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Socio-Demographic Impacts on the Personal Savings Portfolio Choice:
A Decision Tree Approach

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ABSTRACT

Insufficiently-developed financial systems, poor standards of living, and inappropriate education of citizens on the saving products lead to low levels of investment in the financial markets of developing countries. In this paper, special attention is paid to examining the socio-demographic profile of Montenegrin citizens who invest their funds in some of the offered forms of savings, as well as examining main factors that restrict their investment. For this purpose, data collected through the survey of Montenegrin citizens were processed using decision tree method. Survey results have shown that there is a low level of savings, as well as that citizens prefer deposits and life insurance products rather than pension plans and debt securities. Also, the results indicate that the main causes of the current state of savings in Montenegro are low standard of living, citizens´ poor awareness, and the financial system, which causes the insufficiently attractive supply of savings.

KEYWORDS

Bank Deposits, Decision Tree Method, Financial Market, Life Insurance, Montenegro, Pension Plans, Securities, Survey

INTRODUCTION

Montenegro, as one of the developing countries, is characterized by low levels of savings. The main causes of this situation are low standard of living, lack of information regarding the offer and importance of saving for citizens, undeveloped financial market, etc. For this reason, the aim of this research is to determine the current savings portfolio of Montenegrin citizens, to point out the key reasons why citizens do not invest their funds in the financial market, and to present the socio-demographic profile of those respondents who own some of the offered forms of savings.

The financial market of Montenegro is characterized by a poor range of savings products, and these are: term deposits, life insurance products, investments in voluntary pension funds, bonds and

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other debt securities. Because of the suspension of voluntary pension fund management companies by the regulatory body, neither of the two voluntary pension funds currently operates. In 2018, four life insurance companies operated in the insurance market, raising €15,23 million in cash for life insurance, accounting 17,5% of total gross written premium. The number of active life insurance contacts at the end of 2018 was 51870, while the number of life insured people was 52715.[1] Total deposits of population in 2018 amounted to €1327,528 million, of which term deposits amounted to €600,807 million.[2] It is also possible to save money by buying government bonds and corporate bonds in the financial market. The total turnover on government bonds in the amount of €2688791 and turnover on corporate bonds in the amount of €551665, was realized on the Montenegro Stock Exchange in 2018.[3]

A significant number of authors have dealt with some forms of population´s savings, especially savings through voluntary pension plans and life insurance at country level and within the European Union, the USA, etc. There are also a considerable number of papers that indicate the structure of citizens´ savings, depending on their socio-demographic characteristics, but none of these refers to Montenegro which is actually the topic of this research (Börsch-Supan and Brugiavini, 2001; Bikas, 2008; Brunetti and Torricelli, 2010; Temel Nalin, 2013).

The paper is designed to describe the socio-demographic characteristics of the respondents who participated in the survey of savings portfolio. After introduction and literature review, available dataset and methodology are described in the third section. Thereafter, the results of the analysis, based on six Decision Tree models that relate to the profile of respondents who have savings in Montenegro, are presented. In addition to the introduction, literature review and two mentioned sections, the paper contains a conclusion and references.

Generally, this paper points to the fact that savers in Montenegro have the biggest confidence in banks and insurance companies, while citizens have the least interest in paying contributions to voluntary pension funds and investing funds in government and corporate bonds. This result is a consequence of underdeveloped financial system, low level of citizens´ confidence in financial institutions and poor supply of saving products. These listed facts give the possibilities for further researches on this topic, with the aim to improving the financial market of Montenegro.

LITERATURE REVIEW

There are a few authors that have explored the socio-demographic characteristics of citizens from the perspective of savings and particular forms of preferred savings.

Doker et.al (2016) investigated how demographic determinants influenced saving ratios using panel data analysis between 1993 and 2013 on 20 transition economies. They found that unemployment rate, dependency in old age and population density had negative correlation with savings. They concluded that unemployment brought lowering income and savings. Lugauer et al. (2019) found that the number of dependent children is negatively correlated with household saving rates in China. Saving rates are significantly higher for urban households or those employed in the public sector. Households residing in urban areas have higher saving rates in part because they have a lower ratio of education expenditures to income. Curtis et al. (2017), analyzed how the different demographic profiles across Japan, China, and India have influenced each country's household saving rate. They showed that the rapid decline in the share of dependent children accounts for the majority of the increased saving rates in China and India. On the other hand, the decrease in Japan's saving rate was partially caused by the large and growing retirement-aged population. Tsega et al, (2014) also studied the determinants of household saving in Ethiopia. They found out that income, age, sex, marital status are the major determinants of household saving in Ethiopia. Chufa (2018) recognized the fact that the determinants of the household saving in Ethiopia are influenced by demographic and economic factors. Income is the most crucial factor of the household saving with positive influence on saving.

He found out that marital status and family size of household had negative relationship with the savings, while age, location and income had a positive influence on saving.

For example, Börsch-Supan et al. (2001) showed that the households in Germany saved the most in the 45-49 age range. Older people save less, while those under the age of 35 invest their free funds principally in real estates. Banks and Tanner (1999) showed that households in United Kingdom invested mostly in pension funds or real estates, and then in deposits and securities, while the savings depend on age, income and education of citizens. Based on the available statistics, Bikas (2008) analyzed savings in Lithuania and showed that Lithuanians saved poorly, i.e. they mainly invested their funds in deposits and real estate, as well as kept their funds in cash. Also, he stated that women mainly had term deposits, while men were more inclined to invest funds in riskier forms of assets. Brunetti and Torricelli (2010) showed that in the period 1995-2006 Italian households held about 70% of their wealth in the deposits, and then in government and corporate bonds. Also, savings through life insurance decreased drastically in 2006 compared to 1995, while savings through voluntary pension funds were at a very low level, approximately equal at the beginning and end of the observed period.

Temel Nalin (2013) indicates that household´s income, level of education, profession, place of residence (rural/urban), car ownership and size of household are significant variables that lead to changes in the citizens´ behavior when choosing a savings portfolio in Turkey. Exactly, higher household´s income, higher level of education and age increase the probability of savings of Turkish citizens. Nonetheless, singles have a greater tendency to save, because they have no possibility to use funds of family and relatives. Further, household with higher income have stronger wish to invest the funds in the capital market compared to other options. It has also been found that the status or profession of "the head of the house" is a significant determinant of the choice of a savings portfolio. The investing in capital market instruments is more likely for households that live in cities, compared to those living in rural areas. If a household in Turkey has cars, then it is more likely to invest surplus funds in the financial market. Also, household´s size plays an important role in deciding whether to save and what their savings portfolio will look like. Tunalé and Tatoçlu (2010) examined factors that had influence on investing decision of 1300 households from Istanbul. The results suggest that social and personal factors, like: profession, gender, level of education, marital status, household´s size, participation in social insurance and income, are important determinants for savings structure decision of household in Istanbul. Using survey method for households in Turkey in 2003, Bozkuó and Üçdoçruk (2008) examined also the factors that had an impact on the choice of savings portfolio. Their results indicate that the propensity to save is closely related to the age and level of education of "the head of the house", as well as with a level of household´s total income.

