



# Spatial Differentiation of Food Expenditures in an Enlarged European Union

Borkowski Bolesław<sup>1\*</sup>, Krawiec Monika<sup>1</sup>, Szczesny Wiesław<sup>1</sup>, Yochanan Shachmurove<sup>2</sup> and Monika Świątkowska<sup>3</sup>

<sup>1</sup>Faculty of Applied Informatics and Mathematics, Warsaw University of Life Sciences, Poland

<sup>2</sup>Department of Economics and Business, The City College and the Graduate Center of the City University of New York, Poland

<sup>3</sup>Faculty of Human Nutrition and Consumer Science, Warsaw University of Life Sciences, Poland

## Abstract

This paper studies the structure of consumption profiles for European countries. The analysis covers twenty European Union (EU) member states for the year 1961 and 28 EU countries for the year 2011. The paper uses data from the Organization for Economic Cooperation and Development (OECD) for thirteen product groups. The analysis utilizes the Grade Correspondence and Cluster Analysis (GCCA) method. The study shows significant differentiations of consumption profiles among the European countries. However, the general profile of consumption can be described as stable.

**Keywords:** Food consumption; Panel data; Dynamic econometric analysis; Organization for Economic Cooperation and Development (OECD); Grade Correspondence and Cluster Analysis (GCCA) method

## JEL Classifications

F00, D1, E2, N54, O52

## Introduction

The studies on consumption expenditures have a long history dating back to the nineteenth century. These studies include the works of [1,2]. The profile of food consumption is an important aspect of the life in a society and food expenditures are indicators from the economical point of view. Consumption expenditures also reveal eating habits, food intake for nutritional evaluations, environmental impact and in general food and nutrition policies taking into account the whole food chain. Studying the differentiations among European countries of food expenditures is important for policy makers who may want to direct the expenditures toward healthier food. It is also important for trading planners who may encourage allocating resources towards producing healthy food, thus reducing its price. It is significant for nutritionists who are responsible for advocating healthier dietary guidelines. Such study may encourage researching and bring the public attention dietary reference values and may encourage diet studies, not only by medical doctors, nutritionist and public health officials, but also economists and financial planners.

The value of consumption demand in a given country is a multi-argument function, mostly affected by population size and its structure, value of income, regional conditions and local habits. In high-income countries, the relationship between income and consumption is weaker than in low-income countries. In accordance to Engel's law, after a certain level of alimentation is reached, additional amounts of consumption have decreasing utility. At that point, the pace of increased demand for foodstuffs is decelerating as income increases. Most often, the literature concentrates on the relationships between income and consumption expenditure for a given country [3]. Few studies have taken a macro-regional view and include a comparative analysis of multiple European countries [4]. In this respect, the Data Food Networking [5] databank contains country-level dietary estimates based on food availability data collected through European household budget surveys. Estimates in the databank are harmonized to allow for comparison across countries. The data are more oriented toward nutrition and cover the period 1980-2004, although some update are expected [6-9] of particular interest for this paper are chapters 8 and 9 in the European Nutrition and Health Report [9]. Chapter 8 of that publication describes data on diet-related health indicators and status and Chapter 9 to analyze food and nutrition policies in countries of the European Union

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### \*Correspondence:

Borkowski Bolesław, Warsaw University of Life Sciences, Faculty of Applied Informatics and Mathematics, Poland,  
Tel: + 48 796 164 777;  
E-mail: boleslaw\_borkowski@sggw.pl

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**Table 1:** List of commodity groups.

X1	Alcoholic Beverages
X2	Animal Fats
X3	Cereals (Excluding Beer)
X4	Eggs
X5	Fish and Seafood
X6	Fruits (Excluding Wine)
X7	Meat
X8	Milk (Excluding Butter)
X9	Other Food
X10	Starchy Roots
X11	Sugar and Sweeteners
X12	Vegetable Oils
X13	Vegetable

**Source:** Own elaboration using OECD data (<http://www.fao.org/faostat/en/#data>).

(chapter 9).

Until now, studies show that the level and profile of consumption are widely different between European countries [10-15]. Some works [16] show different levels of income flexibility in terms of food products for the studied country. Find that the values of coefficients of income consumption flexibility for four Central European countries: Poland, Czech Republic, Slovakia and Hungary, are currently on comparable levels as to those in old European Union (EU) countries [17]. In European countries, preferences and habits of consumers change over time. These changes can be driven by various causes, such

as changes in income level, new cultural influences, globalization of trade, product availability, legal regulations, generic promotion and policy instruments promoting sustainable consumption [18-22].

This paper analyses the time path of consumption profile for 23 EU countries, excluding Cyprus and Luxembourg. Table 1 presents the 13 product groups. The data are from the FAO and EUROSTAT for the period 1961 until 2011. This work uses multidimensional methods. Additionally, the analysis is able to extract homogenous groups with similar consumption structures.

