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## Examination of Urban Consumers' Propensity to Consume Margarine by Applying Correspondence Analysis

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### Abstract

It is well known that margarine as food is of great nutritious significance to the nourishment of the population. The aim of this paper is to carry out research, which is based on the data obtained from the survey, regarding the propensity of urban population market consumers to consume margarine. The survey has been carried out on a representative sample of the citizens of urban area. Correspondence analysis will be used in this paper, with the aim of determining the impact of selected factors on consumers' preferences for margarine.

**Keywords:** Margarine market, margarine consumption, consumers' preferences, correspondence analysis

### Introduction

Margarine as food plays an important role in human nutrition. This paper aims at examining propensity of urban market consumers' to consume margarine based on a sample of citizens of Novi Sad through the application of contemporary statistical methods. Novi Sad is the second largest city as well as second biggest industrial centre in Serbia. The impact of a larger number of representative factors which have an effect on supply and demand of margarine, will also be examined, as well as interdependency of the above factors. Correspondent analysis methods will be used in the paper which enables the examination and determination of matching – correspondencies of modalities of several factors by decomposition of a singular value, as well as  $\chi^2$  – independency test.

Correspondence analysis is used in situations where it is necessary to quantify

the quality of information contained in a nominal variable. As the main objective of Correspondence Analysis can also be specified testing connectivity between categories of rows or columns.

correspondent analysis method can be considered as a technique used in the description of the data, as the manner of their presentation in an appropriate graphic form. This presentation accelerates and simplifies the testing and interpretation of results.

Case studies are, on the one hand, factors that may have an impact on consumption and consumer preferences for margarine, and on the other hand consumers preferences in using and purchasing margarine.

### Working methods and data sources

The aim of this paper is to apply correspondence analysis method to the data obtained on the basis of consumers' preferences for margarine. The data to which correspondence analysis is applied have been obtained

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on the basis of the survey carried out on the sample of citizens of Novi Sad. The research includes 500 people surveyed, according to the plan of a simple random sample. The task of this paper would be to determine, on the basis of representative variables taken as factors in correspondence analysis, the correlation of margarine consumption (consumers' propensity to consume margarine) and the examined variables (factors).

Population age structures (5 categories) have been taken as variables in this paper, household size (5 categories), and degree of professional qualifications (4 categories), frequency of buying margarine (7 categories), main reason for using this foodstuff (7 categories) and type of margarine (4 categories). 4 categories of margarine were indicated in the original survey questionnaire, in relation to the last category as follows: dairy margarine, vegetable margarine, diet margarine and soya margarine. In respect to the fact that there was not a single response regarding the consumption of soya margarine, the research results refer to the remaining 3 categories.

Statistical software Statistica10.0 has been used for the purpose of statistical data processing in this paper.

Correspondence analysis is widely used in research related to the marketing and market (particularly in research of consumers' preferences). Greenacre (2007) indicates in his book "Correspondence Analysis in Practice" that correspondence analysis is a statistical technique which serves a useful purpose to a great number of researchers, scientists and people working in the practical field who deal with the collection and processing of categorical data, especially in terms of sociological research. This technique is a great help to the analysis of the data from cross tables, provided in the form of numerical frequencies, and as a result, they provide a simple graphic representation which enables faster interpretation and understanding of the data. According to the group of authors (Hair *et al.*, 2006), correspondence analysis represents an explana-

tory technique used for data analysis which is adjusted to the aim of the analysis of simple two-directional and multidirectional tables which contain some of the measures regarding correspondence between rows and columns. Unlike the usual, traditional testing of hypotheses which serve to prove (disprove) a priori assumptions regarding the relation that exists among variables, a more detailed, i.e. in-depth data analysis is used for the identification of systematic relations among variables in the events when there is no information or a priori expectations are incomplete in terms of the character of such relations.