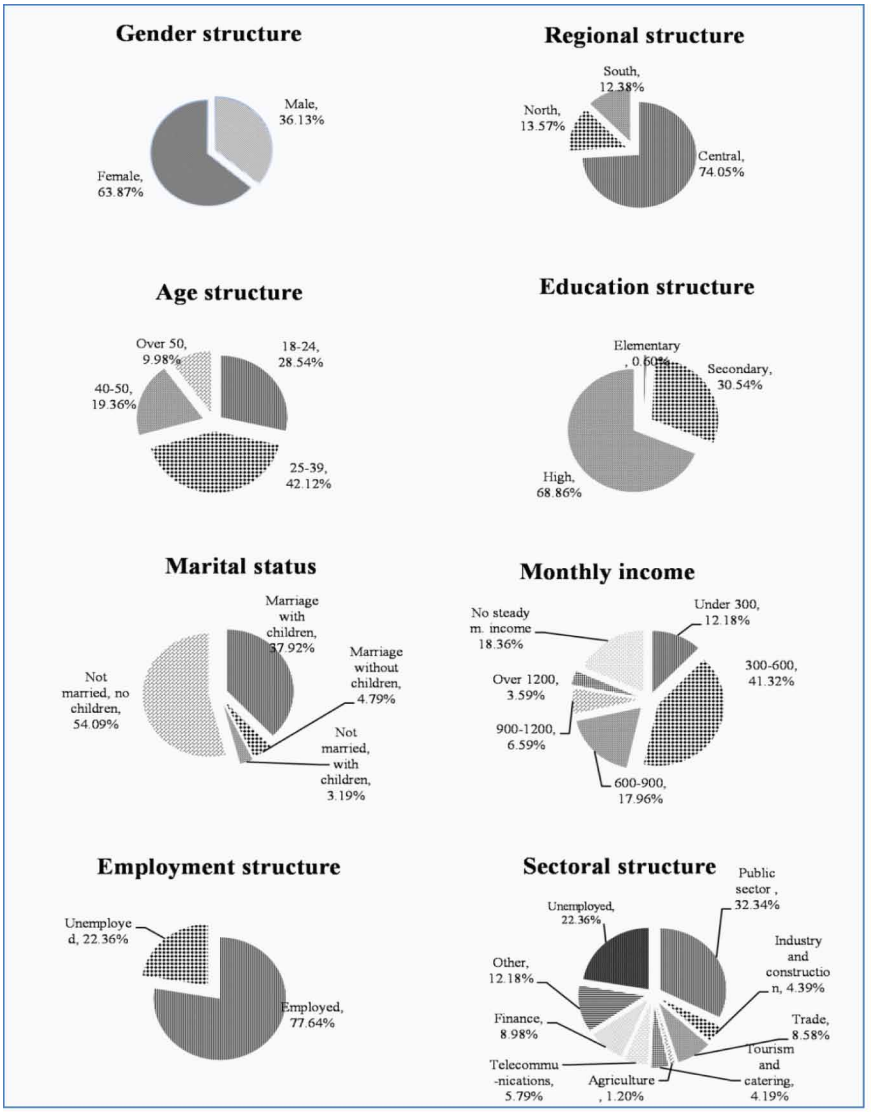
Analyzing the above researches that deal with the impact of socio-demographic characteristics on the choice of savings portfolio, it can be noticed that they mainly relate to developed countries. Countries whose financial market is still developing and have a lower level of funding, including Montenegro, have not been analyzed so far. For this reason, the aim of this paper is to supplement existing empirical results in this regard.

Also, most of these studies used standard statistical methods to analyze the impact of socio-demographic factors, while for the first time, in this paper, the machine learning method, the Decision Tree method, is used to give a deeper and semantically richer insight into the links between these factors and the choice of savings portfolio.

DESCRIPTION OF DATA AND METHODOLOGY

The survey, which was conducted in May 2019 with the aim to define the socio-demographic profile of citizens from the aspect of savings structure in Montenegro, was attended by 501 respondents. The survey was conducted electronically via Google Forms as anonymous. It was forwarded to the email addresses of students of the Faculty of Economics, Department of Finance and their parents, as well as to the addresses of representative Montenegrin companies from different sectors and regions, with

Figure 1. The socio-demographic profile of respondents (Source: Authors' calculation)



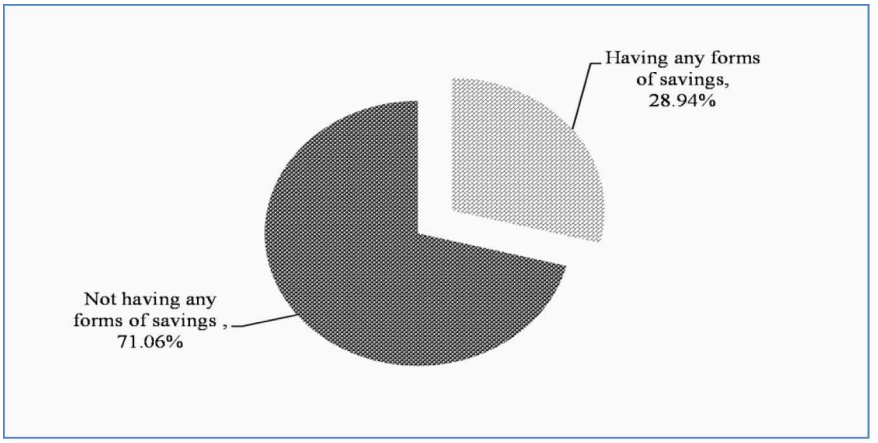
a request to forward it to their employees. The survey was also posted on social networks. Out of 600 e-mail addresses to which the request for filling in the survey was sent, 501 valid answers were received, so the response rate was 83.5%. In the first part of the survey, respondents are segmented according to the demographic and sociological factors, while the second part examines whether citizens have savings and the reasons for not having a certain form of savings.

Figure 1 shows socio-demographic profile of respondants.

In Figure 1 it can be seen that the lagrest number of respondents are female, from the central region of Montenegro, highly educated and not marriaged. Also, they are young and employed people who works mostly in public and trade sector, with monthly income between €300 and €600.

When analyzing the savings of citizens on the basis of the given sample it can be concluded that savings are on a low level in Montenegro, given that 356 respondents, or 71,06% of respondents, have no form of savings (Figure 2).

Figure 2. Having or not having any form of savings (Source: Authors' calculation)



In Figure 3 it can be seen that the largest number of respondents–244 of them (68,54%) who have no form of savings stated insufficient monthly income as the main reason. 13,48% of respondents noted that they prefer spending over saving, while 9,27% of them did not have enough confidence in financial institutions in Montenegro. The least percentage of respondents, 8,71%, noted lack of knowledge and information on investing in some form of savings as the main reason of not having any form of savings.

Table 1 shows the types of savings for respondents who answered that they had some form of savings.

Table 1 shows that, from the mentioned types of savings, the largest number of respondents has life insurance policy, while the smallest number of respondents invests in voluntary pension fund.