## Methodology

This paper utilizes the toolset of Grade Correspondence and Cluster Analysis (GCCA) [23,24]. Provide a detailed analysis of this toolset. In order to accustom the reader with the tools, Table 2 presents an empirical example. To illustrate the method, three European countries are selected. Two of them (Germany and Italy) are big economies differing in consumption structures, whereas much smaller Greece is a representative of other European middle-size countries. Table 2 contains the juxtaposed expenditure on consumption for the important food, alcohol and tobacco products for those three chosen European Union countries for the year 2011. The first three rows of the Table 2 contain the value of expenditure in millions of Euros divided for the product groups. The next three rows present these consumption expenditures in percentages. Rows named aver1 and aver2 represent the average structures: aver1 is an arithmetical simple average of coordinates of these expenditure structures for individual countries, while aver2 is a weighted mean obtained from a complex object constructed from a sum of expenditure for individual products.

**Table 2:** Food expenditure in million Euros.

	Bread and cereals	Meat	Fish	Milk, cheese and eggs	Oils and fats	Fruits, vegetables, potatoes	Other food	Non-alcoholic beverages	Alcoholic beverages and narcotics	Tobacco	Total
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	
Germany	30910	34090	4700	21990	4340	26450	21260	19170	21710	24090	<b>208710</b>
Italy	27038	32969	9829	19124	5565	25516	10094	9273	7960	18524	<b>165892</b>
Greece	5849	4953	1372	3943	1931	4734	1884	1314	2377	4596	<b>32953</b>
Germany	14.80%	16.30%	2.30%	10.50%	2.10%	12.70%	10.20%	9.20%	10.40%	11.50%	<b>100%</b>
Italy	16.30%	19.90%	5.90%	11.50%	3.40%	15.40%	6.10%	5.60%	4.80%	11.20%	<b>100%</b>
Greece	17.70%	15.00%	4.20%	12.00%	5.90%	14.40%	5.70%	4.00%	7.20%	13.90%	<b>100%</b>
aver1	16.30%	17.10%	4.10%	11.30%	3.80%	14.10%	7.30%	6.30%	7.50%	12.20%	100%
aver2	15.70%	17.70%	3.90%	11.10%	2.90%	13.90%	8.20%	7.30%	7.90%	11.60%	100%

**Source:** Own elaboration using OECD data (Table 1).

**Table 3:** Presentation of expenditure structures as a share of average expenditures in studied countries.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	
Germany	<b>0.91</b>	<b>0.96</b>	<b>0.55</b>	<b>0.93</b>	<b>0.55</b>	<b>0.90</b>	<b>1.39</b>	<b>1.47</b>	<b>1.39</b>	<b>0.94</b>	33.3%
Italy	<b>1.00</b>	<b>1.16</b>	<b>1.44</b>	<b>1.02</b>	<b>0.89</b>	<b>1.09</b>	<b>0.83</b>	<b>0.89</b>	<b>0.64</b>	<b>0.91</b>	33.3%
Greece	<b>1.09</b>	<b>0.88</b>	<b>1.01</b>	<b>1.05</b>	<b>1.56</b>	<b>1.02</b>	<b>0.78</b>	<b>0.64</b>	<b>0.97</b>	<b>1.14</b>	33.3%
	16.3%	17.1%	4.1%	11.3%	3.8%	14.1%	7.3%	6.3%	7.5%	12.2%	
Germany	<b>0.95</b>	<b>0.92</b>	<b>0.58</b>	<b>0.95</b>	<b>0.72</b>	<b>0.91</b>	<b>1.25</b>	<b>1.26</b>	<b>1.32</b>	<b>1.00</b>	51.2%
Italy	<b>1.04</b>	<b>1.12</b>	<b>1.52</b>	<b>1.04</b>	<b>1.16</b>	<b>1.11</b>	<b>0.75</b>	<b>0.77</b>	<b>0.61</b>	<b>0.96</b>	40.7%
Greece	<b>1.13</b>	<b>0.85</b>	<b>1.07</b>	<b>1.08</b>	<b>2.02</b>	<b>1.03</b>	<b>0.70</b>	<b>0.55</b>	<b>0.92</b>	<b>1.20</b>	8.1%
	15.7%	17.7%	3.9%	11.1%	2.9%	13.9%	8.2%	7.3%	7.9%	11.6%	

**Source:** Own elaboration using OECD data (Table 1).

**Table 4:** Differentiation of expenditure structures for Germany and Italy.

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
<b>y</b>	Germany	14.8%	16.3%	2.3%	10.5%	2.1%	12.7%	10.2%	9.2%	10.4%	11.5%
<b>x</b>	Italy	16.3%	19.9%	5.9%	11.5%	3.4%	15.4%	6.1%	5.6%	4.8%	11.2%
	$h_i=y/x_i$	0.91	0.82	0.38	0.91	0.62	0.82	1.67	1.64	2.17	1.03
	<b>P(0;0)</b>	<b>P(1,1)</b>	<b>P(2,2)</b>	<b>P(3,3)</b>	<b>P(4,4)</b>	<b>P(5,5)</b>	<b>P(6,6)</b>	<b>P(7,7)</b>	<b>P(8,8)</b>	<b>P(9,9)</b>	<b>P(10,10)</b>
<b>Fy</b>	0	0.148	0.311	0.334	0.439	0.460	0.587	0.689	0.781	0.885	1.000
<b>Fx</b>	0	0.163	0.362	0.421	0.536	0.570	0.724	0.784	0.840	0.888	1.000

Source: Ownelaboration.