Detroja *et al.* (2006) emphasize that correspondence analysis is a powerful multivariation technique based on a general decomposition of a singular value. Considering a great importance of graphic representation of tables of contingency in a low-dimensional space for a simple and efficient interpretation of some dependency among rows and columns, the need for correspondence analysis arises which enables optimal graphic representation of contingency tables in a low-dimensional space (Jobson, 1992). Correspondence analysis can be treated as a decomposition technique of total  $\chi^2$  - value by determining a small number of dimensions which can serve to represent deviations of real values from the expected values. Thereby  $\chi^2$  - value is based upon the sum of square deviations of real frequencies from the expected ones in the contingency table (Bendixen, 2003).

Correspondence analysis also includes determination of inertia value. Overall or total inertia value is determined as a quotient of total  $\chi^2$  - value and total number of units of observation in the contingency table. Inertia is a measure of variation in the table and it does not depend on the size of a sample. Provided that correspondence analysis is carried out in greater detail, decomposition of total inertia into the components of rows and columns is possible, similar to the method of variance analysis, at which inertia of rows and columns is determined. That way more precise explanations are obtained

regarding homogeneity, considering that zero hypotheses in the analysis of the contingency table are a hypothesis of homogeneity of rows, that is, columns. Contribution to the inertia of rows and columns is usually expressed relatively in relation to the total inertia. Maximum number of characteristic values which arises from the two-dimensional table equals the produce of number of columns reduced by 1 and the number of rows reduced by 1 (STATISTICA 10.0, 2011).

There are numerous examples of the application of correspondence analysis in the research of consumers' preferences for different sorts of agricultural farm products and foodstuffs.

Green *et al.* (1987) use correspondence analysis as a technique which enables the analysis of relations regarding the prediction of profiles of consumers' choices and their demographic features.

Hoffman and DeLeeuw (1992) use correspondence analysis in the context of connecting objects – different brands of goods, on the basis of centroid principles. Authors state that according to this principle, trademarks which are geometrically close to each other are actually similar trade marks.

Pantelić and Savić (2000) state that tests based on - distribution are frequently used in the course of analysis of the data obtained on the basis of marketing research.

Lacomba (2001) refers to correspondence analysis as a visual technique which is faster and simpler than other similar techniques and which provides an insight into the structure of consumers' preferences with reference to different products.

Kleij and Musters (2003) study consumer preferences according to different varieties of mayonnaise by using correspondence analysis which provides visualization comparable to preference maps.

Liggett *et al.* (2008) apply the method of multi-dimensional scaling as a appropriate method that in some way enables estimation of perfect product on the basis of consumers' opinion about similar products.

Panea *et al.* (2009) refers to a correspondence analysis as an useful technique for simultaneous graphical presentation of continuous and categorical variables and use this method in the analysis of beef-quality based on consumers' profile.

Avilez *et al.* (2010) apply correspondence analysis as a method for investigating of relationship between milk production, farm size and producers' educational level.

Guerrero *et al.* (2010) apply correspondence analysis in investigation of relationship of European consumers' preferences towards the certain foods and expression "traditional".

Nićin (2010) uses a correspondence analysis method in the research of preferences of consumers in Novi Sad according to the consumption of cheese.

Beh *et al.* (2011) use correspondence analysis in studying perceptions of food of consumers in Europe.

Chollet *et al.* (2011) use correspondence analysis in examination of eight sensor characteristics of beer.

De Souza *et al.* (2011) apply correspondence analysis with purpose to determine the best sweetener that producers use in production of Swiss cheese.

Larsson and Orsini (2011) use correspondence analysis in researching the consumption of fish products.

