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## **Application of conjoint analysis in the study of the wine consumers' preferences**

**Abstract:** In our paper, the results concerning the research devoted to wine consumers' preferences, obtained with the use of method called the conjoint analysis, are presented. The basis for measurements of such the preferences is the utility function that enables to assign numerical characteristics to each of available variates. The conjoint analysis is a survey-based multivariate statistical technique where respondent has different objects at the disposal, each of which is determined by the chosen set of relevant attributes, taking the given values (levels), in order to give some information about the total preferences regarding these objects. The objective of our work is to gain the knowledge about the wine consumers' preferences and, in particular, to establish what factors are vital for them when purchasing wine. We conduct a questionnaire survey based on a sample consisting of 248 randomly chosen respondents, declaring wine consumption. The collected sample has been divided into the female and male groups, as well as into the three age categories (18–35 years, 36–55 years and 56 years or more). In our study, we have stated that the price of wine is the most decisive factor when it comes to selection of the preferred sort of wine. The wine dryness and its color turn out to be the second and the third most significant factors regarding this choice, while the sort of wine and the number of awarded prizes or accolades are the least important factors for buying the specific kind of wine.

**Key words:** preferences analysis, consumer, conjoint analysis, wine

**JEL classification:** C10, C38, C80, C88, D12, D91, E21

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## Introduction

Both the decision-making process and the issue of selection are associated with the widely understood human activity and are the subjects of investigations in various fields of science. Interests in the topic of human behavior concern not only the area of psychology, social psychology and sociology, but also include such the branches of science as mathematical programming, operational research, marketing research and economics [Walesiak and Bać 2000].

In the 19th century, a German economist H.H. Gossen introduced the concept of utility as a subjective pleasure and satisfaction resulting from the consumption of goods and services and formulated the basic principles of utility theory [Zawadzka 2002]. The main assumption of the utility theory is the principle stating that consumers purchasing certain goods or services behave rationally and that their decisions and choices are optimal in terms of the currently existing restrictive conditions. Simultaneously, it has been proved that consumers feel the subjective satisfaction due to the availability of a specific consumption structure and that this satisfaction is associated with the utility of the given product [Stanimir 2006].

A direct measurement of the satisfaction level felt by consumers is impossible and therefore, the concept of preferences has been introduced [Stanimir 2006]. The basis for the preferences measurement is the utility function, which enables to assign numerical characteristics to the variants that may be chosen. This allows us to quantify the preferences regarding the considered variants. It should be pointed out that the utility and the usability theories are considered as the principles of microeconomics, while the studies devoted to the preference testing may be classified as the research tools of microeconometrics [Pelka and Rybicka 2012].

Preferences reflect the consumers' tastes and likings, as well as their expectations towards the goods on the market. Hence, learning about these preferences allows the company to increase its productivity, competitiveness and market share, as well as to meet the demands of clients, by introducing new products and adapting better manufacturing standards. This is particularly important nowadays, as companies must operate in rapidly changing economic conditions and circumstances [Szymańska 2013]. The necessity of the investigations reflecting the consumers' preferences and requirements results not only from the need of reaching larger financial profits and gains in market share, but also from the company's ambitions to be modern and innovative, as well as from its desire to manufacture products of steadily increasing quality [Szymańska 2013, Kotlarz 2014].

The aim of our study is to identify the preferences of wine consumers, in particular to determine what factors are the most decisive for wine buyers. It may be observed that the Polish wine market is growing from year to year and the share of this beverage in the structure of the consumed alcohol is also increasing. At the same time, the consumers' knowledge and awareness about wines is growing as well [Czarniecka-Skubina et al. 2012]. Despite these positive tendencies, wine consump-

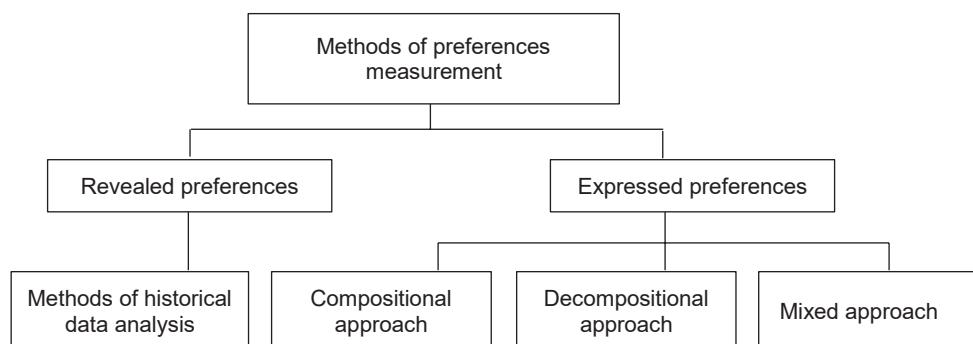
tion in Poland still remains at a relatively low level and differs from the European average [Marczak and Wiśniewski 2018]. The wine industry is not an easy branch of trade in our country, as it faces a number of challenges as well as, there is a lot of fierce competition among the wine traders since consumers are not only more demanding, but also have higher and higher social and financial aspirations. All these factors make the research regarding the wine preferences a reasonable direction of studies.

