SIMULATION INSURED RESULTS BY PURCHASING A LIFE INSURANCE

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Abstract: *In this paper we are doing a comparative analysis, using Eviews 8.00, for a unit-linked product, depending on the annual premium paid by the policyholder. It reviewed the situation when the insured survives till the end of the insurance contract and then he receives the account value. We presented the contract evolutions through three different investment programs. There were considered three different risk investment programs 2, 4, 6, on a scale from 1-6.*

Key words: *insurance market, premium, account value, risk, unit- linked products*

JEL CLASSIFICATION: *G01, G14, G22*

1. ITRODUCTION

The products with investment components are complex products but are riskier than traditional life insurance. This type of insurance has two components: the protection component - life insurance and investment component, through access to investment programs.

We will analyse three types of investment programs:

- investing the 100% in shares the investment premium, very high risk 6 (on a scale of 1 to 6);
- investing the investment premium 50% in fixed income instruments (government bonds, bonds, deposits), 50% in shares, in units of risk, 4;
- investing the 100% investment premium in fixed income instruments (government bonds, bonds, deposits) risk class 2.

Premiums paid for investments are converted into units within investment programs that the policyholder has chosen from the beginning. The amount of the

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account is calculated by multiplying the number of units in the account of the insurance contract by the selling price valid for that time. We will analyse a unit-linked product with the following features: age of insured person 36 years, female gender, frequency of payment - annual insurance premiums, amount insured in case of death 16,000.00 lei, period of payment of insurance premiums 20 years, investment premium 1.800,00 lei, primary insurance premium 1.940,16 lei.

2. THE EVOLUTION OF THE CONTRACT THROUGH INVESTMENT PROGRAMS USED

People with a long-term investment horizon, willing to gamble at a high level, looking for long-term returns, will opt for a 6-risk investment program. The objective of the program is to achieve long-term capital growth by investing 100% in shares. The amount of the account at the end of the contract is 73,258 lei. From the point of view of the insured's earnings, it is the most advantageous but not recommended in times of financial crisis, being too risky.

Table 1. The evolution of the insurance contract investing 100% in shares

Year	Amount of premiums (for investments)	Amount of premiums (for death)	Insured amount (for basic insurance)	Predicted yiel	Account value	Death Benefit	Repurchase
1	1800	140	16000	5.10%	1777	17777	0
2	3690	287	16753	5.10%	3474	20227	0
3	5675	442	17506	5.10%	5429	22935	4399
4	7758	604	18259	5.10%	7543	25802	6448
5	9946	774	19015	5.10%	9825	28840	8665
6	12243	953	19762	5.10%	12287	32049	11063
7	14656	1141	20505	5.10%	14940	35445	13651
8	17188	1338	21241	5.10%	17796	39037	16445
9	19848	1545	21973	5.10%	20867	42840	19456
10	22640	1762	22702	5.10%	24167	46869	22698
11	25572	1990	23435	5.10%	27710	51145	26186
12	28651	2230	24161	5.10%	31511	55672	29935
13	31884	2482	24885	5.10%	35584	60469	33963
14	35278	2746	25604	5.10%	39947	65551	38285
15	38842	3023	26323	5.10%	44618	70941	42922
16	42584	3315	27044	5.10%	49613	76657	47891
17	46513	3621	27760	5.10%	54954	82714	53215
18	50639	3942	28473	5.10%	60660	89133	58915
19	54971	4279	29186	5.10%	66754	95940	65016
20	**59519**	**4633**	**29902**	5.10%	**73258**	**103160**	**73258**

Source: author's work with the EQUITY investment program - NN Romania

People with a low risk appetite, who want to know their investment safely but who also seek opportunities to get better return on a fixed income investment program, will opt for investing in a diversified portfolio, as shown in Table 2, in which case the

client has opted to invest the investment premium equally in shares and fixed income securities, the value of the account at the end of the contract is **70,828** lei.

Table 2. The evolution of the insurance contract by investing the investment premium 50% in fixed income instruments and 50% in shares

Year	Amount of premiums (for investments)	Amount of premiums (for death)	Insured amount (for basic insurance)	Predicted yiel	Account value	Death Benefit	Repurchase
1	1800	140	16000	3.90%	1765	17765	0
2	3690	287	16753	4.00%	3442	20195	0
3	5675	442	17506	4.10%	5378	22884	4362
4	7758	604	18259	4.40%	7465	25724	6387
5	9946	774	19015	4.40%	9712	28727	8573
6	12243	953	19762	4.40%	12130	31892	10929
7	14656	1141	20505	4.40%	14728	35233	13466
8	17188	1338	21241	4.40%	17518	38759	16197
9	19848	1545	21973	4.40%	20511	42484	19132
10	22640	1762	22702	4.40%	23719	46421	22286
11	25572	1990	23435	4.40%	27155	50590	25670
12	28651	2230	24161	4.40%	30833	54994	29300
13	31884	2482	24885	4.40%	34766	59651	33190
14	35278	2746	25604	4.40%	38970	64574	37357
15	38842	3023	26323	4.40%	43461	69784	41816
16	42584	3315	27044	4.40%	48254	75298	46586
17	46513	3621	27760	4.40%	53369	81129	51686
18	50639	3942	28473	4.40%	58823	87296	57136
19	54971	4279	29186	4.40%	64636	93822	62957
20	**59519**	**4633**	**29902**	4.40%	**70828**	**100730**	**70828**