## Examination results

According to the survey results approximately equal number of the examinees out of the total number of the surveyed households (250) state that they buy margarine

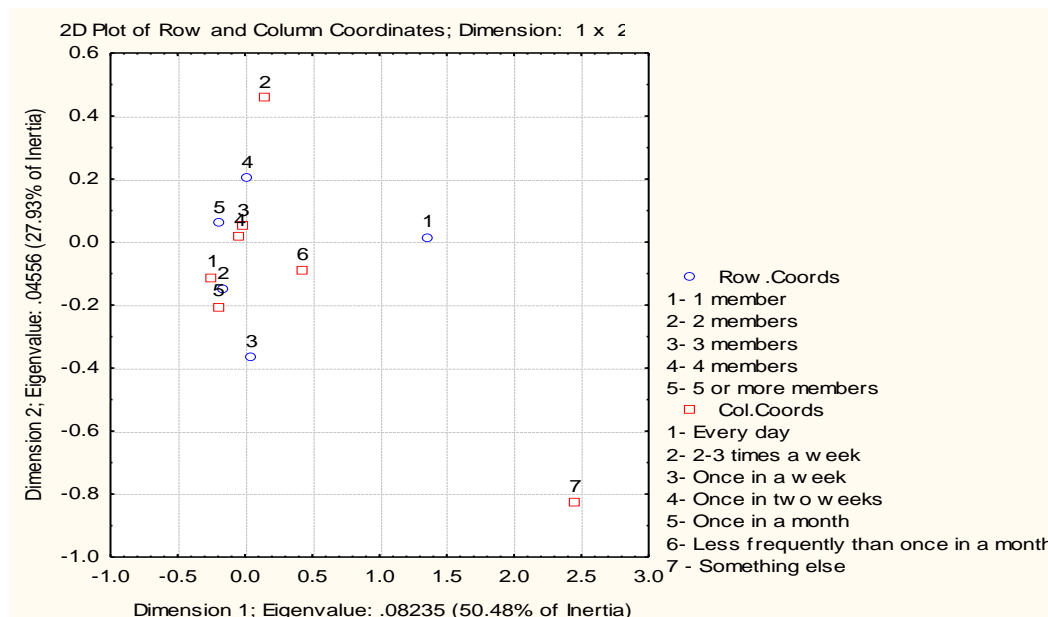
once a month (24.7%), once a week (23.4 %) and once every two weeks (22.6%). The percentage of the examinees who buy margarine once a month is in decline proportionately to the household size. The fourth position is taken by the examinees who have responded that they buy margarine 2-3 times a week (13%). Less frequently than once a month, margarine is bought by 8.4% of the examinees. Margarine is bought on a daily basis by 7.1% of the examinees. Response “something else” (which is not defined by the questionnaire) has been provided by 0.84% of the examinees.

Household size has displayed a statistically significant correspondence with the frequency of buying margarine  $\chi^2 = 38.99$  ( $p=0,028, \alpha = 0.05$ ), whereas total inertia is in the amount of 0.163 (Table 1.). 50.5% of total inertia has been explained by means of the first dimension, 27.9% of total inertia has been explained by means of the second one, 18.5% of total inertia has been explained by means of the third dimension, and 3.1% of total inertia has been explained by means of the fourth dimension- variability, which means that in total about 78% of total inertia – variability of the observed phenomenon has been explained by means of the first two dimensions. The first two dimensions explain in a statistically significant way the variability of the observed phenomenon. Examinees from households with one member who buy margarine once a month or less frequently have contributed to a great extent to the explanations of inertia, as well as those whose response to this question has been “something else”, examinees from households with two members who buy margarine once a week or once a month, examinees from households with 3 and 4

members who buy margarine 2-3 times a week, as well as the examinees from the largest households who buy margarine every day or less frequently than once a month.

Definitely the greatest contribution to the explanation of inertia is made by the examinees from households with one member whose response is “something else”– response which is not provided within the questions by the questionnaire, as well as the examinees from households with three members who buy margarine 2-3 times a week.

It can be concluded on the basis of two-dimensional graphic representation of coordinates of rows and columns that there is a correspondence of examinees from households with two members with buying margarine everyday and once a month, as well as of the examinees from the largest households and households with four members with buying margarine once a week or once every two weeks (Figure 1).



