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USING ORDINAL REGRESSION MODELLING TO EVALUATE THE FINANCIAL POTENTIAL OF HOUSEHOLDS

Abstract. *The chances of economic recovery and growth in Romania depend, given that the markets are dominated by vigilance regarding the level of public debt and fear of inflation, by the level of internal saving. And since the main sector of an economy that is saving is the household one, adopting financial policies that stimulate saving in this sector is crucial for the anti-crisis and economic recovery governmental programmes.*

The base of these policies requires knowledge about the saving/investment behaviour of households in Romania. After 1989 the important transformations that take place in the economic and social spheres also influence the saving behaviour. The ratio between consumption and saving becomes floating, the balance leaning in favour of consumption, while saving rates even become negative during 2003 and 2008. Moreover, the lack of an investment culture in Romania determined by half a century of centrally planned economy, as well as the lack of precise, correct and complete information regarding the alternatives for placing savings available currently on the financial market in Romania, led to a concentration of population savings only in bank deposits or keeping them in cash.

The main purpose of this paper is the analysis of the financial/investment behaviour of households and the identification of its predictors.

Based on the data resulted from the database of the Household Budget Survey with the experimental questionnaire "Financial placements of households" obtained from the recordings in May 2010 by the National Institute of Statistics, an ordinal regression model was built with the view to identify the economic, social and demographic variables that have a significant influence on the financial placements of the population.

Keywords: *saving behaviour; financial potential of households; ordinal regression.*

JEL Classification: **C14, C25, D14**

1. Introduction

The empiric approach of the households saving behaviour is usually done in two plans: macroeconomic and microeconomic (individual).

The macroeconomic approach is realised from the perspective of the influence of economic growth, inflation, unemployment, interest rate, in the context of demographic ageing, on the saving rate. According to the theory of life cycle (Ando and Modigliani, 1963), the financial behaviour differs for the youth

and the elderly, as compared to the mature. A still important part of the young people who did not reach employment age yet diminish the savings rate, since their parents allot a big part of their incomes to supporting their children. In the same direction, the increase in the average life span imposes the increase of the saving rate during the active life with the view to maintaining the level of consumption (living standard) during the active life. Thus, the increase in the weight of the elderly in a population is equivalent to diminishing the population savings, since this segment is dissaving or is saving at a very reduced pace. The purpose of the elderly segment is very important from the point of view of its financial behaviour, this being a category that dissaves, thus consumes from the savings accumulated during the active life (Artus, 2002).

Friedman's theory of permanent income (Friedman, 1957) states that, in certain contexts, the active population may be stimulated to increase their caution savings in order to compensate for a possible relative decrease of their income after retirement.

Orienting the population towards various ways of placing their savings may only be approached at macroeconomic level. The microeconomic approach, through surveys or enquiries, allowed for the identification of those characteristics of the households that influence the saving behaviour.

At international level, recent studies indicate that for analysing and determining the saving/investment behaviour new data sources are necessary. Thus, in the developed countries were designed and implemented either additional modules in the household surveys or independent ones, having a detailed observation plan that contain characteristics regarding the household capital and real estate. These surveys are done periodically on ad-hoc samples or on panel samples, which facilitate highlighting of the "generation effect" on the propensity to save, indebt, placement, investments, intergenerational transfers and capital owning of the households.

For France, the main data source used is the Survey of capital of the INSEE (l'Institut national de la statistique et des études économiques), whose observation plan contains characteristics that define owning of real estate, financial and professional goods of households, as well as their debts and bonds. This survey is done starting with 1986.

In Germany, the Federal Statistics Office (Statistisches Bundesamt) has a survey every 5 years on a sample of 50000 households. The last wave of the "Incomes and consumption" survey took place in 2008.

The Bank of Italy does, every 2 years, a survey on incomes and capital on sample of 8012 households. The observation plan of the survey also comprises characteristics regarding indebtedness of the households.