**Table 5:** Maximal curves of differentiation of expenditure structures for Germany and Italy.

		X3	X5	X2	X6	X1	X4	X10	X8	X7	X9
<b>y</b>	Germany	2.3%	2.1%	16.3%	12.7%	14.8%	10.5%	11.5%	9.2%	10.2%	10.4%
<b>x</b>	Italy	5.9%	3.4%	19.9%	15.4%	16.3%	11.5%	11.2%	5.6%	6.1%	4.8%
	$h_i=y/x_i$	0.38	0.62	0.82	0.82	0.91	0.91	1.03	1.64	1.67	2.17
	<b>P(0;0)</b>	<b>P(1,1)</b>	<b>P(2,2)</b>	<b>P(3,3)</b>	<b>P(4,4)</b>	<b>P(5,5)</b>	<b>P(6,6)</b>	<b>P(7,7)</b>	<b>P(8,8)</b>	<b>P(9,9)</b>	<b>P(10,10)</b>
<b>Fy</b>	0	0.023	0.043	0.207	0.333	0.481	0.587	0.702	0.794	0.896	1.000
<b>Fx</b>	0	0.059	0.093	0.292	0.445	0.608	0.724	0.835	0.891	0.952	1.000

Source: Own elaboration using OECD data (Table 1).

Table 3 presents the structures of food expenditures for individual groups of products. The first part of Table 3 shows that the share of expenditures for individual product groups corresponds to the average expenditure level, e.g., the share of “bread and cereals” in Germany out of average expenditures is 0.91 (Table 3), calculated as a quotient of expenditure on the first group as a percentage share of total expenditures and average expenditures (14.8%/16.3%). The second part of Table 3 calculates the expenditures for individual product groups in countries as a share of total expenditures (e.g., Greece 17.7%/15.7%).

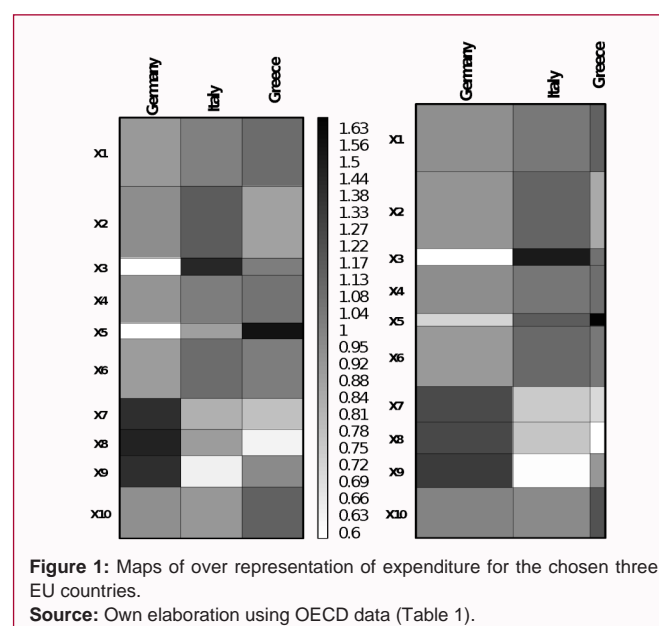
The basic tool for visualizing the data in GCCA is a map of overrepresentation [25]. It presents the quotients of values of individual cells corresponding to individual countries and their respective cells from the average structure (Table 3). This means that there are at least two visualizations for two different references (aver1 and aver2).