Surveys relating to the investigation of the customers' preferences provide a lot of feedback information. Using the gained information, managers may create an appropriate business offer, which is well adapted to the consumers' needs and expectations. All this contributes to an increase of the customers' satisfaction and commitment, which results in reaching better financial results [Kotlarz 2014].

### Measurement of consumers' preferences

Research on consumers' preferences can be conducted using historical data or consumers' declarations, expressing their intentions of buying the specific sort of the product [Bąk 2004, Pełka and Rybicka 2012].

Sets of historical data show customers' choices that have already been made. In turn, sets of data having anticipatory character illustrate consumers' intentions of purchasing the offered goods and are collected in the form of surveys. These two types of data sets allow clear specification of both the methods concerning analysis of the revealed preferences and the methods of analysis related to the expressed preferences [Szymańska 2013]. In order to analyze the revealed preferences, the methods of historical data analysis are used, while in the research devoted to the expressed preferences the following three research approaches determine the methodology of measuring this kind of preferences: the compositional approach, the decompositional approach, and a mixed approach [Bąk 2004].



**Figure 1**

Classification of methods used in preferences measurement

Source: Bąk [2004].

With the help of compositional methods, the individual product features are evaluated or compared and subsequently, general preferences regarding the compared objects (goods or services) are determined. In this case, the total utility of the multidimensional profile of a given product is a weighted sum of the levels of evaluation of individual attributes, where the weights express importance of the considered attributes for consumers involved in the survey study [Bąk 2004, after Zwerina 1997].

In the decompositional methods, the corresponding products are evaluated or compared. The total preferences of respondents are obtained through their evaluations of the product profiles for the selected attributes. Subsequently, using the collected evaluations and appropriate estimation methods, the division of total respondents' preferences into the so-called partial utilities is carried out. These partial utilities are obtained by calculating the share of each of the chosen attributes in the estimated total value of the profile utility [Green and Wind 1975, Bąk 2004, Sagan 2009, Szymańska 2013]. One of the basic methods of the preferences structure analysis is the conjoint analysis, which is also known under various names, as for example: the analysis of total co-occurrence of variables, the multifactorial combined measurement, an additive combined measurement [Sagan 2009].

In turn, the mixed approach combines both the compositional and the decompositional methods. The best-known mixed methods of conjoint analysis include the hybrid and the adaptive methods [Stanimir 2006].

### **Conjoint analysis design**

Conjoint analysis is a method that allows for measurement and prediction of the buyers' preferences. Its implementation is preceded by conducting a survey, where respondents get acquainted with the sets of objects composed of real or hypothetical products or services, which are described by explanatory variables taking the given values [Bąk 2004]. While filling the survey questionnaire, respondents evaluate the presented objects. The main objective of the research is to measure consumers' preferences towards the presented objects, and the final result of measurement is the set of values assigned to the explained variable [Pełka and Rybicka 2012].

The general model of the conjoint analysis method has the following form [Walesiak and Bąk 2000, after van der Lans 1992]:

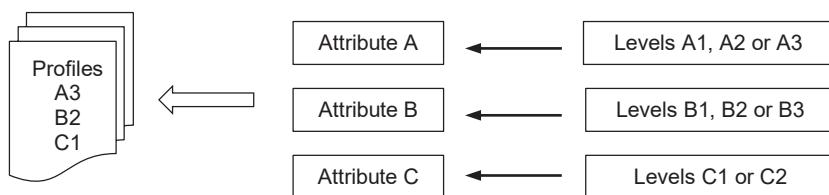
$$U_i^s = f_s(u_{1(is)}, u_{2(is)}, \dots, u_{m(is)}) \quad (1)$$

where:

$U_i^s$  – total utility of the  $i$ -th profile of the  $s$ -th respondent,

- $f_s$  – analytical form of the preference function for the  $s$ -th respondent,  
 $u_{j(is)}$  – position of the  $i$ -th profile with regard to the  $j$ -th variable from the view of  
the  $s$ -th respondent,  $j = 1, \dots, m$ .

