

FACTOR ANALYSIS OF MEDICINE RETAIL IN MACEDONIA

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ABSTRACT

Retail is one of the basic factors of socio-cultural changes and irreplaceable factor of urban development. The main functions of retail is connecting producers and final consumers and reduce the time and space differences between production and consumption, in order to meet the needs of end consumers. The aim of the research in this paper is to reduce the number of characteristics of the retail clients in a small number of basic characteristics. This will ensure better understanding and planning of buyers' behavior in the retail of medicines. The data are provided with the conducted survey research, based on a random and representative sample. To the collected data is applied factor analysis in order to get reduction from large number of characteristics, ie source variables, to smaller number of factors. Namely, a factor analysis of the 12 basic characteristics creates 4 extracted factors. The results of the research refer to the determination of the correlation matrix, the Kaiser-Meyer-Olkin measure, the communities for each individual variable, the matrix of the factor structure, the Cattelli diagram, and the definition of the derived factors. By identifying the basic characteristics of the retail clients, improvement of the quality and services in the retailing of medicines is ensured, a better understanding of the preferences of the buyers and anticipation of the trends in the retail sale of drugs based on the behavior of the drug buyers.

Key words: medicines marketing, retail, customer behavior, factor analysis.

JEL: C1

Introduction

According to the statistics of the European Union (EUROSTAT), retailing is one of the sectors of non-financial services, as well as: the trade of motor vehicles; wholesale; catering; transport and storage; media and communication; research and development and business services (according to European Commission, 2009, p.19). With the retail the consumers are provided with an appropriate offer, that is, an assortment, which by their quantity, price and quality meets their needs. Also, according to EUROSTAT, retail activities are classified in several forms, using different criteria such as the place of sale and the type of products. The sale of medicines that is the subject of this paper is a specialized retail of non-food products.

The sales in retail of medicines and medicinal alcohol in the Republic of Macedonia for 2009, 2011, 2013 and 2015 year, as well as its share in the total sales in the retail of products in the Republic of Macedonia for the respective years is presented in Table 1. Namely, for the defined years, it can be concluded that the sales in the retail of medicinal products and medicinal alcohol in the total retail of all products in the Republic of Macedonia participates with about 3%. That percentage is the highest in 2009 and the lowest in 2011. Also, the trend in the sales of medicines and medicinal alcohol can be seen in the graphic representation shown in Figure 1. In the analysis of the retail of medicinal products, very important are the information that obtained for the number of realized prescriptions and the total value of the realized prescriptions in the period from 2010 to 2014. Namely, from Table 2 it is possible to see a continuous increase in the number of realized recipes, by 26.89% from 2010 to 2014. This continuous increase in the number of realized medicines can be seen in Figure 2

Also, the total value of the realized prescriptions realized is continuously growing in the observed period of time, as can be seen in Table 3 and Fig. 3. From 2010 to 2014, this value increased by a significant 27.29%.

Table 1. The sales of medicines and medicinal alcohol in the Republic of Macedonia and participation in total retail of all products in the Republic of Macedonia

| Year | The sales of medicines and medicinal alcohol in the Republic of Macedonia (in 000 den) | Participation in sales of medicines and medicinal alcohol in total retail of all products in the Republic of Macedonia |
|------|--|--|
| 2009 | 3283652 | 3,61 |
| 2011 | 1920466 | 2,01 |
| 2013 | 3886896 | 3,11 |
| 2015 | 3786821 | 2,98 |

(Source: <http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/09-NacEk-NatEc.pdf>
<http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/04-Zdravstvo-Health.pdf>)