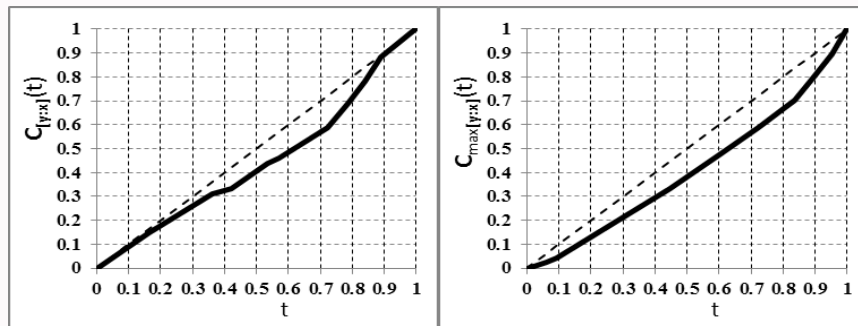
Figure 1 shows the visualizations. The values of individual quotients from Table 3 (values presented in bold) are depicted by varying shades of grey as per the attached scale. The heights of rows in both maps correspond to values of coordinates of average structures aver1 (left side) and aver2 (right side). The widths of columns on the left side map are constant (Table 3, last column, first three rows). For the map on the right, the column width is proportional to the share in total expenditures in the studied countries. In general, a map of overrepresentation is a unit square  $[0;1] \times [0;1]$  divided into rectangles, where individual vertical and horizontal strips correspond to “average” structures of rows and columns in a data table. In the case of Figure 1, the corresponding numerical values are presented in untitled rows and columns of Table 3. For the case of correspondence with the arithmetical average – the left side map – allows for the comparison of consumption profiles in different countries. It is a useful tool for graphical illustration of food expenditure profiles in countries regardless their size (it illustrates each profile in relation to the profile set as the arithmetic average of all displayed profiles). The right side map – is a tool for illustration of food expenditure profiles in separate countries in comparison to the profile of total expenditures of all investigated countries (e.g. to the weighted mean of profiles,

where the weights of consumption profiles in separate countries are proportional to their total expenditures).

Graphical representation in Figure 1 shows that in Italy one observes a greater share of expenditures on Fish (X3) than the average in the studied countries. However, the expenditure on alcohol (X9) is significantly smaller. Moreover, in Italy, one notes a greater than average share of expenditures on meat (X2) and on fruit, vegetables and potatoes (X6). Germany is characterized by a greater average consumption for X7, X8, and X9. Conversely, German X3 and X5 consumption expenditures are significantly smaller than that of the other countries. Greece is characterized by greater expenditures on consumption of oils and fats (X5) and smaller expenditures on non-alcoholic beverages (X8).

The over representation maps, given above, are graphical illustrations of the differentiation of food expenditure profiles between the considered countries and the average structure for





**Figure 2:** Curves of differentiation and maximal expenditure structure for Germany as compared with Italy.  
**Source:** Own elaboration based on Table 4.

the whole set. Whereas, the coefficient of differentiation of two structures  $ar$ , based on a curve of differentiation of two distributions, is the numerical measure of differentiation between two profiles. The construction of this coefficient utilizes a generalized Lorenz curve [2,26]. The coefficient  $ar$  is defined by an equation analogous to the Gini coefficient. To construct the measure based on two structures

$$\mathbf{x} = (x_1, x_2, \dots, x_n), \mathbf{y} = (y_1, y_2, \dots, y_n) \in \mathfrak{R}_+^n : x_i, y_i \geq 0, \sum_{i=1}^n x_i = \sum_{i=1}^n y_i = 1$$

One defines a curve  $C_{[y:x]}$  formed as a linear combination of  $n+1$  points:

$$P_0 = (0,0), P_j = (x_j^{\wedge}, y_j^{\wedge}), j = 1, 2, \dots, n$$

where,  $x_j^{\wedge} = \sum_{i=1}^j x_i, y_j^{\wedge} = \sum_{i=1}^j y_i$ .

Naturally, this means:

$$P_n = (1,1), \text{ for } x_n^{\wedge} = \sum_{i=1}^n x_i = 1, y_n^{\wedge} = \sum_{i=1}^n y_i = 1$$

If  $x_i > 0$  for  $i=1, \dots, n$ , then the function whose plot matches the set  $\{(C_{[y:x]}(u), u) : u \in [0;1]\}$  is a continuous function.

The curve  $C_{[y:x]}$  defines a concrete, non-decreasing, sectionally linear function. That function is the basis for designating a measure of differentiation of two equivalent, ordered structures  $\mathbf{x}$  and  $\mathbf{y}$ :

$$ar(\mathbf{y}:\mathbf{x}) = ar(C_{[y:x]}) = 1 - 2 \int_0^1 C_{[y:x]}(t) dt \quad (1)$$

The coefficient  $ar$  takes values from the interval  $[-1,1]$ . More details on this coefficient are available in [23,27]. Table 4 presents the expenditure structures for individual product groups in chosen countries: Germany and Italy. Functions  $F_y$  and  $F_x$  denote the cumulative shares of consumption expenditures.

The structure of expenditure scan be presented in different ways. The  $ar$  value changes in relation to the arrangement of structure coordinates. The maximal value of  $ar$  (coefficient  $ar_{max}$ ) is obtained for:  $h_i = y_i/x_i$

Figure 2 presents the graphical representation of a differentiation curve as defined by points in the last two rows of Table 4. The left side of Figure 2 shows a differentiation curve in the order of coordinates of structures depicted in Table 4. The right side of Figure 2 exhibits the differentiation curve in the order of non-decreasing quotients  $y_i/x_i$  as depicted in the third row of Table 5. The latter is a convex curve, called a curve of maximal differentiation of two structures and is usually depicted by  $C_{max[y:x]}$ . Its numerical coefficient of differentiation is defined by equation (1), denoted by  $ar_{max}$ . In the cases of Table 4 and 5, the values of the coefficients of differentiation are respectively  $ar=0.1159$  and  $ar_{max}=0.1863$ . These results affirm that

the differentiation expenditure between the studied countries is not high.