In the United Kingdom the Institute for Economic and Social Research does yearly, since 1991, a household survey on a panel sample. The module regarding real estate and mortgage credits is placed in the questionnaire only every five years.

In Romania no survey of such magnitude takes place, most studies related to a part of this topics are based on surveys regarding other issues, but that also

have a small module with the help of which the general characteristics related to financial and saving behaviour of households may be defined.

Between 1995 and 2000 the statistical data regarding the income and consumption of the population were obtained based on information collected with the help of a permanent multifunctional statistical research (the household integrated survey) on the living condition of the population. The survey was structured on several modules, one of which was referring to the income and expenditure budget of the household.

Starting with 2001, the Household Budget Survey (HBS) is done, which integrates in the questionnaire variables regarding the size and the structure of the household, the income sources and the destination expenditure, the consumption of households by main groups of products, namely food, non-food and services. The survey is currently the main data source used for characterising financial behaviour.

The microeconomic approach, through surveys or polls, allowed for the identification of those characteristics of the households that influence the saving behaviour. Some of the most recent studies (Abdelkhalek et al., 2009, Kulikov et al., 2007, Rehman et al., 2011), have indicated a series of results, some predictable, others less predictable:

- The saving rate depends positively on regular household income, but more pronouncedly on transitory income;
- The young and the elderly appear to save more than the middle-aged;
- Higher levels of education lead to lower saving.

The few studies done in Romania are elaborated either by the National Bank of Romania or by the Bank Deposit Guarantee Fund.

The study "Attitudes and behaviour regarding saving and use of services and banking instruments" done by Metro Media Transilvania in December 2005 shows that the categories that manage to save to a higher extent are: men, young, educated, employed, large income per family member, large personal income, coming from urban areas.

According to the study "Saving and Investments" done by GfK Romania in 2010 on a sample of 1228 persons from the urban area and commissioned by the Bank Deposit Guarantee Fund, 80% of the population does not have savings. Among the 20% who have savings, most chose to place them in accounts or deposits in the baking system, 28% prefer to keep them in cash and less than 10% choose other types of placements.

2. The data used and methodology

I tried to deepen the analysis of the saving behaviour of the population by using the data base of the HBS with the experimental questionnaire "Financial placements of the households" collected in May 2010. The sample comprised the 3120 permanent household sample of the HBS. The answer rate was 83.9%. the design and implementation of the experimental section was financed through the grant "Modelling the financial behaviour of the population under the impact of demographic ageing. System of specific indicators and measures for counteracting

the financial disequilibria", financed by the Romanian governments through the contract number 91-016/2007 CNMP.

From the literature on saving behaviour I synthesized a number of important results that may be used as working hypotheses:

H1: the saving/investing behaviour is positively influenced by the stability of the household and its income;

H2: the households of the youth and the elderly have savings to a higher extent than those whose heads are middle-aged;

H3: the education level may have an influence on saving, but whether it is positive or negative is inconclusive, empirical studies leading to contradictory conclusions;

H4: the households in the urban area have financial placements to a higher extent than those in the rural area;