The explained variable represents the preferences of respondents, in particular their evaluations of the product. In turn, the explanatory variables describe goods or services and are called attributes or factors, while their realizations are known as levels. Attributes and their levels generate different variants of goods or services, which are called profiles, stimuli, treatments or runs [Walesiak and Gatnar 2009]. The relations between attributes, levels and profiles are depicted in Figure 2.



**Figure 2**

Relations between profiles, attributes and levels

Source: Ramirez-Hurtado [2010].

Profiles of the considered products or services, described by the set of attributes, are presented to respondents for evaluation. The number of all possible profiles depends both on the number of attributes and on the number of their levels. In the case of  $N$  attributes with  $k$  levels each, the number of profiles that should be evaluated is equal to  $k^N$ . For example, with six attributes each having three levels,  $3^6 = 729$  hypothetical products should be presented to respondents for assessment. With such a large number of profiles under evaluation, the problem consisting in the perception difficulties occurs in practice and for this reason, only a part of available data is selected for the research [Ramirez-Hurtado 2010]. A reduction in the number of variants is carried out using statistical or heuristic methods [Stanimir 2006].

Profile assessments reflect the respondents' preferences (their total utilities) and form the basis for further analysis. These evaluations consist in the decomposition of total utilities profiles into the partial utilities of attribute levels, as well as in estimating the share of individual attributes in the total utility of each profile [Walesiak and Bąk 2000, after Green and Wind 1975]. Knowledge of the partial utilities makes it possible to estimate the significance (the so-called attribute importance) in the assessment of the profiles considered in the study [Walesiak and Gatnar 2009].

The relative importance of the  $j$ -th attribute for the  $s$ -th respondent is calculated from the following formula [Walesiak 1996, Walesiak and Gatnar 2009]:

$$W_j^s = \frac{\max_{l_j} \{U_{jl_j}^s\} - \min_{l_j} \{U_{jl_j}^s\}}{\sum_{j=1}^m \left( \max_{l_j} \{U_{jl_j}^s\} - \min_{l_j} \{U_{jl_j}^s\} \right)} \cdot 100\% \quad (2)$$

where:

$U_{jl_j}^s$  – partial utility of the  $l$ -th level of the  $j$ -th variable for the  $s$ -th respondent,  
 $l_j$  – the number of levels for the variable  $Z_j$ .

An average importance of variables  $W_j$  is obtained from the formula:

$$W_j = \frac{1}{S} \sum_{s=1}^S W_j^s \quad (3)$$

where:

$W_j^s$  – such as in formula (2),  
 $S$  – the number of respondents.

## Research methodology

The survey was carried out in the period between September and November 2019, among the wine consumers from Warsaw. It involved 248 randomly chosen respondents. It should be noted that such a selection of research sample does not allow for application of statistical inference methods, but nevertheless it may be successfully used in gaining knowledge about the preferences of wine consumers [Szreder 2004].

The conducted study used the traditional conjoint analysis, based on the partial factor system. In order to employ this scheme, the following six attributes (variables), characterizing wines, together with the corresponding levels have been established:

- price (up to 20 PLN; from 21 to 30 PLN; from 31 to 50 PLN; from 51 PLN);
- color (red; pink; white);
- type (still; sparkling);
- dryness (dry; semi-dry; semi-sweet; sweet);
- region – place of origin [region 1: France, Spain, Portugal, Italy; region 2: Austria, Bulgaria, Greece, Moldova, Germany, Hungary; region 3: North America and South America (Argentina, Chile, USA); region 4: Australia, New Zealand, Africa (South Africa)];
- honors – awards and accolades (yes; no).

Combinations of the considered attribute levels allowed to create the set of hypothetical profiles of the given product. In the presented study, six variables were selected, with: 4, 3, 2, 4, 4, 2 levels, respectively. Thus, it was possible to obtain

$4 \times 3 \times 2 \times 4 \times 4 \times 2 = 768$  wine profiles and, theoretically, that number of profiles should be presented to respondents. However, such a large number of variants made it impossible to evaluate the product and hence, the set of accessible profiles was limited to their certain subset. The complete factor system (including all of possible profiles) was reduced to a partial factor system by using the ORTHOPLAN command from the SPSS package. As a result, 18 wine profiles were obtained and only these 18 profiles were examined in the survey.

Respondents could express their preferences by evaluating individual wine profiles on a scale from 1 to 10, where 1 meant the least preferred profile, whereas 10 denoted the most preferred one. Data relating to the respondents' assessments were prepared in the SCORE format, i.e. in the form of point evaluations that the respondents had to assign to each of the given profile.