In order to familiarize the complex operations within the GCCA method, let us assume having in our disposal the data matrix  $\mathbf{P}$  (objects  $\times$  variables) of  $m \times n$  dimension that contains non-negative values, e.g. the data given in table  $P = \{p_{ij} : i=1, \dots, m, j=1, \dots, n\}$  for  $\sum p_{ij}=1, p_{ij} \geq 0$ . Thus, without changing the generality, one can assume that the normalized table  $\mathbf{P}$  may be described by the continuous distribution  $\mathbf{P}^*$  within the square  $[0;1] \times [0;1]$  determined by the density given by:

$$h^*(u, v) = \frac{p_{ij}}{P_{i+} \cdot P_{+j}}, (u, v) \in R_{ij}, R_{ij} = [(S_{i-1}, S_i) \times (T_{j-1}, T_j)] \quad (2)$$

where:

$$S_i = p_{1+} + \dots + p_{i+}; T_j = p_{+1} + \dots + p_{+j}; S_0 = T_0 = 0$$

The density chart defined above is a map of overrepresentation of data contained in the matrix  $\mathbf{P}$ . The basic purpose of GCCA is to study the differentiation of rows and columns and to order them in a way in order to achieve the maximal contrast between the outlying rows and columns. This goal is realized by using the Grade Correspondence Analysis (GCA) algorithm, available in GradeStat (<http://gradestat.ipipan.waw.pl/index.html>). The rows and columns of matrix  $\mathbf{P}$  are reordered as to maximize the coefficient of dependence, calculated for a distribution assigned to the matrix of data, of an assigned distribution  $\mathbf{P}^*$ . Spearman-Rho correlation coefficients and Tau-Kendall are used as coefficients of dependence.

The coefficients “rho” and “tau” are expressed as measures of differentiation of rows (analogically also to columns) of matrix  $\mathbf{P}$ :

$$\tau(\mathbf{P}) = 2 \cdot \sum_{t=2}^m \sum_{s=1}^{t-1} [(p_{t+} \cdot p_{s+}) \cdot a(t:s)] \quad (3)$$

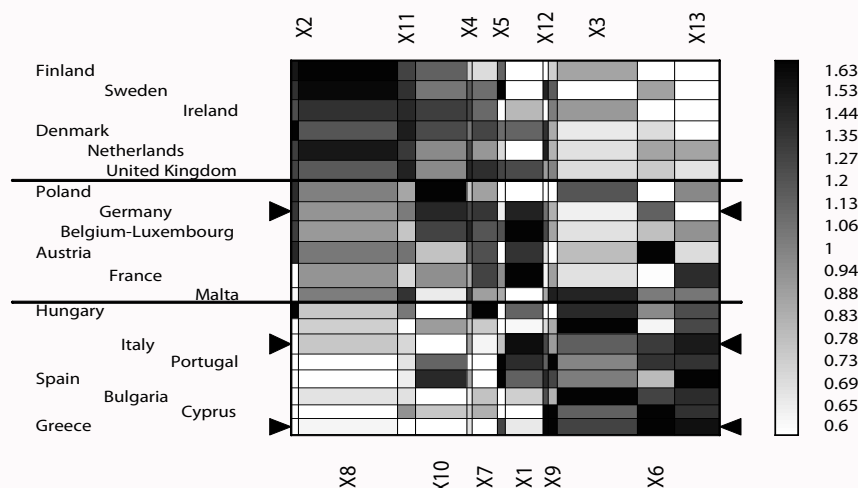
$$\rho^*(\mathbf{P}) = 6 \cdot \sum_{t=2}^m \sum_{s=1}^{t-1} [(S_t^* - S_s^*) \cdot (p_{t+} \cdot p_{s+}) \cdot a(t:s)] \quad (4)$$

where:  $ar(t:s)$  denotes the value of differentiation coefficient of vectors:

