

# The Impact of the Interest Rate and the Income of the Households on the Dynamics of Bank Deposits

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## Abstract

*The purpose of this paper is to use a linear multiple regression model to highlight the relationship between a dependent variable "Population-term deposits in lei (expressed in euros)" and two independent variables "Average total income per household (expressed in euros) and Interest rate at the deposit facility".*

*The paper is based on the processing and analysis of the statistical data sets between 2004-2018, also carrying out a dynamic analysis of the term deposits in lei of the households, in relation to the dynamics of the average total incomes on a household and the interest rate at storage facility.*

**Key words:** bank deposits, average total income per household, interest rate on the deposit facility, multiple linear regression

**J.E.L. classification:** G21, G23, C10.

## 1. Introduction

The Keynesian view is that saving is, in the most general sense of the term, that part of current income that is intended for future consumption. (Keynes, 1936). The "saving paradox" would be that the attempt to save more ultimately leads to a lower level of savings.

Bank deposits are savings products that a commercial bank uses to attract customers and represent for most commercial banks the main financial resource.

The term deposit is a sum of money deposited within the bank for a certain period of time called maturity of the deposit, for which the bank pays the depositor an interest.

The bank deposit is a sure way to keep the cash and get a guaranteed profit from the interest offered by the bank. The money saved will be fine if the bank, in which we will place it, will offer us information on: what the value of the interest received will be; the interest is fixed or variable; under what conditions the deposit may be interrupted before its maturity; performance on the bank's market; the quality of the services offered.

The banks offer is very rich in order to find a product that meets the customers' requirements. On the other hand, an overly diversified offer increases the risk of choosing an inappropriate product.

Saving depends mainly on income. Theoretically, the economic growth leads to the increase of the revenues that will contribute to the increase of the saved amounts in relation to the income.

The saving process bears the imprint of some causal factors either of economic nature (inflation, passive bank interest rate, the yield of securities, the real estate market yield) or of a psycho-sociological nature (confidence in the banking system, prudence, the intention to ensure the future

of the descendants, pessimism about future income).

Considering this context, the paper proposes to use the modeling method, namely "Multiple linear regression" to highlight the influence of the average total income per household on the level of population term deposits, as well as the influence of the interest rate on the deposit facility on the level of population term deposits.

The paper also proposes a dynamic analysis of the term deposits in lei of the population households during 2004-2018, in relation to the dynamics of the average total incomes per household and of the interest rate at the deposit facility.

## 2. Theoretical background and methodology

We chose to use a linear multiple regression model, term used by Pearson in 1908, to highlight the relationship between a dependent variable "Population-term deposits in lei (expressed in euros)" and two independent variables "Total average income per a household (expressed in euros) and the interest rate at the deposit facility".

In most cases, the interconditions between the economic processes are complex, so that the evolution of a variable  $Y$  does not depend on a single factor, but on a number of factors, as is the case with the term deposits of the population. In general, a multifactorial explanatory model is defined by the following relation:

$$y = f(x_j) + u \quad (1)$$

where:  $y$  = endogenous variable, dependent or explained;  $x_j$  = exogenous, independent or explanatory variables;  $u$  = residual or random variable or error;

$f(x_j)$  = the regression function by which the values of variable  $y$ , estimated only by the influence of factors  $x_j$ , considered essential, main, and decisive, except the influence of the other factors of the phenomenon  $y$ , which are considered non-essential, insignificant factors to explain the occurrence and evolution in time and space of the phenomenon  $y$ , they are treated separately using the residual variable  $u$ .

The econometric model must be interpreted as a formal expression of the econometric method of investigating an economic object:

$$\text{Reality } (y) = \text{Theory } [f(x_j)] + \text{Chance } (u)$$

As a general and fundamental rule, the specification of an econometric model is made on the basis of economic theory. The economic phenomenon  $y$  is specified on the basis of the concepts, definitions and cause-effect relationships elaborated by it and the phenomenon  $x_j$  is accepted as an essential factor, or it is rejected and passed into the category of random factors by means of the random variable  $u$ . However, the size of the package of explanatory variables  $x_j$  also depends on the statistical database of the respective variables, on their quantity and quality. (Jula, 2009)

For the variables "Population-term deposits in lei (expressed in euros) and Interest rate on the deposit facility", the work is based on the processing and analysis of the statistical data sets offered by the National Bank of Romania. This is a quick way to find information relevant to the field of research carried out.