The aim of this research is to determine the sociodemographic profile of savers in Montenegro, as well as the profile depending on the selected savings portfolio. Accordingly, the following research questions are defined:

1. What are the characteristics of savers compared to non-savers?
2. What are the characteristics of non-savers depending on the reason?

Figure 3. The reasons for not having some form of savings by respondents (Source: Authors' calculation)

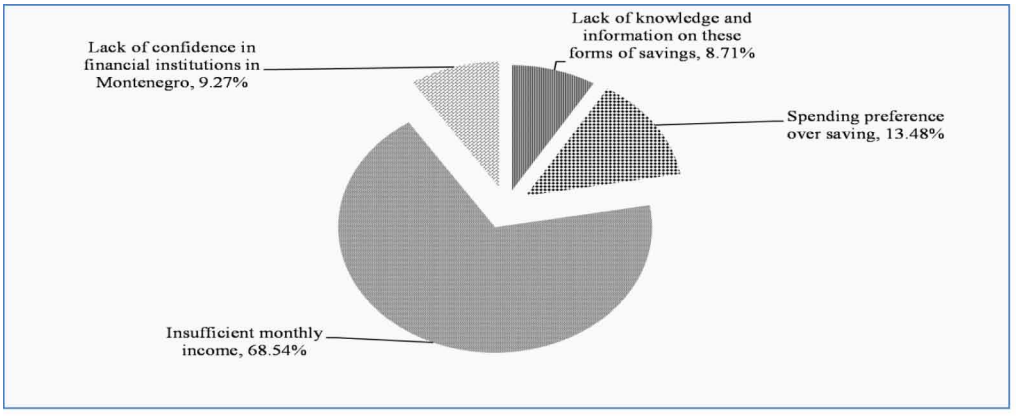


Table 1. The types of savings by respondents

	Yes		No	
	Number	**%**	**Number**	**%**
Contribution payment in voluntary pension fund	16	11,03%	129	88,97%
Term deposit	55	37,93%	90	62,07%
Life insurance policy	76	52,41%	69	47,59%
Buying bonds and other debt securities in financial market	18	12,41%	127	87,59%

Source: Authors´ calculation

3. What are the characteristics of savers depending on the selected type of savings?

For the analysis of the above mentioned characteristics, i.e. sociodemographic profile of savers, the classification Decision Tree (DT) method is used. Classification involves splitting data into classes and finding a model that describes those classes. The DT method splits the data according to the attribute values, choosing for the split the attribute that gives the purest division with respect to the target class. Various measures such as information gain, gain ratio and Gini index are used for the purity of the division (Breiman et al., 1984; Quinlan, 1993). Simultaneously with divisions, a model is generated in the form of a tree graph, whose nodes are the attributes by which the division is made, and the edges are the values of these attributes. The leaves contain finite subsets of the starting data set that are as clean as possible for one of the target classes.

The number of correctly categorized examples relative to the total number of examples represents *the accuracy of classification*, while the number of misclassified examples relative to the total number of examples represents *classification error*. Important measures of classification accuracy are *class precision* (the number of accurately classified instances of one class in relation to all the instances that the model classified in that class), as well as *class recall* (the number of members of the class that the model correctly classified in relation to all members of that class).

Following the paths from root to leaves, the generated DT model gives the class descriptions in the form of if-then rules. Each rule corresponds to one leaf. Not all rules have the same significance. More significant are those rules whose leaf contains more examples of the class represented by that leaf. The number of sample instances belonging to the class relative to the total number of instances in that leaf represents *rule accuracy.*

One of the aims of this paper is to examine whether this method can be used to identify the above mentioned characteristics of the respondents, so the fourth research question is defined as follows:

4. Can the DT method efficiently identify the sociodemographic profile of savers?

RESULTS OF DECISION TREE MODEL ANALYSIS

In order to answer the research questions, the following DT models are generated:

DT1: The socio-demographic profile of saver.
DT2: Reasons for not investing in the financial market of Montenegro.
DT3: The socio-demographic profile of saver in voluntary pension fund.
DT4: The socio-demographic profile of depositor.

DT5: The socio-demographic profile of life insurance policyholder.
DT6: The socio-demographic profile of respondents who invest in securities.

The classification performance of generated DT models are shown in Table 2.

The results in Table 2 confirm the validity of the generated models. Namely, every generated model has classification accuracy about 70% and more, which means that 70% and more examples are accurately classified in this way. Mean class recall and class precision are at most models more than 60% (except the model for reasons of non-savings in which there are classes with very few examples and with which there is a problem of misclassification of the minor class).

DT1 model in Figure 4 shows characteristics of savers compared to non-savers. Reading the path from the roots to the leaves, the set of classification rules shown in Table 3 is derived.

Rules 1-10, from *Table* 3, show that respondents with monthly income between €300 and €600 have savings if they are employed in finance sector or some other sector that is not specified by survey and if they are highly educated and female. Unlike women, educated and employed male respondents with incomes of €300-€600 are not prone to save, i.e. have no forms of savings (rule 4).

Highly educated respondents with monthly income between €600 and €900, who have no children and who are younger than 40 years have no saving (rules 11-13), while those who have two children

Table 2. Classification performance of DT models

DT model	Classification Accuracy	Mean Class Recall	Mean Class Precision	Classification Error
DT1	72,85%	58,62%	66,13%	27,15%
DT2	70,22%	31,83%	54,28%	29,78%
DT3	90,34%	58,99%	82,89%	9,66%
DT4	77,93%	73,74%	78,42%	22,07%
DT5	68,97%	68,59%	69,12%	31,03%
DT6	89,66%	65,49%	78,92%	10,34%

Source: Authors' calculation

Figure 4. The socio-demographic profile of savers (Source: Authors' calculation)