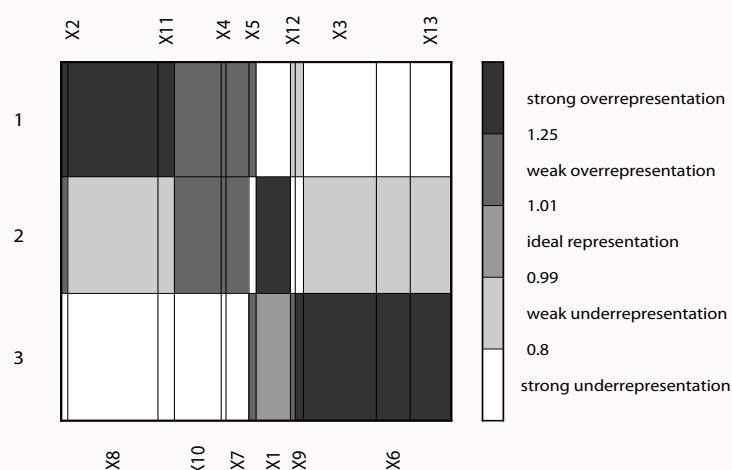
$$\left( \frac{p_{t1}}{p_{t+}}, \frac{p_{t2}}{p_{t+}}, \dots, \frac{p_{tm}}{p_{t+}} \right) \text{ and } \left( \frac{p_{s1}}{p_{s+}}, \frac{p_{s2}}{p_{s+}}, \dots, \frac{p_{sm}}{p_{s+}} \right)$$

$$\text{and } S_t^* = \frac{S_t + S_{t-1}}{2} \text{ where } S_t = p_{1+} + \dots + p_{t+}, i = 1, \dots, m.$$

Based on these coefficients, one constructs a focus of objects to maximize the differentiation between the foci. The differentiations between the two foci as per GCCA are defined as differentiation between the two objects constructed from these foci as sums of their objects [24].



**Figure 3:** Map of consumption structures for twenty EU countries for 1961.  
**Source:** Own elaboration using OECD data (Table 1).



**Figure 4:** Average consumption structures for three groups presented in Figure 3.  
**Source:** Own elaboration using OECD data (Table 1).

## Results

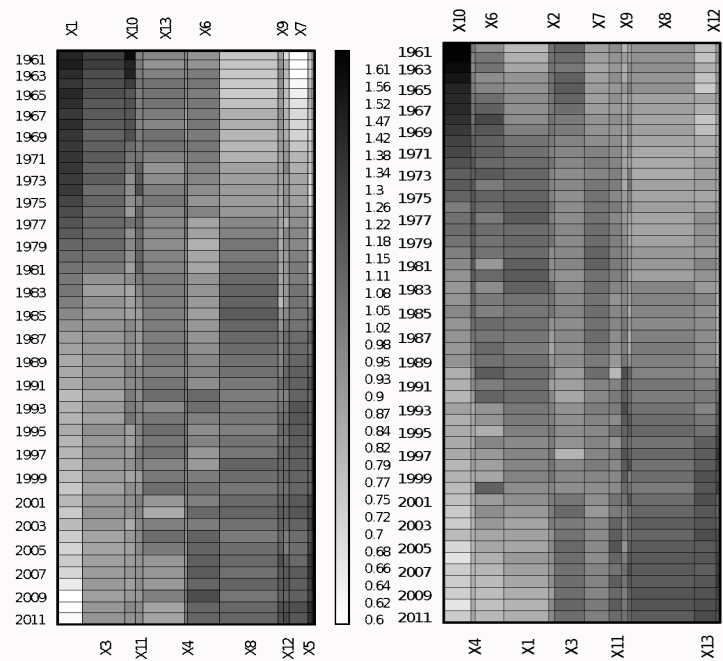
The lack of empirical data has prevented an analysis of the tendency of changes in consumption profiles in all EU countries during the studied period (1961–2011). For the year 1961, there are only data for 20 countries. Empirical data concerning consumption of foodstuffs from individual product groups are from the OECD data and express the consumption in kilogram (kg) per person. In order to analyze the tendency of changes in consumption profiles, we use the product groups detailed in Table 2.

Figure 3 depicts an overrepresentation matrix. Three countries have been highlighted: Italy, Germany and Greece. By using the algorithm GCA, one obtains the maximal similarity (i.e., the minimal value of the coefficient of differentiation  $ar$ ) between adjacent columns and rows. By using the algorithm GCCA, we have designated three focuses of similar profiles of consumption with the use of elbow method through applying the ratio given by the formula (2). It is the classic method described in early 1950s [28]. Figure 4 presents the average consumption structures. The first cluster contains mostly countries of Northern Europe (i.e., Finland, Sweden, but also the United Kingdom and Netherlands). The third group contains

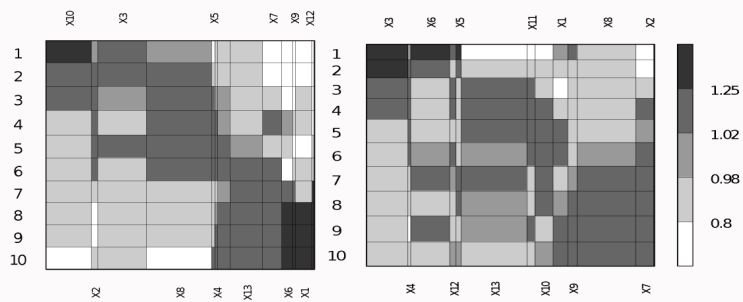
countries from Southern Europe (i.e., Italy, Portugal and Greece). The middle group consists of countries from Central Europe (i.e., Germany, Poland, Austria and France) [28].