For the variable "Total average incomes per household (expressed in euros)" the statistical series from the National Institute of Statistics - Romania (INS) were processed for the purpose of this analysis.

The total income represents the sum of the cash income, regardless of the source of origin (excluding loans and credits taken, the amounts withdrawn from the deposits set up at CEC Bank, other banks and similar institutions) as well as the value of the in-kind income that does not have a salary in nature.

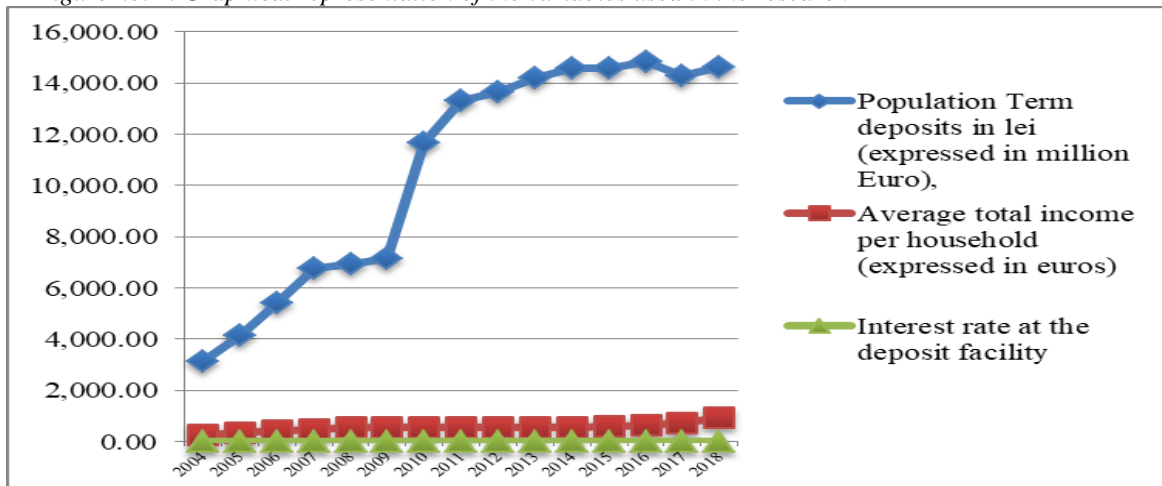
For a relevant research result, we considered it necessary to express the data in Euro as the reference currency, considering its dynamics in the analyzed time horizon, thus ensuring comparability of results over time.

Table no. 1 Value of variables used in research

Years	Population Term deposits in lei (expressed in million Euro)	Average total income per household (expressed in euros)	Interest rate at the deposit facility
2004	3,137.55	273.75	5.00
2005	4,136.16	329.66	1.00
2006	5,432.24	409.95	1.00
2007	6,773.72	467.22	2.00
2008	6,912.43	534.90	6.25
2009	7,133.06	547.75	4.00
2010	11,669.06	537.78	2.25
2011	13,329.48	559.59	2.00
2012	13,638.94	558.86	1.25
2013	14,198.25	570.62	1.00
2014	14,581.11	557.93	0.25
2015	14,597.06	593.83	0.25
2016	14,848.01	648.43	0.25
2017	14,264.35	727.87	0.75
2018	14,617.91	911.52	1.50

Source: Own processing of data taken from the website of National Bank of Romania <http://www.bnr.ro> and from the website of National Institute of Statistics) <http://statistici.insse.ro/>

Figure no. 1. Graphical representation of the variables used in the research



Source: The data presented in Table no. 1

### 3. Processing results

The statistical description of the analyzed variables was made using the average and standard deviation indicators. The variables introduced in the study, according to table no. 2, are: y = Population-Term deposits in lei (expressed in euros), x1 = Average total incomes per household (expressed in euros) and x2 = Interest rate on the deposit facility.