Source: author's work with the MIXT 50 investment program - NN Romania

People with low risk and short-term investment horizon who want their investment to be safe will opt for an investment program that will generate long-term capital growth and stable returns by investing 100% in fixed income instruments, as can be seen from table no.3, the value of the account reaches the value of 68,382 lei in the last year of the contract. If it is desired to withdraw the amounts deposited with the related increases it can be ascertained that in the first years 2 there is no redemption value, the penalties being comparable with the value of the investment.

The value of the account at the end of the contract and the insured person's death allowance are much higher, investing 100% in shares, but the risk is adequate. In the crisis, the low-risk investment program is recommended even if the yield is lower, it is more secure by investing in fixed income instruments.

The insured person would lose much of the investment made if he decides to give up the insurance policy, the redemption value is approaching the value of the account only in the last 2-3 years of the contract, regardless of the investment program chosen.

Table 3. The evolution of the insurance contract by investing the 100% investment premium in fixed income instruments

Year	Amount of premiums (for investments)	Amount of premiums (for death)	Insured amount (for basic insurance)	Predicted yiel	Account value	Death Benefit	Repurchase
1	1800	140	16000	2.20%	1749	17749	0
2	3690	287	16753	2.60%	3393	20146	0
3	5675	442	17506	2.70%	5271	22777	4281
4	7758	604	18259	2.80%	7297	25556	6252
5	9946	774	19015	3.10%	9507	28522	8404
6	12243	953	19762	3.60%	11880	31642	10718
7	14656	1141	20505	3.60%	14423	34928	13203
8	17188	1338	21241	3.60%	17148	38389	15870
9	19848	1545	21973	3.60%	20063	42036	18730
10	22640	1762	22702	3.60%	23180	45882	21795
11	25572	1990	23435	3.60%	26512	49947	25077
12	28651	2230	24161	3.60%	30069	54230	28589
13	31884	2482	24885	3.60%	33866	58751	32345
14	35278	2746	25604	3.60%	37916	63520	36359
15	38842	3023	26323	3.60%	42232	68555	40646
16	42584	3315	27044	3.60%	46831	73875	45222
17	46513	3621	27760	3.60%	51728	79488	50106
18	50639	3942	28473	3.60%	56940	85413	55315
19	54971	4279	29186	3.60%	62485	91671	60868
20	**59519**	**4633**	**29902**	3.60%	**68382**	**98284**	**68382**

Source: author's work with the BOND investment program - NN Romania

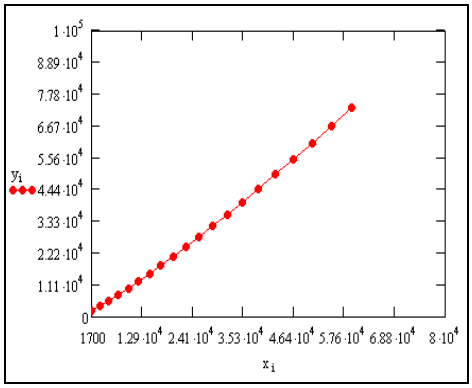
3. SIMULATION OF THE EXPECTED BENEFITS OF THE INSURED WITH A LINEAR REGRESSION MODEL

Classic linear regression model is one of the most commonly used statistical techniques in economic analysis. The easiest way to specify a linear regression equation is to specify the list of variables that need to be used in the equation. Having specified the equation further the estimation method must be chosen. In the classic regression model estimation is performed using least squares. Analysis was performed using systems with one input variable and one output variable (SISO), the dependence between the two variables is direct one, linear, almost in all cases analysed. The data series for the sizes involved in this analysis are given in Tables no. 1,2,3. For the system under consideration, we consider the value of the account as the output size (y) and the amount of the investment premium as input size (x).

