**Logistic regression analysis of financial literacy implications for retirement planning in Croatia**

**Abstract**

The relationship between financial literacy and financial behavior is important, as individuals are increasingly being asked to take on responsibility for their financial wellbeing, especially for their retirement. Therefore, the analysis of individual saving and individual attitudes towards retirement planning is important since this type of investment is important way of preserving security in the years of financial vulnerability. The relevant research indicates that individuals do not save enough for retirement and generally have a rather low level of financial literacy.

This research investigates the relationship between financial literacy and retirement planning in Croatia. In order to analyze the relationship between financial literacy and planning for the retirement, maximum likelihood logistic regression analysis is used. It is shown that those who give a correct answer to financial literacy questions are more likely to have positive attitude towards retirement planning and are more likely to individually save for retirement, which should ensure them higher level of financial security for retirement. Goodness-of-Fit evaluation for estimated logit model is conducted using Andrews and Hosmer-Lemeshow Tests.

**Keywords:** *Financial literacy, Maximum Likelihood Estimation, Logistic regression analysis, Retirement planning, Saving for retirement***,** *Survey Research*

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**1. Introduction**

Retirement systems are becoming more and more complex. Due to the rise in the life expectancy, growing percentage of aging population, declining percentage of young people and low fertility rate, there has been a serious deterioration in the dependancy ratio (Barbić, 2016). In August 2016 the dependency ratio in Croatia was 1:1.22 indicating that 1 retiree is financed by 1.22 employees. Retirement is quite expensive. It is estimated that individuals in retirement need approximately 70% of their current income to cover for their costs of living, while it is highly presumable they will get less than 50% (Barbić, 2016). Therefore, public retirement system can no longer guarantee adequate and sufficient pensions for future retirees.

It is becoming evident that new retirees will not be able to rely on the system of intergenerational solidarity. Therefore, standard of living of new retirees will primarily depend on various types of private savings and private investments. In order to be able to use financial products and services and invest money wisely, individuals need to be financially literate. They need to have at least basic financial knowledge and skills and be aware of the possible risks and threaths connected with their financial choices.

The purpose of this paper is threefold. Firstly, the objective is to provide an overview of financial and retirement literacy in Croatia. Secondly, the relationship between financial literacy and attitudes towards retirement planning and saving for the retirement will be analyzed using logistic regression analysis. Thirdly, this paper should contribute to the economic and educational policy in developing better financial and retirement literacy programs and campaigns.

**2. The importance of financial literacy for retirement planning**

Retirement system in Croatia is composed out of three pillars. First two pillars are obligatory and they are financed through contributions, while the third pillar is voluntary and represents individual capitalized savings.

The penisions of Croatian retirees are generally very low and the current retirement system is unsustainable in the long run. Accordingly, it is very likely that future pensions acquired from the first and second pillar of today’s employees will be rather low as well. Besides the previously mentioned problems of the Croatian retirement system, the period that individuals spend in retirement, therby their costs of living, are futher increased due to the improvement of the life expectancy.

The system is becoming weaker every day and individuals are becoming even more responsible for their retirements and their savings. Although first and second pillar present the source of retirement for most of the current retirees, in time they will remain only as a minimal or initial level of individual social protection and retirees will be mainly personally responsabile for their retirement savings.

In order to be able to make informed financial decisions, individuals should possess financial knowledge and financial skills. Financial literacy presents a combination of financial knowledge and financial skills and it is intended at rising up the level of individual responsibility towards various aspects of using financial products and services and taking risk of different financial decisions (Cvrlje, 2014).

Bernheim et al (2001), Berheim and Garrett (2003), Hilgert et al (2003), van Rooij et al (2008), Lusardi and Mitchell (2009) and Cvrlje (2014) demonstrated strong links between financial knowledge and financial behavior. Lusardi and Mitchell (2011) found that many respondents lack key knowledge of financial concepts and fail to plan for retirement, even when retirement is close at hand. Their findings suggest that financial illiteracy correlates with lower retirement wealth accumulation. Furthermore, in another study (2011), they concluded that financial knowledge and retirement planning are interrelated.