Table no. 2 Statistical description of variables

Descriptive Statistics			
	Mean	Std. Deviation	N
Population-Term deposits in lei (expressed in euros)	10818.549284	4327.0316596	15
Average total incomes per household (expressed in euros)	548.644167	152.6652509	15
Interest rate on the deposit facility	1.944019	1.6395534	15

Source: Table processed in the SPSS programme

The correlation coefficients, whose estimation is presented in the table no 3, are partial correlation coefficients that measure the influence of the average total income per household (x1) on the level of population term deposits (y), as well as the influence of the interest rate on the facility of deposit (x2) on the level of population term deposits (y).

Table no. 3 Calculation of Pearson correlation coefficients

		Population Term deposits in lei (expressed in million Euro),	Average total income per household (expressed in euros)	Interest rate at the deposit facility
Pearson Correlation	Population-Term deposits in lei (expressed in euros)	1.000	.803	-.614
	Average total incomes per household (expressed in euros)	.803	1.000	-.464
	Interest rate on the deposit facility	-.614	-.464	1.000

Source: Table processed in the SPSS programme

The positive value of the first coefficient and its size,  $r_{y/x1} = 0.803$ , indicate a strong, positive influence of income on deposits. This means that as revenues grow, deposits increase.

The correlation between the interest rate and deposits, expressed by the coefficient  $r_{y/x2} = -0.614$ , indicates a partial negative influence, of medium intensity.

This means that as the interest rate drops, so does the level of population deposits.

In order to measure the intensity of the connection between the dependent variable (y) and the two factorial variables (x1 and x2) included in the model, we calculated (in table no 4) the multiple correlation coefficient R (0.848) which shows the weight of the total variation of the dependent variable that could be explained by the simultaneous variation of the independent variables included in the model. The result shows a strong connection between these variables.

Table no. 4 Calculation of the multiple correlation coefficient

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848 <sup>a</sup>	.720	.673	2474.6867815

Source: Table processed in the SPSS programme

- a. Predictors: (Constant), Interest rate at the deposit facility, Average total income per household (expressed in euros)
- b. Dependent Variable: Population-Term deposits in lei (expressed in euros).

Table no. 4 also calculates the ratio of multiple determination (R squared) which shows that the variation of population deposits could be explained in a proportion of 72% by the simultaneous variation of the variables "Interest rate at the deposit facility" and "Average total income per household (expressed in euros)".

The rest of up to 100% represents the influence of other factors not included in the model.

The multiple determination report does not take into account the number of degrees of freedom or the number of parameters that appear in the model. Therefore, in assessing the intensity of the link between variables, an adjusted determination coefficient is used which takes into account this number of parameters. The result (Adjusted R Square) of 0.673 indicates that 67.3% of the variation of the dependent variable could be explained by the two factorial variables.

For multiple regression models, several tests can be constructed, in order to test the model parameters, the regression model and the marginal influence of a variable.

The parameters of the multiple linear regression model were tested using the Student test (Table no. 5), considering the estimators obtained by the method of the least squares and the law of their distribution.

Table no. 5 Calculation of the parameters of the regression model and their testing

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2115.533	3254.988		.650	.528		
Average total income per household (expressed in euros)	18.735	4.890	.661	3.831	.002	.785	1.274
Interest rate at the deposit facility	-810.596	455.368	-.307	-1.780	.100	.785	1.274

Source: Table processed in the SPSS programme

a. Dependent Variable: Population Term deposits in lei (expressed in euros).

In SPSS, the decision is made based on the significance of the test; if  $\text{Sig } t < \alpha$ ,  $H_0$  (the independent variable  $i$  has no partial linear influence on the dependent one) is rejected with the confidence level specified, and if  $\text{sig} > \alpha$ , the null hypothesis is accepted. It is observed that for the parameter of variable  $x_1$  the condition  $\text{Sig } t < 0.05$  is respected and for the parameter of the variable  $x_2$ ,  $\text{Sig } t < 0.1$ . In conclusion, with a probability of 95% the parameter of the first variable is statistically significant, while, for the second parameter, the probability is 90%.