Germany is characterized by a greater than average level of consumption of Starchy Roots (X10). Italy, on the other hand, has consumed more than the average amount of Vegetables. In order to analyze the differences in consumption profiles between groups of countries, we calculate the average values for individual product groups in the designated clusters (Figure 4).

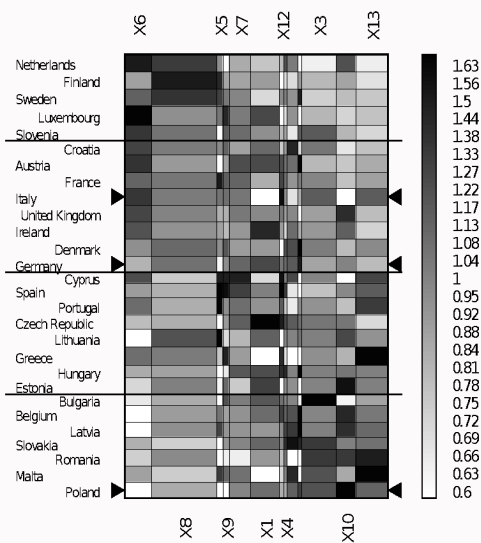
Based on Figure 4, one concludes that the average share of dairy products (X8) for the first group is larger while it is significantly smaller for the third group. A reverse situation is observed in the case of wheat products, fruits and vegetables. Figure 5 details the changes of structures for Italy and Germany between 1961 and 2011. Italy, in the studied period, has significantly decreased the consumption of products from groups: Alcoholic Beverages and Starchy Roots while there is an increase in Milk (Excluding Butter), Meat and Fish and Seafood and Vegetable Oils. Milk (Excluding Butter), Cereals (Excluding Beer), Vegetables and Fruits (Excluding Wine) constitute the largest share of the diet.



**Figure 5:** Overrepresentation map of consumption structures of 13 product groups in kg per person for Italy (left side) and Germany (right side).  
**Source:** Own elaboration using OECD data (Table 1).

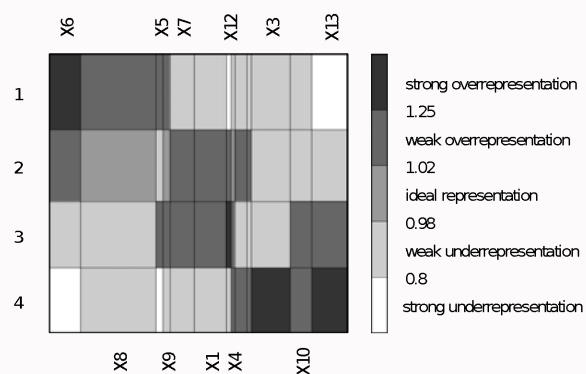


**Figure 6:** Maps of overrepresentation using five-year consumption structures for 13 product groups in kg per person in Italy (left side) and Germany (right side) between 1961 and 2011.  
**Source:** Own elaboration using OECD data (Table 1).



**Figure 7:** Map of consumption structures for 28 EU countries in 2011.  
**Source:** Own elaboration using OECD data (Table1).





**Figure 8:** Map of average structures of consumption for four groups presented in Figure 7.

**Source:** Own elaboration using OECD data (Table1).

**Table 6:** Presentation of coefficient value  $sar_{max}$  for differentiation of expenditure structures and consumption in 2011 with reference to selected years in all EU countries.

No	Country	Expenditure		Consumption			
		2005	2005	2001	1995	1980	1961
1	Austria	0.083	0.038	0.074	0.088	0.065	0.146
2	Belgium	0.057	0.059	0.073			
3	Bulgaria	0.246	0.095	0.107	0.132	0.097	0.233
4	Croatia	0.250	0.108	0.212	0.187		
5	Cyprus	0.134	0.083	0.079	0.063	0.227	0.306
6	Czech Republic	0.072	0.046	0.058	0.044		
7	Denmark	0.044	0.083	0.102	0.155	0.199	0.211
8	Estonia	0.076	0.081	0.127	0.208		
9	Finland	0.028	0.046	0.044	0.082	0.123	0.295
10	France	0.039	0.025	0.055	0.075	0.161	0.242
11	Germany	0.041	0.026	0.041	0.058	0.130	0.172
12	Greece	0.204	0.066	0.093	0.060	0.092	0.272
13	Hungary	0.081	0.053	0.068	0.087	0.126	0.236
14	Ireland	0.183	0.086	0.120	0.126	0.218	0.286
15	Italy	0.024	0.049	0.040	0.079	0.126	0.252
16	Latvia	0.088	0.089	0.121	0.209		
17	Lithuania	0.112	0.102	0.177	0.261		
18	Luxembourg	0.029	0.099	0.073			
19	Malta	0.057	0.057	0.054	0.123	0.136	0.248
20	Netherlands	0.029	0.073	0.097	0.082	0.120	0.200
21	Poland	0.046	0.048	0.059	0.102	0.167	0.291
22	Portugal	0.058	0.050	0.051	0.128	0.253	0.288
23	Romania	0.258	0.031	0.065	0.090	0.125	0.249
24	Slovak Republic	0.098	0.065	0.088	0.101		
25	Slovenia	0.068	0.067	0.049	0.117		
26	Spain	0.041	0.081	0.083	0.079	0.156	0.334
27	Sweden	0.027	0.046	0.055	0.081	0.127	0.191
28	United Kingdom	0.028	0.035	0.074	0.090	0.137	0.140