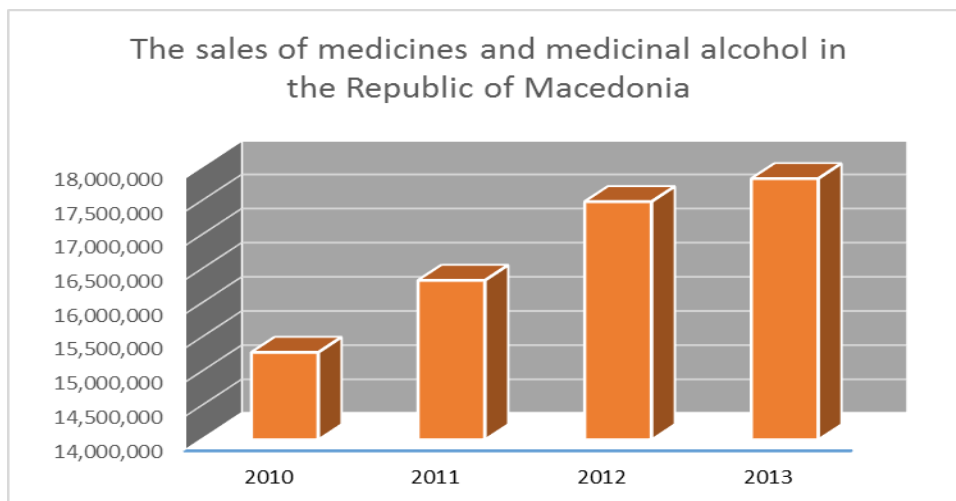
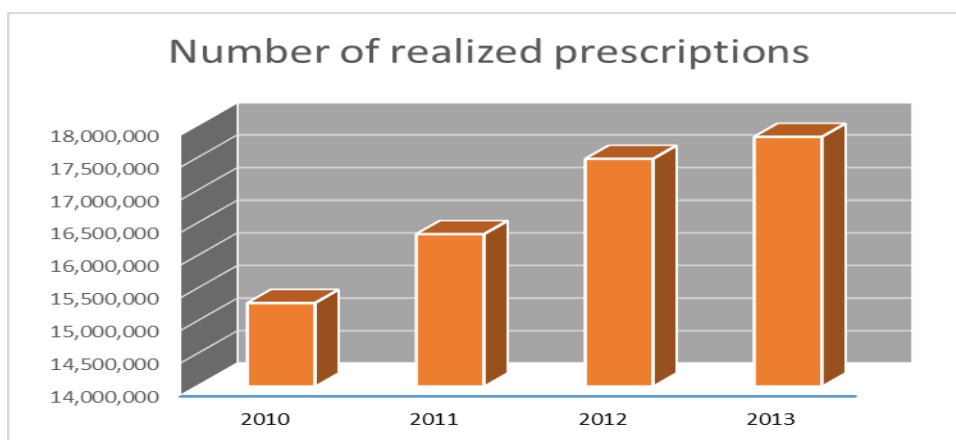


Figure 1: The sales of medicines and medicinal alcohol in the Republic of Macedonia

Table 2. Number of realized prescriptions

| Година | Number of realized prescriptions (1.000) |
|--------|--|
| 2010 | 15277,792 |
| 2011 | 16332,351 |
| 2012 | 17485,146 |
| 2013 | 17822,132 |
| 2014 | 19385,458 |

(Source: <http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/09-NacEk-NatEc.pdf>
<http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/04-Zdravstvo-Health.pdf>)



Слика 2. Number of realized prescriptions

Table 3. Total number of realized prescriptions

| Година | Total number of realized prescriptions (1.000.000 den) |
|--------|--|
| 2010 | 1778,028785 |
| 2011 | 1902,841544 |
| 2012 | 1993,189875 |
| 2013 | 2123,979166 |
| 2014 | 2263,253158 |

(Source: <http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/09-NacEk-NatEc.pdf>
<http://www.stat.gov.mk/Publikacii/PDFGodisnik2013/04-Zdravstvo-Health.pdf>)