Testing the multiple linear regression model was performed, in Table no. 6, using the F. test.

Table no. 6 Testing the multiple linear regression model

ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	188635945.766	2	94317972.883	15.401	.000 <sup>b</sup>
	Residual	73488895.996	12	6124074.666		
	Total	262124841.762	14			

Source: Table processed in the SPSS programme

a. Dependent Variable: Population-Term deposits in lei (expressed in euros),

b. Predictors: (Constant), Interest rate at the deposit facility, Average total income per household (expressed in euros)

Since  $\text{Sig} = 0.000 < 0.05$ , the null hypothesis with a probability of 95% is rejected, i.e. the model significantly explains the dependence of the variable present in the model.

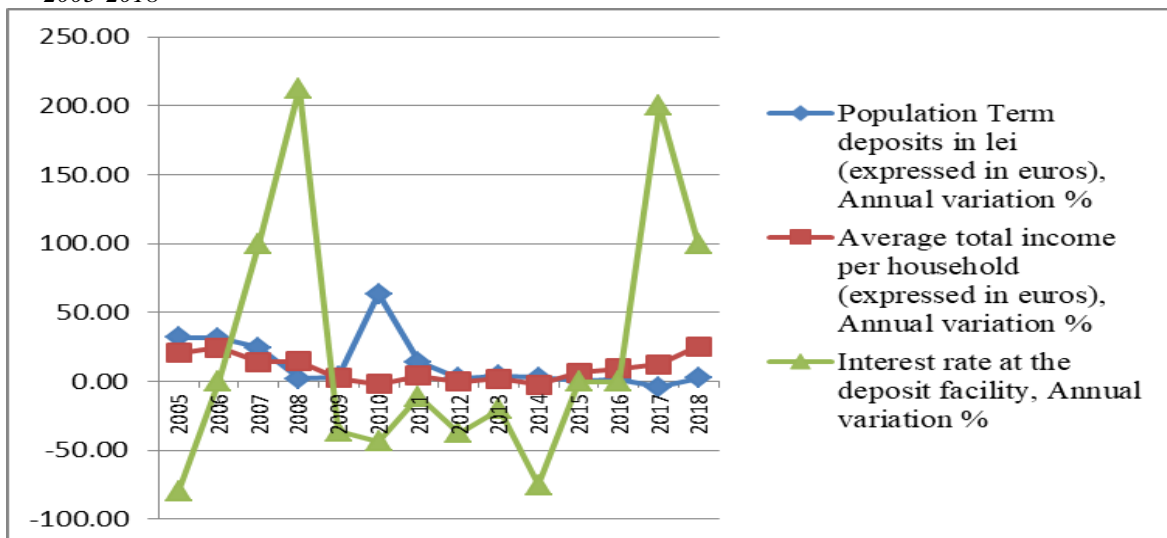
**4. The dynamics of term deposits in lei of the households of the population during 2004-2018, in relation to the dynamics of the average total incomes per household and the interest rate at the deposit facility**

Table no. 7 Annual evolution of the variables used in research during 2004 - 2018