**Figure 1: Two-dimensional plot of the coordinates of rows (household size) and columns (frequency of purchasing the margarine)**

Source: Authors calculation based on questionnaire results

In addition, it can be noticed that with reference to the vertical axes of two-dimensional graphic representation, in terms of the frequency of buying margarine, groups from any household size except for the households with one member are quite homogenous. In other words, with reference to the vertical axes, on the one hand, households with two members and largest households can be noticed as sub-groups, and on the other hand, households with three and

four members. Thereby it can be noticed that households with one member are significantly different from the above sub-groups. With reference to the horizontal axes of the Figure 1 homogenous groups of the examinees from both the smallest and largest households can be noticed.

The largest number of the examinees from all age categories indicates habit as a main reason for using margarine (42.5%).

**Table 1: Eigen values and total inertia for all dimensions (household size of examinees × frequency of margarine purchasing)**

Eigenvalues and total inertia for all dimensions: Total inertia = 0.163, $\chi^2 = 38.99$ , Degrees of freedom = 24; p = 0.027, $\alpha = 0.05$					
Dimension Number	Singular Values	Eigenvalues	% of Total Inertia	Cumulative Inertia	$\chi^2$ value
1	0.29	0.08	50.48	50.48	19.68
2	0.21	0.05	27.93	78.41	10.89
3	0.17	0.03	18.48	96.89	7.20
4	0.07	0.01	3.11	100.00	1.21

Source: Authors calculation based on questionnaire results

Nice flavour of margarine as a main reason has been provided by 30.5% of the examinees. Nutritional value of margarine is in the

third place as a reason for using it – 14.6%. Reasonable price of the product has been indicated as a main reason by 3.4% of the ex-

aminees. High quality of the product has been indicated as a main reason by 3% of the examinees. Age of the examinees has showed a statistically significant correspon-

dence with the responses related to the main reason for margarine consumption,  $\chi^2 = 39.84$  ( $p=0.022$ ), whereas total inertia is 0.171 (Table 2.)

**Table 2: Eigen values and inertia for all dimensions (age of examinees  $\times$  main purpose of using margarine)**

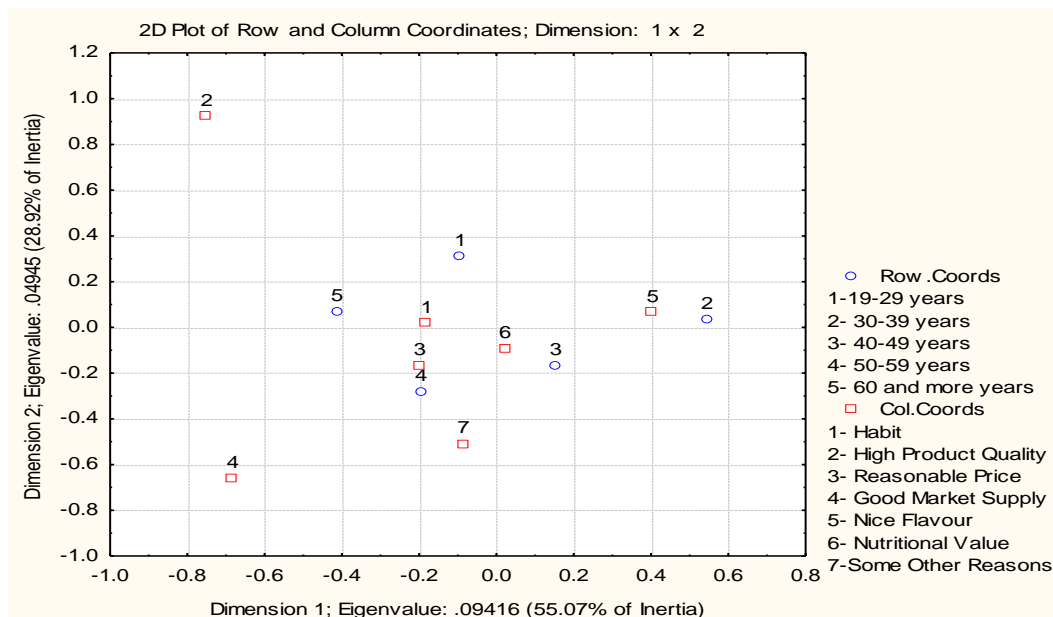
Eigenvalues and total inertia for all dimensions: Total inertia = 0.171, $\chi^2=39.84$ , Degrees of freedom= 24; $p = 0.022$ $\alpha = 0.05$					
Dimension Number	Singular Values	Eigenvalues	% of Total Inertia	Cumulative Inertia	$\chi^2$ value
1	0.31	0.09	55.07	55.07	21.94
2	0.22	0.05	28.92	83.99	11.52
3	0.14	0.02	12.25	96.24	4.88
4	0.08	0.01	3.76	100.00	1.50

