another focus was on Consumption Similarity Index of European countries versus the USA diet and number of GIs. Even in this case, we expect that more resilient and country-specific diets belong to those countries with a higher number of GIs.

13 Sourced at: http://ec.europa.eu/agriculture/quality/database/index_en.htm (accessed March, 24, 2010)

-Tab. 7- GIs and similarity to the USA diet.

		number of GI			
	CSI	*GI*	*pop (000)*	***standardised for the population (*000)***	***Pearson-Bravais Correlation***
italy	0,652267492	300	60304	0,004974794	0,103225317
spain	0,675401837	185	45989	0,004022701	
greece	0,647532864	98	11257	0,008705694	
portugal	0,711402013	119	10618	0,011207384	
france	0,704569906	233	65447	0,003560133	
germany	0,647715047	94	82438	0,001140251	
denmark	0,727353102	6	5476	0,00109569	
finland	0,68906044	8	5336	0,00149925	
norway	0,63237545	0	4623	0	
sweden	0,693106504	7	9083	0,00077067	

In this case the hypothesis is not confirmed. It means that *even countries with a higher number of GIs may follow the influence of the USA diet at the population level.*

Synthesis index do not permits to explain well complex phenomena underneath; in effects, a necessary consideration is that sometime food variety in a statistical meaning differs from food variety in a nutritional meaning.

Food variety may results in fact from a *diet levelling*, or in other words, from a caloric increase from food items not present before in the diet. So far a loss in the Gini Index is not good in itself, if simply means an "*add to the basket*" strategy at the supermarket, with an overall increase in the calories ingested. In effect, countries of Southern Europe which present the higher number for GIs at the same time are the ones which worsened more their diet during last decades. The evident paradox is that GIs are somehow separated from "real world" food culture, and in the end, not able to assess the conservation of local food patterns.

More useful the Entropy, which forecasts a significant correlation instead between levelling in the diets and number of GIs.

A possible explanation is also that GIs were launched later on in order to recover specific food patterns in the moment when there was striking perception of their possible loss.

-Tab.8- GIs prompting for internal variety of national diets?

		number of GI			
	E	*GI*	*pop (000)*	***standardised for the population (*000)***	***Pearson-Bravais Correlation***
italy	0,730596	300	60304	0,004974794	0,490967819
spain	0,762095	185	45989	0,004022701	
greece	0,730969	98	11257	0,008705694	
portugal	0,792594	119	10618	0,011207384	
france	0,740862	233	65447	0,003560133	
germany	0,77183	94	82438	0,001140251	
denmark	0,756252	6	5476	0,00109569	
finland	0,711087	8	5336	0,00149925	
norway	0,657374	0	4623	0	
sweden	0,734087	7	9083	0,00077067	

Conclusions

Even if the time series/dataset used are short and still inconclusive, at least for price considerations, and GIs role, there are significant evidences that need to be stressed at the time to draw the conclusions.

European diets changed over time in a meaningful and systematic way. The impact of a global food pattern is not more questionable in itself, and the phenomenon of diets convergence is real.

Anyway, more varied diets are not necessarily desirable, since this major variety is due prominently to a higher intake from dense foods (sugars, meat, dairy products). This aspect is strongly counter-intuitive because of nutritionists pretending more and more varied diets as a rule to follow in itself. Major food-variety availability, if appealing from the consumers' perspective, is not good as such.