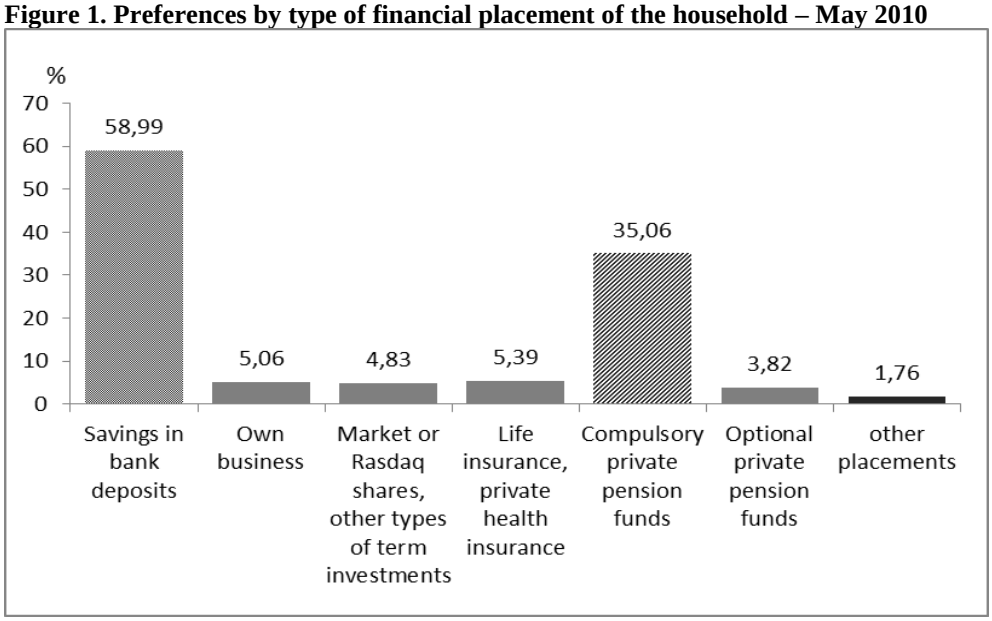
H5: if the gender of the household head is female, the saving odds are smaller;

H6: the employment level of the persons in the household influences positively the value of the financial placements.

3. General Results

Among the 2617 households interviewed in May 2010, 1217 (66%) declared they have no placements. For the 890 households that have at least one financial placement, the preferences by type of placement are presented in Figure 1. The other category – households without placements – either has no income to place, in the context of general decrease of incomes, either keeps the money "under the mattress", out of mistrust in the financial system, but also because of th obvious lack of financial education.

Figure 1. Preferences by type of financial placement of the household – May 2010



The elderly households (the head of the household is aged 65 years or more) are the ones that save through bank deposits to the highest extent (25%), while the young households (the head of the household is aged less than 35 years) resort to this instrument to the lowest extent (11%).

Because of the Romanian legislation regarding the second pension pillar, the placements in compulsory private pensions belong to the highest extent to young households (44%), the other households having lower and lower weights, for example 9% for households with heads aged 55-64 years and 3% for the elderly households.

The variable "Total placements" obtained by summing all the placements of a household is heterogeneously distributed, strongly asymmetric (the average is 4603 RON, the median 1500 RON and the modal value is 250 RON).

Sixty six percent of the households have no financial placement. Even for those who have placements, their value is small (77% of the placement are at most 3500 RON).

4. Ordinal regression model specification

The crucial limitation of linear regression is that it cannot deal with dependent variables that are nominal and ordinal.

Since the 1980s numerous regression models for nominal and ordinal outcomes have been developed. Over the past three decades, logit type models have become the most popular statistical methods in the social sciences.

The main purpose of this paper being the analysis of the financial/investment behaviour of the households, I will next try to identify the determinant factors of this behaviour. Starting from the idea that the cumulated value of the placements of a household quantifies the financial behaviour of the household, I intended to identify the variables that explain its variation. Since the variable "Total placements" has a great degree of variation, I transformed it into an ordinal variable by creating unequal interval groups. The interval limits were determined following the analysis of the distribution shape.

The modelling of the household financial behaviour was done with the help of an ordinal regression model. For processing the data I used SPSS. The SPSS Ordinal Regression procedure, or PLUM (Polytomous Universal Model), is an extension of the general linear model to ordinal categorical data.

The basic equation of the ordinal regression is:

$$Ln\left[\frac{\Pr(Y \le y_j / X_1 ..... X_p)}{\Pr(Y > y_j / X_1 ..... X_p)}\right] = \alpha_j - (\beta_1 X_1 + ... + \beta_p X_p) \quad j = 1,2,...c-1;$$

where Y – predicted variable,
y_j = the j category of the variable Y,

α_j= threshold, specific to the first c-1 values of ordinal scale. Their significance is similar to the constant in the OLS regression. They are useful especially for computing the predicted values,

$X_1 ..... X_p$ = predictors,

p= number of predictors,

c= number of categories of the predicted variable.