The next step of the conducted analysis was to estimate the parameters of the regression model (i.e. the partial utilities) with the use of the ordinary least squares (OLS) method, where the explained variable referred to the total utility assigned by respondents to the individual profiles. For this purpose, the CONJOINT command from the SPSS statistical package was used in order to analyze, with the help of the conjoint analysis approach, the set of data collected according to the rules of the full-profile or the full-concept approach [Walesiak and Bąk 1997]. In the next stage, the relative importance and the average importance of each variable in the process of wine selection were determined for each respondent.

## Research results

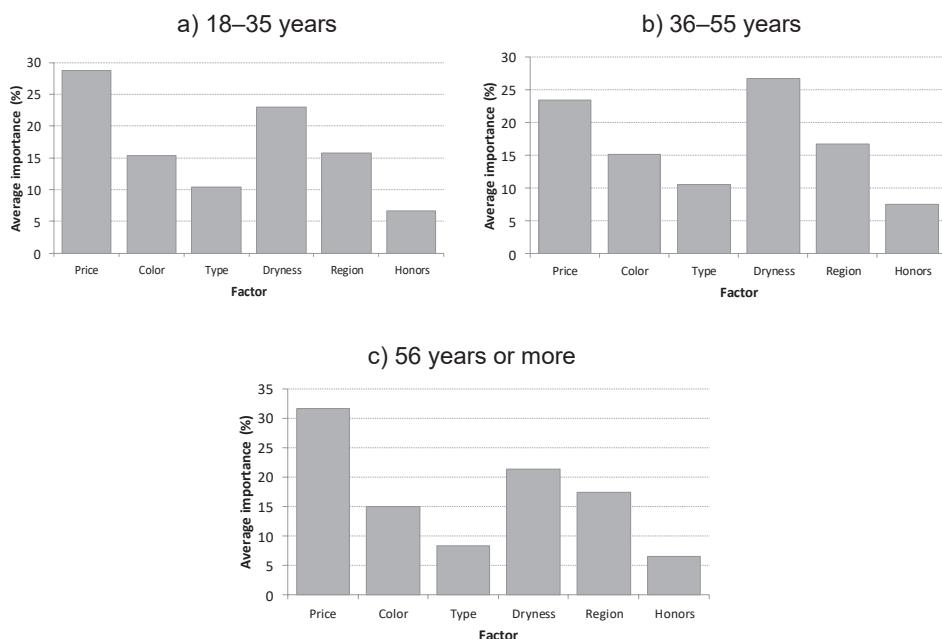
The most important attribute for respondents when making decisions about the wine selection is – both for women and men – the price (Fig. 3). An average validity of the price for respondents ranges from 26.6% for women to 28.3% for men. The second most significant factor for consumers with reference to the wine selection is the dryness of wine – its validity amounts to approximately 24% for both women and men. It turns out that the factors, such as the region where the wine is produced and its color are less important than the price and the dryness. The least important factors in wine selection are the type of wine (with its division for still and sparkling wine) and the factor stating, whether the wine received any awards or accolades. No significant differences are observed regarding importance of the factors between female and male respondents.

The age of respondents has a greater impact on preferences regarding the choice of wine than their sex (Fig. 4). For the youngest respondents, the most important factor taken into account when making the wine selection turns out to be the price (with 28.8% of validity), which is followed by the dryness (with 23.0% of validity), the region of wine origin (with 15.8% of importance), the color of wine and its type (with significances of 15.3% and 10.4%, respectively). The least important factor

**Figure 3**

Average importance of factors for all respondents with reference to sex

Source: Own elaboration.

**Figure 4**

Average importance of factors for all respondents with reference to age

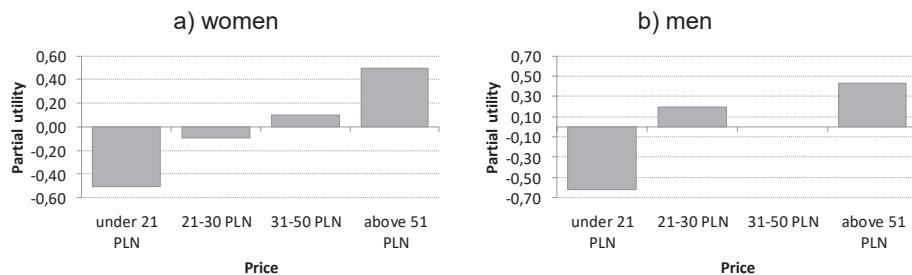
Source: Own elaboration.