Years	Popula tion Term deposits in lei (expressed in million Euro)	Annual varia tion ( $\Delta$ )	Ann ual varia tion %	Average total income per house hold (expres sed in euros)	Annual varia tion ( $\Delta$ )	Ann ual varia tion %	Inte rest rate at the depo sit facility	Annua l varia tion ( $\Delta$ )	Ann ual varia tion %
2004	3,137.55			273.75			5.00		
2005	4,136.16	998.61	31.83	329.66	55.90	20.42	1.00	-4.00	-80.00
2006	5,432.24	1,296.08	31.34	409.95	80.29	24.36	1.00	0.00	0.00
2007	6,773.72	1,341.48	24.69	467.22	57.27	13.97	2.00	1.00	100.00
2008	6,912.43	138.70	2.05	534.90	67.68	14.49	6.25	4.25	212.50
2009	7,133.06	220.63	3.19	547.75	12.85	2.40	4.00	-2.25	-36.00
2010	11,669.06	4,536.00	63.59	537.78	-9.97	-1.82	2.25	-1.75	-43.75
2011	13,329.48	1,660.42	14.23	559.59	21.81	4.06	2.00	-0.25	-11.11
2012	13,638.94	309.47	2.32	558.86	-0.73	-0.13	1.25	-0.75	-37.50
2013	14,198.25	559.31	4.10	570.62	11.75	2.10	1.00	-0.25	-20.00
2014	14,581.11	382.86	2.70	557.93	-12.68	-2.22	0.25	-0.75	-75.00
2015	14,597.06	15.95	0.11	593.83	35.89	6.43	0.25	0.00	0.00
2016	14,848.01	250.96	1.72	648.43	54.61	9.20	0.25	0.00	0.00
2017	14,264.35	-583.67	-3.93	727.87	79.44	12.25	0.75	0.50	200.00
2018	14,617.91	353.57	2.48	911.52	183.65	25.23	1.50	0.75	100.00

Source: Own processing of data taken from the website of National Bank of Romania <http://www.bnr.ro> and from the website of National Institute of Statistics) <http://statistici.insse.ro/>

Figure no. 2. Graphical representation of the annual evolution of the variables used in research during 2005-2018



Source: The data presented in Table no. 7

The analysis of the statistical data regarding the evolution of the term deposits in lei of the households of the population during the time period 2004-2018, reveals that there are three periods of antagonistic dynamics.

The first period was between 2004 and 2007, characterized by an increase in the value of these economies and followed by a second regression trend, temporarily located in 2008-2009 and between 2012 and 2018. We should also note that the two periods are not homogeneous in terms of evolution. Thus, the growth period experienced a reversal trend from 31.83% in 2005 and 31.34% in 2006 to 24.69% in 2007; Regarding the second period, we observe an oscillating regression in the analyzed period. It is worth noting the behavior of this type of savings in 2010-2011, which was influenced by the legislation regarding the activity of the Deposit Guarantee Fund in the banking system. Although in 2008, the interest rate on the deposit facility had the highest value of 6.25%, this did not lead to increased savings.

One of the reasons for the downward trend in the volume of non-governmental deposits is that bank interest rates relative to non-bank customers have been steadily declining.

From the analysis of the dynamics of term deposits in lei of the population households, the idea emerges that banking economies have become totally unprofitable, especially due to the interest granted by commercial banks.

Although nowadays bank deposits are no longer such a great source of income, they still remain a good saving option that we must take advantage of when we have the opportunity.

## 5. Conclusions

The saving process bears the imprint of some causal factors either of economic nature (inflation, passive bank interest rate, the yield of securities, the real estate market yield) or of a psycho-sociological nature (confidence in the banking system, prudence, the intention to ensure the future of the descendants, pessimism about future revenue).

Theoretically, economies depend mainly on incomes. The economic growth leads to the increase of the revenues that will contribute to the increase of the saved amounts in comparison with the income.

Regarding the use of a multiple linear regression model, one can observe the influence of the variables introduced in the study,  $y$  = Population-Term deposits in lei (expressed in euros),  $x_1$  = Total average incomes per household (expressed in euros) and  $x_2$  = Rate interest at the deposit facility. The ratio of multiple determination (R squared) was also calculated which shows that the variation of the population deposits could be explained in a proportion of 72% by the simultaneous variation of the variables "Interest rate at the deposit facility" and "Average total income per household (expressed in euro)" The rest of up to 100% represents the influence of other factors not included in the model.

The multiple determination report does not take into account the number of degrees of freedom or the number of parameters that appear in the model. Therefore, in assessing the intensity of the link between variables, an adjusted determination coefficient is used which takes into account this number of parameters. The result (Adjusted R Square) of 0.673 indicates that 67.3% of the variation of the dependent variable could be explained by the two factorial variables.

For multiple regression models, several tests can be constructed, in order to test the model parameters, the regression model and the marginal influence of a variable.

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