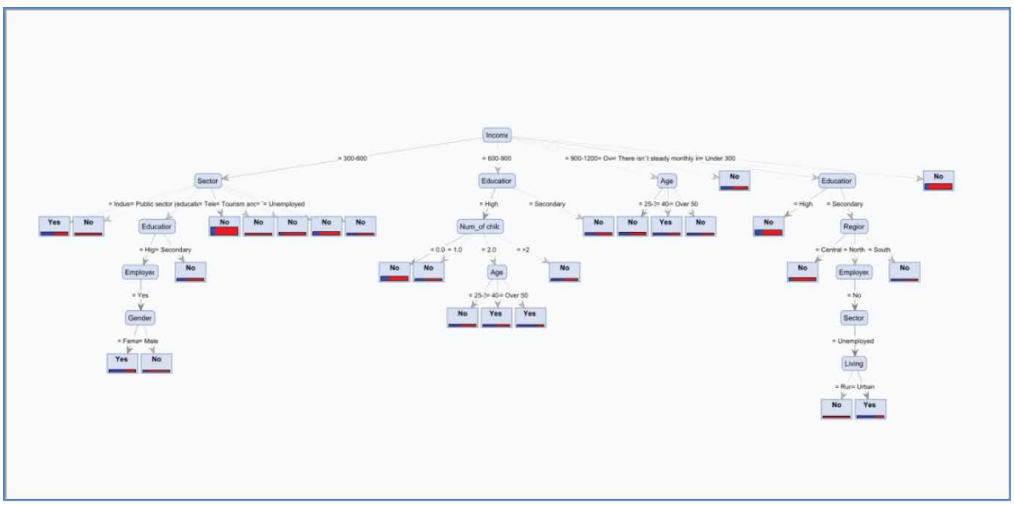


Table 3. Rules of sociodemografic profile of savers vs. non-savers

No. of rule	Rule	Rule Accuracy
1.	if Income=300-600 and Sector=Finance then Yes (12/10)	54.55%
2.	if Income=300-600 and Sector=Industry and construction then No (0/7)	100.00%
3.	if Income=300-600 and Sector=Other and Education=High and Employed=Yes and Gender=Female then Yes (8/5)	61.54%
4.	if Income=300-600 and Sector=Other and Education=High and Employed=Yes and Gender=Male then No (1/5)	83.33%
5.	if Income=300-600 and Sector=Other and Education=Secondary then No (5/8)	61.54%
6.	if Income=300-600 and Sector=Public sector then No (17/78)	82.11%
7.	if Income=300-600 and Sector=Telecommunications then No (0/4)	100.00%
8.	if Income=300-600 and Sector=Tourism and catering then No (2/13)	86.67%
9.	if Income=300-600 and Sector=Trade then No (7/20)	74.07%
10.	if Income=300-600 and Sector=Unemployed then No (2/3)	60.00%
11.	if Income=600-900 and Education=High and Child=0.0 then No (12/29)	70.73%
12.	if Income=600-900 and Education=High and Child=1.0 then No (3/5)	62.50%
13.	if Income=600-900 and Education=High and Child=2.0 and Age=25-39 then No (4/5)	55.56%
14.	if Income=600-900 and Education=High and Child=2.0 and Age=Over 50 then Yes (3/1)	75.00%
15.	if Income=600-900 and Education=High and Child=>2 then No (4/5)	55.56%
16.	if Income=600-900 and Education=Secondary then No (5/8)	61.54%
17.	if Income=900-1200 and Age=25-39 then No (7/11)	61.11%
18.	if Income=900-1200 and Age=40-50 then Yes (5/4)	55.56%
19.	if Income=Over 1200 then No (8/10)	55.56%
20.	if Income=There isn't steady monthly income and Education=High then No (15/37)	71.15%
21.	if Income=There isn't steady monthly income and Education=Secondary and Region=Central then No (3/20)	86.96%
22.	if Income=There isn't steady monthly income and Education=Secondary and Region=North and Employed=No and Sector=Unemployed and Living=Rural then No (0/4)	100.00%
23.	if Income=There isn't steady monthly income and Education=Secondary and Region=North and Employed=No and Sector=Unemployed and Living=Urban then Yes (6/3)	66.67%
24.	if Income=Under 300 then No (9/52)	85.25%

Source: Authors´ calculation

and who are over 50 years old have it (rules 14). Highly educated respondents from this category of monthly income who have more then two children have no savings (rule 15), as well as those with only secondary education (rule 16). Thus, in this most represented category of monthly income in Montenegro, savers are mostly highly educated respondents over 40 years of age with families with two children.

Respondents with monthly earnings in range €900-€1200, who are between 40 and 50 years old made some types of savings, while younger from this category of earnings are non-savers (rules 18

Table 4. Rules of sociodemografic profile of non-savers depending on the reasons

No. of rule	Rule	Rule Accuracy
1.	if Income=300-600 and Age=18-24 and Education=High then Insufficient monthly income (2/0/11/2)	73.33%
2.	if Income=300-600 and Age=25-39 and Education=High then Insufficient monthly income (2/7/37/4)	74.00%
3.	if Income=300-600 and Age=25-39 and Education=Secondary and Region=Central and Living=Urban and Gender=Female then Insufficient monthly income (0/1/9/0)	90.00%
4.	if Income=300-600 and Age=25-39 and Education=Secondary and Region=South then Insufficient monthly income (0/0/3/1)	75.00%
5.	if Income=300-600 and Age=40-50 then Insufficient monthly income (2/4/33/2)	80.49%
6.	if Income=300-600 and Age=Over 50 then Insufficient monthly income (1/1/15/0)	88.24%
7.	if Income=900-1200 and Region=Central and Living=Urban and Education=High and Employed=Yes and Gender=Female then Spending preference over saving (1/3/0/0)	75.00%
8.	if Income=There isn't steady monthly income then Insufficient monthly income (6/8/46/6)	69.70%
9.	if Income=Under 300 then Insufficient monthly income (2/2/46/2)	88.46%

Source: Authors' calculation

and 17). With respect to previous results, it can be seen that the most represented savers in Montenegro are people between 40 and 50 years of age.

Further, highly educated respondents without steady monthly income have no savings (rule 20), as well as those with secondary education from central region (rule 21). Respondents with secondary education from the north of Montenegro from this category of income, also, have no savings if they live in rural areas of the north region (rule 22), while they do have them if they live in urban areas (rule 23).

Respondents whose monthly earnings are under €300 did not make any savings, either (rule 24). The high accuracy of this rule (85.24%) and the number of respondents it covers (about 12% of the total respondents) indicate that this margin in the amount of income is a decisive factor in opting for savings.

Table 4 shows socio-demographic profile of respondents depending on the reasons due to which they have no investment in the financial market (DT2 model).

Table 4 shows that highly educated respondents, who are between 18 and 24 years old with monthly income in range €300-€600, stated insufficient monthly income as the main reason for not investing in the financial market (rule 1).

Insufficient monthly income is the reason due to which highly educated respondents, with income between €300 and €600 and who are within the 25-39 age range, do not invest in any forms of savings (rule 2). The same goes for female respondents with the same income level and same age, who have secondary education and live in an urban area of the central region (rule 3). The same is for respondents of the same age and monthly income from the south region with secondary education, as well as for the respondents over 40 with the same level of monthly income (rules 4-6).

Highly educated and employed female respondents, who live in urban parts of the central region and with monthly earnings between €900 and €1200, prefer spending over saving (rule 7).

Respondents with monthly income under €300, or without steady monthly earnings do not invest in some forms of savings because of insufficient monthly income (rules 9 and 8).

Therefore, insufficient monthly income is the dominant reason for the lack of investment in the financial market of Montenegro, regardless of citizens' income level, age and education.