reflects to the question, whether the wine won any prizes or distinctions (with only 6.6% of significance). On the other hand, consumers from the age group 36–55 years are, according to the authors, more aware and they have, on average, more financial abilities than younger people and, as a consequence, for them the dryness is the most important factor relating to the selection of wine (with 26.6% of significance). For this age group, the price is of less importance than for younger people (with valid-

ity of 23.4%). Furthermore, in the case of the oldest age group a high validity of the price (31.7%) may be observed, while the dryness of wine, that comes second in the overall rank of importance, reaches among the elderly people the validity of 21.3%, which is the lowest of all age groups. It means that for the oldest respondents, who are the most aware and demanding consumers, the price is seen as a determinant of the wine quality.

Figures 5–12 depict the partial utilities of the levels of individual variables with their division for the gender and age groups.

For both women and men, the most preferred price of wine is the highest price – from 51 PLN (Fig. 5). The wines with higher prices are identified as the wines of high quality and therefore also of good flavor. In turn, the wines with the lowest prices (up to 20 PLN) are considered by the respondents as the wines of low quality and simultaneously, they are the least preferred wines regardless of the gender.

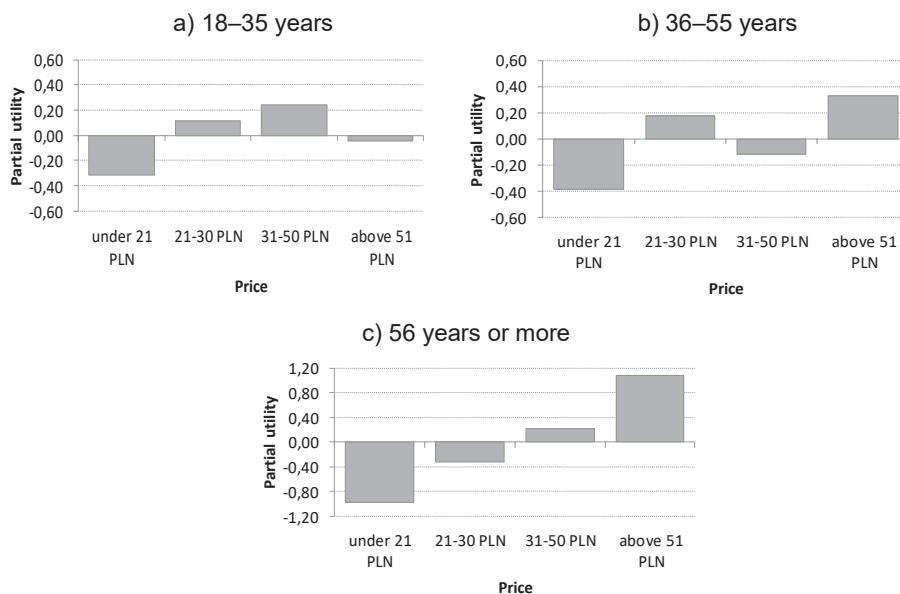


**Figure 5**

Partial utilities of the levels of the variable “price” with reference to sex

Source: Own elaboration.

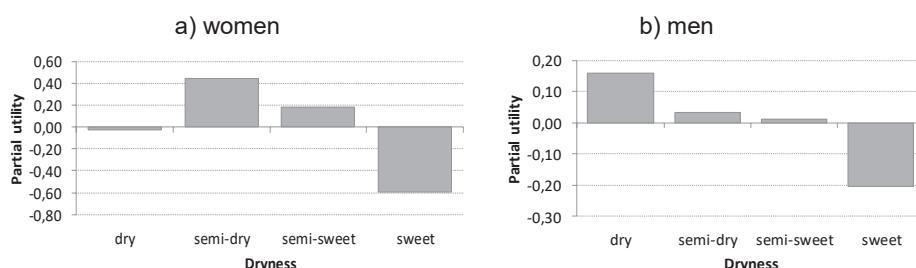
Consumers’ preferences relating to the price levels are more diverse with reference to the age groups (Fig. 6). The youngest age group prefers wines from the range 31–50 PLN, while people aged 36 or more often choose the most expensive wines – with prices above 51 PLN. In turn, cheaper wines – with a price up to 20 PLN – are the least preferred in all of the considered age groups. These observations confirm that for consumers, regardless of the gender and age, the price is a major factor taken into account when it comes to the wine acquirement, and that higher prices are mostly preferred. This shows that the price is an important attribute of wine quality for consumers. An increasing level of affluence in the Polish society implies that in particular the elderly people seek of high-quality goods and prefer expensive wines. Nowadays, wine is becoming more and more luxury product in Poland, as it may also be seen from the results of other studies, which indicate that the demand for wines from the premium price range has grown rapidly in recent years [Marczak and Wiśniewski 2018].