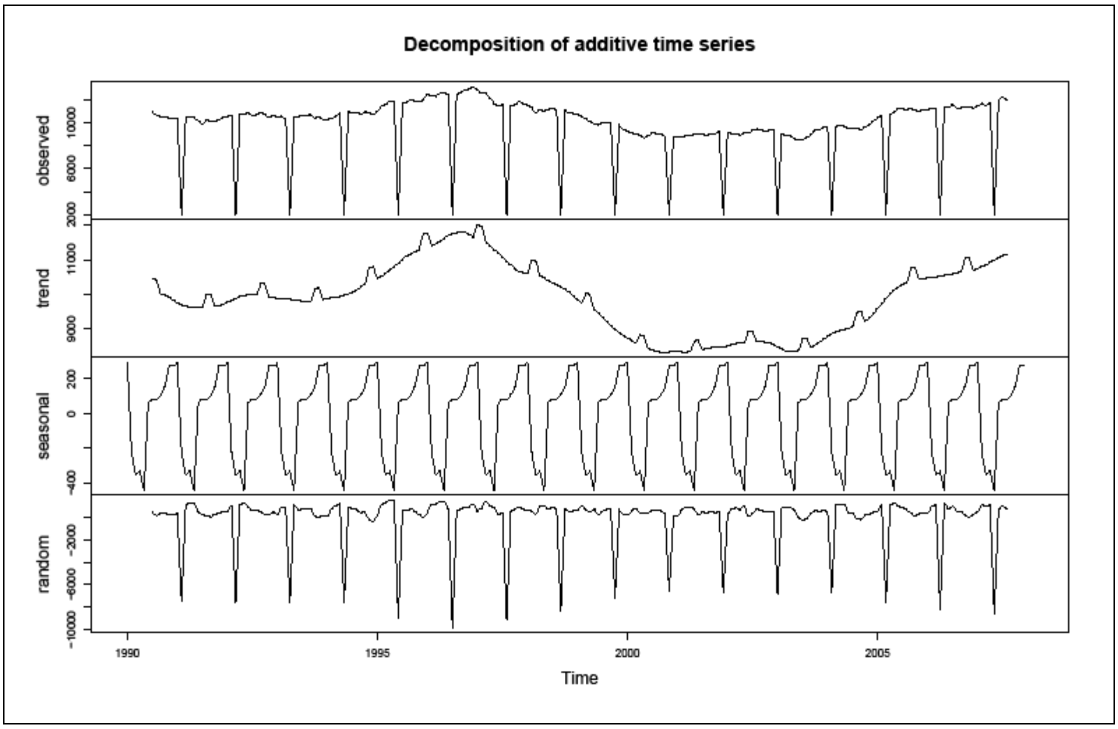
Another interesting result of the present research is that diets converge over time. Here, there seems to be room for further investigation on the role of supply-side factors (trade specialization, intra-industry trade, competitive advantages...) and consumers' demand in a world in which taste is increasingly standardised.

Traditional economic factors, as prices seem to confirm the classic economic hypotesis of price elasticity of food items, even if price transmission is not a mechanical aspect of modern food chains.

Even if it is not completely clear the way prices interact with consumptions, it is possible that underlying cultural factors play a role.

It is somehow necessary to monitor continuously food prices in order to expect drops or increase in consumptions. During last 20 years, price index is fluctuating without a clear trend (see **Figure 13** below).

-Fig. 13 Food Prices Index (FAO): a decomposition of trend, season and error terms



The trade in processed foods (FAO/FBS) did not show a deterministic increase of calories consumed pro-capite (at least in Italy) .

The two way trade instead proved to be an useful tool to predict increasing convergence in food patterns (CSI on imp-exp trade). Further clues for research should include monitoring the retail sector, verifying if concentration at the consumers level among the top groups mean a loss in variety of the diets.

Or on the contrary, if the competition among firms of retailers lead to improved food supply and so far, to a more varied diet.

Unfortunately, at the moment there seems to be a lack of this kind of data, which indeed would be of paramount importance in shedding light on a very promising and interesting supply-side factor.

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APPENDIX

Table 1.

italy	calories it	trade prepared food nes
1961	2915	10272
1962	2979	17354
1963	3046	18379
1964	3035	18827
1965	3089	15359
1966	3112	24197
1967	3191	31833
1968	3252	27400
1969	3300	34392
1970	3422	35909
1971	3409	39894
1972	3454	44232
1973	3534	43510
1974	3454	64269
1975	3365	59140
1976	3369	71528
1977	3308	71535
1978	3486	75770
1979	3593	100938
1980	3590	86233
1981	3503	86553
1982	3390	88078
1983	3362	117954
1984	3415	125530
1985	3425	156102
1986	3508	158636
1987	3528	164320
1988	3545	128887
1989	3591	148455
1990	3591	177838
1991	3644	200974
1992	3539	210485
1993	3465	241598
1994	3471	282893
1995	3481	294109
1996	3531	374442
1997	3543	389946
1998	3635	446110
1999	3655	463382
2000	3682	536150
2001	3656	589650
2002	3657	663062
2003	3664	694992
2004	3704	785015
2005	3685	778853