**Source:** Own elaboration using OECD data (Table 1).

Germany has limited the consumption of Starchy Roots while increasing that of Vegetable Oils and Milk (Excluding Butter). The greatest share in the diet belongs to the following product groups: Milk (Excluding Butter), Alcoholic Beverages, Cereals (Excluding

Beer) and Meat.

These changes are even more visible using five-year averages, as presented in Figure 6. Figure 7 and 8 present consumption-structures

**Table 7:** The values of differentiation coefficient  $ar_{max}$  consumption structure in Italy in reference to the other chosen countries.

	Austria	France	Germany	Greece	Poland	Romania	Spain	swede
1951	0.24	0.23	0.31	11	0.41	0.28	0.14	0.42
1980	0.21	0.22	CI?	0.19	0.3	0.17	11	0.32
1995		0.18	0.25	0.14	0.24	0.2	0.2	0.26
2005	0.21	0.15	0.23	0.28	18	1	0.11	0.21
2011	0.19	0.12	0.22	0.26	0.26	0.24	0.2	0.17

Source: Own elaboration using OECD data (Table 1).

for 28 EU countries for the year 2011. When comparing 2011 to 1961, we observe that the consumption structures for Italy and Germany have converged, while the Polish consumption structure has significantly diverged from that of Germany.

The fact that consumption structures in the studied countries during the period have been changing is visible in Table 6. The table contains coefficient values  $ar_{max}$  describing the differentiation of consumption structure in 2011, in reference to chosen years from the period of 1961-2011. Moreover, the expenditure column shows 2011 the differentiation expenditure. The structure from 2005 is divided into individual groups of food products and alcohol and tobacco as presented in Table 2. From this table one observes that the structure changes slowly (see Finland, Germany, Italy, Sweden) during those 50 years. Changes are significant for almost all observed countries for periods of 6 and 10 years. Structures of expenditure for countries such as Bulgaria, Croatia, Ireland and Romania have changed significantly for the period between 2005 and 2011.

Figure 3 and 7 present the consumption structures for 1961 and 2011. Based on these figures, one concludes that these structures in 2011 are less differentiated than in 1961. In order to measure the differentiation, observe the coefficient of differentiation  $\tau_{abs}$ . This coefficient has values from the interval of [0;1] and is defined by an equation analogous to equation 3 with the coefficient  $ar$  replaced with  $ar_{max}$ . For the years presented in Table 4 (1961, 1980, 1995, 2001, 2005 and 2011), the values of  $\tau_{abs}$  are, respectively: 0.310, 0.254, 0.225, 0.208, 0.198 and 0.189. This means that the consumption structures for the 28 EU countries are becoming less differentiated. Table 7 presents the differentiated consumption structures for Italy in reference to the other chosen countries. Our research proved that differentiation continuously went down.

## Conclusion

This study of the European countries, based on data from the Organization for Economic Cooperation and Development (OECD) database concerning expenditures and consumption of foodstuffs for individual product groups expressed in kilograms per person (Another approach, often applied, is to examine data on calorie intake per person). This paper utilizes the tools of Grade Correspondence and Cluster Analysis (GCCA). The analysis reveals significant consumption differentiations among the European countries. The division of European countries based on size and consumption structures, is similar to the geographical division. This division follows regional differentiations of consumption structure maybe caused by climate conditions, cultural habits and supply considerations.

During the studied period, the profiles of consumption structures have significantly changed. The greatest changes occurred between 1961 and 1980. Interestingly, for the period after 1980, the size of changes has visibly subsided. The consumption structures for Italy and Germany have converged, while those in Poland have diverged from

those in Germany. For the Mediterranean countries, the structure of consumption is dominated by vegetables, fruit and fish. The study shows that consumption structures are less differentiated among the European countries in 2011 as compared with the year 1961. Furthermore, the European preferences and habits of consumers are stable over time. Studying the differentiations among European countries of food expenditures is important for policy makers, trading planners, nutritionists, health officials and economists. The study may encourage economists and financial professionals to further research in the area of consumption expenditures and consumptions. Connecting the line between consumption profiles and their implications to better health and wellbeing is left for future research.

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