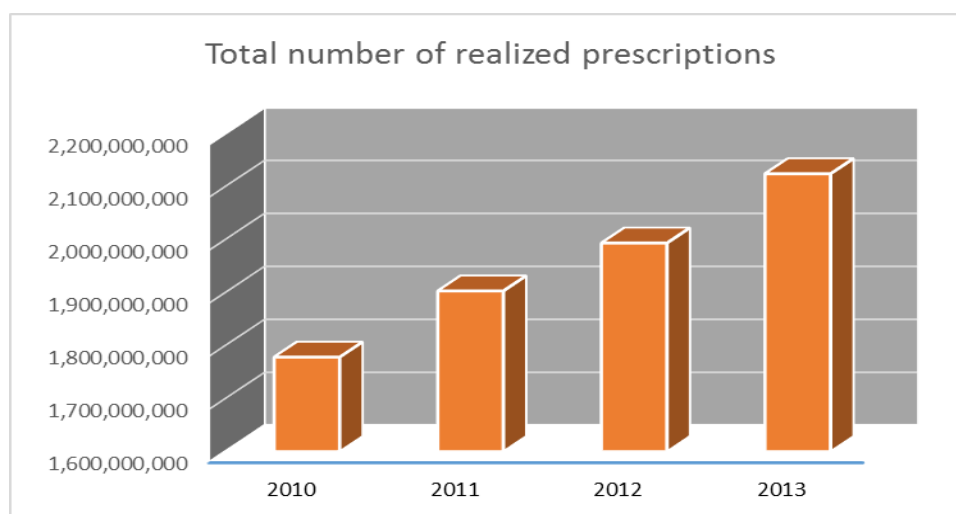


Figure 3. Total number of realized prescriptions

Survey of medicines retail in Macedonia

A survey questionnaire was created for the survey on medicines retailing in the Republic of Macedonia, which refers to medicines purchasers in pharmacies. The survey was conducted on the basis of a random and representative sample of 40 pharmacies in 16 cities in the Republic of Macedonia (Struga, Gevgelija, Gosvativar, Prilep, Kumanovo, Bitola, Skopje, Strumica, Kavadarci, Ohrid, Tetovo, Veles, Delcevo, Kicevo, Negotino, Berovo). The choice of towns as well as pharmacies in cities as elements in the sample is realized in a random way. In addition, significant information was obtained about the age structure, education level and monthly income of the families of the surveyed buyers, which are found in the following Figures.