**Figure 6**

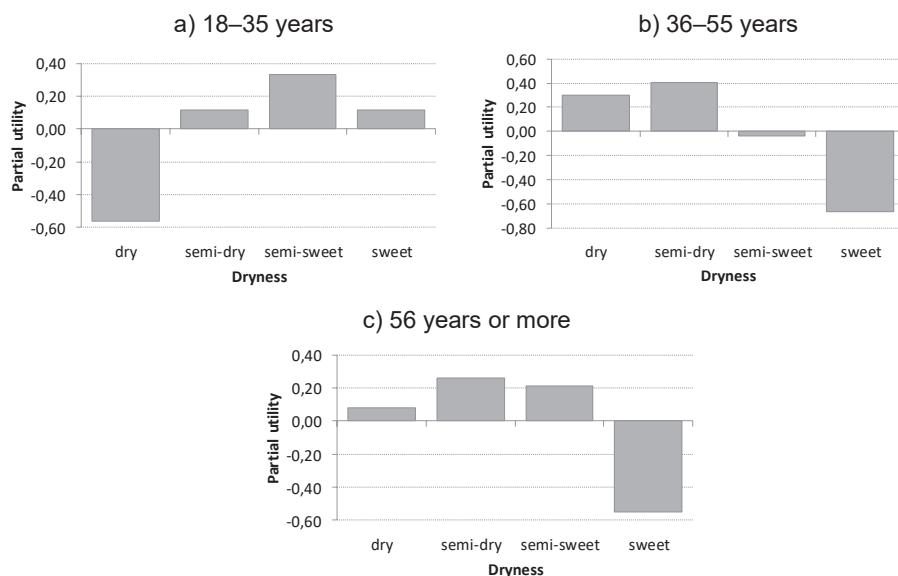
Partial utilities of the levels of the variable “price” with reference to age  
Source: Own elaboration.

The dryness of wine is, after the price, the second most important factor when it comes to wine selection (Figs. 7 and 8). It may be seen that women prefer semi-dry wines, whereas men are in favor of dry wines. In turn, the lowest rated wines are the sweet wines, which are the least preferred wines both among women and men.

The greater diversity of preferences with regard to the dryness factor may be observed when it comes to the age of consumers. The youngest of them, aged 18–35, prefer semi-sweet wines, while dry wines are definitely not preferred by consumers from this age group. On the other hand, for consumers from the age groups over

**Figure 7**

Partial utilities of the levels of the variable “dryness” with reference to sex  
Source: Own elaboration.

**Figure 8**

Partial utilities of the levels of the variable “dryness” with reference to age

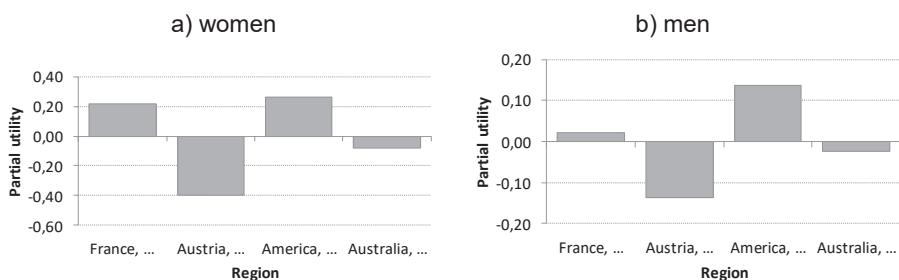
Source: Own elaboration.

35 years, semi-dry wines are the most preferred of all wines, whereas sweet wines are the least desirable by them.

When analyzing consumers' preferences with reference to the country of wine origin (Figs. 9 and 10), we conclude that the wines from South and North America (Argentina, Chile, USA) are mostly preferred. This fact provides an evidence that currently consumers are trying to seek new taste experiences and direct their attentions towards the wines from non-European countries. It should be noted that in the countries of the New World grapes grow in warmer climate and, generally, in more favorable circumstances, which makes them more ripe and tasty [Wierzchołowski 2013].