Table 5. Rules for socio-demographic profile of savers in the form of voluntary pension insurance

No. of Rule	Rule	Rule Accuracy
1.	if Age=18-24 then No (37/1)	97.37%
2.	if Age=25-39 and Sector=Finance then No (10/0)	100.00%
3.	if Age=25-39 and Sector=Industry and construction and Education=High and Employed=Yes and Child≤1.500 then No (2/0)	100.00%
4.	if Age=25-39 and Sector=Other then No (12/1)	92.31%
5.	if Age=25-39 and Sector=Public sector then No (17/2)	89.47%
6.	if Age=25-39 and Sector=Telecommunications then No (6/1)	85.71%
7.	if Age=25-39 and Sector=Tourism and catering then No (2/0)	100.00%
8.	if Age=25-39 and Sector=Trade then No (5/1)	83.33%
9.	if Age=25-39 and Sector=Unemployed then No (3/0)	100.00%
10.	if Age=40-50 then No (21/4)	84.00%
11.	if Age=Over 50 and Marital_stat=Marriage with children and Income=300-600 and Living=Urban and Gender=Female then No (4/1)	80.00%
12.	if Age=Over 50 and Marital_stat=Marriage with children and Income=300-600 and Living=Urban and Gender=Male and Child>2.500 then No (2/0)	100.00%
13.	if Age=Over 50 and Marital_stat=Marriage with children and Income=300-600 and Living=Urban and Gender=Male and Child≤2.500 then Yes (0/2)	100.00%
14.	if Age=Over 50 and Marital_stat=Marriage with children and Income=600-900 then No (2/1)	66.67%
15.	if Age=Over 50 and Marital_stat=Marriage with children and Income=900-1200 then No (2/0)	100.00%
16.	if Age=Over 50 and Marital_stat=Not married, with children then No (2/0)	100.00%

Source: Authors' calculation

The other four DT models show the demographic profile of respondents who invest in some forms of savings. The first of them generates the rules shown in Table 5 which represent the sociodemographic profile of savers in the form of voluntary pension insurance.

Table 5 shows that respondents within the 18-24 age range are not interested to invest in voluntary pension funds (rule 1). The same goes for respondents who are between 25 and 39 years old and who are employed in financial sector, public sector, sector of telecommunications, tourism and hospitality, trade or some other sector, or who are unemployed (rules 2,4,5,6,7,8,9). The same is true for highly educated respondents employed in industry and construction sector, without children, or who have only one (rule 3).

Respondents who are between 40 and 50 years old are not inclined to this type of savings (rule 10).

Participants in the survey who are married and have children, thereby who are over 50 years old with monthly income between €300 and €600, do not invest their funds in voluntary pension fund if they are female and live in urban environment (rule 11). The same is true for male respondents who are married and over 50 years old, with monthly income ranging from €300 to €600 and who live in the urban area and if they have three or more children (rule 12), while those with fewer than three children have this form of investment (rule 13).

The decision not to invest in this form of savings was made by respondents who are married and have children and who have monthly income in range €600-€1200 (rules 14 and 15). The same decision was made by those respondents who are not married and have children (rule 16).

Table 6. Rules for socio-demographic profile of depositors

No. of Rule	Rule	Rule Accuracy
1.	if Region=Central and Sector=Finance and Employed=Yes and Child>0.500 then Yes (5/1)	83.33%
2.	if Region=Central and Sector=Finance and Employed=Yes and Child≤0.500 and Age=18-24 then No (1/2)	66.67%
3.	if Region=Central and Sector=Finance and Employed=Yes and Child≤0.500 and Age=25-39 then No (0/6)	100.00%
4.	if Region=Central and Sector=Industry and construction then Yes (3/0)	100.00%
5.	if Region=Central and Sector=Other and Age=18-24 then No (1/2)	66.67%
6.	if Region=Central and Sector=Other and Age=25-39 then No (2/6)	75.00%
7.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Marriage with children and Income=300-600 then No (2/6)	75.00%
8.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Marriage with children and Income=600-900 then No (3/6)	66.67%
9.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Marriage with children and Income=900-1200 then Yes (4/0)	100.00%
10.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Marriage with children and Income=Over 1200 then Yes (2/1)	66.67%
11.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Marriage without children then No (0/2)	100.00%
12.	if Region=Central and Sector=Public sector and Employed=Yes and Marital_stat=Not married, no children and Living=Urban and Income=600-900 then Yes (2/0)	100.00%
13.	if Region=Central and Sector=Telecommunications then Yes (3/2)	60.00%
14.	if Region=Central and Sector=Tourism and catering then Yes (2/0)	100.00%
15.	if Region=Central and Sector=Trade then No (2/8)	80.00%
16.	if Region=Central and Sector=Unemployed then No (5/11)	68.75%
17.	if Region=North then No (2/18)	90.00%
18.	if Region=South and Income=300-600 and Living=Urban and Education=High then Yes (2/0)	100.00%
19.	if Region=South and Income=300-600 and Living=Urban and Education=Secondary then No (1/2)	66.67%
20.	if Region=South and Income=600-900 then Yes (3/0)	100.00%
21.	if Region=South and Income=900-1200 then No (1/4)	80.00%
22.	if Region=South and Income=Over 1200 then No (1/2)	66.67%
23.	if Region=South and Income=There isn't steady monthly income and Living=Urban and Age=18-24 then Yes (2/1)	66.67%
24.	if Region=South and Income=There isn't steady monthly income and Living=Urban and Age=25-39 then No (0/2)	100.00%
25.	if Region=South and Income=Under 300 then No (0/2)	100.00%

Source: Authors' calculation

The analysis of the above mentioned rules indicates that the savers in the voluntary pension insurance are younger persons employed in industry sector, as well as persons over the age 50 of who are married and have fewer then three children.

Table 6 shows rules from DT4 model which refers to socio-demographic profile of depositors.

Table 6 shows that employed respondents in the sector of finance from the central region, who have more than one child, have a deposit in some of Montenegrin banks (rule 1), while respondents from the same sector and region, who have one child or have no children and who are between 18 and 39 years old, do not have deposit (rules 2 and 3). Respondents who work in industry and construction

and who are from the central region have deposit (rule 4). Rules 5 and 6 show that respondents from the central region who did not specify the sector they work in, do not have this type of investment only if they are between 18 and 40 years old.

For the central region, employed respondents in public sector who are married and have children have term deposit if their monthly income is over €900 (rules 9 and 10), while those with lower incomes do not have this type of savings (rules 7 and 8). Also, employed persons in public sector who are married, without children, have no deposit in a Montenegrin bank (rule 11). Rule 12 refer to respondents from the same sector and region, but who are not married and have no children and shows that deposit is owned only by respondents with income range of €600-€900. Rules 13-16 indicate that employed respondents in the sector of telecommunications, tourism and hospitality have this type of savings. From the analysis of employees in public sector it can be seen that income level is important factor which has impact on decision about having term deposit.

Respondents from the north region do not invest their funds in this form of savings (rule 17).

In the south region of Montenegro, highly educated respondents who live in urban part of the region and who belong to the income range €300-€600, have a bank deposit (rule 18), while those with secondary education and the same income do not have it (rule 19). Deposit in some bank is owned by respondents from the south region with monthly earnings between €600 and €900 (rule 20). The decision not to invest in this type of savings is made by respondents with the income over €900 or under €300 (rules 21, 22 and 25).

Respondents without steady monthly income, who live in the urban area, have a bank deposit if they are between 18 and 24 years old (rule 23), while those between 25 and 39 years of age, do not possess this form of savings (rule 24). This points to the fact that in the south region, only young and highly educated respondents are aware of the importance of investing in deposits.

The rules presented in Table 7 indicate to socio-demographic profile of life insurance policyholders (DT5 model).