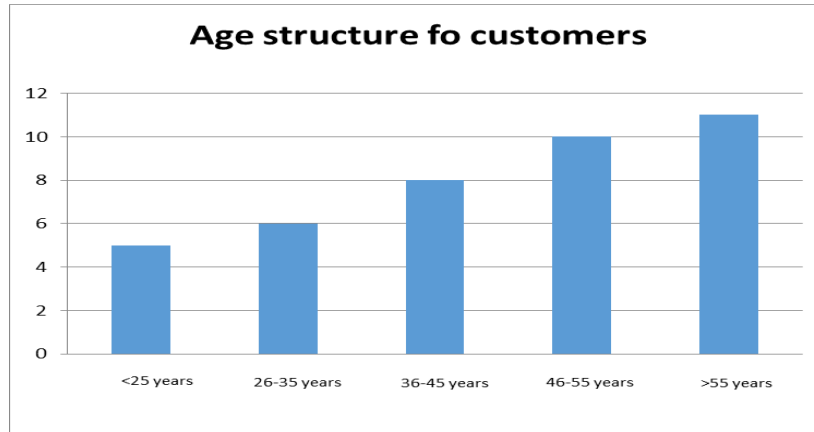


Figure 4. Number of customers by age structure

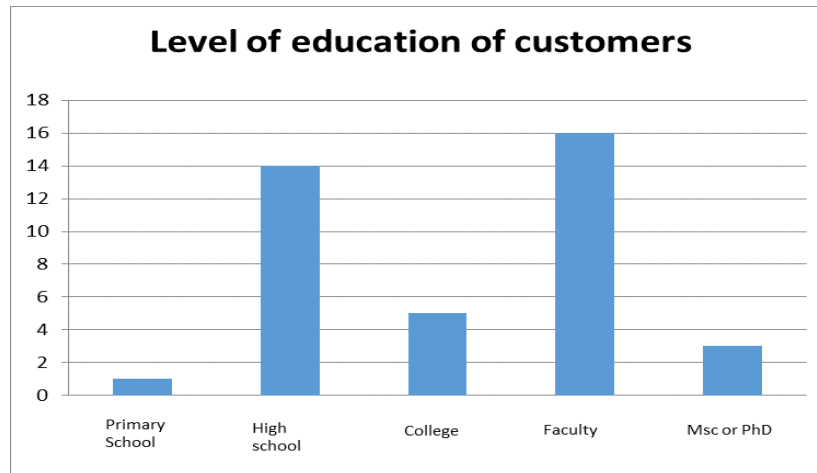


Figure 5. Number of customers by level of education

A maximum of 27.5% of surveyed costumers in pharmacies are older than 55 years and 25% are aged 46 to 55 years. At least, or 12.5% of customers are under 25 years of age. As seen in the Figure 4, the most of the surveyed costumers belong to the older age groups. 72.5% of surveyed customers are older than 35 years or three buyers of four belong to those age groups older than 35 years. The average age of the surveyed customer is 44 years and the average variability of customers is 14 years (See Figure 4).

Most or 42.5% of the surveyed customers have high education and at least 2.5% have elementary education. Half of the surveyed customers in pharmacies have completed elementary education, secondary and higher education (see Figure 5).

Most, or 40% of the surveyed customers in pharmacies are from families whose monthly income is from 30000 to 40000 denars. Only one of the surveyed buyers in pharmacies or 2.5% comes from a family that realizes monthly income to 10,000 denars. 82.5% of the surveyed buyers are from families that monthly realize income higher than 20000 denars.

Factor analysis of medicines retail

Factor analysis is one of the methods of multidimensional analysis whose main aim is to reduce a number of interconnected variables into a smaller number of common factors, which will describe and explain their interconnectedness. At the outset, it is assumed that there is a linear correlation between the variables, and each factor is not correlated with other factors. Thus, instead of a large number of correlated variables, the analysis is realized on uncorrelated factors and thus eliminates the problem of collinear variables. This analysis treat one certain issue: Are the attitudes of medicines purchasers in the retail market really different or could be grouped into certain groups? The use of factorial analysis enables a large number of purchasing features that make up the medicines consumers to reduced on a smaller number of features that can be described. Using this analysis enables not only a better understanding of medicines consumers, but also planning for more successful medicines marketing.

Medicines sales are influenced by a number of factors: demographic changes, lifestyle changes, changes in buying patterns, purchasing power of the population, customer preferences, poverty, technology in retail, and so on. Consumers, in the medicine retailing have a range of needs, define a multitude of requirements and have certain expectations. In doing so, it is important accessibility to the place of purchase, the best time to buy, the quality and prices of medicines. In addition, the offer, assortment, service, promotion, location, quantity, price, quality and great competition are also significant. Pharmacies, on the medicine market, present a wide product and service assortment and, depending on that, gain a competitive advantage. In this sense they use various promotional tools: advertising, promotion for sale, public relations, direct marketing, etc. The factor analysis analyzes the most important influencing factors in the retail of medicines. Namely, with the realization of the factor analysis, a lot of information regarding the consumers should be obtained, and can be treated a certaian issues: why consumers prefer a pharmacy or why they consider two pharmacies similar, whether the large pharmacy means better supply, good quality, cheaper prices, better service, better location, internet access. It is necessary to evaluate the importance of these attributes.

The main objective of applying the factor analysis in medicine retail is to determine the basic structure of the data and to reduce the number of variables in the groups. The methodology for applying this analysis involves the definition of a basic component and a common factor.

The aim of this paper is to use factor analysis of the collected data, from the conducted survey, to improve the understanding of the customers in the medicine retail. Namely, with its application from various number of features, basic characteristics would be obtained, ie a smaller number of factors would be derived from a larger number of variables. In this research, using the factor analysis of 12 variables, 4 extracted factors are obtained.