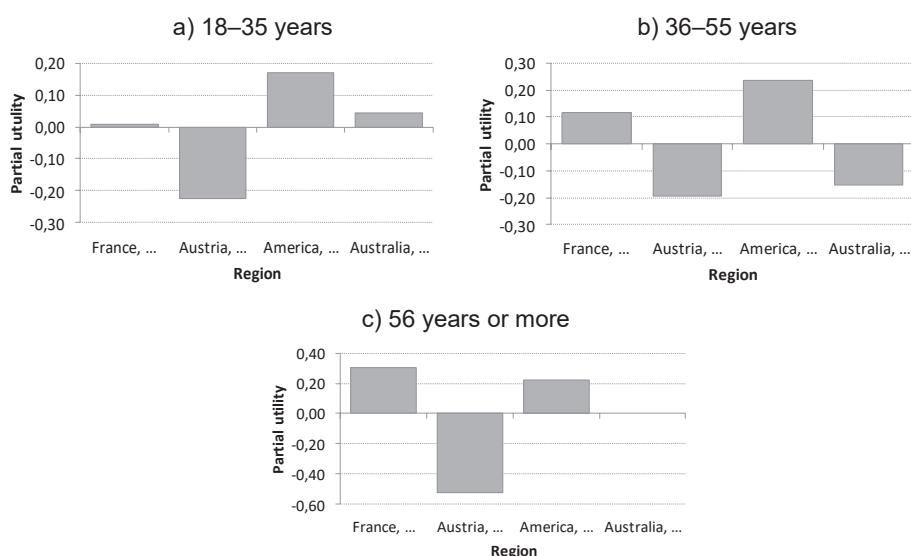
In the case of European countries, the sorts of wine from the countries renowned for wine production, such as France, Spain, Portugal or Italy, are mostly preferred. On the other hand, the least preferred wines – for consumers of both sexes, regardless of the age – are the brands of wine from European countries that are not so famous for the wine cultivation, such as Austria, Bulgaria, Greece, Moldova, Germany or Hungary.

Regarding the color of wine, women prefer pink wines, whereas men predominantly choose white wines (Fig. 11). In the 18–35 and 36–55 age groups, there are no significant differences in the consumers' preferences when it comes to the color of wine. In both of the mentioned age groups, white wine is the most preferred, while

**Figure 9**

Partial utilities of the levels of the variable “region” with reference to sex

Source: Own elaboration.

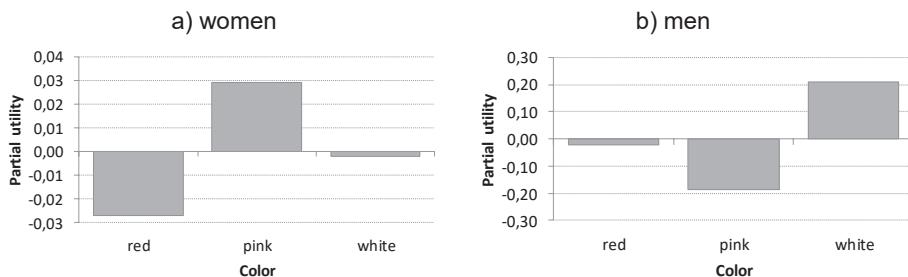
**Figure 10**

Partial utilities of the levels of the variable “region” with reference to age

Source: Own elaboration.

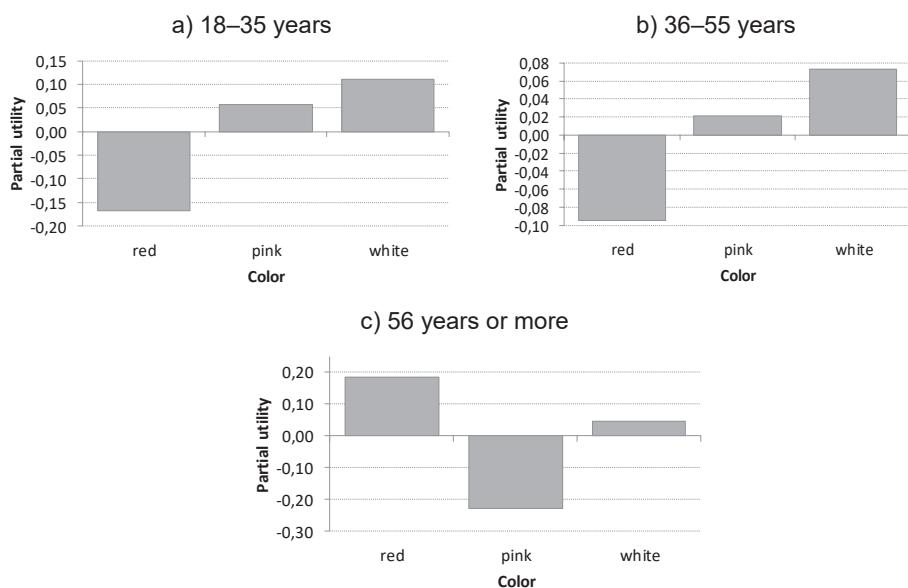
red is the least preferred color. In turn, the oldest consumers act “traditionally” – they acquire red wines most preferably and are not keen on buying rosé wines (Fig. 12).