Table 7 shows that respondents employed in the sector of finance with monthly income between €300 and €600 have no life insurance policy (rule 1). Employed respondents with the same earnings, who live in the central region of Montenegro, but who did not specify a sector they work in, have life insurance policy (rule 2), while if they live in the north and south region, they do not have this type of savings (rules 3 and 4). Highly educated respondents, employed in the public sector with monthly income in range €300-€600, invest their funds in life insurance (rule 5), while those with secondary education have no life insurance policy (rule 6). Life insurance policy is bought by respondents employed in trade sector, as well as by unemployed with monthly earnings between €300 and €600 (rules 7 and 8).

Respondents from the central region, with a monthly income between €600 and €900 and if they are male from 25 to 39 years old, do not have a life insurance policy (rule 9). Rules 10 and 11 shows that respondents who are 40-50 years old, with monthly income of €600-€900 do not invest their funds in life insurance if they are employed in the public sector or in any other sector that is not specified. Respondents who are over 50 years old from the same category of income do not invest in life insurance if they are from the central region (rule 12). Observing rules 13-15, it can be seen that respondents with a monthly income of €900-€1200, aged 25-39, or over 50, invest their funds in the life insurance policy, as well as those respondents aged 40-50, who live in the central region. Respondents with the highest income (over €1200) have life insurance policy if they are from the central region, but do not have it if they live in the south region (rules 16 and 17). Thus, most respondents who invest in life insurance are from the central region.

Rules 18-20 indicate that respondents without steady monthly income, who are between 18 and 24 years old and who are not married and have no children, have life insurance policy only if they are from the central region.

Table 7. Rules for socio-demographic profile of life insurance policyholders

No. of Rule	Rule	Rule Accuracy
1.	if Income=300-600 and Sector=Finance then No (5/6)	54.55%
2.	if Income=300-600 and Sector=Other and Employed=Yes and Region=Central then Yes (6/3)	66.67%
3.	if Income=300-600 and Sector=Other and Employed=Yes and Region=North then No (1/2)	66.67%
4.	if Income=300-600 and Sector=Other and Employed=Yes and Region=South then No (0/2)	100.00%
5.	if Income=300-600 and Sector=Public sector and Employed=Yes and Education=High then Yes (9/2)	81.82%
6.	if Income=300-600 and Sector=Public sector and Employed=Yes and Education=Secondary then No (1/5)	83.33%
7.	if Income=300-600 and Sector=Trade then Yes (6/1)	85.71%
8.	if Income=300-600 and Sector=Unemployed then Yes (2/0)	100.00%
9.	if Income=600-900 and Age=25-39 and Region=Central and Employed=Yes and Gender=Male then No (2/3)	60.00%
10.	if Income=600-900 and Age=40-50 and Employed=Yes and Sector=Other then No (0/2)	100.00%
11.	if Income=600-900 and Age=40-50 and Employed=Yes and Sector=Public sector then No (1/2)	66.67%
12.	if Income=600-900 and Age=Over 50 and Region=Central then No (0/2)	100.00%
13.	if Income=900-1200 and Age=25-39 then Yes (4/3)	57.14%
14.	if Income=900-1200 and Age=40-50 and Region=Central then Yes (3/0)	100.00%
15.	if Income=900-1200 and Age=Over 50 then Yes (2/1)	66.67%
16.	if Income=Over 1200 and Region=Central then Yes (4/1)	80.00%
17.	if Income=Over 1200 and Region=South then No (1/2)	66.67%
18.	if Income=There isn't steady monthly income and Age=18-24 and Marital_stat=Not married, no children and Region=Central then Yes (9/3)	75.00%
19.	if Income=There isn't steady monthly income and Age=18-24 and Marital_stat=Not married, no children and Region=North then No (3/4)	57.14%
20.	if Income=There isn't steady monthly income and Age=18-24 and Marital_stat=Not married, no children and Region=South then No (0/3)	100.00%
21.	if Income=There isn't steady monthly income and Age=25-39 and Living=Urban and Sector=Unemployed then No (0/2)	100.00%
22.	if Income=Under 300 then No (3/6)	66.67%

Source: Authors' calculation

Unemployed persons from the urban part of region who are between 25 and 39 years old, and who are without steady monthly income, do not have this type of investment (rule 21). Also, the policy is not held by respondents with the income under €300 (rule 22).

Finally, the rules that describe the securities investor profile are derived from the model DT6.

Rules 1-5 from Table 8, which refer to respondents who are married and have two or more children, show that securities are bought by respondents who are within the 18-24 age range, as well

Table 8. Rules for socio-demographic profile of respondents who invest in securities

No. of Rule	Rule	Rule Accuracy
1.	if Child>1.500 and Marital_stat=Marriage with children and Age=18-24 then Yes (0/2)	100.00%
2.	if Child>1.500 and Marital_stat=Marriage with children and Age=25-39 and Living=Urban and Gender=Female then No (16/0)	100.00%
3.	if Child>1.500 and Marital_stat=Marriage with children and Age=25-39 and Living=Urban and Gender=Male then Yes (2/3)	60.00%
4.	if Child>1.500 and Marital_stat=Marriage with children and Age=40-50 then No (12/4)	75.00%
5.	if Child>1.500 and Marital_stat=Marriage with children and Age=Over 50 then No (10/4)	71.43%
6.	if Child>1.500 and Marital_stat=Not married, with children then No (2/0)	100.00%
7.	if Child≤1.500 and Sector=Finance and Age=18-24 then No (3/1)	75.00%
8.	if Child≤1.500 and Sector=Finance and Age=25-39 then No (8/0)	100.00%
9.	if Child≤1.500 and Sector=Finance and Age=40-50 and Gender=Female and Employed=Yes and Income=300-600 then No (2/0)	100.00%
10.	if Child≤1.500 and Sector=Industry and construction then No (3/0)	100.00%
11.	if Child≤1.500 and Sector=Other then No (17/1)	94.44%
12.	if Child≤1.500 and Sector=Public sector then No (16/1)	94.12%
13.	if Child≤1.500 and Sector=Telecommunications then No (3/0)	100.00%
14.	if Child≤1.500 and Sector=Tourism and catering then No (3/0)	100.00%
15.	if Child≤1.500 and Sector=Trade then No (7/0)	100.00%
16.	if Child≤1.500 and Sector=Unemployed then No (22/1)	95.65%

Source: Authors' calculation

as the respondents aged 25-39, but males who live in urban. Respondents who are not married, but have minimum two children do not have this form of investment (rule 6).

To respondents who have one child or without children the following applies. Employed respondents in the sector of finance, who are between 18 and 39 years old do not invest their funds in securities (rules 7 and 8). Also, female respondents from the same sector, who are within the 40-50 age range and have monthly income between €300 and €600, do not invest their funds in securities (rule 9). Respondents employed in industry, public sector, sector of telecommunications, tourism and hospitality, trade or some other sector, or who are unemployed, do not have this type of investment (rules 10-16).

Hence, it can be seen that investing in securities is a poorly represented form of savings and is owned by younger male respondents (18-39 years old) with a minimum of two children, as well as women aged 40-50 with monthly income over 600 €.