The main element in the algorithm of this model is the logit, computed as a logarithm, of the ratio between "the odds that the value of the predicted variable to be less than or equal to Y_j" and "the odds that he value of the predicted variable to be greater than Y_j".

For modelling the saving/investment behaviour of the households I used the predicted variable "Situation of financial placements" (PF). This is a categorical ordinal variable with the following categories:

0 – no financial placements;
1 – with financial placements in the interval (0, 500] RON;
2 – with financial placements in the interval (500, 1500] RON;
3 – with financial placements in the interval (1500, 3500] RON;
4 – with financial placements in the interval (3500, 7500] RON;
5 – with financial placements above 7500 RON.

The choice of the predictors was based on the literature. Empirical studies done so far indicate that the determinants of saving/investment are of economic, demographic and social nature.

Taking into account these aspects, I included the following variables in the model:

NBP = the number of goods owned by the household. Numeric variable obtained from the experimental section of the HBD May 2010. The goods registered by the survey are: main dwelling, secondary dwelling, other dwellings – holiday house, lands, forests, garages, parking, offices, commercial spaces, shops, livestock, cars and agricultural machinery.

LnVP = numeric variable computed as the logarithmic value of the variable "Income per person in the household". This is obtained by summing the income in cash and in kind registered in section 7 of the HBS related to the number of household members.

CG_St = professional status of the household head. Categorial nominal variable registered in section 1 of the HBS. The categories are: 1-employee, 2-employer or free lancer, 3-self-employed in agriculture, 4-pensioner and 5-other status;

CG_Gen = gender of the household head. Nominal binary variable registered in section 1 of the HBS, coded 1-male, 2-female;

So = dichotomous nominal variable obtained by centralising at household level, the information regarding the household members occupational status. The variables are: 1-there is at least one unemployed person in the household, 0-there are no unemployed persons in the household.;

CG_V = the age group to which the household head belongs. Ordinal variable obtained by typological grouping of the variable "Age of the household head" registered in section 1of the HBS. The categories are: 1-age less than or equal to 35 years, 2-age within the interval (35, 50] years, 3-age within the interval (50, 65] years and 4-age greater than 65 years.
MR = the residence area of the household. Nominal variable registered in section 1 of the HBS. The categories are: 1-urban, 2-rural;
P18 = number of persons in the household aged up to 18 years. Numeric variable obtained by processing the information in section 1 f the HBS for each household.

5. Econometric results

Based on the variables presented above I built a model explaining the saving/investment behaviour by computing the predicted probabilities of membership in the categories. The equations for the categories of the predicted variable are the following:

$$Ln\left(\frac{\Pr(PF=0)}{\Pr(PF>0)}\right)=9.247-(0.145\times NPB+0.929\times LnVP+\beta^{CGSt}\times CGSt$$
$$+\beta^{So}\times So+\beta^{CGV}\times CGV+\beta^{MR}\times MR+\beta^{CGSt*P18}\times CGSt*P18)$$

$$Ln\left(\frac{\Pr(PF\le 500)}{\Pr(PF>500)}\right)=9.719-(0.145\times NPB+0.929\times LnVP+\beta^{CGSt}\times CGSt$$
$$+\beta^{So}\times So+\beta^{CGV}\times CGV+\beta^{MR}\times MR+\beta^{CGSt*P18}\times CGSt*P18)$$

$$Ln\left(\frac{\Pr(PF\le 1500)}{\Pr(PF>1500)}\right)=10.397-(0.145\times NPB+0.929\times LnVP+\beta^{CGSt}\times CGSt$$
$$+\beta^{So}\times So+\beta^{CGV}\times CGV+\beta^{MR}\times MR+\beta^{CGSt*P18}\times CGSt*P18)$$