**Source:** Authors calculation based on questionnaire results

About 55% of total inertia – variability has been explained by means of the first dimension, 28.9% of total inertia – variability has been explained by means of the second dimension, 12.2% of total inertia – variability has been explained by means of the third dimension, and 3.8% of total inertia – variability has been explained by means of the fourth dimension, which means that in total about 84% of total inertia variability of the observed phenomenon has been explained by means of the first two dimensions. The first two dimensions explain variability of the observed phenomenon in a statistically significant way. Great contribution to the explanations of the inertia has been made by the youngest examinees, who indicate high quality of the product, good market supply and “some other reasons” as main reasons for margarine consumptions, then by the examinees aged 30-39 who indicate habit, high quality of the product and nice flavour, next by the examinees aged 40-49 who indicate high quality of the product and “some other reasons”, followed by the examinees aged 50-59 and the oldest examinees who refer to the high quality of the product, good market supply and nice flavour.

Definitely the greatest contribution to the explanation of inertia has been provided by the examinees aged 30-39, who indicate nice, flavour as a main reason for margarine consumption, as well as the oldest examinees who indicate high quality of the product.

It can be concluded on the basis of two-dimensional graphic representation of coordinates of rows and columns that there is a correspondence of the examinees aged 50-59 with the reasonable price of margarine as a main reason for its use, correspondence of the examinees aged 30-39 with the nice flavour as a main reason, as well as the examinees aged 40-49 who indicate nutritional value of margarine as a main reason. Furthermore, in relation to the vertical axes of two-dimensional graphic representation, in terms of the frequency of margarine consumption, pretty homogenous youngest group of the examinees and group of the examinees aged 50-59 can be noticed, whereas in relation to the horizontal axes of the graphic, pretty homogenous group of the examinees aged 30-39 and the oldest group of the examinees on the one hand, and a group of the examinees aged 40-49 and 50-59 on the other hand can be noticed (Figure 2).



**Figure 2: Two-dimensional plot of the coordinates of rows (age of examinees) and columns (main purpose of using margarine)**

Source: Authors calculation based on questionnaire results

The greatest number of the examinees of all the categories buys dairy margarine (50.4%). There is an equal percentage of those who buy both vegetable and diet margarine (25.6%, i.e. 23.9% of the examinees).

Degree of professional qualifications has showed no statistically significant correspondence with the type of margarine that consumers most frequently buy,  $\chi^2=7.22$  ( $p=0.301, \alpha = 0.05$ ), whereas total inertial amounts to 0.0303 (Table 3). 68.86% of total inertia – variability has been explained by means of the first dimension, and the rest of the total inertia – variability has been ex-

plained by means of the second dimension, which means that in total a complete total inertia-variability of the observed phenomenon has been explained by means of the first two dimensions. The first two dimensions explain in a statistically significant way variability of the observed phenomenon. Significant contribution to the explanations of the inertia has been made by the examinees with primary education, who buy dairy margarine and diet margarine, then by the examinees with secondary education who buy vegetable margarine, as well as by the examinees with high school education who buy both dairy and vegetable margarine.