As we can see, the system analysed is one with a single input variable and a single output variable, the dependence between the two variables being a linear one. For this reason, the model chosen for the correlation between the two sizes is linear, of the following form:

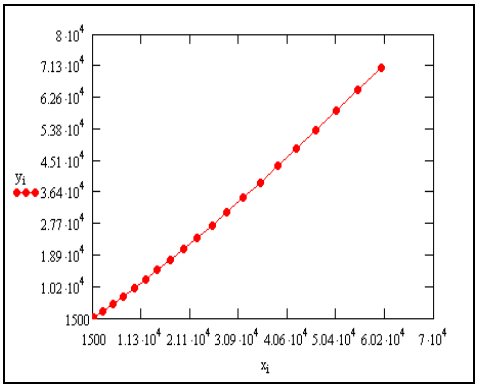
$$y_i = c_1 + c_2 \cdot x_i + e_i, \quad i = \overline{1,20} \tag{1}$$

Figures 1, 2, 3 represent the dependence between the amount of the account and the amount of the investment premiums.



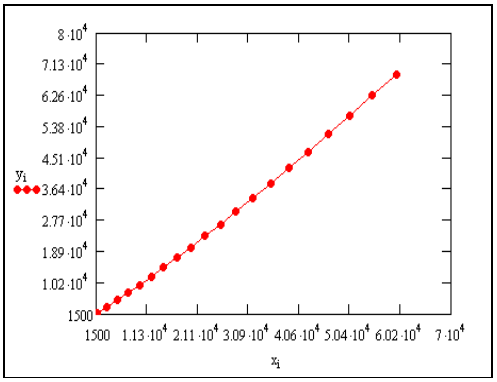
Source: Author's processing

Figure 1. Dependency between variables using the risk investment program 6



Source: Author's processing

Figure 2. Dependency between variables using the risk investment program 4



Source: Author's processing

Figure 3. Dependency between variables using the risk investment program 2

From the above figures, we can see that there is a linear dependence between the two variables, observing the upward trend in the amount of the account versus the sum of the investment premiums. With Eviews 8.00, the parameters of the linear regression model, defined in relation (1), will be determined and the assumptions based on which the chosen model can be validated will be checked. Thus, the linear model for determining the value of the account according to the premium invested in the three types of investment programs determined by using the Eviews program is given by the following relations:

- for the 6 risk scale investment program

$$y = -2646,390367 + 1,23730047 \cdot x \qquad (2)$$

- for the 4 risk scale investment program

$$y = -2320,976 + 1,196237 \cdot x \quad (3)$$

- for the 2 risk scale investment program

$$y = -2072,42491762 + 1,15554626343 \cdot x \quad (4)$$

According to the above relationships, we can say that if we increase the investment premium for the last year analysed by 1 leu, the estimated value of the account will increase by 1.27 lei in terms of the first investment program, namely by 1.20 lei and 1.15 lei through the other two investment programs.

In Tables no. 4, 5, 6, are represented both the linear regression model parameter values (column 2) and the values of the applied statistical tests. Thus, we note that the value of R-squared is very close to value 1, the high value of this indicator demonstrating a dynamics of the well-specified account value relative to the amount of investment premiums. The Durbin-Watson test is applied to verify the hypothesis that the residue series is uncorrelated. The calculated value of this test, taken from Tables 4, 5, 6 (Dw between 0.136024 and 0.137439) is compared with its tabulated values. For a significance threshold of 5%, and for a number of 20 observations, the tabulated values of the Durbin-Watson test are d1 = 1,2 d2 = 1,41.

By comparing the tabulated values with the calculated value, we can say that the series of residues is correlated. To demonstrate that the model is a good one, we can also apply other tests using Eviews.

In all cases the p-value is above the threshold of 0.05 so the null hypothesis that is here cannot be rejected H0: The residual series is normally again distributed a positive characteristic of the analysed model.

The change in the value of the account determined by the linear regression (green) model with the residue (blue) is shown in Figure 4 (through the risk investment program 6), Figure 5 (through the risk investment program 4) Figure 6 (through Risk Investment Program 2).

Table 4. Investment program –risk 6

Dependent Variable: Y
Method: Least Squares
Date: 06/23/15 Time: 11:23
Sample: 1 20
Included observations: 20
Y=C(1)+C(2)*X

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2646.390	493.1857	-5.365910	0.0000
C(2)	1.237300	0.015547	79.58235	0.0000

R-squared	0.997166	Mean dependent var	30135.70
Adjusted R-squared	0.997009	S.D. dependent var	22174.74
S.E. of regression	1212.837	Akaike info criterion	17.13395
Sum squared resid	26477505	Schwarz criterion	17.23352
Log likelihood	-169.3395	Hannan-Quinn criter.	17.15339
F-statistic	6333.351	Durbin-Watson stat	0.136024
Prob(F-statistic)	0.000000		

Table 5. Investment program -risk 4

Dependent Variable: Y
Method: Least Squares
Date: 06/30/15 Time: 10:43
Sample: 1 20
Included observations: 20
Y=C(1)+C(2)*X

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2320.976	428.2473	-5.419711	0.0000
C(2)	1.196237	0.013500	88.60839	0.0000