Reserches investigating financial literacy in Croatia suggest that Croatians have a rather low level of financial literacy (Barbić, 2016; CNB, 2015; Vehovec et al, 2015; Cvrlje, 2014). The results of the study made by Škreblin Kirbiš et al (2011) showed that among active population in Croatia, 54% of respondents are retirement illiterate. When compared with financially and retirement literate respondents, this group had statistically significant lower personal income, lower level of general education and were more often unemployed or employed on a definite period of time.

According to the CNB (2015) the lowest level of financial literacy (3,6 out of 7) in Croatia was found among the elder respondents (>70 years). Their findings showed that 74% of all respondents expect to recive their retirement from the first pillar based on intergenerational solidarity; 55% of respondents expect to receive retiremet from the second pillar and only 17% responedents expect retirement from the third voluntary pillar.

Most of the researches showed individuals are insufficiently focused on retirement planning (Škreblin Kirbiš et al., 2011). Many Croatians stated that they are not sure whether they made quality plans for their retirement (CNB, 2015). Insuffcient level of financial consciousness might result in very low standard of living of future retirees. Zaidi (2010a) emphasizes that the extension of life expectancy and low level of private retirement savings will eventually result in greater poverty of the elederly. Given the evidence on widespread financial illiteracy and limited retirement knowledge, there is an obvious policy interest in the question whether financial literacy and financial education affect attitudes towards retirement planning and saving behavior.

**3. Data and model description**

**3.1. Data**

The sample used in this paper is comprised of people living in Croatia, aged 20-79 years. The questionnaire was conducted with a judgemental sample of 30 respondents living in Zagreb. Moreover, the questionnaire was pretested on 100 respondents living in Croatia. Feedback from both samples was used in finalizing questionnaire which was conducted in July 2014. It was administred in the form of telephone survey using the base of randomly selected telephone numbers of fixed and mobile telephony. The total of 494 respondents was gathered and in this paper sample size of 451 is used due to incomplete data.

The questionnaire was created according to Lusardi and Mitchell (2009) basic financial literacy scale and it included a set of questions regarding financial concepts and financial calculations (inflation, interest rate compounding, risk diversification, percentage calculation etc.). Before applying the questionnaire to the final sample, it was necessary to test the financial literacy scale for validity and reliability (Hair et al, 2010). In order to test the financial literacy scale validity, the exploratory factor analysis is used. Exploratory factor analysis is a statistical method used to test the connection within the group of observed variables, measured by items or questions (Beavers et al, 2013). In the literature exploring similar matters, there is no consensus regarding the percentage of variance that should be explained in order to consider a certain factor sufficient. According to some studies, it should be around 75-90%, but many authors state that any amount exceeding 50% of the variance is sufficient (Beavers et al, 2013). Using the exploratory factor analysis unsufficiently informative variables are excluded. The following relative criteria are used: (1) Kaiser criteria; (2) Catell diagram; (3) Percentage of explained variance; (4) Theoretical meaningfulness (Milošević, 2010). One factor which satisfies the mentioned criteria and comprises information about financial literacy of Croatian financial cosumers is retained. Table 1 and Table 2 show the exploratory factor analysis results.

|  |  |  |
| --- | --- | --- |
| Component | Initial Eigenvalues | Extraction Sums of Squared Loadings |
| Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 1.541 | 51.355 | 51.355 | 1.541 | 51.355 | 51.355 |
| 2 | .776 | 25.855 | 77.210 |  |  |  |
| 3 | .684 | 22.790 | 100.000 |  |  |  |

Table 1: Total Variance Explained (SPSS) [Authors]

From Table 1 it is obvious that the eigenvalue for the first component is quite larger than the eigenvalue for the next component (1.541 versus 0.776). Additionally, the first component accounts for 51.355% of the total variance. This suggests that the scale items are unidimensional

|  |  |
| --- | --- |
| Inflation | 0.692 |
| Interest | 0.754 |
| Diversification | 0.702 |