**Table 3: Eigen values and total inertia for all dimensions (level of education of examinees x margarine type)**

Eigenvalues and total inertia for all dimensions: Total inertia = 0.030, $\chi^2 = 7.22$ , Degrees of freedom = 6; $p = 0.301, \alpha = 0.05$					
Dimension Number	Singular Values	Eigenvalues	% of Total Inertia	Cumulative Inertia	$\chi^2$ value
1	0.14	0.02	68.9	68.9	4.97
2	0.10	0.01	31.1	100.00	2.25

Source: Authors calculation based on questionnaire results

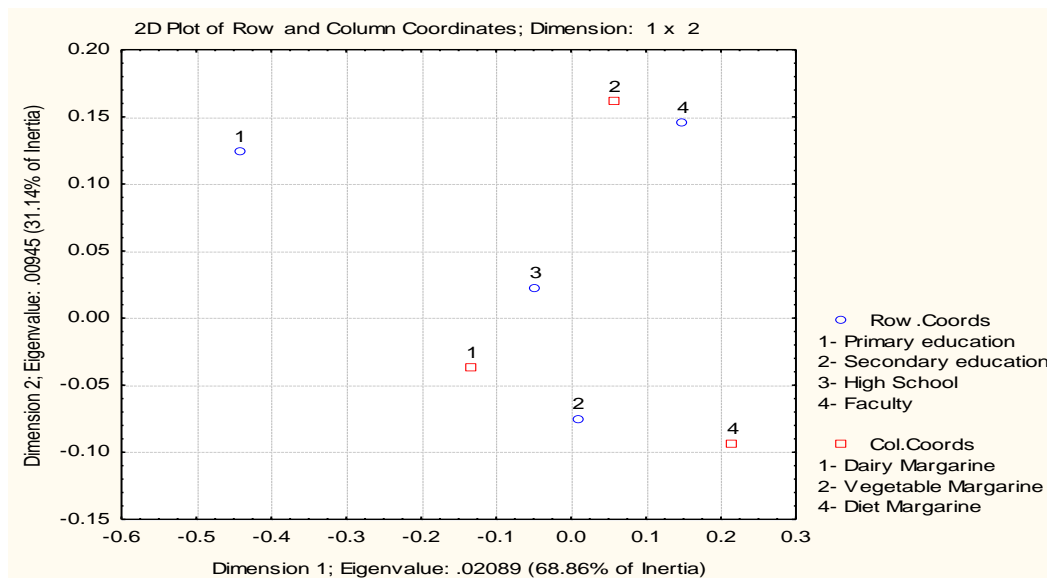
It can be concluded on the basis of two-dimensional graphic representation of coor-

dinates of rows and columns that there is a correspondence of the examinees with high



school education with vegetable margarine purchase. Furthermore, pretty homogenous groups of the examinees with secondary education and high school education can be noticed in relation to the vertical axes of two-dimensional graphic representation, in

terms of the type of margarine that is bought, whereas pretty homogenous groups of the examinees with primary education and high school education can be noticed in relation to the horizontal axes of the graphic (Figure 3).



**Figure 3: Two-dimensional plot of the coordinates of rows (level of education of examinees) and columns (margarine type)**

Source: Authors calculation based on questionnaire results

### Conclusions

Based on the survey that has been carried out and statistical processing through the application of up-to-date statistical software STATISTICA, it has been established that over 70% of the examinees buy margarine with the frequency varying from once a week to once a month. The age of the examinees has displayed a statistically significant correspondence with the responses related to the main reason of using margarine ( $\chi^2 = 39.84$ ;  $p = 0.022$ ,  $\alpha = 0.05$ ), meaning that the main reason of using margarine is not independent of the age of the examinees. Household size has also displayed a statistically significant correspondence with the frequency of buying margarine ( $\chi^2 = 38.99$ ;  $p = 0.028$ ,  $\alpha = 0.05$ ), which indicates that the frequency of buying margarine is not independent of the number of house-

hold members. Since a significant correspondence of modalities of previously crossed questions has been established on the basis of the derived method of correspondence analysis, the resulting conclusions indicate that this technique can be applied to the examination of some performances of margarine as foodstuff.

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