Finally, it can be concluded that generated DT models (DT1-DT6) successfully identified characteristics of savers, reasons for non-savings, as well as socio-demografic profile of savers depending on the form of savings. In a way, it is answered in the first three research questions. The results and validity of the model (good classification performance) confirmed that the DT method is efficient for analysis of this type, which also answers the fourth research question.

In order to confirm that the analysis based on the DT model is more adequate for this type of research, but also deeper and semantically richer than standard statistical methods, a comparison was made with regression analysis, the results of which are shown in Table 9.

Table 9 indicates that the age group of 40 to 50 increases the probability of owning some form of savings compared to those older than 50. Women are less likely to be savers than men, while those with incomes of less than 600€ are more likely to have savings than those with incomes of more than 1.200€. Employees in the public sector, telecommunications, tourism, and the unemployed are savers more likely than employees in finance sector, with this probability being highest for the unemployed. Employees in trade are more likely to have savings in the form of voluntary pension insurance than employees in finance sector. Those in the age group of 40 to 50 are less likely to have savings in the form of bank deposits than those over the age of 50, while those in the northern region are more likely to have this type of savings comparing with the central region. Also, the tourism and some other sectors, that is not specified by survey, increase the probability of this type for savings relative to finance sector. Insurance savings are more likely for those with high school than for college students, while unemployment reduces this probability. As far as government bonds are concerned, it is less likely that the age group of 25 to 35 will opt for this type of savings than those over 50, also women rather than men, as well as the unemployed compared with employed in finance sector.

A very low coefficient of determination, as well as a small number of statistically significant coefficients, shows that regression is not an adequate method for this analysis. The reason is that regressors are mostly the nominal variables that must be encoded by dummy variables. Unlike regression methods, classification methods (such as DT) are equally efficient with numerical and nominal input variables.

In addition, comparing the results, it can be seen that the DT method gives a semantically richer analysis than regression. Namely, while regression methods could determine whether the amount of income influences the savings commitment and how much, this method determines how the amount of income interacts with other factors and influences the commitment, thereby obtaining richer and more accurate insight into the issue. The regression method shows that the probability of someone being a saver is higher if he has an income between 300 and 600 euros than if his income is higher than 1200 euros. The DT method generates a rule (number 3 in Table 3) that those with income between 300 and 600 euros, which are highly educated, female and employed in other sectors not specified in the survey (private sector and entrepreneurship, for example) are savers. Confidence in this rule is about 61%, and the rule applies to 8 respondents. This is not the only such a rule- from the DT model all groups of respondents who are savers and their socio-demographic profiles can be identified. Thus, the first rule from the same table tells us that 12 respondents from the finance sector with incomes of 300 to 600 euros have some form of savings. Obviously, characteristic socio-demographic patterns can be efficiently detected by the DT method, which is not possible with the regression method.

As mentioned above, comparing the results, it can be seen that the DT method gives a semantically richer analysis than regression. Namely, while regression methods could determine whether the amount of income influences the savings commitment and how much, this method determines how the amount of income interacts with other factors and influences the commitment, thereby obtaining richer and more accurate insight into the issue.

CONCLUSION

The aim of this research is to discover existing links between the savings portfolio and the socio-demographic characteristics of Montenegrin citizens. In this paper, for the first time, the DT method was used to identify these links. The results showed that this method could provide better description of the socio-demographic profile of the respondents depending on the type of savings, than the standard statistical methods used in previous studies.

Table 9. Regression models by types of savings

	Savings		Voluntary_ retirement		Bank_deposit		Insurance_policy/ card		Goverment_bonds	
Attribute	StdCoef	p value	StdCoef	p value	StdCoef	p value	StdCoef	p value	StdCoef	p value
Age = 18-24	0.093	0.680	-0.771	0.338	-0.128	0.779	0.100	0.811	-0.175	0.828
Age = 25-39	0.272	0.187	-0.802	0.102	0.209	0.583	0.027	0.939	**-1.712**	0.020
Age = 40-50	**0.361**	0.034	-0.226	0.559	**-0.566**	0.068	-0.281	0.344	-0.322	0.503
Education = Elementary	0.732	0.928								
Education = Secondary	0.151	0.231	-0.299	0.467	-0.327	0.177	**0.423**	0.062	-0.722	0.195
Gender = Female	**-0.196**	0.090	0.340	0.383	0.340	0.124	-0.171	0.412	**-1.273**	0.004
Income = 300-600	**0.464**	0.085	-0.339	0.601	-0.289	0.541	0.133	0.768	0.167	0.839
Income = 600-900	0.103	0.628	-0.711	0.193	-0.217	0.597	0.582	0.139	0.698	0.323
Income = 900-1200	-0.032	0.835	-3.995	0.895	-0.246	0.467	0.063	0.843	0.169	0.751
Income = There isn't steady monthly income	0.158	0.604	-4.027	0.903	0.222	0.692	0.935	0.116	0.345	0.702
Income = Under 300	**0.546**	0.012	-0.432	0.329	0.218	0.509	0.440	0.131	0.307	0.550
Living = Rural	-0.036	0.756	0.216	0.519	0.036	0.900	0.029	0.894	-3.391	0.869
Marital_stat = Marriage without children	0.197	0.228	-1.298	0.969	0.145	0.560	-0.210	0.349	-1.445	0.962
Marital_stat = Not married, no children	0.090	0.699	0.516	0.597	0.030	0.954	-0.176	0.689	0.214	0.833
Marital_stat = Not married, with children	0.066	0.572	0.382	0.192	0.251	0.289	0.418	0.117	-1.797	0.945
Num_of child	-0.152	0.486	0.367	0.694	0.033	0.951	-0.101	0.800	0.876	0.366
Region = North	-0.058	0.614	-0.479	0.369	**0.873**	0.009	-0.123	0.578	-3.940	0.850
Region = South	-0.132	0.215	0.342	0.369	-0.103	0.644	0.076	0.733	-0.059	0.863
Sector = Agriculture	0.159	0.230	0.147	0.997	1.068	0.940	0.897	0.948	-0.170	0.996
Sector = Industry and construction	0.191	0.125	0.679	0.128	-0.188	0.458	-0.106	0.637	-2.375	0.920
Sector = Other	0.017	0.903	0.171	0.772	**0.493**	0.079	0.002	0.993	-0.377	0.472
Sector = Public sector (education, healt care, state authorities...)	**0.403**	0.021	1.007	0.109	0.215	0.474	-0.095	0.744	-0.243	0.619
Sector = Telecommunications	**0.287**	0.031	0.525	0.196	-0.243	0.295	-0.159	0.458	0.133	0.689
Sector = Tourism and catering	**0.252**	0.064	-1.456	0.964	-0.064	0.767	0.215	0.338	-1.534	0.959
Sector = Trade	0.112	0.418	**0.822**	0.064	**0.816**	0.006	-0.264	0.278	-0.545	0.236
Sector = Unemployed	**0.481**	0.065	0.580	0.464	0.127	0.757	**-0.934**	0.067	**-1.245**	0.056
Intercept	1.048	0.366	-5.607	0.279	0.792	0.912	-0.024	0.877	-6.463	0.769
Relative_Error:	37.24%		15.55%		34.63%		41.77%		12.69%	
Root_Mean_Squared_Error:	0.432		0.281		0.417		0.456		0.256	
Correlation:	0.166		0.054		0.423		0.406		0.445	
Squared_Correlation:	0.028		0.003		0.179		0.165		0.198	

Note: Comparison group attributes are: Region-Central; Age- Over 50; Education - High; Gender - Male; Sector - Finance; Living - Urban; Martial_stat- Marriage with children; Num_of child-0; Income - Over 1200

Statistically significant coefficients are bolded (with a significance threshold of 0.1, p-value <0.1)

Source: Authors' calculation

The results of research obtained using the DT model lead to numerous conclusions about how much the citizens of Montenegro are prone to savings and what is the socio-demographic profile of the persons who have decided to invest their funds in the financial market.