Table 2: Component Matrix (SPSS) [Authors]

Furthermore, Table 2 presents component loadings, which are the correlations between the variable and the component. All three items have factor loadings 0.6 and above. After the exploratory factor analysis, reliability analysis of the measuring instrument and the latent variables is conducted. Cronbach alpha is oftenly used to test the internal consistency of the measurement scales and to verfy the reliability of the measuring instrument. Cronbach alpha coefficient for financial literacy scale was 0.739 suggesting that the items have relatively high internal consistency.

|  |  |
| --- | --- |
| **Financial literacy** | **Items** |
| Interest rate | Imagine that the interest rate on your savings was 1% per year and inflation was 2% per year. After 1 year you will have more than today. |
| Inflation | Suppose you had 100 kn on your account and the interest rate is 2% per year. After 5 years you will have exactly 102 kn. |
| Risk diversification | By investing money in securities of various joint stock companies and other legal entities, the average investor increases his risk of loss. |

Table 2: Items used to define basic financial literacy [Authors]

Based on previously described procedures, a set of three questions to measure basic level of financial literacy is designed. Table 2 reports the precise wording of the basic financial literacy questions that analyse numerical skills and understanding of basic concpts such as interest rates, inflation, and risk diversification. The respondents were asked to choose between two options; correct and incorrect. Figure 1 summarizes the responses to the basic financial literacy questions.



Figure 1: Responsens to the basic financial literacy questions [Authors]

The respondents demonstrated a rather low level of basic financial literacy. Most of the respondents (59.2%) correctly answered to the interest rate question. Howeveer, 50.11% of respondents answered incorrectly to the inflation question while only 35.03% respondents gave the correct answer to the risk diversification question.

In the next step, the level of retirement planning is investigated based on: (1) Positive attitudes towards retirement planning, and (2) Private retirement saving/investment plan.

|  |  |
| --- | --- |
| **Planning for the retirement** | **Statements** |
| Positive attitude towards retirement planning | I think it is very important to have a retirement plan. |
| Private retirement saving/investment plan | I have private retirement savings/investments (third pillar). |

Table 3: Planning for the retirement [Authors]

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Figure 2: Planning for retirement [Authors]

Results of our study show that 57, 43 % of respondents has positive attitude towards retirement planning. However, only 11, 31% of them involves in private retirement investments.

**3.2. The logistic regression model**

Logistic regression refers to special form of regression in which the dependent variable is dichotomous variable. The form of the logistic regression variate is similar to the variate in multiple regression. The variate represents a single multivariate relationship with regression-like coefficients indicating the relative impact of each predictor variable. In relation to discriminant multivariate analysis, logistic regression has the advantage of being less affected when the basic assumptions, particularly normality of the variables, are not met (Hair et al., 2010).

Regardless of the similarities between linear and logistic regression, the linear regression cannot be applied directly when the outcome variable is categorical. The reason is that one of the linear regression assumptions is the linear relationship between variables and when the outcome variable is categorical, this assumption is violated. One day to resolve that is to express non-linear relationship in a linear way. The logistic regression equation expresses the linear regression equation in logarithmic terms and this overcomes the problem of violating linearity assumption (Field, 2009). The logistic model is estimated using maximum likelihood estimation (ML) method. ML estimator finds the maximum likelihood parameter estimates by maximizing the likelihood function, which expresses the probability of the observed data as a function of the unknown parameters.The ML procedure is used in an iterative manner, to find the most likely estimates for parameters (Menard, 2002, Cvrlje et al., 2015).

The probability model is a regression (see Greene, 2012):

** (X)

The logistic distribution is given by (1):

**, (1)

where  indicates logistic cumulative distribution function which has been used in many applications, partly because of its mathematical convenience. The logistic distribution is similar to the normal except in the tails, which are considerably heavier (Greene, 2012).