The data in the survey were collected on the basis of a questionnaire conducted on 40 respondents. One of the basic assumptions for applying the factor analysis is data measuring on an interval scale, or an ordinary measurement scale. Namely, consumers on the scale from 1 to 5 gave their opinion, where "1" meant "I do not agree" and "5" "I agree." Factor analysis of the characteristics of the consumers in the medicine retail is realized on 12 source variables:

Table 4. Description of source variables

| Variable name | Variable description |
|---------------|--|
| NACZIV | Changes in lifestyle affect the medicine purchase |
| NACKUP | There is a change in the way of medicine purchased |
| MESPRI | Monthly incomes affect on the medicine purchase |

| | |
|---------|---|
| SIROM | Poverty affects on the medicine purchase |
| PREFER | Prefererations of consumers |
| LOKAC | The location of the pharmacy is crucial in the choice of medicines purchase |
| CENI | Drug prices are the most important for consumers |
| SIRASOR | A wide assortiman of medicines is important for consumers |
| PROMO | The promotion of products is important in the selection and purchase of medicines |
| KVALIT | The quality of the offered medicines influences in consumers decision |
| USLUGA | The service at the pharmacy is decisive in the medicine purchase |
| TEHL | The technology in medicine retailing enhances service for consumers |

From Table 5 for descriptive statistics on retail consumer's responses, it can be concluded that they most agree with: the quality of the offered medicines influences on their decision to buy medicines (4.10), poverty affects the purchase of the necessary medicines (4.05) and monthly income affect on the medicine purchase (3.95). The most of the consumers disagree with presumption that technology in medicine retail enhances the service they receive. Most variability in customer responses refers to their view that medicines prices are the most important when making a decision to buy medicines, medicine retail technology enhances the service they receive and the preferences to buy certain drugs. The lowest variability in responses, or consumers, most agree that the quality of the offered medicines affects on their decision to buy medicines.

Table 5. Descriptive statistics for variables

| Descriptive Statistics | | | |
|-------------------------------|------|----------------|------------|
| | Mean | Std. Deviation | Analysis N |
| NACZIV | 3,78 | ,947 | 40 |
| NACKUP | 3,90 | ,871 | 40 |
| MESPRI | 3,95 | ,677 | 40 |
| SIROM | 4,05 | ,639 | 40 |
| PREFER | 3,68 | 1,023 | 40 |
| LOKAC | 3,53 | ,933 | 40 |
| CENI | 3,55 | 1,085 | 40 |
| SIRASOR | 3,78 | ,891 | 40 |
| PROMO | 3,68 | ,829 | 40 |
| KVALIT | 4,10 | ,441 | 40 |
| USLUGA | 3,65 | ,949 | 40 |
| TEHL | 3,40 | 1,081 | 40 |

The correlation matrix (see Table 6) which contains the coefficients of the simple linear correlation of each pair of variables is the basis for the realization of the factor analysis. So, one of the conditions for applying the factor analysis is the connection between the source variables. Namely, from the correlation matrix can be determined the relationship between some variables. For example, among the source data "NACZIV", "NACKUP", "PROMO" and "LOKAC" there

is a correlation, and a plurality of variables can be identified as one of the possible factors. By examining the correlation matrix, the suitability of data for the use of the factor analysis procedure is confirmed. Also, the value of the Kaiser-Meyer-Olkin measure, (See Table 7), is the next criterion by which we examine the suitability of data for the application of factor analysis. Namely, if the value of this measure is less than 0.5 then the correlation matrix is not suitable for factor analysis. Because Kaiser-Meyer-Olkin's value is 0.735 and is greater than 0.5, this confirms the fact that the collected data about the characteristics of the retailers in the medicines market are suitable for the realization of factor analysis.