$$Ln\left(\frac{\Pr(PF\le 3500)}{\Pr(PF>3500)}\right)=11.236-(0.145\times NPB+0.929\times LnVP+\beta^{CGSt}\times CGSt$$
$$+\beta^{So}\times So+\beta^{CGV}\times CGV+\beta^{MR}\times MR+\beta^{CGSt*P18}\times CGSt*P18)$$

$$Ln\left(\frac{\Pr(PF\le 7500)}{\Pr(PF>7500)}\right)=11.992-(0.145\times NPB+0.929\times LnVP+\beta^{CGSt}\times CGSt$$
$$+\beta^{So}\times So+\beta^{CGV}\times CGV+\beta^{MR}\times MR+\beta^{CGSt*P18}\times CGSt*P18)$$

If the predictor is a numerical variable (NBP and LnVP), the exponent of the coefficient in the regression model show how the odds change for a respondent to belong to a category with higher value of placements if the predictor increases by one unit. If the predictor is dichotomous (G_Gen, So and MR), the exponent of the coefficient shows how the odds of having higher value of placements change if the respondent is part of the category coded with one as compared to the one coded with zero. For the polytomous variables (CGV and CGSt), the number of the

coefficients is equal to the number of the categories, excluding the reference category. The exponent of these coefficients shows the change in the odds of having financial placements with higher value if the respondent belongs to that category as compared to the reference category.

Before I start looking at the effects of each explanatory variable in the model, I need to determine whether the model improves our ability to predict the outcome. To do this, I compare a model without any explanatory variables (the baseline or 'Intercept Only' model) against the model with all the explanatory variables. The computed value of chi-square to test the difference between the -2LL for the two models is 364. The statistically significant chi-square statistic ($p<.00001$) indicates that the final model gives a significant improvement over the baseline intercept-only model. This means that the model gives better predictions than just guessing based on the marginal probabilities for the outcome categories.

The χ^2 test computed based on deviances is 12136. These statistics are intended to test whether the observed data are consistent with the fitted model. Since $p=0.366$, the null hypothesis is not rejected, thus the data and the model predictions are similar and the model is good.

The pseudo-R^2 Nagelkerke is 0.286, indicating that the variables in the model explain 28.6% of the variation in saving/investment through financial placement.

The premise or assumption of parallel lines, equality of the β parameters for various values of α, is not infirmed by the data, the significance level of the chi-square test being greater than 0.01, respectively 0.013. this level of significance was chosen because the data come from a large sample and there are 7 predictors.

The analysis of the model coefficients (Table 1) confirms the systematic effect of the economic, demographic and social predictors included in the model on saving/investment.

The household assets (quantified by the number of goods owned) has a positive influence on the household placements. The coefficient of this variable in the model is 0.24. The exponent of this coefficient is 1.27, which indicates that a one unit increase in the number of goods owned, the odds of the household to be in the groups with high value financial placements increases 1.27 times.

The influence of the household income is also positive and strong. The exponent of the coefficient (1.224) is 3.4, which means that a one unit increase in the logarithm of the income per person, the odds to have financial placements of high value increase 3.4 times.

Table 1. The coefficients of the model

		Estimate	Std, Error	Wald	df	Sig,	Exp
Threshold	[PF = 0]	9.247	0.643	206.882	1	0.000	
	[PF = 1]	9.719	0.646	226.516	1	0.000	
	[PF = 2]	10.397	0.65	255.643	1	0.000	
	[PF = 3]	11.236	0.656	293.284	1	0.000	
	[PF = 4]	11.992	0.662	327.837	1	0.000	
Location	NPB	0.24	0.054	19.99	1	0.000	1.27