The logistic regression model predicts the probability of an event occurring for a given person based on observations of whether or not the event did occur for that person. The observed and predicted values are used to assess the fit of the model and the measure which is used is log-likelihood denoted by *LL*:

**  (X)

The log-likelihood is based on summing the probabilities accociated with predicted and actaul outcomes (Tabachnik and Fidell, 2007).

In logistic regression estimation, the value of the model chi-square is defined by following equation(Field, 2009):

** (X)

So the baseline model log-likelihood (the model where only constant is included) is substracted from estimated model log likelihood.

Moreover, regarding R2, there are three common measures that are similar in interpretation to R2 in linear regression: Hosmer and Lemeshow’s $R\_{HL}^{2}$, Cox and Snell’s $R\_{CS}^{2}$ and Nagelkerke’s $R\_{N}^{2}$. : Hosmer and Lemeshow’s $R\_{HL}^{2}$, Cox and Snell’s $R\_{CS}^{2}$ are included in the output of SPSS software and detailed computation is explained in Field (2009). Although they are different in computation, they are conceptually similar and point to the substanitive significance of the model. $R\_{HL}^{2}$ is calclulated by dividing the model chi-square (based on the log-likelihood) by the original log-likelihood, i.e. the log-likelihood of the model before any predictors were entered (Field, 2009):

$$R\_{HL}^{2}=\frac{-2LL(model)}{-2LL(baseline)}$$

Moreover, the Hosmer–Lemeshow test is used to anaylse the goodness of fit for logistic regression models. The test assesses whether or not the observed event rates match expected event rates in subgroups of the model population. The significance of the test statistic of the test points to the poor model fit (for detailed explanation see Hosmer, Lemeshow, 2013). The final thing which is often analysed in logistic regression estimation is the odds ratio. It can be interpreted in terms of the change in odds. The value greater than one indicates that as the predictor increase, the odds of the outcome ocurring increase, and vice versa.

**3. The results of the model estimation**

After extracting one factor, logistic regression analysis is conducted in order to assess the impact of financial literacy on attitude towards retirement planning as well as on investment for retirement in form of third retirement pillar. Two logistic regression models are estimated. The predictor variable in both models is financial literacy. The response variable in Model 1 is attitude towards retirement planning, while the response variable in Model 2 is investment in third retirement pillar. Table 4 shows the result of logistic regression estimation for Model 1. The coefficient $\hat{β}\_{Model 1}$ represents the logit of the attitude towards retirement planning associated with one-unit change in financial literacy. The crucial statistic is a Wald statistic that has chi-square distribution and equals 6.616 with corresponding p-value equal 0.01. It indicates whether the estimated coeffcient is statistically different from zero. The chi-square is equal to $-2LL$ with financial literacy included minus the value of $-2LL $ when only the constant was in the model, so it shows the effects of the removal. Regarding the siginificance of the chi square, it is sigificant at 1% which tells us that removing financial literacy would have a significant effect on the predictive ability of the model. In other words it is not reccomended to remove it since financial literacy is significant at 1% significance in explaining the attitude towards retirement planning. Therefore, being financially literate or not is a significant predictor whether the person will have positive attitude towards retirement planning. Moreover, the odds ratio refers to the ratio of odds after a unit change in predictor over original odds and equals 1.280. The odds ratio is interpreted in terms of change in odds. Therefore, odds of a person who is financially literate having positive attitude towards retirement planning is 1.28 times higher than those of a person who is not financially literate. The population value of odds ratio is between 1.059 and 1.547 with 95% confidence.