Table 6. Correlation matrix for consumers answers

| Correlation Matrix ^a | | | | | | | | | | | | | |
|---------------------------------|---------|--------|--------|-------|--------|-------|-------|---------|-------|--------|--------|-------|-------|
| | NACZIV | NACKUP | MESPRI | SIROM | PREFER | LOKAC | CENI | SIRASOR | PROMO | KVALIT | USLUGA | TEHL | |
| Correlation | NACZIV | ,656 | ,302 | ,231 | ,108 | ,340 | ,049 | ,242 | ,427 | ,239 | ,224 | ,341 | |
| | NACKUP | ,656 | 1,000 | ,339 | ,378 | ,222 | ,508 | -,049 | ,069 | ,522 | ,227 | ,112 | ,343 |
| | MESPRI | ,302 | ,339 | 1,000 | ,599 | ,087 | ,286 | ,248 | ,236 | ,244 | ,360 | ,132 | ,063 |
| | SIROM | ,231 | ,378 | ,599 | 1,000 | ,261 | ,514 | ,218 | ,110 | ,322 | ,437 | ,199 | ,082 |
| | PREFER | ,108 | ,222 | ,087 | ,261 | 1,000 | ,533 | ,142 | ,199 | ,447 | ,187 | ,250 | ,538 |
| | LOKAC | ,340 | ,508 | ,286 | ,514 | ,533 | 1,000 | ,189 | ,022 | ,558 | ,367 | ,358 | ,371 |
| | CENI | ,049 | -,049 | ,248 | ,218 | ,142 | ,189 | 1,000 | ,237 | ,033 | ,203 | ,391 | ,289 |
| | SIRASOR | ,242 | ,069 | ,236 | ,110 | ,199 | ,022 | ,237 | 1,000 | ,211 | ,124 | ,056 | ,495 |
| | PROMO | ,427 | ,522 | ,244 | ,322 | ,447 | ,558 | ,033 | ,211 | 1,000 | ,091 | ,341 | ,521 |
| | KVALIT | ,239 | ,227 | ,360 | ,437 | ,187 | ,367 | ,203 | ,124 | ,091 | 1,000 | ,147 | ,021 |
| | USLUGA | ,224 | ,112 | ,132 | ,199 | ,250 | ,358 | ,391 | ,056 | ,341 | ,147 | 1,000 | ,390 |
| | TEHL | ,341 | ,343 | ,063 | ,082 | ,538 | ,371 | ,289 | ,495 | ,521 | ,021 | ,390 | 1,000 |
| Sig. (1-tailed) | NACZIV | ,000 | ,029 | ,076 | ,254 | ,016 | ,383 | ,066 | ,003 | ,069 | ,082 | ,016 | |
| | NACKUP | ,000 | ,016 | ,008 | ,085 | ,000 | ,382 | ,335 | ,000 | ,080 | ,246 | ,015 | |
| | MESPRI | ,029 | ,016 | ,000 | ,297 | ,037 | ,062 | ,072 | ,064 | ,011 | ,209 | ,350 | |
| | SIROM | ,076 | ,008 | ,000 | ,052 | ,000 | ,088 | ,249 | ,021 | ,002 | ,109 | ,308 | |
| | PREFER | ,254 | ,085 | ,297 | ,052 | ,000 | ,191 | ,109 | ,002 | ,123 | ,060 | ,000 | |
| | LOKAC | ,016 | ,000 | ,037 | ,000 | ,000 | ,122 | ,446 | ,000 | ,010 | ,012 | ,009 | |
| | CENI | ,383 | ,382 | ,062 | ,088 | ,191 | ,122 | ,070 | ,420 | ,104 | ,006 | ,035 | |
| | SIRASOR | ,066 | ,335 | ,072 | ,249 | ,109 | ,446 | ,070 | ,096 | ,223 | ,365 | ,001 | |
| | PROMO | ,003 | ,000 | ,064 | ,021 | ,002 | ,000 | ,420 | ,096 | ,288 | ,016 | ,000 | |
| | KVALIT | ,069 | ,080 | ,011 | ,002 | ,123 | ,010 | ,104 | ,223 | ,288 | ,183 | ,448 | |
| | USLUGA | ,082 | ,246 | ,209 | ,109 | ,060 | ,012 | ,006 | ,365 | ,016 | ,183 | ,006 | |
| | TEHL | ,016 | ,015 | ,350 | ,308 | ,000 | ,009 | ,035 | ,001 | ,000 | ,448 | ,006 | |

a. Determinant = ,008

Table 7. Values of Kaiser-meyer-Olkin measure

| | | |
|--|--------------------|-------------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | ,735 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 164,339 |
| | df | 66 |
| | Sig. | ,000 |