Table 2

	entropy	*csi it fra*	*gruber lloyd it*	*csi it germ*
1961	63,34	73,04	0,89	68,33
1962	64,26	73,23	0,87	67,87
1963	65,07	73,25	0,8	67,46
1964	64,50	72,42	0,9	67,75
1965	65,03	72,53	0,99	67,48
1966	65,39	71,76	0,97	67,30
1967	65,81	69,83	0,95	67,10
1968	65,98	70,75	1	67,01
1969	66,11	70,55	0,97	66,94
1970	66,15	71,10	0,95	66,93
1971	65,91	70,89	0,97	67,05
1972	66,33	70,89	0,98	66,84
1973	65,79	69,80	0,89	67,11
1974	67,01	71,62	0,85	66,50
1975	66,69	69,85	0,95	66,65
1976	67,41	71,29	0,92	66,30
1977	67,01	72,27	0,97	66,49
1978	67,57	71,31	1	66,21
1979	67,45	71,55	0,96	66,28
1980	68,26	73,54	0,88	65,87
1981	68,55	73,35	0,91	65,72
1982	70,17	74,27	0,92	64,92
1983	70,91	74,29	0,95	64,55
1984	69,69	73,63	0,93	65,16
1985	70,55	74,11	0,93	64,72
1986	70,93	74,21	0,99	64,53
1987	71,93	73,79	0,96	64,04
1988	71,49	73,71	0,96	64,26
1989	71,85	73,43	0,96	64,08
1990	72,07	74,07	0,97	63,96
1991	72,52	73,65	0,96	63,74
1992	73,07	74,26	0,97	63,46
1993	72,70	75,27	0,93	63,65
1994	73,22	75,22	0,94	63,39
1995	72,45	75,04	0,94	63,78
1996	73,04	75,20	0,9	63,48
1997	72,73	75,69	0,93	63,63
1998	73,21	76,37	0,94	63,40
1999	73,28	76,29	0,97	63,36
2000	73,47	76,83	1	63,26
2001	72,99	77,66	0,98	63,50
2002	73,03	77,54	0,99	63,48
2003	72,99	77,77	1	63,50
2004	73,45	78,01	1	63,28
2005	73,06	79,48	0,98	63,47

Table 3

	TRADE FRANCE TOT	*TRADE GERMANY TOT*
1991	556.554.305	296.528.795
1992	584.521.357	297.250.910
1993	708.827.715	409.176.769
1994	569.868.264	436.697.743
1995	510.553.208	475.786.120
1996	745.488.009	458.687.480
1997	550.259.354	464.370.292
1998	654.642.895	469.572.992
1999	657.131.021	491.140.556
2000	749.140.815	491.451.255
2001	425.304.098	439.817.422
2002	470.223.304	414.450.671
2003	578.947.015	463.971.584
2004	581.151.798	510.983.940
2005	484.631.055	494.546.801
2006	508.579.746	481.575.024
2007	392.727.095	433.936.356
2008	473.136.086	456.366.050

Table 4

	TRADE FRANCE TOT	*CSI IT FR*	*TRADE GERMANY TOT*	*CSI IT DEU*
1991	556.554.305	73,65	296.528.795	63,74
1992	584.521.357	74,26	297.250.910	63,46
1993	708.827.715	75,27	409.176.769	63,65
1994	569.868.264	75,22	436.697.743	63,39
1995	510.553.208	75,04	475.786.120	63,78
1996	745.488.009	75,20	458.687.480	63,48
1997	550.259.354	75,69	464.370.292	63,63
1998	654.642.895	76,37	469.572.992	63,40
1999	657.131.021	76,29	491.140.556	63,36
2000	749.140.815	76,83	491.451.255	63,26
2001	425.304.098	77,66	439.817.422	63,50
2002	470.223.304	77,54	414.450.671	63,48
2003	578.947.015	77,77	463.971.584	63,50
2004	581.151.798	78,01	510.983.940	63,28
2005	484.631.055	79,48	494.546.801	63,47
2006	508.579.746	/	481.575.024	/
2007	392.727.095	/	433.936.356	/
2008	473.136.086	/	456.366.050	/

CORR TRADE WITH FRANCE ON CSI IT FR

-0,319337315

CORR TRADE DEU ON CSI IT DEU

-0,433628383