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| --- | --- | --- | --- | --- | --- |
|  | $\hat{β}\_{Model 1}$(SE) | p-value | Odds ratio | Lower 95% | Upper 95% |
| Included |
| Constant | 0.304 (0.096) | 0.011 |  |  |  |
| FL | 0.247 (0.097) | 0.002 | 1.280 | 1.059 | 1.547 |
| Note: $R\_{HL}^{2}=$0.011, $R\_{CS}^{2}=$0.015, $R\_{N}^{2}$=0.02, $χ^{2}$(1)=6.616, p-value=0.01 |

Table 4: The logistic regression estimation results for Model 1

Table 2 shows the results of logistic regression estimation for Model 2. The coefficient $\hat{β}\_{Model 2}$ refers to logit of the investment in third retirement pillar associated with one-unit change in financial literacy. Wald statistic equas 5.038 and shows that financial literacy is significant at 5% significance in explaining the investment in third retirement pillar. This tells us that model is better at predicting whether somenone will invest in third pillar than it was before financial literacy is added. Therefore, financial literacy is a significant predictor whether the person will invest for retirement in form of third retirement pillar. Moreover, the odds of a person who is financially literate investing into third retirement pillar is 1.42 times higher than those of a person who is not financially literate. The population value of odds ratio is between 1.049 and 1.912 with 95% confidence.

Table 5: The logistic regression estimation results for Model 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | $\hat{β}\_{Model 2}$ (SE) | p-value | Odds ratio | Lower 95% | Upper 95% |
| Included |
| Constant | -2.106 (0.155) | 0.023 |  |  |  |
| FL | 0.348 (0.153) | 0.000 | 1.416 | 1.049 | 1.912 |
| Note: $R\_{HL}^{2}=$0.016, $R\_{CS}^{2}=$0.012, $R\_{N}^{2}$=0.023, $χ^{2}$(1)=5.038, p-value=0.02 |

The values of Hosmer and Lemeshow’s $R\_{HL}^{2}$, Cox and Snell’s $R\_{CS}^{2}$ and Nagelkerke’s $R\_{N}^{2}$ for estimated models are also shown in the Tables 4 and 5. Although they are quite low, this is expected due to the fact that financial literacy is not expected to be the only factor which affects the attitude towards the retirement planning. However, in this research the aim is to analyse whether the impact of financial literacy on attitude towards retirement planning as well as on investment for retirement is significant, without including other factors.

Moerover, the classification shows how well models predict group membership, because financial literacy is used to predict the oucome variables. The Model 1 overall correctly classifies 55.7% of examinees, while Model 2 correctly classifies 88.7% of examinees. Hosmer and Lemeshow test is also conducted for both models. The value of $χ^{2}$(6) equals 9.940 with corresponding p-value of 0.326 for Model 1. For Model 2, $χ^{2}$(6) equals 12.437 with p-value equal to 0.053. In both cases the conclusion is that the null hypothesis may not be rejected at 5% significance. If the p-value is low, the null hypothesis is rejected and the model lacks proper fit. Since both p-values are larger than 0.05, this indicates models should not be rejected.

**4. Conclusions**

The financial literacy and retirement planning habits among Croatian consumers as well as the relationship between financial literacy and retirement planning are analysed in this paper. The findings of the paper show that financial illiteracy is widespread and that the lack of basic financial literacy has important consequences for retirement planning, what points to policy implications. Furthermore, the results indicate that people generally have positive attitude towards retirement planning but only few of them involves in private retirement savings. This situation is primarly caused by inadequate level of information individuals have when it comes to the long-term sustainability of the Croatian retirement system. They are still not aware that their financial wellbeing in the retirement will mainly depend on their own savings and investments.

The logistic regression analysis has shown that financial literacy is a significant predictor whether the person will invest for retirement in form of third retirement pillar and whether the person will have positive attitude towards retirement planning. Individuals who possess basic financial literacy knowledge and skills will be more prone to have positive attitude toward retirement planning as well as engage in private retirement investments. This suggests that financial knowledge and skills are very important in the context of making financial and retirement decisions.

This study emphasized the role of basic financial literacy as by effectively boosting retirement planning behavior among households. One of the reasons why this is important for individuals and households is the evidence that many individuals enter retirement with very little or none wealth. This has profound implications not only on individual welfare but also for public policy, as low retirement savings means more poverty among elder and more individuals dependent on state benefits.

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