	LnVP	1.224	0.093	174.617	1	0.000	3.40
	[CG_V=1]	-0.318	0.203	2.451	1	0.117	0.73
	[CG_V=2]	-0.445	0.178	6.273	1	0.012	0.64
	[CG_V=3]	-0.151	0.119	1.6	1	0.206	0.86
	[CG_V=4]	0a	.	.	0	.	
	[St=1]	0	0.278	0	1	0.999	1.00
	[St=2]	1.248	0.387	10.383	1	0.001	3.48
	[St=3]	-0.074	0.334	0.049	1	0.824	0.93
	[St=4]	-0.099	0.284	0.122	1	0.727	0.91
	[St=5]	0a	.	.	0	.	
	[CG_Gen =1]	0.242	0.098	6.076	1	0.014	1.27
	[CG_Gen =2]	0a	.	.	0	.	
	[MR=1]	0.189	0.098	3.74	1	0.053	1.21
	[MR=2]	0a	.	.	0	.	
	[So=0]	-0.438	0.175	6.235	1	0.013	0.65
	[So=1]	0	.	.	0	.	
	[St=1] * P18	0.35	0.1	12.117	1	0.000	1.42
	[St=2] * P18	0.136	0.231	0.345	1	0.557	1.15
	[St=3] * P18	0.473	0.163	8.403	1	0.004	1.60
	[St=4] * P18	0.398	0.137	8.433	1	0.004	1.49
	[St=5] * P18	0.364	0.273	1.779	1	0.182	1.44

Link function: Logit,

a. This parameter is set to zero because it is redundant.

The age of the household head influences the possibility to save/invest only for those in the age group (35, 50] years. The odds of the households in this group are only 0.86 of those for the reference group (age of the household head greater than 65 years).

The only group by professional status of the household head for which the odds of having higher value financial placements are higher is that of employers and free lancers. Their odds are 3.48 times larger than for those in the reference category (unemployed, housewives, other status).

The presence of the statistically significant interaction between the predictors “Professional status” and “Number of persons in the household aged less than 18 years” shows that in the case of households of employers and free lancers the odds of having higher value placements are not influenced by the presence of children under 18 years, while for those of employees, self-employed in agriculture and even pensioners, the propensity to save/invest is stronger.

If the household is situated in the urban area, its odds of having higher value financial placements are 1.21 times greater and if the gender of the head is male, the odds are 1.27 times higher.

The model also takes into account unemployment, as a social problem. Thus, the presence of unemployed in the household causes the odds of having consistent financial placements to be 0.65 of the odd of households without unemployed members.

6. Conclusions

The study shows that only about one third of the Romanian households have financial placements and the preferred way to place their savings is through the banking system. The values of the deposits is generally small, 44% of the households having at most 5000 RON (1100 Euro) at the moment of the survey).

With the help of the ordinal regression model I identified the predictors of the saving/investment behaviour of the households. The working hypotheses, resulted from the studied literature, were partially validated.

Thus, the first hypothesis, regarding the influence of the economic factors was validates. There is a positive relationship between the stability of the household (quantified by the number of goods owned) and the income per household member, an increase in the later leading to higher odds that the household will save/invest a larger amount.

The second hypothesis is also validated. The odds to have financial placements with a higher value are smaller for those households for which the person with the highest income belongs to the (35, 50] years age group. This conclusion is in accordance with previous empirical studies done in Romania (Metro Media Transilvania, 2005) and Estonia (Kulikov et al., 2007), but they do not confirm the theory of life cycle (Ando and Modigliani, 1963) and the theory of permanent income (Friedman, 1957).

It is interesting that the education level does not have a significant influence on the propensity to save/invest of the households.

Generally, households in the urban area, those unaffected by unemployment and whose head is a male have greater odds to have financial placements with higher value (the hypotheses 4, 5 and 6 are confirmed).

Recommendations and perspectives

The fact that only one third of the households manages to save questions the success of the economic recovery. It is necessary to attract the population towards saving, even for those in the medium and small income categories, so that their income is not completely directed towards consumption. A more deeper understanding of the saving decisions of the households and the development of financial education programmes for the population may attract significant savings.

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