Table 8. Extraction data

| | Initial | Extraction |
|--------|---------|------------|
| NACZIV | 1,000 | ,679 |
| NACKUP | 1,000 | ,791 |
| MESPRI | 1,000 | ,702 |
| SIROM | 1,000 | ,717 |
| PREFER | 1,000 | ,605 |
| LOKAC | 1,000 | ,785 |

| | | |
|---------|-------|------|
| CENI | 1,000 | ,697 |
| SIRASOR | 1,000 | ,802 |
| PROMO | 1,000 | ,696 |
| KVALIT | 1,000 | ,526 |
| USLUGA | 1,000 | ,513 |
| TEHL | 1,000 | ,842 |

Table 9. Total Variance Explained

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|-----------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4,128 | 34,400 | 34,400 | 4,128 | 34,400 | 34,400 |
| 2 | 1,625 | 13,545 | 47,945 | 1,625 | 13,545 | 47,945 |
| 3 | 1,436 | 11,966 | 59,910 | 1,436 | 11,966 | 59,910 |
| 4 | 1,166 | 9,713 | 69,623 | 1,166 | 9,713 | 69,623 |
| 5 | ,921 | 7,674 | 77,297 | | | |
| 6 | ,708 | 5,903 | 83,200 | | | |
| 7 | ,520 | 4,335 | 87,535 | | | |
| 8 | ,377 | 3,140 | 90,675 | | | |
| 9 | ,346 | 2,880 | 93,555 | | | |
| 10 | ,296 | 2,470 | 96,025 | | | |
| 11 | ,277 | 2,308 | 98,333 | | | |
| 12 | ,200 | 1,667 | 100,000 | | | |

In Table 8, the communalities of the variables are estimated. From extraction data of factor loads, the importance of each source variable for individual factors is evident, given that all variables have communalities greater than 0.50.

Table 9 shows the initial results on the basis of which the factors are extracted. For the factor analysis of the main components, it is characteristic to extract factors that have values greater than one. The results shown in the table show that four factors were drawn according to that criterion, because the value of the fifth factor is 0.921. In this case, we will opt for a solution that explains 60% of the total variance. The results shown in the table above show that the percentage of variance explained by four extracted factors is 69.623%

Figure 6 presents a Cattell diagram (scree plot) for 12 variables referring to customer characteristics that is also applied to a number of factors. The diagram also distinguishes 4 of the other factors. It is also necessary to determine the matrix of the factor structure of the extracted factors. This defines the importance of each variable for a single factor. Analyzing the data in the Component Matrix table (See Table 10), it is found that individual variables are categorized by several factors, and the factor analysis shows that the first factor is defined by high factor load with a greater number of variables. Since the initial matrix does not have a characteristic of a simple structure, it does not realize the rotation of the factors that change the relationship between variables and factors. Often rotation of the factors is performed by the orthogonal rotation method, or more precisely with the method of varimax rotation of the factors. Table 11 (Rotated Component Matrix) represents the matrix of the factor structure for 12 variables after the

realization of the varimax rotation of the factors. This changes the structure of the factor loads, that is, the factor loads are deployed on all four factors, which is not the case in the non-rotation matrix. This allows for a better interpretation of the factors relative to the initial factor matrix.

From Table 10 can be seen that the first factor is defined with the following variables: Preferir5, Lokacija6, Usluga11 and Tehnolog12. The second factor is defined with the variables: MesPrime3, Sirom4 and Kvalitet10. The third factor is defined with the variables: NacZiveenje1, NacKup2 and Promocija9. The fourth factor is defined with the variables: Ceni7 and SirokAsort8.

It can be concluded that the four extracted factors of those variables that relate to the characteristics of medicines purchasers for each factor and their factor load

1. Factor "Pharmacy characteristics" and make up the following variables:
 - Consumer's preference (0,758)
 - The location of the pharmacy is crucial in the choice of medicines purchase (0,666)
 - The service at the pharmacy is decisive in the medicine purchase (0,674)
 - The technology in medicine retailing enhances service for consumers (0,640)
2. Factor "Opportunities, needs and demands of consumers "
 - Monthly incomes affect on the medicine purchase (0,772)
 - Poverty affects on the medicine purchase (0,787)
 - The quality of the offered medicines influences in consumers decision (0,715)
3. Factor "Consumer behavior"
 - Changes in lifestyle affect the medicine purchase (0,742)
 - There is a change in the way of medicine purchased (0,834)
 - The promotion of products is important in the selection and purchase of medicines (0,610)
4. Factor "Characteristics of medicine"
 - Medicines prices are the most important for consumers (0,405)
 - A wide assortment of medicines is important for consumers (0,880)