The results showed that only 28,94% of respondents have some forms of savings, what indicates that savings in the financial market of Montenegro are on a low level. The main reason for this situation is insufficient income. Among the four savings forms analyzed in the paper, the smallest percentage of respondents stated that they invested funds in a voluntary pension fund (11,03%) and in purchasing bonds and other debt sicurities in the financial market (12,41%). On the other side, the largest number of respondents who have some forms of savings, have a life insurance policy. It leads to conclusion that citizens express the greatest confidence toward insurance companies. The result that indicates that Montenegrin citizens prefer insurance companies over banks, can be justified by low interest rates on term deposits in Montenegrin banks, as well as the double benefit of a life insurance policy. A deposit in some of Montenegrin banks is owned by slightly more than one third of respondents who have some form of savings (37,93%).

To sum all, it can be noticed that the low level of investment in the financial market in Montenegro is primarily a result of poor standard of living, but also of insufficient information and awareness of citizens about importance of savings and their need to provide material security for their own future and the future of their inheritors. However, the cause of insufficient citizens' savings should certainly be sought in the specifics of the financial system, namely in the inappropriate supply of savings instruments and the underdevelopment of the financial market, which could be a topic of some new research.

This paper has empirical, methodological and practical contributions. Specifically, the results are compounded by a lack of empirical findings for emerging markets such as Montenegro. Methodologically speaking, according to the available literature for the analysis of this type, for the first time the DT method is applied, which makes it more efficient and accurate than standard statistical analyses. Finally, identified patterns for savers, depending on the type of savings, can serve financial institutions as a tool to target audiences more easily.

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ENDNOTES

[1] The report of the state of the insurance market in Montenegro for 2018, Insurance supervision agency, June 2019.
[2] Monetary financial institutions statistics, Central Bank of Montenegro.
[3] Capital market statistics, Central Bank of Montenegro.

APPENDIX

Survey – Questionnaire

1. Region of Montenegro
   a. Central
   b. North
   c. South
2. Part of town
   a. Urban
   b. Rural
3. Age
   a. 18-24
   b. 25-39
   c. 40-50
   d. Over 50
4. Gender
   a. Female
   b. Male
5. Education
   a. Elementary
   b. Secondary
   c. High
6. Are you employed?
   a. Yes
   b. No
7. In which sector you are employed?
   a. Agriculture
   b. Finance
   c. Industry and construction
   d. Public sector (education, healt care, state authorities...)
   e. Telecommunications
   f. Tourism and catering
   g. Trade
   h. Unemployed
   i. Other
8. Marital status
   a. Marriage with children
   b. Marriage without children
   c. Not married, no children
   d. Not married, with children
9. Number of children
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4
   f. 5
   g. 6

10. Monthly net income (€)
    a. Under 300
    b. 300-600
    c. 600-900
    d. 900-1200
    e. Over 1200
    f. There isn't steady monthly income
11. Do you have any form of savings (bank deposit, life insurance, voluntary retirement fund, bonds, etc.)?
    a. Yes
    b. No
12. What is the main reason why you have no savings?
    a. Insufficient monthly income
    b. Lack of confidence in financial institutions in Montenegro
    c. Lack of knowledge and information on these forms of savings
    d. Spending preference over saving
13. What would motivate you to change your mind and start saving?
    a. Better standard of living and higher income
    b. Higher and better money back guarantee - payment of savings from regulatory institutions in Montenegro
    c. More transparent work of institutions for saving and better information
14. If you start saving, which form of savings would you prefer?
    a. Term bank deposit
    b. Life insurance policy/card
    c. Contribution payment in voluntary retirement fund
    d. Buying of bonds and other debt securities on financial market
    e. No one
15. Do you have a voluntary retirement fund account?
    a. Yes
    b. No
16. What is the main reason of opening voluntary retirement fund account?
    a. Expected yield
    b. Interest for this form of saving on our market
    c. Positive experience of acquaintance
    d. I have not account
17. What is the main reason why you have no voluntary retirement fund account?
    a. Insufficient cash assets for a few forms of savings
    b. Lack of confidence in voluntary retirement fund's work
    c. Lack of information about voluntary retirement fund's work
    d. I have account
18. Do you have a term deposit in some bank?
    a. Yes
    b. No
19. What is the main reason why you have a term bank deposit?
    a. Deposits are least risky form of saving
    b. High confidence in banking sector in Montenegro
    c. Lack of information about other forms of savings
    d. I have no deposit

20. What is the main reason why you have no term bank deposit?
    a. Insufficient cash assets for a few forms of savings
    b. Lack of confidence in banking sector in Montenegro
    c. Low interest rates and yield
    d. I have term bank deposit
21. Do you have a life insurance policy/card?
    a. Yes
    b. No
22. What is the main reason why you decided to make a life insuranse policy/card?
    a. Benefits of a life insurance policy (in addition to saving, it covers a risk of death)
    b. Positive experience of acquaintances
    c. There isn't special reason, by persuasion of friend
    d. I haven't life insurance policy
23. What is the main reason why you have no life insurance policy/card?
    a. Insufficient cash assets for a few forms of savings
    b. Lack of confidence in insurance company's work
    c. Lack of information about life insurance products
    d. Other forms of savings give better yields than life insurance policy
    e. I have life insurance policy
24. Did you buy a goverment bonds or other debt securities on financial market of Montenegro?
    a. Yes
    b. No
25. What was the main reason for this type of investment?
    a. Positive experience of acquaintances
    b. Wish for new and different forms of savings in regard to classic forms
    c. Yields that are given by securities
    d. I haven't this type of investment
26. What is the main reason why you don't invest funds in goverment bonds or other debt securities?
    a. Insufficient cash assets for a few forms of savings
    b. Lack of confidence in issuers of debt securities and financial system of Montenegro
    c. Lack of information
    d. I have this type of investment
27. If you could provide additional savings beyond this what you currently have, which form of savings would you prefer?
    a. Buying of bonds and other debt securities on financial market
    b. Contribution payment in voluntary retirement fund
    c. Life insurance policy/card
    d. Term bank deposit
    e. No one

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