Regarding the consumers’ preferences towards the type of wine according to its division for still or sparkling wine, we observe that people from the age groups up to 55 years are more likely to buy still wines and that these wines are equally popular among men and women. In turn, sparkling wines are more preferred by the persons aged over 55.

**Figure 11**

Partial utilities of the levels of the variable "color" with reference to sex

Source: Own elaboration.

**Figure 12**

Partial utilities of the levels of the variable "color" with reference to age

Source: Own elaboration.

## Summary

In the presented paper an approach called the conjoint analysis is used in order to study the preferences of wine consumers. The methodology of conjoint analysis is based on collecting data pertaining to the consumers' reactions regarding the investigated object. The measurement of preferences is carried out with the use of utility

function, which allows to assign the numerical characteristics to each of available variants.

The conducted research has shown that, both for women and men, the price of wine is the most decisive factor when it comes to selection of the preferred kind of wine. More expensive wines are particularly preferred by the elderly people, aged over 55 years. In turn, the second most important factor that consumers consider while buying wine is its dryness, whereby younger people prefer wines with the higher sugar content.

Furthermore, it has been established that the wine color and the country of wine origin are less significant in the process of wine selection. Regarding the color, white wines are mostly preferred, while with reference to the region of production, wines from South and North America (Chile, Argentina, USA) are the most popular among customers. In addition, wines from Southern and Western European countries that are known as the recognized wine producers (France, Spain, Portugal, Italy) are quite popular as well, but there is a lower demand for wines originating from the countries of Central and Eastern Europe. When it comes to the type of wine (still or sparkling) and the question, whether it has been honored with any awards or accolades, these factors turn out to be the least important factors taken into account by the wine consumers.

It has also been stated that, with reference to wine purchase preferences, the age of respondents has a greater impact on its diversity than the sex factor. Simultaneously, it may be seen that preferences of both women and men are very similar, but there are considerable differences between the age groups regarding the dryness, the color and the type of wine.

Nowadays, the requirements of consumers and the economic environment are changing so rapidly that, there is a constant need of studies devoted to the customers' preferences. Conjoint analysis is a very useful tool that may be applied for this purpose. Since the modern consumers are becoming more and more aware and demanding, an appropriate recognition of their tastes and wishes is of vital importance, since it enables to get valuable information in order to construct the product that meets the clients' expectations. All this contributes to an increase of company's market share and to its growing competitiveness.

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## Zastosowanie *conjoint analysis* w badaniu preferencji konsumentów wina

**Abstrakt:** W artykule przedstawiono wyniki badań preferencji konsumentów wina przy wykorzystaniu metody *conjoint analysis*, czyli addytywnego pomiaru łącznego. Podstawę pomiaru preferencji stanowi tu funkcja użyteczności, która umożliwia przypisanie charakterystyki liczbowej każdemu z dostępnych wariantów będących przedmiotem wyboru. *Conjoint analysis* jest jedną z metod wielowymiarowej analizy statystycznej. Opiera się ona na prezentacji respondentom zbioru obiektów (profilów produktów lub usług) opisanych wybranymi atrybutami, z których każdy przyjmuje określone wartości (poziomy), w celu uzyskania informacji o całkowitych preferencjach odnośnie tych obiektów. Celem opracowania było rozpoznanie preferencji konsumentów wina, w szczególności określenie, jakimi kryteriami kierują się oni, podejmując decyzję o zakupie wina. Przeprowadzono badania ankietowe przy wykorzystaniu kwestionariusza ankiety wśród 248 wybranych w sposób przypadkowy osób deklarujących spożywanie wina, w podziale na kobiety i mężczyzn oraz trzy grupy wiekowe (18–35 lat, 36–55 lat oraz 56 lat lub więcej). W wyniku analizy stwierdzono, że czynnikiem decydującym o wyborze wina jest dla konsumentów przede wszystkim cena. W dalszej kolejności konsumenci uwzględniają wytrawność wina i jego barwę. Najmniej ważnymi czynnikami okazały się rodzaj wina (spokojne, musujące) oraz to, czy wino było laureatem nagród lub wyróżnień.

**Słowa kluczowe:** analiza preferencji, konsument, *conjoint analysis*, wino

**Kody JEL:** C10, C38, C80, C88, D12, D91, E21

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