Table 10. Extraction Method: Principal Component Analysis

| | Component | | | |
|--------------|-------------|-------------|-------------|-------------|
| | 1 | 2 | 3 | 4 |
| NacZiveenje1 | ,058 | ,222 | ,742 | ,276 |
| NacKup2 | ,163 | ,263 | ,834 | -,016 |
| MesPrim3 | -,053 | ,772 | ,228 | ,227 |
| Sirom4 | ,222 | ,787 | ,210 | -,064 |
| Preferir5 | ,758 | ,032 | ,169 | ,041 |
| Lokcija6 | ,666 | ,400 | ,381 | -,190 |
| Ceni7 | ,384 | ,404 | -,411 | ,465 |
| SirokAsort8 | ,042 | ,067 | ,148 | ,880 |
| Promocija9 | ,560 | ,062 | ,610 | ,086 |
| Kvalitet10 | ,109 | ,715 | ,055 | -,001 |
| Usluga11 | ,674 | ,180 | -,091 | ,134 |
| Tehnolog12 | ,640 | -,151 | ,317 | ,556 |

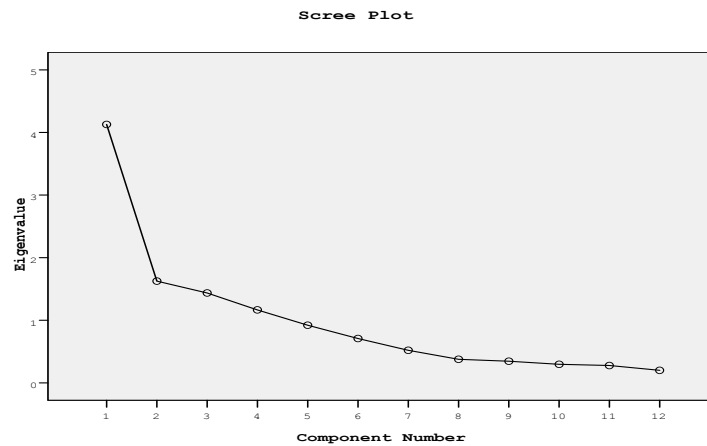


Figure 6. Cately diagram for consumers

Table 11. Rotation Method: Varimax with Kaiser Normalization

| Component | 1 | 2 | 3 | 4 |
|-----------|-------|-------|-------|------|
| 1 | ,622 | ,506 | ,536 | ,265 |
| 2 | ,505 | -,757 | -,074 | ,408 |
| 3 | ,177 | ,414 | -,796 | ,405 |
| 4 | -,571 | ,009 | ,272 | ,774 |

Conclusion and recommendation

The efficient and functioning of pharmacies in medicines retailing is also of interest for the employees of the pharmaceutical workers and for the users of their services. In that sense, and using the information obtained with the qualitative and quantitative analysis in this paper, it is necessary to continuously monitor, record and process data related to preferences, loyalty, needs, wishes, satisfaction and the motives of the customers as direct participants in the medicines retail sale. Also, the application of factor analysis is important, as a modern multivariate statistical technique, with relevant software support, data processing, statistical evaluation as the basis for making quality business decisions in the medicines retail. Of course, this application is a consequence of the continuous increase in the number of data related to medicines retail, the number and value of realized prescriptions, the increased number of consumers, the increased volume of work of pharmacies, which are initiated by numerous factors that influence the medicines retail. This allows valid identification and assessment of the factors that most affect the medicines retail. Also, factor analysis is in the function and interest of marketing retailers in pharmacies to make their marketing decisions more objective and more reliable; customers to make their decision on the basis of high quality products and services and unbiased choice.

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