R-squared	0.997713	Mean dependent var	29373.15
Adjusted R-squared	0.997586	S.D. dependent var	21432.93
S.E. of regression	1053.141	Akaike info criterion	16.85158
Sum squared resid	19963892	Schwarz criterion	16.95115
Log likelihood	-166.5158	Hannan-Quinn criter.	16.87102
F-statistic	7851.447	Durbin-Watson stat	0.136362
Prob(F-statistic)	0.000000		

Source: Author's processing *Source: Author's processing*

Table 6. Investment program –risk 2

Dependent Variable: Y
Method: Least Squares
Date: 06/30/15 Time: 13:32
Sample: 1 20
Included observations: 20
Y=C(1)+C(2)*X

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2072.425	373.9969	-5.541289	0.0000
C(2)	1.155546	0.011790	98.01023	0.0000

R-squared	0.998130	Mean dependent var	28543.60
Adjusted R-squared	0.998026	S.D. dependent var	20699.55
S.E. of regression	919.7288	Akaike info criterion	16.58067
Sum squared resid	15226220	Schwarz criterion	16.68025
Log likelihood	-163.8067	Hannan-Quinn criter.	16.60011
F-statistic	9606.005	Durbin-Watson stat	0.137439
Prob(F-statistic)	0.000000		

Source: Author's processing

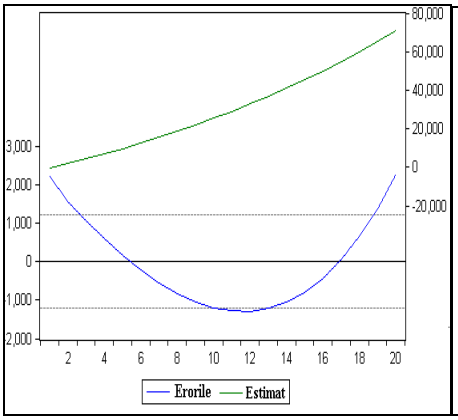


Figure 4. The changes value of the account over time - investment program with risk 6

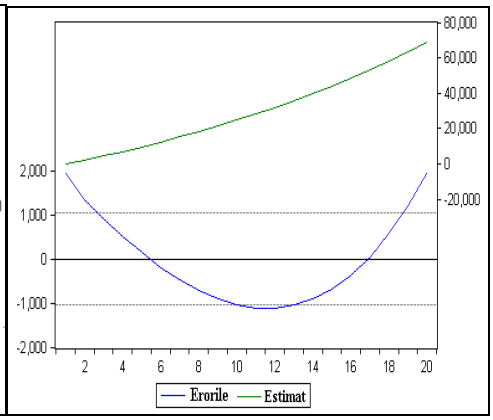


Figure 5. The changes value of the account over time - investment program with risk 4

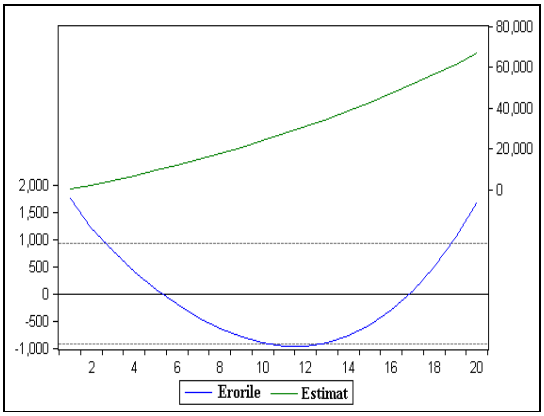


Figure 6. The changes value of the account over time - investment program with risk 2

The covariance matrix of the linear regression model estimators is presented in relations (5) (through the investment program with risk 6), (6) (through the investment program with risk 4), (7) (through the investment program with risk 2):

$$\Omega = \begin{pmatrix} 243232,1796510476 & -6,404397583266227 \\ -6,404397583266227 & 0,0002417223567322038 \end{pmatrix} \quad (5)$$

$$\Omega = \begin{pmatrix} 183395,7074214528 & -4,828880072843989 \\ -4,828880072843989 & 0,0001822573093580069 \end{pmatrix} \quad (6)$$

$$\Omega = \begin{pmatrix} 139873,69895489 & -3,682928717879241 \\ -3,682928717879 & 0,0001390054564520 \end{pmatrix} \quad (7)$$

From the above, we can conclude that there is a strong linear dependence between the two variables in the model.

4. CONCLUSIONS

We have determined the best insurance product, the most financially advantageous for the insured. Due to developments analysed products, the product with the best financial results, at the end of the contract, if the insured survives till the end of the contract, is the unit-linked product using the invitational program, investing 100% shares but the risk assumes by the insured to obtain these results, is the biggest one.

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